Lower Boise River Subbasin Assessment and Total Maximum Daily Load

2015 Total Phosphorus TMDL for the Lower Boise River, Mason Creek, and Sand Hollow Creek

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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<td>§303(d)</td>
<td>refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section</td>
</tr>
<tr>
<td>μ</td>
<td>micro, one-one thousandth</td>
</tr>
<tr>
<td>§</td>
<td>section (usually a section of federal or state rules or statutes)</td>
</tr>
<tr>
<td>AU</td>
<td>assessment unit</td>
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<tr>
<td>AWS</td>
<td>agricultural water supply</td>
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<tr>
<td>BAG</td>
<td>basin advisory group</td>
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<tr>
<td>BMP</td>
<td>best management practice</td>
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<tr>
<td>BOR</td>
<td>United States Bureau of Reclamation</td>
</tr>
<tr>
<td>BURP</td>
<td>Beneficial Use Reconnaissance Program</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations (refers to citations in the federal administrative rules)</td>
</tr>
<tr>
<td>cfs</td>
<td>cubic feet per second</td>
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<tr>
<td>CWAL</td>
<td>cold water aquatic life</td>
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<tr>
<td>DMA</td>
<td>Designated Management Agency</td>
</tr>
<tr>
<td>DO</td>
<td>dissolved oxygen</td>
</tr>
<tr>
<td>DWS</td>
<td>domestic water supply</td>
</tr>
<tr>
<td>EPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>GIS</td>
<td>geographic information system</td>
</tr>
<tr>
<td>HUC</td>
<td>hydrologic unit code</td>
</tr>
<tr>
<td>IDAPA</td>
<td>Refers to citations of Idaho administrative rules</td>
</tr>
<tr>
<td>IDFG</td>
<td>Idaho Department of Fish and Game</td>
</tr>
<tr>
<td>IDL</td>
<td>Idaho Department of Lands</td>
</tr>
<tr>
<td>IDWR</td>
<td>Idaho Department of Water Resources</td>
</tr>
<tr>
<td>LA</td>
<td>load allocation</td>
</tr>
<tr>
<td>LBWC</td>
<td>Lower Boise Watershed Council</td>
</tr>
<tr>
<td>LC</td>
<td>load capacity</td>
</tr>
<tr>
<td>m</td>
<td>meter</td>
</tr>
<tr>
<td>mgd</td>
<td>million gallons per day</td>
</tr>
<tr>
<td>mg/L</td>
<td>milligrams per liter</td>
</tr>
<tr>
<td>mL</td>
<td>milliliter</td>
</tr>
<tr>
<td>MOS</td>
<td>margin of safety</td>
</tr>
<tr>
<td>MS4</td>
<td>municipal separate storm sewer system</td>
</tr>
<tr>
<td>n/a</td>
<td>not applicable</td>
</tr>
<tr>
<td>NA</td>
<td>not assessed</td>
</tr>
<tr>
<td>NB</td>
<td>natural background</td>
</tr>
<tr>
<td>NFS</td>
<td>not fully supporting</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
</tr>
<tr>
<td>NRCS</td>
<td>Natural Resources Conservation Service</td>
</tr>
</tbody>
</table>
NTU  nephelometric turbidity unit
PCR  primary contact recreation
POTW Publicly Owned Treatment Works
QA   quality assurance
RM   river mile
SBA  subbasin assessment
SCR  secondary contact recreation
SS   salmonid spawning
SSC  suspended sediment concentration
TAC  technical advisory committee
TMDL total maximum daily load
TN   total nitrogen
TP   total phosphorus
TSS  total suspended sediment
US   United States
USC  United States Code
USDA United States Department of Agriculture
USFS United States Forest Service
USGS United States Geological Survey
WAG  watershed advisory group
WBAG Water Body Assessment Guidance
WBID water body identification number
WLA  wasteload allocation
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 3 water bodies (5 assessment units) in the lower Boise River subbasin that have been placed in Category 5 of Idaho’s most recent federally approved 2012 Integrated Report (DEQ 2014c).

This addendum 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 and previous TMDLs, see the lower Boise River Subbasin Assessment, TMDLs, Addendums, and Five-Year Review (DEQ 1999, 2008, 2009, 2010b).

The TMDL analysis 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 and Mason Creek between Diversion Dam and Parma, along with Sand Hollow Creek, a tributary to the Snake River. Nuisance levels of aquatic growth associated with TP in the lower Boise River (also referred to as the “LBR”) from Middleton to the mouth were associated with impaired cold water aquatic life and contact recreation in the 2012 Integrated Report. Within the physically-complex network of the lower Boise River watershed, tributaries, irrigation conveyances, ground water, unmeasured flows, and other nonpoint sources, along with Publicly Owned Treatment Works (POTW), Municipal Separate Storm Sewer Systems (MS4), industrial wastewater and stormwater sources, and other point sources affect TP levels and nuisance algae in the subbasin.

This subbasin assessment and total maximum daily load (TMDL) addendum quantifies TP pollutant sources and allocates responsibility for load and wasteload allocations needed for the lower Boise River, Mason Creek, and Sand Hollow Creek, to achieve water quality objectives. For more detailed information about the subbasin and previous TMDLs and Implementation Plans, see:

- Lower Boise River TMDL Five-Year Review (DEQ 2009)
• Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008) Sediment and Bacteria Allocations Addendum to the Lower Boise River TMDL (DEQ 2008a)
• 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 and Tributary Subbasin Assessments (DEQ 2001a)
• Lake Lowell TMDL: Addendum to the Lower Boise River Subbasin Assessment and Total Maximum Daily Loads (DEQ 2010b)
• Mason Creek Subbasin Assessment (2001c)
• Sand Hollow Creek Subbasin Assessment (2001d) (tributary to the Snake River)

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 described under Section 140.12 (IDAPA 58.01.02). As described in the Lower Boise River TMDL (DEQ, 1999), 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, which 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. There are at least seven 3rd order, one 4th order, and one 6th order tributaries to the lower Boise River (Figure 1).

Another 6th order stream, Sand Hollow Creek, is included in the subbasin but drains to the Snake River approximately one mile north of the mouth of the lower Boise River (Figure 1).

This addendum specifically addresses the following five impaired AUs:
• Boise River–Middleton to Indian Creek (ID17050114SW005_06b)
• Boise River–Indian Creek to Mouth (ID17050114SW001_06)
• Mason Creek–Entire Watershed (ID17050114SW006_02)
• Sand Hollow Creek–C Line Canal to I-84 (ID17050114SW016_03)
• Sand Hollow Creek–Sharp Road to Snake River (ID17050114SW017_06)

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

The impaired beneficial uses in the subbasin are cold water aquatic life, contact recreation, and salmonid spawning (SS). TP pollutant sources to the lower Boise River include upstream contributions (background), 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 \( \leq 70 \) mg/L from May 1 - September 30 in the Snake River-Hells Canyon (SR-HC) TMDL (DEQ and ODEQ 2004)

Figure 1. The lower Boise River subbasin. The impaired AUs that are specifically addressed in this TMDL addendum are identified by their AU number on the map (impaired AUs in this TMDL addendum begin with 17050114).
Key Findings


The lower Boise River from Middleton to the confluence with the Snake River, along with Mason Creek, and two segments of Sand Hollow Creek (a tributary to the Snake River) are listed as impaired (Category 5) from TP or Nutrients Suspected in the 2012 Integrated Report (Table 1). In addition, upstream and tributary AUs that are not listed as impaired on 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 beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation, while Mason and Sand Hollow Creeks have designated beneficial uses of contact recreation and presumed uses of cold water aquatic life.

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

<table>
<thead>
<tr>
<th>Water Body</th>
<th>Assessment Unit</th>
<th>Pollutant</th>
<th>TMDL Completed</th>
<th>Recommended Changes to the Next Integrated Report</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River–Middleton to Indian Creek</td>
<td>ID17050114SW005_06b</td>
<td>Total Phosphorus</td>
<td>Yes</td>
<td>Move to Category 4a</td>
<td>TP TMDL Completed</td>
</tr>
<tr>
<td>Boise River–Indian Creek to Mouth</td>
<td>ID17050114SW001_06</td>
<td>Total Phosphorus</td>
<td>Yes</td>
<td>Move to Category 4a</td>
<td>TP TMDL Completed</td>
</tr>
<tr>
<td>Mason Creek–Entire Watershed</td>
<td>ID17050114SW006_02</td>
<td>Cause Unknown - Nutrients Suspected</td>
<td>Yes</td>
<td>Move to Category 4a</td>
<td>TP TMDL Completed</td>
</tr>
<tr>
<td>Sand Hollow Creek–C Line Canal to I-84</td>
<td>ID17050114SW016_03</td>
<td>Cause Unknown - Nutrients Suspected</td>
<td>Yes</td>
<td>Move to Category 4a</td>
<td>TP TMDL Completed</td>
</tr>
<tr>
<td>Sand Hollow Creek–Sharp Road to Snake River</td>
<td>ID17050114SW017_06</td>
<td>Cause Unknown - Nutrients Suspected</td>
<td>Yes</td>
<td>Move to Category 4a</td>
<td>TP TMDL Completed</td>
</tr>
</tbody>
</table>

The 2012 Integrated Report also places the lower Boise River, from Diversion Dam to the mouth, as in Category 4c – Waters of the State Not Impaired by a Pollutant. The report further states:

“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. ‘ (p.48, LBR TMDL, IDEQ, 2000).’

The lower Boise River TP TMDL addendum 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, but can be given up to two permit cycles (10 years from the approval of the TMDL) to achieve their wasteload allocations.

This TP TMDL addendum, however, does not define an implementation time frame for agricultural and other nonpoint sources; rather, implementation would begin as soon as possible and continue until the load allocation targets are met. This acknowledges that 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.

DEQ, through the lower Boise River TP TMDL 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 (SWCC), 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 the post-TMDL implementation, monitoring and analyses should be conducted under DEQ, 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:

- Available funding, cost-sharing, willing partners to help manage agricultural and other nonpoint source TP contributions,
- Effectiveness of agricultural 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, and
- 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 concentrations (and TP load equivalents) $\leq 0.07$ mg/L in the lower Boise River near Parma and in Sand Hollow Creek to achieve the 2004 Snake River-Hells Canyon TMDL TP target; and

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

**Achieve the SR-HC TMDL Target of TP $\leq 0.07$ from May 1 – September 30**

The final Snake River-Hells Canyon (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 (Snake 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 develop individual nutrient TMDLs or plans for implementation that satisfy final SR-HC nutrient TMDL requirements. Load allocations were developed to achieve target TP concentrations of $\leq 0.07$ mg/L in the Snake River and Brownlee Reservoir, particularly during periods when dissolved oxygen levels are low. Compliance with the SR-HC TMDL was determined by applying a TP target of $\leq 0.07$ mg/L at the mouth of the lower Boise River (near Parma) from May 1 – September 30.

The lower Boise River TMDL utilizes 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 $\leq 0.07$ mg/L identified in the SR-HC TMDL. This analysis utilized 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 $\leq 150$ mg/m$^2$ in the lower Boise River. As a result, the TP allocations in this

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1 TP load equivalent, for purposes of this TMDL, is defined as the mass of TP (e.g. lbs/day, kg/day) that corresponds with an identified TP concentration (mg/L).
TMDL represent the TP loadings that are assured to achieve both the SR-HC TMDL and lower Boise River mean monthly periphyton target, and not the maximum potential TP loadings into the lower Boise River that would solely achieve the SR-HC TMDL target.

**Achieve the Mean Monthly Benthic Chlorophyll a Target**

The TMDL also utilizes the AQUATOX model, USGS 2012 and 2013 synoptic sampling data, historical data, and other available information to develop TP allocations needed to achieve mean monthly benthic (periphyton) chlorophyll a target of ≤ 150 mg/m² within the two impaired AUs of the lower Boise River. If it appears that full support of beneficial uses in the lower Boise River are 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 model scenario (Scenario 3) and TMDL allocation structure that achieves the May 1 – September 30 TP target of ≤ 0.07 mg/L near Parma, as well as achieves the ≤ 150 mg/m² mean monthly periphyton target is as follows:

- **Scenario 3 – Final Model Scenario and TMDL Allocation Structure**
  - Point sources at 0.1 mg/L TP May – September
  - Point Sources 0.35 mg/L TP October – April (except 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%
  - Non-stormwater (dry weather) TP loads by 84%

**May 1 – September 30 TMDL Allocations**

The following TP sector allocations represent the gross load and load reductions necessary to achieve:

- **The SR-HC TMDL target of ≤ 0.07 mg/L at the mouth of the lower Boise River and the mouth of Sand Hollow Creek, and**
- **The mean monthly periphyton target of ≤ 150 mg/m² within the impaired AUs of the lower Boise River**
Figure 2. TP loads, capacities, and water quality targets for May 1 – September 30, presented as daily averages. These are calculated for: 1) the Boise River near Parma; 2) Mason Creek, a lower Boise River tributary; and: 3) Sand Hollow, a Snake River tributary.

<table>
<thead>
<tr>
<th>Water Body 1</th>
<th>Flow 2 (cfs)</th>
<th>Flow Rank (%)</th>
<th>Current Load 2</th>
<th>Load Capacity 3</th>
<th>Water Quality Targets 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>TP Conc. (mg/L)</td>
<td>TP Load (lbs/day)</td>
<td>Target TP Conc. (mg/L)</td>
</tr>
<tr>
<td><strong>Lower Boise River near Parma – (AU 001_06)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3268 10th</td>
<td>0.21</td>
<td>3747</td>
<td>≤ 0.07</td>
<td>1233</td>
<td>-2514 (67%)</td>
</tr>
<tr>
<td>912 40th</td>
<td>0.31</td>
<td>1531</td>
<td>≤ 0.07</td>
<td>344</td>
<td>-1187 (78%)</td>
</tr>
<tr>
<td>705 60th</td>
<td>0.31</td>
<td>1190</td>
<td>≤ 0.07</td>
<td>266</td>
<td>-924 (78%)</td>
</tr>
<tr>
<td>USGS August Synoptic Sample 4</td>
<td>624 69th</td>
<td>0.30</td>
<td>1010</td>
<td>≤ 0.07</td>
<td>235</td>
</tr>
<tr>
<td>383 90th</td>
<td>0.36</td>
<td>738</td>
<td>≤ 0.07</td>
<td>145</td>
<td>-593 (80%)</td>
</tr>
<tr>
<td><strong>Mason Creek – (AU 006_02)</strong> (Tributary to the lower Boise River)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>148 Mean</td>
<td>0.41</td>
<td>322</td>
<td>≤ 0.07</td>
<td>56</td>
<td>-266 (82%)</td>
</tr>
<tr>
<td><strong>Sand Hollow – (AU 017_06)</strong> (Tributary to the Snake River)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>141 Mean</td>
<td>0.4</td>
<td>303</td>
<td>≤ 0.07</td>
<td>53</td>
<td>-250 (83%)</td>
</tr>
</tbody>
</table>

1 All assessment units (AUs) begin with ID17050114.
2 Lower Boise River – based on data from May 1 – September 30, 1987 through 2012 and duration curves with water quality targets.
Mason Creek – based on USGS and ISDA mean data from May 1 – September 30, 1995 through 2012.
3 Lower Boise River load capacities and water quality targets are applied near Parma, using duration curves.
Mason Creek and Sand Hollow Creek – mean load capacities and water quality targets calculated and applied as instream conditions.
4 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.
Table 2. 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, with higher weekly average limits based on the coefficient of variation, in NPDES permits. The green highlight represents data derived from the USGS August 2012 mass balance model for the lower Boise River (Etheridge 2013). See Section 5.4.1 for further description of the TP allocation development.

<table>
<thead>
<tr>
<th>Parma Flow (cfs)</th>
<th>Background TP Allocations1 (per day as monthly average)</th>
<th>NPDES WWTF and Industry TP Allocations2 (per day as monthly average)</th>
<th>Fish Hatchery TP Allocations3 (per day as monthly average)</th>
<th>Tributary TP Allocations w/o NPDES Flows and TP Loads4 (per day as monthly average)</th>
<th>Ground Water TP Allocations5 (per day as monthly average)</th>
<th>Dry Weather Stormwater TP Allocations (Accounted for in Tribs)5 (per day as monthly average)</th>
<th>Wet Weather Stormwater TP Allocations7 (per day as monthly average)</th>
<th>TP Input Allocations (per day as monthly average)</th>
<th>TP Inputs Reaching Parma</th>
<th>Parma TP Load w/Allocations (per day as monthly average)</th>
<th>Parma TP Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3268</td>
<td>0.018 317</td>
<td>135.6 0.10 73</td>
<td>37 0.10 20</td>
<td>822 0.07 310</td>
<td>-1390 0.07 -524</td>
<td>168 0.07 63</td>
<td>30 0.25 41</td>
<td>236 254% 601 84%</td>
<td>594 51% 303 80%</td>
<td>625 38% 237 80%</td>
<td>651 34% 224 78%</td>
</tr>
<tr>
<td>912</td>
<td>0.018 88</td>
<td>135.6 0.10 73</td>
<td>37 0.10 20</td>
<td>822 0.07 310</td>
<td>164 0.07 62</td>
<td>168 0.07 63</td>
<td>30 0.25 41</td>
<td>594 51% 303 80%</td>
<td>625 38% 237 80%</td>
<td>651 34% 224 78%</td>
<td></td>
</tr>
<tr>
<td>705</td>
<td>0.018 68</td>
<td>135.6 0.10 73</td>
<td>37 0.10 20</td>
<td>822 0.07 310</td>
<td>300 0.07 113</td>
<td>168 0.07 63</td>
<td>30 0.25 41</td>
<td>625 38% 237 80%</td>
<td>651 34% 224 78%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>624</td>
<td>0.015 50</td>
<td>120.0 0.10 65</td>
<td>34 0.10 18</td>
<td>822 0.07 335</td>
<td>485 0.07 183</td>
<td>168 0.07 63</td>
<td>No Storm Event</td>
<td>651 34% 224 78%</td>
<td>651 34% 224 78%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>383</td>
<td>0.018 37</td>
<td>135.6 0.10 73</td>
<td>37 0.10 20</td>
<td>822 0.07 310</td>
<td>398 0.07 150</td>
<td>168 0.07 63</td>
<td>30 0.25 41</td>
<td>631 23% 145 80%</td>
<td>651 34% 224 78%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 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). Long-term median data and the USGS 2012-2013 synoptic data (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L.
2 POTW and industrial discharge data are based on facility design flows, represented in Table 24. The USGS August 2012 synthetic sample data represent only POTW contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).
3 Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 24.
4 Tributary data were calculated by removing all industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries. The USGS August 2012 synthetic sample calculated tributaries by removing the contributions from only the Meridian and Nampa facilities (Etheridge 2013).
5 The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1315) under various river flow scenarios (Alex Etheridge, pers. comm. 2014). The USGS August 2012 synoptic identified ground water flows as 485 cfs with 0.21 mg/L concentration (Etheridge 2013).
6 Non-stormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E), 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. Non-stormwater (dry weather) 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.
7 Stormwater (wet weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E), 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 synthetic sample (Etheridge 2013).
8 * Note: 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.
Table 3. 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, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

<table>
<thead>
<tr>
<th></th>
<th>Average Daily Background TP^1</th>
<th>Average Daily NPDES POTW and Industry TP^2</th>
<th>Average Fish Hatchery TP^3</th>
<th>Average Tributary (w/o NPDES Flows and Loads) TP^4</th>
<th>Average Ground Water and Unmeasured TP^5</th>
<th>Average Non-Stormwater Dry Weather TP^6</th>
<th>Average Stormwater Wet Weather TP^7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current TP Conc.</strong></td>
<td>0.018</td>
<td>3.27</td>
<td>0.05</td>
<td>0.25</td>
<td>0.21</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Current TP Load</strong></td>
<td>37</td>
<td>1506</td>
<td>9</td>
<td>1144</td>
<td>450</td>
<td>394</td>
<td>71</td>
</tr>
<tr>
<td><strong>Target TP Conc.</strong></td>
<td>0.018</td>
<td>0.1</td>
<td>0.1</td>
<td>0.07</td>
<td>0.07</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>TP Allocation</strong></td>
<td>37</td>
<td>73</td>
<td>20</td>
<td>310</td>
<td>150</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Percent Reduction (%)</strong></td>
<td>0%</td>
<td>-95%</td>
<td>110%</td>
<td>-73%</td>
<td>-67%</td>
<td>-84%</td>
<td>-42%</td>
</tr>
</tbody>
</table>

^1 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.

^2 Publicly Owned Treatment Works (POTW) and industrial discharge data are based on facility design flows, represented in Table 24.

^3 Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 24.

^4 Tributary data (Table 25) were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.

^5 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.

^6 Non-stormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 17 and Appendix E) 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. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

^7 Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 17Appendix E) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.
Figure 3. Current vs. projected TP loads for the lower Boise River from May 1 – September 30.

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s. Stormwater (wet weather) allocations represent a 42% TP load reduction on average across all MS4s.
* Non-stormwater (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. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
Table 4. Point source wasteload and nonpoint source load allocations, May 1 – September 30, for Sand Hollow, a Snake River tributary, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

<table>
<thead>
<tr>
<th>Sand Hollow Creek</th>
<th>Current Flow (mgd/cfs)(^2)</th>
<th>Design Flow (mgd/cfs)(^2)</th>
<th>Current TP Conc. (mg/L)</th>
<th>Current TP Load (lbs/day)</th>
<th>Target TP Conc. (mg/L)</th>
<th>Average TP Allocation (lbs/day as a monthly average)</th>
<th>Average TP Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parma</td>
<td>0.09 mgd 0.14 cfs</td>
<td>0.68 mgd 1.05 cfs</td>
<td>0.21</td>
<td>0.15</td>
<td>≤ 0.07</td>
<td>0.4</td>
<td>+157%</td>
</tr>
<tr>
<td>Nonpoint, ground water and unmeasured</td>
<td>140.7 cfs 139.7 cfs</td>
<td>0.40 301.2</td>
<td>0.07</td>
<td>52.7</td>
<td>-83%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>140.8 cfs 140.8 cfs</td>
<td>0.399 301.4</td>
<td>≤ 0.07</td>
<td>53.1</td>
<td>-82%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) The TP effluent limits identified in NPDES permits will depend on actual flows in Sand Hollow Creek, and will fluctuate from year to year. It is expected that the point source facility will achieve the wasteload allocation targets with 2 permit cycles.

\(^2\) Nonpoint, ground water, and unmeasured are flows and loads from May 1 – September 30 (1983 – 2012), minus flows and loads from the POTW.
Figure 4. Current vs. projected TP loads for Sand Hollow Creek from May 1 – September 30.
October 1 – April 30 TMDL Allocations

The following TP sector allocations represent the gross load and load reductions necessary to achieve:

- The mean monthly periphyton target of $\leq 150 \text{ mg/m}^2$ within the impaired AUs of the lower Boise River
- Average TP load reductions in the lower Boise River, Mason Creek, and Sand Hollow Creek that are expected to fully support beneficial uses and TP concentrations are at or near the EPA Gold Book recommended value of 0.1 mg/L (EPA 1986)

Table 5. TP loads and water quality targets for October 1 – April 30, expressed per day as monthly averages. These are calculated for: 1) the Boise River near Parma; 2) Mason Creek, a lower Boise River tributary, and: 3) Sand Hollow, a Snake River tributary.

<table>
<thead>
<tr>
<th>Water Body</th>
<th>Flow$^1$ (cfs)</th>
<th>Flow Rank (%)</th>
<th>Water Quality Targets$^3$</th>
<th>Current Load$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TP Conc. (mg/L)</td>
</tr>
<tr>
<td>Lower Boise River near Parma – (AU 001_06)</td>
<td>1293 Mean</td>
<td>0.3</td>
<td></td>
<td>2302.0</td>
</tr>
<tr>
<td>Mason Creek – (AU 006_02)</td>
<td>67.7 Mean</td>
<td>0.25</td>
<td></td>
<td>93</td>
</tr>
<tr>
<td>(Tributary to the lower Boise River)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Hollow – (AU 017_06)</td>
<td>63.6 Mean</td>
<td>0.33</td>
<td></td>
<td>113</td>
</tr>
<tr>
<td>(Tributary to the Snake River)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 All assessment units (AUs) begin with ID17050114.
3 Mean load capacities and water quality targets calculated and applied as instream conditions.
Table 6. 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, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

<table>
<thead>
<tr>
<th></th>
<th>Average Daily Background TP&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Average NPDES POTW and Industry TP&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Average Fish Hatchery TP&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Average Tributary (w/o NPDES Flows and Loads) TP&lt;sup&gt;4&lt;/sup&gt;</th>
<th>Average Ground Water and Unmeasured TP&lt;sup&gt;5&lt;/sup&gt;</th>
<th>Average Non-Stormwater Dry Weather TP&lt;sup&gt;6&lt;/sup&gt;</th>
<th>Average Stormwater Wet Weather TP&lt;sup&gt;7&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current TP Conc. (mg/L)</td>
<td>0.018</td>
<td>3.32</td>
<td>0.07</td>
<td>0.22</td>
<td>0.15</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Current TP Load (lbs/day)</td>
<td>Flow Dependent</td>
<td>1394</td>
<td>13</td>
<td>580</td>
<td>127</td>
<td>44</td>
<td>107</td>
</tr>
<tr>
<td>Target TP Conc. (mg/L)</td>
<td>0.018</td>
<td>0.35</td>
<td>0.1</td>
<td>0.07</td>
<td>0.07</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>TP Allocation (lbs/day as a monthly average)</td>
<td>Flow Dependent</td>
<td>256</td>
<td>20</td>
<td>178</td>
<td>57</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Percent Reduction (%)</td>
<td>0%</td>
<td>-82%</td>
<td>+50%</td>
<td>-69%</td>
<td>-55%</td>
<td>-84%</td>
<td>-43%</td>
</tr>
</tbody>
</table>

<sup>1</sup> 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). The actual background loading (lbs) is variable depending on the river inflow from upstream, groundwater, and tributary/drain sources.

<sup>2</sup> POTW and industrial discharge data are based on facility design flows, represented in Error! Reference source not found.. Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa identified in Table 24..Error! Reference source not found..

<sup>3</sup> Tributary data (Table 29) were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.

<sup>4</sup> The USGS October 2012 and March 2013 mass balance models were used to estimate average ground water flows.

<sup>5</sup> Non-stormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 31 and Appendix E) 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. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

<sup>6</sup> Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Appendix E) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.
Figure 5. Current projected TP loads for the lower Boise River from October 1 – April 30.

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

* Non-stormwater (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. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and groundwater load allocations.
Table 7. Point source wasteload and nonpoint source load allocations, October 1 – April 30, for Sand Hollow, a Snake River tributary, presented per day as monthly averages\(^1\). DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

<table>
<thead>
<tr>
<th>Sand Hollow Creek</th>
<th>Current Flow (mgd/cfs)(^2)</th>
<th>Design Flow (mgd/cfs)(^2)</th>
<th>Current TP Conc. (mg/L)</th>
<th>Current TP Load (lbs/day)</th>
<th>Target TP Conc. (mg/L)</th>
<th>Average TP Allocation (lbs/day as a monthly average)</th>
<th>Average TP Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parma</td>
<td>0.13 mgd</td>
<td>0.68 mgd</td>
<td>0.12</td>
<td>0.1</td>
<td>0.35</td>
<td>1.99</td>
<td>+1426%</td>
</tr>
<tr>
<td>Nonpoint, ground water and unmeasured</td>
<td>63.4 cfs</td>
<td>62.6 cfs</td>
<td>0.33</td>
<td>113.2</td>
<td>0.07</td>
<td>23.6</td>
<td>-79%</td>
</tr>
<tr>
<td>Total</td>
<td>63.6 cfs</td>
<td>63.6 cfs</td>
<td>0.33</td>
<td>113.3</td>
<td>0.075</td>
<td>25.7</td>
<td>-77%</td>
</tr>
</tbody>
</table>

\(^1\) The TP effluent limits identified in NPDES permits will depend on actual flows in Sand Hollow, and will fluctuate from year to year. It is expected that the point source facility will achieve the wasteload allocation targets with 2 permit cycles.

\(^2\) Nonpoint, ground water, and unmeasured are flows and loads from May 1 – September 30 (1983 – 2012), minus flows and loads from the POTW.
Current vs. Projected TP Loads in Sand Hollow Creek
(October 1 - April 30)

Figure 6. Current vs. projected TP loads for Sand Hollow Creek from October 1 – April 30.
Instream Periphyton and TP Reductions

The final TMDL model scenario (Scenario 3) and TMDL allocation described above reduces the predicted year-round periphyton growth, and TP concentrations and loads in the lower Boise River. Specifically, the final TMDL model scenario (Scenario 3) and TP allocation structure:

- Achieves the mean monthly benthic chlorophyll a target of ≤ 150 mg/m² in the impaired AUs of the lower Boise River. Multiple lines of evidence indicate that the TMDL phosphorus reductions are sufficient 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 in model segment 10 and September in segment 11, these are likely due to growth of low nutrient diatoms which can proliferate under low nutrient and other habitat conditions. These rationales are further discussed in the Model Report (DEQ 2014a).

- 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.
Figure 7. 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/m².
Figure 8. Predicted mean monthly periphyton from January 1, 2012 through April 22, 2013 under the final TMDL scenario (Scenario 3) 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/m².
Figure 9. Current modeled mean monthly periphyton from January 1, 2012 through April 22, 2013 in the TP-impaired AU's of the lower Boise River. The red line indicates the mean monthly periphyton target of ≤ 150 mg/m².
Figure 10. 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/m².
Figure 11. 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/m².
Figure 12. 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/m².
Figure 13. 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 14. 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.
It is clear that 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. That is, TP reductions beyond those modeled the final TMDL model scenario (Scenario 3) do not yield measureable improvements in periphyton reductions. Figure 15 further represents the annual average periphyton in segments 9-13 (the 2 impaired AUs of the lower Boise River) under the various model scenarios. This illustrates, again, that large reductions in periphyton growth are expected to occur under the final model scenario, but additional TP reductions would result in only slight periphyton reductions.

Figure 15. Annual average periphyton in model segments 9-13 (the impaired AUs of the lower Boise River) under seven model scenarios. Further descriptions of each model scenario are available in the preceding paragraphs and Section 5 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, during, and after the public comment period in Month 2015, and in the subsequent TMDL implementation. A distribution list and detailed identification of LBWC and public participation through the TMDL development are available in Appendix C. 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: http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx. Posted information includes this draft of the TMDL, the items listed below, and much more:

- November 2013 – Draft Lower Boise River Subbasin Assessment and Total Phosphorus TMDL Addendum (v1)
- February 2014 – Draft Lower Boise River Subbasin Assessment and Total Phosphorus TMDL Addendum (v2)
- February 2014 – Draft Lower Boise River Phosphorus: AQUATOX Model Report (v2)
- April 2014 – Calibrated AQUATOX model, import files, and data
- February 2014 – Lower Boise River AQUATOX Model Calibration Comments
- November 2014 – Draft Lower Boise River Subbasin Assessment and Total Phosphorus TMDL Addendum (v3)
- November 2014 – AQUATOX model TMDL scenario files, import files, and data
- January 2015 – Draft Lower Boise River Subbasin Assessment and Total Phosphorus TMDL Addendum (v4)
Introduction

This document addresses 5 assessment units in the lower Boise River subbasin (two main stem AUs, two Sand Hollow Creek AUs, and one Mason Creek AU) that have been placed in Category 5 of Idaho’s most recent federally approved 2012 Integrated Report (DEQ 2014c). The purpose of this total maximum daily load (TMDL) addendum is to characterize and document 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, 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 lower Boise River subbasin. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation 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. The Idaho Department of Environmental Quality (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 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 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 presents an addendum to previously completed lower Boise River subbasin assessments, TMDLs and addendums (DEQ 1999, 2003, 2008, 2009, 2010b, 2012). Addendums address waters within a hydrologic unit code (HUC) that did not previously receive a TMDL for a specific pollutant, or they update the TMDL for a specific pollutant with an existing EPA approved TMDL. This TMDL addresses water bodies in the subbasin that are on Idaho’s current §303(d) list for Total Phosphorus (TP) and 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 Lower Boise River TMDL Subbasin Assessment TMDL (DEQ 1999), the Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008), and the Lower Boise River Total Phosphorus Five-Year Review (2009).

1.2 Subwatershed Characteristics
The lower Boise River watershed is one of the more complex watersheds in Idaho (Figure 16; DEQ 2009). Figure 18 shows the subwatershed delineations that are operated, in part, based on this conveyance network (DEQ 2009). Figure 19 provides a simplified schematic of the diversions, drains, and tributaries along the lower Boise River (Etheridge 2013), while Figure 20 displays the daily mean flows at the upper end of the lower Boise River at Diversion Dam, near Middleton, and near the mouth at Parma.

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

- Five Mile and Ten Mile Creek Subbasin Assessment (DEQ 2001)
- Mason Creek Subbasin Assessment (DEQ 2001)
The following description comes from the 1999 Lower Boise River TMDL Subbasin Assessment (DEQ 1999):

“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), 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.

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.”

In addition, the Lower Boise River TMDL Subbasin Assessment (DEQ 1999) provides a concise description of the movement and management of water between Diversion Dam and Parma, which DEQ asserts is still largely applicable 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

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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.
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 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."

In addition to be listed in Category 5 because of excess nutrients, the 2012 Integrated Report identifies the lower Boise River, from Diversion Dam to the mouth, as Category 4c – Waters of the State Not Impaired by a Pollutant in recognition of the impact of flow and habitat alteration on beneficial use support. The 2012 report states:

"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." (p.48, LBR TMDL, IDEQ, 2000)."

Sources of phosphorus are diverse due to the land ownership and management in the watershed (Figure 17) 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 16. The lower Boise River subbasin and delineation of subwatersheds (DEQ 2009).
Figure 17. Land use in the lower Boise River Subbasin.
Figure 18. Lower Boise River dams and diversions (canals) permitted through the Idaho Department of Water Resources (IDWR) (DEQ 2009).
Figure 19. Diversions, drains, and tributaries along the lower Boise River (copied from Etheridge 2013).
Figure 20. Daily mean flows (cfs) in the lower Boise River at Diversion Dam (USBR), near Middleton (Idaho Power Company), and near Parma (USGS).

Lower Boise River

This TMDL addresses two lower Boise River main stem AUs identified as impaired on the 2012 §303(d) list (Figure 21):

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

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

The lower Boise River is a 64-mile stretch of river that flows through Ada County and Canyon County. 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 subwatershed were provided in the Lower Boise River Subbasin Assessment (DEQ 1999) and Lower Boise River TMDL Five-Year Review (DEQ 2009), which are available at: [http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx](http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx)
Mason Creek

This TMDL addresses one Mason Creek AU identified as impaired on the 2012 §303(d) list (Figure 21):

- Mason Creek–Entire Watershed (ID17050114SW006_02)

The Mason Creek subwatershed drains 62 square miles of rangeland, agricultural land and urban areas. Mason Creek is located in the southern portion of the lower Boise River watershed and flows through Canyon County, but the headwaters are located in Ada County. The stream flows in a northwesterly direction from its origin at the New York Canal to its confluence with the lower Boise River in the city of Caldwell.

Detailed discussions of the Mason Creek subwatershed were provided in the Mason Creek Subbasin Assessment (DEQ 2001c), which is available at: http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx

Sand Hollow

The TMDL addresses two Sand Hollow Creek AUs identified as impaired on the 2012 §303(d) list (Figure 21):

- Sand Hollow Creek–C Line Canal to I-84 (ID17050114SW016_03)
- Sand Hollow Creek–Sharp Road to Snake River (ID17050114SW017_06)

The Sand Hollow Creek subwatershed drains 93 square miles of rangeland, agricultural land and mixed rural farmstead. Sand Hollow Creek is located in the northwest portion of the lower Boise River watershed, although it ultimately drains to the Snake River. Sand Hollow Creek largely flows through Canyon County. However, the headwaters are located in Gem and Payette Counties, north of the town of Notus along the topography separating the lower Boise River and lower Payette River subbasins. The stream flows in a southwesterly direction from its origin to Interstate 84, then in a northwesterly direction from the interstate to its confluence with the Snake River approximately one mile north of the mouth of the Boise River.

Detailed discussions of the Sand Hollow Creek subwatershed were provided in the Sand Hollow Creek Subbasin Assessment (DEQ 2001c), which is available at: http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx
Figure 21. 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 17050114).
2 Subbasin Assessment—Water Quality Concerns and Status

A subbasin assessment 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. This section identifies §303(d)-listed waters that are addressed in the TMDL, listing history, and the rationales for listing, the 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 in the subbasin.

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

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 8 shows the pollutants listed and the basis for listing for each §303(d)-listed AU and pollutant combination in the lower Boise River subbasin that is addressed in this TMDL. It also shows three AUs that are not on the §303(d) list but are intimately tied to the water quality of the listed AUs.

Two AUs on the main stem lower Boise River are listed as impaired for TP, in part, due to EPA’s Partial Approval/Partial Disapproval of Idaho’s Final 2008 303(d) list letter dated February 4, 2009, in which EPA disapproved delisting of the lower Boise River for nutrients (total phosphorus) because DEQ did not demonstrate good cause to delist, and that DEQ provided insufficient rationale to justify the exclusion of existing and readily available data. EPA subsequently took public comment on this reversal that ended May 15, 2009. EPA concluded in their final decision letter dated October 13, 2009 that the lower Boise River is water quality-limited and EPA returned the lower Boise River to Idaho’s 303(d) list. EPA's final determination on the lower Boise River (EPA 2009a) is available at [http://www.deq.idaho.gov/media/773615-2008-ir-epa-response-lower-boise-river-hemcreek-101309.pdf](http://www.deq.idaho.gov/media/773615-2008-ir-epa-response-lower-boise-river-hemcreek-101309.pdf)
Table 8. Lower Boise River subbasin §303(d)-listed assessment unit and pollutant combinations that are addressed in this TMDL.

<table>
<thead>
<tr>
<th>Assessment Unit Name</th>
<th>Assessment Unit Number</th>
<th>Listed Pollutants</th>
<th>Listing Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River–Middleton to Indian Creek</td>
<td>ID17050114SW005_06b</td>
<td>Total Phosphorus</td>
<td>1996 §303(d) list - Nutrients</td>
</tr>
<tr>
<td>Boise River–Indian Creek to Mouth</td>
<td>ID17050114SW001_06</td>
<td>Total Phosphorus</td>
<td>1996 §303(d) list - Nutrients</td>
</tr>
<tr>
<td>Mason Creek–Entire Watershed</td>
<td>ID17050114SW006_02</td>
<td>Cause Unknown - Nutrients Suspected</td>
<td>1996 §303(d) list - Nutrients</td>
</tr>
<tr>
<td>Sand Hollow Creek – C-Line Canal to I-84</td>
<td>ID17050114SW016_03</td>
<td>Cause Unknown - Nutrients Suspected</td>
<td>1996 §303(d) list - Nutrients</td>
</tr>
<tr>
<td>Sand Hollow Creek – Sharp Road to Snake River</td>
<td>ID17050114SW017_06</td>
<td>Cause Unknown - Nutrients Suspected</td>
<td>1996 §303(d) list - Nutrients</td>
</tr>
</tbody>
</table>

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.

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 WQS have three sections that address nondesignated waters. Section 101.02 and 101.03 specifically address nondesignated man-made waterways and private waters. All other undesignated waters are addressed by section 101.01. Under this section, absent information on existing uses, DEQ presumes that most of 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).

2.2.4 Man-made Waterways and Private Waters

Man-made waterways and private waters have no presumed use protections. Manmade 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.
2.2.5 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 Boise River AUs are designated for cold water aquatic life and recreational uses. Mason Creek and Sand Hollow are designated for recreational uses, but are undesignated for aquatic life. Under section 101.01 (discussed above) Mason Creek and Sand Hollow are presumed to support cold water aquatic life, and so are protected for this use through the application of the applicable cold water aquatic life criteria. Part of the purpose of a Subbasin Assessment is to review whether the uses that are designated are attainable uses. For the Lower Boise Subbasin, this means looking at whether cold water aquatic life and recreational uses are attainable uses in the Boise River, Mason Creek and Sand Hollow AUs.

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, Mason Creek and Sand Hollow Creek AUs. In the impaired AUs of the lower Boise River, 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 (1999) of the lower Boise River. Similarly, USGS has documented the presence of cold water aquatic fishes and macroinvertebrates throughout the lower Boise River, including the impaired AUs (MacCoy 2004, 2006).

The DEQ Beneficial Use Reconnaissance Program (BURP) has collected fish and macroinvertebrate data on Mason Creek and Sand Hollow Creek. The data for both streams identify the presence of aquatic macroinvertebrates, and the Mason Creek BURP report identifies the presence of cool water fishes such as redside shiner, smallmouth bass, and northern pikeminnow. Additionally, the USGS found 7 trout in Mason Creek during October 2011 (Etheridge et al. 2014). The Sand Hollow BURP report did not include fisheries data, but the 2001 Sand Hollow Creek Subbasin Assessment identifies game, nongame, and trout fishes that have been collected in the creek (DEQ 2001d). The 2001 Mason Creek and Sand Hollow Creek Subbasin Assessments (DEQ 2001c, 200d) also document that during the summer, contact recreation occurs at several locations in both streams, although the managing irrigation districts discourage such activities (alternatively, canals can be posted as no trespassing).

Based upon the above described information, the AUs addressed by this Subbasin Assessment and TMDL are appropriately designated for cold water aquatic life and recreational uses because these are existing or attained uses. Beneficial uses of the impaired AUs addressed in this TMDL are presented in.
Table 9. Lower Boise River subbasin beneficial uses of §303(d)-listed streams addressed in this TMDL.

<table>
<thead>
<tr>
<th>Assessment Unit Name</th>
<th>Assessment Unit Number</th>
<th>Beneficial Uses&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Type of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River—Middleton to Indian Creek</td>
<td>ID17050114SW005_06b</td>
<td>COLD, SS, PCR</td>
<td>Designated</td>
</tr>
<tr>
<td>Boise River—Indian Creek to Mouth</td>
<td>ID17050114SW001_06</td>
<td>COLD, PCR SS&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Designated Existing&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mason Creek—Entire Watershed</td>
<td>ID17050114SW006_02</td>
<td>COLD SCR</td>
<td>Presumed</td>
</tr>
<tr>
<td>Sand Hollow Creek—C-Line Canal to I-84</td>
<td>ID17050114SW016_03</td>
<td>COLD SCR</td>
<td>Presumed</td>
</tr>
<tr>
<td>Sand Hollow Creek—Sharp Road to Snake River</td>
<td>ID17050114SW017_06</td>
<td>COLD SCR</td>
<td>Presumed</td>
</tr>
</tbody>
</table>

<sup>a</sup> Cold water aquatic life (COLD), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR).

<sup>b</sup> 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).

2.2.6 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 10).

Table 10. Numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Primary Contact Recreation</th>
<th>Secondary Contact Recreation</th>
<th>Cold Water Aquatic Life</th>
<th>Salmonid Spawning&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacteria</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geometric mean</td>
<td>&lt;126 &lt;i&gt;E. coli&lt;/i&gt;/100 mL</td>
<td>&lt;126 &lt;i&gt;E. coli&lt;/i&gt;/100 mL</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Single sample&lt;sup&gt;c&lt;/sup&gt;</td>
<td>≤406 &lt;i&gt;E. coli&lt;/i&gt;/100 mL</td>
<td>≤576 &lt;i&gt;E. coli&lt;/i&gt;/100 mL</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>pH</td>
<td>—</td>
<td>—</td>
<td>Between 6.5 and 9.0</td>
<td>Between 6.5 and 9.5</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------</td>
<td>---------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Dissolved oxygen (DO)</td>
<td>—</td>
<td>—</td>
<td>DO exceeds 6.0</td>
<td>Water Column DO: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>milligrams/liter (mg/L)</td>
<td>Inter gravel DO: DO exceeds 5.0 mg/L for a 1-day minimum and exceeds 6.0 mg/L for a 7-day average</td>
</tr>
<tr>
<td>Temperature</td>
<td>—</td>
<td>—</td>
<td>22 °C or less daily maximum; 19 °C or less daily average</td>
<td>13 °C or less daily maximum; 9 °C or less daily average</td>
</tr>
<tr>
<td>Truckidity</td>
<td>—</td>
<td>—</td>
<td>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.</td>
<td>—</td>
</tr>
<tr>
<td>Ammonia</td>
<td>—</td>
<td>—</td>
<td>Ammonia not to exceed calculated concentration based on pH and temperature.</td>
<td>—</td>
</tr>
</tbody>
</table>

a During spawning and incubation periods for inhabiting species
b *Escherichia coli* per 100 milliliters
c 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 set forth in Subsections 251.01.b.i., 251.01.b.ii., and 251.01.b.iii., then additional samples must be taken as specified in Subsection 251.01.c.
d 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.

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 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 ≤ 150 mg/m². To date, the LBWC has supported this target only for season May 1 through September 30 and for recreational beneficial uses. DEQ expanded the target to annul. The expanded annual target was based on discussions with the 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/m2 was based largely on work conducted in Montana, in which 70% of the public identified as acceptable for recreation during the growing season from July 1 – September 30 (Supplee et al. 2008, 2009). In contrast, less than 30% of the public identified periphyton of ≥ 200 mg/m² as acceptable for recreation. The target is similar to other locations, including Montana, Minnesota, Colorado, and the Clark Fork River, for which the
maximum summer periphyton target is ≤ 150 mg/m² (TSIC 1998, MDEQ 2008, CDPHE 2013, MPAC 2013).

Additional scientific findings support the use of a benthic chlorophyll a target of ≤150 mg/m² 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/m² and enriched waters often have benthic chlorophyll a concentrations > 150 mg/m² (Welch et al. 1988, Dodds and Welch 2000). Biggs (2000) asserted that chlorophyll-a levels > 150-200 mg/m² 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) (e.g. 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 concentration leads 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). Above 100 mg/m² chlorophyll a, Welch et al. (1988) observed that filamentous species tended to dominate the periphytic composition.

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 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 58.01.02.050.02. The procedure relies heavily upon 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 22).
Figure 22. Determination steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

2.3 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 assessment units of the lower Boise River, Mason Creek, and Sand Hollow Creek.
Since the Lower Boise River TMDL Subbasin Assessment 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 Total Phosphorus Five-Year Review (DEQ 2009), available at http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx.

Similarly, DEQ completed the Mason Creek Subbasin Assessment (2001c) and the Sand Hollow Creek Subbasin Assessment (2001d), which identify data collected in the respective subwatersheds. Both of these reports are available at http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx.

Since then, water quality and quantity data have continued to be collected in the lower Boise River subbasin by DEQ, LBWC, USGS, ISDA, municipalities, and other agencies and organizations (see Appendix B – Data Sources).

The DEQ BURP has monitored several sites on the lower Boise River and within the subbasin (Figure 23). 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.

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 (See Appendix B. Data Sources) 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 DEQ’s AQUATOX Model Report (DEQ 2014a) and DEQ’s AQUATOX Quality Assurance Project Plan (DEQ 2014b).

USGS data, available through the National Water Information System (NWIS) 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). 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 molybdenium blue by ascorbic acid.
These methods are typically applicable for orthophosphate concentrations in the range of 0.01 to 6 mg/L.

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 the assumption 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 five-year assessments of the TMDL. It is important to note that using this conservative approach provides reasonable assurance that this TMDL will achieve water quality standards to support beneficial uses.

**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.

The first component is magnitude, which 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.

The second component is the duration, or the period of time over which concentrations can be averaged and beneficial uses (e.g. aquatic life and contact recreation) can be exposed to elevated levels of pollutants without harm. Since collected 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: 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).

The third component is the frequency, or how often characteristic water quality conditions may occur in the river without impairing the beneficial uses. While the robustness of the dataset is
important for evaluating the frequency, an estimation of the level of various magnitudes of conditions occur once in three seasons and once in ten seasons is described below.

**Lower Boise River**

Due to higher flows in the lower Boise River than are typically feasible for completing BURP activities, BURP protocol could not be completed 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/wq2010/](http://mapcase.deq.idaho.gov/wq2010/).
Figure 23. DEQ BURP sites in the lower Boise River Subbasin.
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, subsequent TP concentration near Parma (0.32 mg/L) are 2.7 times greater than at Glenwood Bridge (Figure 24). The TP concentrations in the Boise River near Parma are approximately 16 times greater than at the upstream monitoring location of Diversion Dam.

**Figure 24.** TP data collected by USGS on the lower Boise River. The green boxes, indicate the 25th and 75th data percentiles and are parted by the line representing the median value. Measured values below the detection limit at Diversion were given the detection limit 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 25). 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 are approximately 14 times greater than at the upstream monitoring location of Diversion Dam.

![Suspended Sediment Concentration](image)

**Figure 25.** Suspended sediment concentration (SSC) data collected by USGS on the lower Boise River. The green boxes indicate the 25th and 75th 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 26). Median chlorophyll a is approximately 2.7 times greater at Glenwood Bridge (13.9 mg/m²) than Eckert Road (5.0 mg/m²). The median chlorophyll a increases by approximately 4.2 times from Glenwood to Middleton (58.2 mg/m²), and Middleton to Caldwell (249.0 mg/m²). Conversely, chlorophyll a at Parma (181.0 mg/m²) 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, suspended sediment concentrations, available light, phosphorus and other nutrient sources, and water temperatures, to name a few.
Algae Community Composition

The lower Boise River algal community composition analyses conducted by Rushforth (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 2014) (Figure 27):

- 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 28) help to 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*).

<table>
<thead>
<tr>
<th>Model segment</th>
<th>River Mile</th>
<th>Site</th>
<th>Lat</th>
<th>Long</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>61.1</td>
<td>Diversion</td>
<td>43.54531</td>
<td>-116.099469</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Blue-greens Cladophora</td>
<td>Greens</td>
<td>High-nutrient diatoms</td>
</tr>
<tr>
<td></td>
<td>September</td>
<td>none</td>
<td>common</td>
<td>abundant</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>none</td>
<td>common</td>
<td>abundant</td>
</tr>
<tr>
<td>2</td>
<td>58.3</td>
<td>Eckert Road</td>
<td>43.56572</td>
<td>-116.132058</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Blue-greens Cladophora</td>
<td>Greens</td>
<td>High-nutrient diatoms</td>
</tr>
<tr>
<td></td>
<td>September</td>
<td>abundant</td>
<td>rare</td>
<td>abundant</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>none</td>
<td>common</td>
<td>common</td>
</tr>
<tr>
<td>3</td>
<td>50.17</td>
<td>Veteran's Parkway</td>
<td>43.6306</td>
<td>-116.241141</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Blue-greens Cladophora</td>
<td>Greens</td>
<td>High-nutrient diatoms</td>
</tr>
<tr>
<td></td>
<td>September</td>
<td>none</td>
<td>none</td>
<td>abundant</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>abundant</td>
<td>none</td>
<td>abundant</td>
</tr>
<tr>
<td>4</td>
<td>47.5</td>
<td>Glenwood</td>
<td>43.66104</td>
<td>-116.279638</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Blue-greens Cladophora</td>
<td>Greens</td>
<td>High-nutrient diatoms</td>
</tr>
<tr>
<td></td>
<td>September</td>
<td>none</td>
<td>rare</td>
<td>abundant</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>none</td>
<td>common</td>
<td>abundant</td>
</tr>
<tr>
<td>5</td>
<td>45.51</td>
<td>Loss to N Channel</td>
<td>43.67043</td>
<td>-116.30753</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>LOSS TO NORTH CHANNEL</td>
<td>43.67043</td>
<td>-116.30753</td>
</tr>
<tr>
<td>7</td>
<td>44.16</td>
<td>Boise WWTP West Boise</td>
<td>43.67271</td>
<td>-116.331657</td>
</tr>
<tr>
<td>8</td>
<td>40.2</td>
<td>GAIN FROM NORTH CHANNEL</td>
<td>43.68138</td>
<td>-116.424625</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Blue-greens Cladophora</td>
<td>Greens</td>
<td>High-nutrient diatoms</td>
</tr>
<tr>
<td></td>
<td>September</td>
<td>none</td>
<td>common</td>
<td>abundant</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>common</td>
<td>none</td>
<td>abundant</td>
</tr>
<tr>
<td>9</td>
<td>31.43</td>
<td>Boise River NR Middleton</td>
<td>43.68704</td>
<td>-116.586769</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Blue-greens Cladophora</td>
<td>Greens</td>
<td>High-nutrient diatoms</td>
</tr>
<tr>
<td></td>
<td>September</td>
<td>none</td>
<td>rare</td>
<td>abundant</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>none</td>
<td>common</td>
<td>abundant</td>
</tr>
<tr>
<td>10</td>
<td>23.98</td>
<td>Boise River at HWY 20-26</td>
<td>43.66898</td>
<td>-116.689233</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Boise River at Notus</td>
<td>43.72088</td>
<td>-116.798002</td>
</tr>
<tr>
<td>12</td>
<td>10.6</td>
<td>Above Dixie Drain</td>
<td>43.73225</td>
<td>-116.889004</td>
</tr>
<tr>
<td>13</td>
<td>8.77</td>
<td>Boise River at HWY 95 Crossing</td>
<td>43.74721</td>
<td>-116.912461</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Blue-greens Cladophora</td>
<td>Greens</td>
<td>High-nutrient diatoms</td>
</tr>
<tr>
<td></td>
<td>September</td>
<td>none</td>
<td>common</td>
<td>abundant</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>common</td>
<td>none</td>
<td>abundant</td>
</tr>
<tr>
<td>14</td>
<td>3.8</td>
<td>Parma</td>
<td>43.78151</td>
<td>-116.972794</td>
</tr>
</tbody>
</table>

Figure 27. Summary of periphytic algal community compositions on the lower Boise River (Rushforth 2007, as displayed in DEQ 2014).
Figure 28. DEQ depiction (DEQ 2014c) of algal community composition in sampled segments, based on previous analyses in the lower Boise River (Rushforth 2007b). Segment 1 = Eckert Road; Segment 2 = Veteran’s Parkway; Segment 3 = Glenwood Bridge; Segment 8 = Middleton; Segment 9 = Caldwell; Segment 13 = Parma.

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 watershed during August and October 2012, and March 2013 (a sampling event that takes place over a relatively short timeframe and under relatively stable hydrologic conditions). The resulting mass balance model and report spanned 46.4 river miles along the Boise River from Veteran’s Parkway in Boise, ID, river mile (RM) 50.2, to Parma, ID (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 wastewater treatment facilities and two fish hatcheries. Idaho Department of Water Resources diversion flow measurements were utilized within the sampled reaches (Etheridge 2013).
A TP mass-balance model was developed by the USGS to evaluate sources of phosphorus to the Boise River during the sampling timeframe (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).

According to the USGS mass-balance model and report (Etheridge 2013):

“...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.”

The report is consistent with other data collected in the lower Boise River (see Appendix B – Data Sources) indicating that at the upstream sampling location, near Veteran’s Parkway (RM 50.2), TP concentrations were between 0.01 and 0.02 mg/L. Conversely, at the downstream sampling location, near Parma, TP concentrations were > 0.29 mg/L during each of the synoptic events (Table 11).

Table 11. Results of USGS synoptic sampling on the lower Boise River in 2012 and 2013.

<table>
<thead>
<tr>
<th>Week of…</th>
<th>Location</th>
<th>Flow (cfs)</th>
<th>TP Concentration (mg/L)</th>
<th>TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 20, 2012</td>
<td>Veteran’s Parkway (RM 50.2)</td>
<td>759</td>
<td>0.015 (0.02)</td>
<td>61.4</td>
</tr>
<tr>
<td></td>
<td>Parma (RM 3.8)</td>
<td>624</td>
<td>0.30</td>
<td>1,010</td>
</tr>
<tr>
<td>October 29, 2012</td>
<td>Veteran’s Parkway (RM 50.2)</td>
<td>234</td>
<td>&lt;0.01</td>
<td>5.10</td>
</tr>
<tr>
<td></td>
<td>Parma (RM 3.8)</td>
<td>924</td>
<td>0.29</td>
<td>1,450</td>
</tr>
<tr>
<td>March 4, 2013</td>
<td>Veteran’s Parkway (RM 50.2)</td>
<td>243</td>
<td>0.01</td>
<td>13.1</td>
</tr>
<tr>
<td></td>
<td>Parma (RM 3.8)</td>
<td>846</td>
<td>0.34</td>
<td>1,550</td>
</tr>
</tbody>
</table>

1 Information in this table can be found in Table 7 of the USGS mass balance report (Etheridge 2013).
2 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).

Forms of Phosphorus

TP includes particulate, non-particulate, inorganic, and organic forms of phosphorus. Orthophosphate (OP) is the bioavailable portion of the TP which can be readily utilized by algae. Therefore, higher levels of OP in TP indicate a greater potential for algal growth.

The Lower Boise River Nutrient Subbasin Assessment (DEQ 2001b) 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 29). At flows greater than the 10th percentile flow rank (≤ 3268 cfs), the mean OP:TP ratio is 0.8, ranging from 0.5 to > 1; whereas, less than the 10th percentile flow rank (≥ 3268 cfs), the mean OP:TP ratio is 0.62, ranging from 0.4 to 0.89.

![Figure 29. 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 measure 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.](image)

Monthly median OP:TP ratios range from a low of 0.64 in April to a high of 0.93 in November (Figure 30). 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 timeframe average 0.83.
Figure 30. Orthophosphorus to TP ratios from USGS data on the lower Boise River near Parma. The green boxes indicate the 25th and 75th 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 OP:TP ratio of 0.053 in August 2009, and 2) a low OP:TP 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 non-irrigation 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) 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 (Etheridge 2013) states:

"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. The OP concentration in Mason Creek was 0.65 mg/L during a runoff period in January 2012, when agricultural fields were fallow (uncropped), suggesting that the low end of estimated OP concentrations in runoff from cropped fields in production is a good estimate for conditions near the mouth of Mason Creek (RM 25.0)…

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."

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, they 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).

**Mason Creek**

DEQ BURP data have been collected on Mason Creek. The BURP data and summary reports can be obtained through DEQ’s 305(b) Integrated Report webpage at [http://mapcase.deq.idaho.gov/wq2010/](http://mapcase.deq.idaho.gov/wq2010/).

The USGS sampled Mason Creek as part of the lower Boise River synoptic sampling efforts in 2012 and 2013 and found that TP concentrations ranged from 0.14 in March to 0.31 mg/L in August (Table 12).

**Table 12. Results of USGS synoptic sampling on Mason Creek in 2012 and 2013.**

<table>
<thead>
<tr>
<th>Week of…</th>
<th>Flow (cfs)</th>
<th>TP Concentration (mg/L)</th>
<th>TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 20, 2012</td>
<td>155</td>
<td>0.31</td>
<td>259</td>
</tr>
<tr>
<td>October 29, 2012</td>
<td>66.1</td>
<td>0.18</td>
<td>64.2</td>
</tr>
<tr>
<td>March 4, 2013</td>
<td>44.7</td>
<td>0.14</td>
<td>33.8</td>
</tr>
</tbody>
</table>

\(^1\) Information in this table can be found in Table 7 of the USGS mass balance report (Etheridge 2013).
Sand Hollow

DEQ BURP data have been collected on Sand Hollow Creek. The BURP data and summary reports can be obtained through DEQ’s 2010 305(b) Integrated Report webpage at http://mapcase.deq.idaho.gov/wq2010/.

The USGS also sampled Sand Hollow as part of the lower Boise River synoptic sampling efforts in 2012 and 2013 and found that TP concentrations ranged from 0.09 in March to 0.35 mg/L in August (Table 13). These concentrations result in TP loads that directly contribute to the Snake River.

Table 13. Results of USGS synoptic sampling on Sand Hollow Creek in 2012 and 2013.

<table>
<thead>
<tr>
<th>Week of…</th>
<th>Flow (cfs)</th>
<th>TP Concentration (mg/L)</th>
<th>TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 20, 2012</td>
<td>169</td>
<td>0.35</td>
<td>319</td>
</tr>
<tr>
<td>October 29, 2012</td>
<td>62.0</td>
<td>0.20</td>
<td>66.9</td>
</tr>
<tr>
<td>March 4, 2013</td>
<td>38.7</td>
<td>0.09</td>
<td>18.8</td>
</tr>
</tbody>
</table>

1 Information in this table can be found in Table 7 of the USGS mass balance report (Etheridge 2013).

2.3.1 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 was used to develop the current TMDL. However, DEQ acknowledges there are additional questions to be investigated (Table 14).

Additional monitoring efforts (Sections 4.1 and 5.1.5) 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 chapters 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 which 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 14. Data gaps identified during the development of the lower Boise River TMDL.

<table>
<thead>
<tr>
<th>Pollutant or Factor</th>
<th>Data Gap</th>
<th>Potential Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus</td>
<td>Better understanding of the phosphorus concentrations and loads in the Boise River, particularly, near Parma</td>
<td>USGS real time water quality monitoring near Parma – Initiated in 2014</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>Better understanding of how phosphorus is diverted, used, and returned to the river (quantities, qualities, types, durations, etc.)</td>
<td>Additional studies utilizing markers to track phosphorus through the subbasin.</td>
</tr>
</tbody>
</table>
### 2.3.2 Status of Beneficial Uses

Based on an analysis of: 1) the 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), cold water aquatic life and contact recreation beneficial uses are impaired by excess nutrients, in the form of TP, within the lower Boise River, Mason Creek, and Sand Hollow Creek. This impairment from excess TP can be expressed as visible slime and other nuisance aquatic growths in these water bodies, impacts to other water quality and aesthetic parameters (see Section 2.2.5), along with 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 designated, existing, or presumed beneficial uses in the lower Boise River subbasin (see Section 2.2.5). TP load and wasteload allocations have not previously been established for the lower Boise River subbasin; however, discussions of nonpoint and point sources in the subbasin have been addressed in:

- Lower Boise River TMDL Five-Year Review (DEQ 2009)
- Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008) Sediment and Bacteria Allocations Addendum to the Lower Boise River TMDL (DEQ 2008a)
- 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 and Tributary Subbasin Assessments (DEQ 2001a)
Lake Lowell TMDL: Addendum to the Lower Boise River Subbasin Assessment and Total Maximum Daily Loads (DEQ 2010b)
- Mason Creek Subbasin Assessment (2001c)
- Sand Hollow Creek Subbasin Assessment (2001d) (tributary to the Snake River)

In addition, DEQ asserts that a new implementation plan should be drafted to reflect this current TMDL for the lower Boise River.

### 3.1 Point Sources

Major point sources within the lower Boise River watershed are mostly POTWs. These POTWs treat raw sewage and discharge effluent to meet 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, as well as into Sand Hollow Creek (a tributary to the Snake River). The phosphorus loads from these POTWs and other facilities are calculated based on discharge monitoring data flows and effluent concentrations (Table 15).

#### Table 15. Current annual point source discharge to the lower Boise River and the Snake River.

<table>
<thead>
<tr>
<th>Source</th>
<th>NPDES Permit No.</th>
<th>Main stem RM or Receiving Water</th>
<th>Mean Discharge (MGD)</th>
<th>Mean TP Concentration (mg/L)</th>
<th>Mean TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River - Main stem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lander</td>
<td>ID-002044-3</td>
<td>RM 50.0</td>
<td>12.39</td>
<td>1.87</td>
<td>193.3</td>
</tr>
<tr>
<td>West Boise</td>
<td>ID-002398-1</td>
<td>RM 44.2</td>
<td>15.11</td>
<td>4.78</td>
<td>602.6</td>
</tr>
<tr>
<td>Middleton</td>
<td>ID-002183-1</td>
<td>RM 27.1</td>
<td>0.46</td>
<td>4.02</td>
<td>15.5</td>
</tr>
<tr>
<td>Caldwell</td>
<td>ID-002150-4</td>
<td>RM 22.6</td>
<td>6.45</td>
<td>2.26</td>
<td>121.6</td>
</tr>
<tr>
<td>IDFG-Eagle</td>
<td>Aquaculture General Permit</td>
<td>RM 41.8</td>
<td>2.62</td>
<td>0.02</td>
<td>0.4</td>
</tr>
<tr>
<td>Boise River - Tributaries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aivmor</td>
<td>In Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Star</td>
<td>ID-002359-1</td>
<td>Lawrence Kennedy Canal (Mill Slough/Boise River)</td>
<td>0.53</td>
<td>1.50</td>
<td>6.7</td>
</tr>
<tr>
<td>Meridian</td>
<td>ID-002019-2</td>
<td>Fivemile Creek (Fifteenmile Creek)</td>
<td>5.40</td>
<td>1.01</td>
<td>45.5</td>
</tr>
<tr>
<td>Sorrento Lactalis</td>
<td>ID-002803-7</td>
<td>Mason Creek</td>
<td>0.63</td>
<td>0.02</td>
<td>0.1</td>
</tr>
<tr>
<td>Nampa</td>
<td>ID-002206-3</td>
<td>Indian Creek</td>
<td>10.10</td>
<td>5.03</td>
<td>423.9</td>
</tr>
<tr>
<td>Kuna</td>
<td>ID-002835-5</td>
<td>Indian Creek</td>
<td>0.49</td>
<td>2.45</td>
<td>9.9</td>
</tr>
<tr>
<td>IDFG-Nampa</td>
<td>Aquaculture General Permit</td>
<td>Wilson Drain and Pond (Indian Creek)</td>
<td>20.42</td>
<td>0.07</td>
<td>11.8</td>
</tr>
<tr>
<td>Darigold</td>
<td>ID-002495-3</td>
<td>RM 22.6 (unmeasured drain)</td>
<td>0.25</td>
<td>0.23</td>
<td>0.5</td>
</tr>
<tr>
<td>Notus</td>
<td>ID-002101-6</td>
<td>Conway Gulch</td>
<td>0.06</td>
<td>4.6</td>
<td>2.2</td>
</tr>
</tbody>
</table>
### 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 which 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 publicly owned treatment works. 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 upon meeting certain definitions in federal regulations [see: 40 CFR 122.26(b)(4), (b)(5) and/or (b)(16)]. To prevent harmful pollutants from being discharged through an MS4, operators of a regulated MS4s must obtain an NPDES permit from EPA, implement a comprehensive municipal stormwater

<table>
<thead>
<tr>
<th>Source</th>
<th>NPDES Permit No.</th>
<th>Main stem RM or Receiving Water</th>
<th>Mean Discharge (MGD)</th>
<th>Mean TP Concentration (mg/L)</th>
<th>Mean TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilder</td>
<td>ID-0020265</td>
<td>Wilder Ditch Drain</td>
<td>0.16</td>
<td>3.37</td>
<td>4.4</td>
</tr>
<tr>
<td>Greenleaf ³</td>
<td>ID-002830-4</td>
<td>West End Drain (Riverside Canal to Dixie Drain)</td>
<td>0.06</td>
<td>0.06</td>
<td>0.03</td>
</tr>
<tr>
<td>ConAgra (XL 4 Star)</td>
<td>ID-000078-7</td>
<td>Indian Creek</td>
<td>No Discharge Currently</td>
<td>No Discharge Currently</td>
<td>No Discharge Currently</td>
</tr>
</tbody>
</table>

1 River Miles identified by USGS in lower Boise River mass balance report (Etheridge 2013); IDFG-Eagle and Darigold RMds are estimated. IDFG-Eagle discharges at Eagle Island and Darigold discharges to an unmeasured drain that discharges into the lower Boise River.

2 Mean TP concentrations calculated from January 1, 2012 through April 30, 2013 using data provided by facilities and/or DMR data.

3 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. 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).

---

**Snake River**

<table>
<thead>
<tr>
<th>Source</th>
<th>NPDES Permit No.</th>
<th>Main stem RM or Receiving Water</th>
<th>Mean Discharge (MGD)</th>
<th>Mean TP Concentration (mg/L)</th>
<th>Mean TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parma</td>
<td>ID-002177-6</td>
<td>Sand Hollow Creek</td>
<td>0.11</td>
<td>0.15</td>
<td>0.14</td>
</tr>
</tbody>
</table>
management program (SWMP), 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 watershed is regulated under either a Phase I or a Phase II NPDES MS4 Permit issued by EPA Region10. Such NPDES regulated municipal stormwater are point sources and will be assigned wasteload allocations.

MS4 systems in the Treasure Valley also convey other inputs of water such as landscape irrigation, building cooling waters, wash waters, agricultural return, ground water infiltration, and construction discharges. These types of discharges are characterized as non-stormwater discharges.

In effect, in some situations, MS4 systems in the valley share “pipes” with non-point source discharges. These non-stormwater (“dry weather”) discharges can be authorized in MS4 permits if they satisfy specific conditions (please see individual MS4 permits for more information). As a result, all non-precipitation driven discharges from MS4s will be referred to as non-stormwater and identified as a point sources with a wasteload allocation in this TMDL. Non-stormwater discharges originating from agricultural lands e.g. irrigation return flows will be identified as NPDES-exempt agricultural flows. A complete list of authorized non-stormwater discharges as defined by local MS4 permits is shown in Table 16. There are eight EPA issued MS4 stormwater permits and 12 different permittees in the lower Boise watershed. These entities discharge phosphorus into the lower Boise River, directly or indirectly, through drains, tributaries, and other hydrological connections (see Table 17).

Table 16. Delineation of NPDES MS4 Permit Authorized non-stormwater discharges

<table>
<thead>
<tr>
<th>Type of MS4 Authorized Non-stormwater Discharge</th>
<th>Point Source</th>
<th>Non-Point Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorized Non-Stormwater</td>
<td>Agricultural Exempt Non-stormwater</td>
<td></td>
</tr>
<tr>
<td>Uncontaminated water line flushing</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Potable water sources</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>landscape irrigation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>lawn watering</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>irrigation water</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>flows from riparian habitats and wetlands</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>diverted stream flows</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>springs</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>rising ground waters</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Source of Total Phosphorus</td>
<td>Present in Groundwater or Surface Water</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Uncontaminated ground water infiltration</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Uncontaminated pumped ground water or spring water</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Foundation and footing drains</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Uncontaminated air conditioning or compressor condensate</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Water from crawlspace pumps</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Individual residential car washing</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Dechlorinated swimming pool discharges</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Routine external building wash down</td>
<td>X</td>
<td></td>
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<tr>
<td>Street and pavement wash waters</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Fire hydrant flushing</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Flows from emergency firefighting activities</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Table 17. 2010 MS4 NPDES Permit Holders and Non-Permitted Jurisdictions with Annual Flows and Loads (prepared by ACHD and stormwater group).

<table>
<thead>
<tr>
<th>Permit Holder/Jurisdiction</th>
<th>NPDES Permit Number</th>
<th>MS4 Permit Type</th>
<th>Permitted Areas</th>
<th>Non-Permitted Areas</th>
<th>% Impervious Area Ratio</th>
<th>Area Ratio</th>
<th>Flow 7,8,9 (CFS)</th>
<th>Load 7,8,9 (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Urbanized Area 1</td>
<td>City Limits 2,3</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acre (m²)</td>
<td>Acre (m²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ada County</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boise/Garden City</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>87</td>
<td>55,773</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boise</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>83</td>
<td>53,053</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Garden City</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>4</td>
<td>2,720</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Ada County Highway District</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>87</td>
<td>55,773</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Boise State University</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>0.24</td>
<td>153</td>
<td></td>
<td></td>
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<tr>
<td>Ada County Drainage District 3</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>8</td>
<td>4,801</td>
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<td></td>
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<tr>
<td>ITD, District 3</td>
<td>IDS027561</td>
<td>Phase I</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total Area Boise/Garden City Phase I Permit</td>
<td></td>
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<td>87</td>
<td>55,773</td>
<td>0.31</td>
<td></td>
<td></td>
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<tr>
<td>Ada County Highway District</td>
<td>IDS028185</td>
<td>Phase II</td>
<td>62</td>
<td>39,376</td>
<td>84</td>
<td>54,218</td>
<td>28</td>
<td>2,982</td>
</tr>
<tr>
<td>Meridian</td>
<td></td>
<td></td>
<td>24</td>
<td>15,178</td>
<td>28</td>
<td>18,160</td>
<td>4</td>
<td>2,982</td>
</tr>
<tr>
<td>Eagle</td>
<td></td>
<td></td>
<td>12</td>
<td>7,518</td>
<td>30</td>
<td>19,378</td>
<td>18</td>
<td>11,800</td>
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<td>Urbanized Ada County (unincorporated)</td>
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<td></td>
<td>24</td>
<td>16,680</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>Total Area Ada County Phase II Permit</td>
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<td>62</td>
<td>39,376</td>
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<tr>
<td>Total Area Ada County Phase I and II Permits</td>
<td></td>
<td></td>
<td>95,149</td>
<td>95,149</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kuna</td>
<td>NA</td>
<td>-</td>
<td>18</td>
<td>11,619</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Star</td>
<td>NA</td>
<td>-</td>
<td>4</td>
<td>3,288</td>
<td>19</td>
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<tr>
<td>Total Ada County Incorporated Non-Permitted Area</td>
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<td></td>
<td>44</td>
<td>29,749</td>
<td>0.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canyon County</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caldwell</td>
<td>IDS028118</td>
<td>Phase II</td>
<td>17.5</td>
<td>11,172</td>
<td>4.6</td>
<td>2,979</td>
<td>21</td>
<td></td>
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<tr>
<td>Nampa</td>
<td>IDS028126</td>
<td>Phase II</td>
<td>25</td>
<td>16,015</td>
<td>6.5</td>
<td>4,129</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Middleton</td>
<td>IDS028100</td>
<td>Phase II</td>
<td>2.3</td>
<td>1,478</td>
<td>2.9</td>
<td>1,851</td>
<td>13</td>
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<tr>
<td>Urbanized Canyon County (unincorporated)</td>
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<td>-</td>
<td>-</td>
<td>24.8</td>
<td>15,890</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITD, District 3</td>
<td>IDS028177</td>
<td>Phase II</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Canyon Highway District #4</td>
<td>IDS028134</td>
<td>Phase II</td>
<td>8</td>
<td>5,120</td>
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<td></td>
<td></td>
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<tr>
<td>Nampa Highway District #1</td>
<td>IDS028142</td>
<td>Phase II</td>
<td>8.5</td>
<td>5,440</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notus-Parma Highway District #2</td>
<td>IDS028151</td>
<td>Phase II</td>
<td>2</td>
<td>1,280</td>
<td></td>
<td></td>
<td></td>
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<td>Total Area Canyon County Phase II Permits</td>
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<td>Greenleaf</td>
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<td>Parma</td>
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<td>Total Canyon County Incorporated Non-Permitted Area</td>
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<td>May-September Stormwater Wet Weather</td>
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<td>October-April Non-Stormwater Dry Weather</td>
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</tbody>
</table>
1 Urbanized Area based on 2010 Census; which may differ from the MS4 permitted areas which are based on 2003 Decennial Census data

2 Ada County Assessor 7/9/14

3 Canyon County Assessor 5/28/14

4 Data from 2011 NAIP-UTC Canopy Assessment-PlanItGeo(roads, bldgs, parking lots)

5 Area data from NPDES Permit Factsheets (2000 Census)

6 Area ratio= the area contribution of each MS4 Permit relative to the total service area for MS4s

7 Stormwater (wet weather) flows and loads are primarily the result of immediate precipitation

8 Non-stormwater (dry weather) flows are considered non-precipitation flows that include dry weather point sources (see Table 16) and Agricultural Exemption Non-stormwater.

9 The stormwater (wet weather) and non-stormwater (dry weather) flows and load estimates are derived from data provided by the LBWC stormwater workgroup.

*Note: 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.

*Note: the Notus-Parma Highway District #2 (2 mi²; 1280 acres) is no longer part of a Phase II MS4 Permitted Area and is now a Non-Permitted Area.

Error! Reference source not found.
In the Boise and Garden City area, Ada County Highway District (ACHD), Boise, Garden City, Idaho Transportation Department, 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 are available from the Permittee internet site http://www.partnersforcleanwater.org/default.asp. 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.achd.ada.id.us/Departments/TechServices/Drainage.aspx.

Stormwater within the lower Boise River watershed is regulated under either a Phase I or a Phase II NPDES Permit issued by EPA. Permitted stormwater entities are considered point sources and will be assigned “wasteload allocations”.

Stormwater management areas for lower Boise River watershed area have been updated based on 2010 census (US Census Bureau) and current GIS mapping information were estimated by LBWC stormwater group. This information does not present entities with active stormwater management programs and policies, such as retention on-site, within or outside of permitted areas but are 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 and. Cities in urbanized areas include Boise, 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.

includes a breakdown of permitted and non-permitted areas, impervious areas, and annual flows 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);
- Data from 2011 NAIP-UTC Canopy Assessment;
- Flow and load estimates are based on data from the stormwater workgroup

The impervious data includes roads, buildings, and parking lots and was developed as part of the Treasure Valley Urban Tree Canopy project funded by a grant from the U.S Forest Service (2011 NAIP-UTC Canopy Assessment-PlanItGeo).
Figure 31. 2010 Census Boise Urbanized Area and other areas (prepared by ACHD)*
Figure 32. Map of Canyon County stormwater management areas (prepared by ACHD).
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 U.S., the facility must be permitted under EPA’s most recent Multi-Sector General Permit (MSGP) or Construction General Permit (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 or Construction 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. DEQ anticipates including specific requirements for impaired waters as a condition of the 401 certification. The new MSGP will detail the specific monitoring requirements.

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 wasteload allocation for industrial or construction stormwater activities. Industrial and construction stormwater activities are considered in compliance with provisions of the TMDL if operators obtain an MSGP or CGP as applicable under the NPDES program and implement the appropriate BMPs. 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 that BMPs appropriate to the site are applied and maintained to prevent water quality impairment. Table 18 identifies the list active MSGP permits.
Table 18. Active MSGP facilities permitted by the EPA in Ada and Canyon counties (August 2014).

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>COVERAGE DATE</th>
<th>APPLICATION</th>
<th>ORGANIZATION</th>
<th>PROJECT NAME</th>
<th>COUNTY</th>
<th>CITY</th>
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<td>July 18, 2009</td>
<td>Industrial</td>
<td>STAKER PARSON COMPANIES</td>
<td>Idaho Sand Gravel Ten Lane</td>
<td>Canyon</td>
<td>Nampa</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C232</td>
<td>June 27, 2009</td>
<td>Industrial</td>
<td>STAKER PARSON COMPANIES</td>
<td>Idaho Concrete Middleton</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C236</td>
<td>July 27, 2009</td>
<td>Industrial</td>
<td>STAKER PARSON COMPANIES</td>
<td>Idaho Sand Gravel Greenleaf</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C243</td>
<td>June 27, 2009</td>
<td>Industrial</td>
<td>STAKER PARSON COMPANIES</td>
<td>Idaho Concrete Caldwell</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C279</td>
<td>June 22, 2009</td>
<td>Industrial</td>
<td>Mascot dba Knife River</td>
<td>Notus</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C321</td>
<td>June 21, 2009</td>
<td>Industrial</td>
<td>CENTRAL PAVING CO., INC</td>
<td>MIDDLETON GRAVEL PIT</td>
<td>Canyon</td>
<td>MIDDLETON</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C405</td>
<td>July 01, 2009</td>
<td>Industrial</td>
<td>J.R. Simplot Company</td>
<td>NAMPA POTATO PLANT</td>
<td>Canyon</td>
<td>NAMPA</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C414</td>
<td>July 02, 2009</td>
<td>Industrial</td>
<td>UNITED PARCEL SERVICE, INC.</td>
<td>UPS - NAMPA</td>
<td>Canyon</td>
<td>NAMPA</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C417</td>
<td>July 29, 2009</td>
<td>Industrial</td>
<td>SIMPLOT TRANSPORTATION</td>
<td>SIMPLOT TRANSPORTATION</td>
<td>Canyon</td>
<td>CALDWELL</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C425</td>
<td>July 15, 2009</td>
<td>Industrial</td>
<td>Darigold Corp.</td>
<td>Darigold-Caldwell</td>
<td>Canyon</td>
<td>CALDWELL</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C509</td>
<td>July 19, 2009</td>
<td>Industrial</td>
<td>Woodgrain Millwork Inc.</td>
<td>NAMPA</td>
<td>Canyon</td>
<td>NAMPA</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C865</td>
<td>December 14, 2009</td>
<td>Industrial</td>
<td>DEERFLAT SAND GRAVEL, INC</td>
<td>Deerflat Sand Gravel Inc. Pit #2</td>
<td>Canyon</td>
<td>NAMPA</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C908</td>
<td>December 05, 2009</td>
<td>Industrial</td>
<td>Americrete Ready Mix Concrete Inc. dba. GB Redi-mix</td>
<td>GB Redi-mix Nampa</td>
<td>Canyon</td>
<td>NAMPA</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05C938</td>
<td>December 19, 2009</td>
<td>Industrial</td>
<td>Fleetwood Homes, Inc.</td>
<td>Fleetwood Homes, Inc. Plant #230</td>
<td>Canyon</td>
<td>NAMPA</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CA31</td>
<td>March 14, 2010</td>
<td>Industrial</td>
<td>CITY OF CALDWELL</td>
<td>Caldwell Industrial Airport</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CD07</td>
<td>June 05, 2010</td>
<td>Industrial</td>
<td>Rambo Sand and Gravel, Inc.</td>
<td>Rambo Sand and Gravel</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CJ61</td>
<td>April 15, 2011</td>
<td>Industrial</td>
<td>Lows Ready Mix Inc</td>
<td>Notus Pit</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CK01</td>
<td>April 06, 2011</td>
<td>Industrial</td>
<td>NAMPA PAVING ASPHALT</td>
<td>Deward Gravel Pit</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CK27</td>
<td>May 25, 2011</td>
<td>Industrial</td>
<td>AWS - NAMPA HAULING</td>
<td>AWS - NAMPA HAULING</td>
<td>Canyon</td>
<td>Nampa</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CL39</td>
<td>July 03, 2011</td>
<td>Industrial</td>
<td>NAMPA PAVING ASPHALT</td>
<td>Nampa Paving Asphalt</td>
<td>Canyon</td>
<td>Nampa</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CO66</td>
<td>November 04, 2011</td>
<td>Industrial</td>
<td>Syngenta Seeds, Inc.</td>
<td>Madison Avenue Facility</td>
<td>Canyon</td>
<td>Nampa</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CQ04</td>
<td>April 03, 2012</td>
<td>Industrial</td>
<td>CITY OF NAMPA</td>
<td>Nampa Municipal Airport</td>
<td>Canyon</td>
<td>Nampa</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CQ53</td>
<td>April 16, 2012</td>
<td>Industrial</td>
<td>Lehigh Hanson, Inc.</td>
<td>Caldwell plant</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CR34</td>
<td>March 11, 2012</td>
<td>Industrial</td>
<td>DEERFLAT SAND GRAVEL, INC</td>
<td>Deerflat Sand Gravel Pit #3</td>
<td>Canyon</td>
<td>Nampa</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CS15</td>
<td>May 21, 2012</td>
<td>Industrial</td>
<td>Rambo Crushing Co.</td>
<td>Rambo Sand Gravel, Inc.</td>
<td>Canyon</td>
<td>Nampa</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CW59</td>
<td>October 04, 2013</td>
<td>Industrial</td>
<td>WESTERN STOCKMEN</td>
<td>WESTERN STOCKMEN</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
<tr>
<td>IDR05CW60</td>
<td>October 03, 2013</td>
<td>Industrial</td>
<td>IBI LLC</td>
<td>IBI, LLC</td>
<td>Canyon</td>
<td>Caldwell</td>
<td>Active</td>
</tr>
</tbody>
</table>
3.2 Nonpoint Sources

Although the cations 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, Mason Creek, and Sand Hollow Creek. Contributions from these nonpoint sources are acknowledged data gaps, and implementation plans could include details regarding future data collection from these sources. Further, non-stormwater (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 (grazing and dairies/feedlots). For example, tributaries, including agricultural drains, and predictive ground water contributed approximately 880 lbs/day and 562 lbs/day of TP, respectively, relative to approximately 1,440 lbs/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 lbs/day relative to point source contributions of approximately 1,050 lbs/day. This was similar to March 2013, when TP contributions from tributaries and ground water were approximately 378 lbs/day relative to point source contributions of approximately 1,220 lbs/day.

Table 19 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 19. Annual tributary discharge to the lower Boise River and Snake River.

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Lower Boise River Receiving River Mile (RM)</th>
<th>Mean Discharge (cfs)</th>
<th>Mean TP Concentration (mg/L)</th>
<th>Mean TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eagle Drain</td>
<td>42.7</td>
<td>22.0</td>
<td>0.14</td>
<td>16.3</td>
</tr>
<tr>
<td>Dry Creek</td>
<td>42.5</td>
<td>11.2</td>
<td>0.14</td>
<td>8.5</td>
</tr>
<tr>
<td>Thurman Drain</td>
<td>41.9</td>
<td>11.1</td>
<td>0.12</td>
<td>7.4</td>
</tr>
<tr>
<td>Fifteenmile Creek</td>
<td>30.3</td>
<td>88.9</td>
<td>0.33</td>
<td>156.3</td>
</tr>
<tr>
<td>Mill Slough</td>
<td>27.2</td>
<td>76.5</td>
<td>0.20</td>
<td>84.0</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>27.0</td>
<td>27.6</td>
<td>0.28</td>
<td>42.1</td>
</tr>
<tr>
<td>Mason Slough</td>
<td>25.6</td>
<td>8.8</td>
<td>0.30</td>
<td>14.2</td>
</tr>
<tr>
<td>Mason Creek</td>
<td>25.0</td>
<td>101.2</td>
<td>0.32</td>
<td>173.0</td>
</tr>
<tr>
<td>Hartley Gulch</td>
<td>24.4</td>
<td>22.7</td>
<td>0.29</td>
<td>35.9</td>
</tr>
<tr>
<td>Indian Creek</td>
<td>22.4</td>
<td>139.5</td>
<td>0.54</td>
<td>407.8</td>
</tr>
<tr>
<td>Conway Gulch</td>
<td>14.2</td>
<td>31.6</td>
<td>0.28</td>
<td>48.3</td>
</tr>
<tr>
<td>Dixie Drain</td>
<td>10.5</td>
<td>164.0</td>
<td>0.34</td>
<td>300.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>705.0</strong></td>
<td><strong>Mean = 0.34</strong></td>
<td></td>
<td><strong>1294.1</strong></td>
</tr>
<tr>
<td>Snake River</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Hollow Creek</td>
<td>Snake River</td>
<td>95.9</td>
<td>0.36</td>
<td>185.8</td>
</tr>
</tbody>
</table>

Note: These data represent contributions to the Boise River, including flows and TP from contributions from agriculture, and municipal and industrial industrial.

1 As identified by USGS in lower Boise River mass balance report (Etheridge 2013).


3.2.2 Background

Inflows at the upstream boundary of the lower Boise River (Diversion Dam) originate from Lucky Peak Dam releases (operated by the U.S. 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 U.S. Bureau of Reclamation). During the synoptic work 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 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 (IDEP/ODEQ 2004). While there are human-caused changes in the upstream watershed (due to 3 reservoirs), DEQ has determined background TP concentration of 0.018 mg/L as appropriate for this TMDL (Table 20). This is based on the 2005 – 2013 USGS TP data at Diversion Dam, with detection levels of 0.01 mg/L. This 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 non-detect results using the Kaplan-Mier method (Helsel, 2005) and the USGS 2012-2013 synoptic samples (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L, respectively.
Conversely, in October, the Boise River near Parma may come from a variety of known and unknown sources explicitly assigned or estimated in the mass balance model as sources not directly attributed to point source, or biogeochemical. The gaining tributaries are complex due to the numerous water uses and plumbing conveyance 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, non-stormwater (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 lbs/day of TP (Etheridge 2013). Conversely, in October, the Boise River ground water gains of 91.4 cfs accounted for

### Table 20. Background concentrations for the lower Boise River near Parma.

<table>
<thead>
<tr>
<th>Sampling Date</th>
<th>Parma Flow (cfs)(^1)</th>
<th>Background TP Concentration at Diversion (mg/L)(^2)</th>
<th>Potential TP Background Load at Parma (lbs/day)(^3)</th>
<th>TP Load at Parma (lbs/day)(^4)</th>
<th>Max Potential Background TP Contribution at Parma (%)(^5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 2012</td>
<td>624</td>
<td>0.018</td>
<td>61</td>
<td>1,010</td>
<td>6.0%</td>
</tr>
<tr>
<td>October 2012</td>
<td>924</td>
<td>0.018</td>
<td>90</td>
<td>1,450</td>
<td>6.2%</td>
</tr>
<tr>
<td>March 2013</td>
<td>846</td>
<td>0.018</td>
<td>82</td>
<td>1,550</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

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).

1. As identified by USGS in lower Boise River mass balance model (Etheridge 2013).
2. 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. Long-term median data and the USGS 2012-2013 synoptic samples (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L, respectively.
3. Calculated as Parma Flow (cfs) x TP Concentration (mg/L) x 5.39 standard conversion factor (Hammer 1986).
4. Estimated as the Potential TP Background Load at Parma (lbs/day) / TP Load at Parma (lbs/day). 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 lbs/day at Parma, which represents approximately 5.3 to 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, in the absence of diversions and returns along the lower Boise River, 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.

The questions of ground water and other unmeasured flows contributing to loads observed in the mainstem and tributaries are complex due to the numerous water uses and plumbing conveyance 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, non-stormwater (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 lbs/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, estimated at 0.16 mg/L, resulting in 79 lbs/day of TP. Finally, the March discharge balance resulted in a 174 cfs gain from ground water, or 21 percent 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 lbs/day (Etheridge 2013, and Alex Etheridge, pers. comm. 2014).

It should be noted that these groundwater and unmeasured sources described above do not include the shallow groundwater that drains into and discharges with the tributaries and drains, particularly during October to April when most of the flow in the tributaries and drains is the shallow ground water draining the agricultural lands.

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 modified surface hydrology system because water is diverted and often reused downstream from its original source. In the lower Boise River watershed, wastewater and agricultural return flow is often subsequently diverted and utilized again for irrigation, industrial, or municipal purposes. Further, 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. In which, 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 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 lower Boise River watershed 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, and the interrelationships among the complex plumbing, water re-use, 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 2001b) and Lower Boise River Implementation Plan: Total Phosphorus (DEQ 2008).

4 Subbasin Assessment—Summary of Past and Present Pollution Control Efforts
Information concerning pollution control efforts for POTWs, urban and suburban storm drainage, 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. These permits document the requirements of the permittees. Additionally, status of implementing permits is included in stormwater management plans and annual reports which are included on permittee websites as required by the permits. Permits can be found on EPA’s NOI Application Search http://cfpub.epa.gov/npdes/stormwater/noi/noihitlist_new.cfm?CFID=25634902&CFTOKEN=40772253&jsessionid=cc30914e297abd18ec942e14c3173776a264.

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 the 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, 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.

319 Grants and Projects
In 1987, Congress established the Nonpoint Source Management Program under section 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 non-point 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 south-west 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 dollars toward 319 grants in the lower Boise River subbasin for the implementation of BMPs to reduce and prevent pollutant runoff (e.g. sediment and nutrients) from reaching surface waters (Table 21). Currently, contract S443 is being implemented by the Lower Boise Watershed Council, which includes the implementation of projects using sprinkler and drip irrigations systems to reduce water use and pollutant delivery relative to traditional surface irrigation practices.
Table 21. 319 project grants in the lower Boise River subbasin.

<table>
<thead>
<tr>
<th>Subgrant</th>
<th>Grant Year</th>
<th>Year Close</th>
<th>Project Name</th>
<th>Sponsor</th>
<th>Budget1</th>
</tr>
</thead>
<tbody>
<tr>
<td>QC037900</td>
<td>1997</td>
<td></td>
<td>LBRWQP TandE</td>
<td></td>
<td>$32,000.00</td>
</tr>
<tr>
<td>QC051900</td>
<td>1999</td>
<td></td>
<td>LBRWQP DNA Finger Printing</td>
<td>Lower Boise River WQ Plan</td>
<td>$46,839.00</td>
</tr>
<tr>
<td>QC061100</td>
<td>2000</td>
<td></td>
<td>Dixie Surge System</td>
<td>Canyon SWCD</td>
<td>$18,000.00</td>
</tr>
<tr>
<td>S104</td>
<td>2004</td>
<td></td>
<td>Boise River Side Channel Reconstruction</td>
<td>Trout Unlimited</td>
<td>$159,525.00</td>
</tr>
<tr>
<td>S120</td>
<td>2000-2005</td>
<td></td>
<td>Jerrell Glenn Wetland Restoration</td>
<td>Jerrell Glenn</td>
<td>$22,250.00</td>
</tr>
<tr>
<td>S130/Ph1</td>
<td>2002</td>
<td></td>
<td>Indian Creek LID Demonstration Caldwell</td>
<td>City of Caldwell</td>
<td>$28,668.00</td>
</tr>
<tr>
<td>S130/Ph2</td>
<td>2002</td>
<td></td>
<td>Indian Creek LID Demonstration Caldwell</td>
<td>City of Caldwell</td>
<td>$73,332.00</td>
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<tr>
<td>S131</td>
<td>2001</td>
<td></td>
<td>Downtown Boise Graywater Recycling</td>
<td>The Christensen group</td>
<td>$50,000.00</td>
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<tr>
<td>S132</td>
<td>2002</td>
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<td>Barber Park Living Roof Demonstration</td>
<td>Ada County</td>
<td>$150,703.00</td>
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<tr>
<td>S195</td>
<td>2002</td>
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<td>Indian Creek Stormwater Runoff Phase 2</td>
<td>City of Caldwell</td>
<td>$79,383.00</td>
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<td>S231</td>
<td>2006-2008</td>
<td></td>
<td>Dry Creek Streambed Protection Patterson Property</td>
<td>Ada SWCD</td>
<td>$58,365.67</td>
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<tr>
<td>S232</td>
<td>2004</td>
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<td>Boise River Side Channel Formerly S104</td>
<td>Trout Unlimited</td>
<td>$34,525.00</td>
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<tr>
<td>S323</td>
<td>2009</td>
<td></td>
<td>Canyon Co. BMPs for WQ Improvement</td>
<td>Lower Boise Watershed Council</td>
<td>$250,000.00</td>
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<td>S3562</td>
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<td>Ada County BMPs Four Corners</td>
<td>Ada SWCD2</td>
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<td>S443</td>
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<td>Canyon County BMPs</td>
<td>Lower Boise Watershed Council</td>
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<tr>
<td>S521</td>
<td>2014</td>
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<td>Canyon County BMP Program</td>
<td>Lower Boise Watershed Council</td>
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</tbody>
</table>

1 Total subgrant amount allocated for each project, but not necessarily the amount spent.

2 Ada SWCD 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 lower Boise River watershed. The drill has been purchased and sediment and phosphorus losses are expected to be reduced by up to 95%.

*Note: Because 319 granting did not require Load Reduction Estimates until recently, estimates are only available for subgrants S120, S231, and S323.
Soil and Water Conservations Districts
In addition to 319 grants, numerous projects have been completed within the lower Boise River 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, and landowners) addresses agricultural nonpoint source pollution through voluntary BMPs. Table 22 provides a list of BMPs installed in the Lower Boise River subbasin from 2008-2013.

Table 22. Best Management Practices (BMPs) installed in the lower Boise River Subbasin between October 2008 and December 2013.

<table>
<thead>
<tr>
<th>Practices in the Willow Creek watershed</th>
<th>Sum of Land Unit Acres</th>
<th>Sum of Applied Amount</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANYON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock Pipeline</td>
<td>1,150.4</td>
<td>15,340.0</td>
<td>ft</td>
</tr>
<tr>
<td>Watering Facility</td>
<td>1,118.1</td>
<td>3.0</td>
<td>ea</td>
</tr>
<tr>
<td>GEM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cover Crop</td>
<td>24.5</td>
<td>10.0</td>
<td>ac</td>
</tr>
<tr>
<td>Integrated Pest Management (IPM)</td>
<td>32.7</td>
<td>32.7</td>
<td>ac</td>
</tr>
<tr>
<td>Nutrient Management</td>
<td>32.7</td>
<td>32.7</td>
<td>ac</td>
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<table>
<thead>
<tr>
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<th>Sum of Applied Amount</th>
<th>Units</th>
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<td>ADA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel Bed Stabilization</td>
<td>2.2</td>
<td>1,400.0</td>
<td>ac</td>
</tr>
<tr>
<td>Conservation Cover</td>
<td>2.2</td>
<td>2.2</td>
<td>ac</td>
</tr>
<tr>
<td>Riparian Forest Buffer</td>
<td>2.2</td>
<td>2.2</td>
<td>ac</td>
</tr>
<tr>
<td>Riparian Herbaceous Cover</td>
<td>2.2</td>
<td>1.0</td>
<td>ac</td>
</tr>
<tr>
<td>Stream Habitat Improvement and Management</td>
<td>2.2</td>
<td>2.2</td>
<td>ac</td>
</tr>
<tr>
<td>Streambank and Shoreline Protection</td>
<td>2.2</td>
<td>1,400.0</td>
<td>ac</td>
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<td>2.2</td>
<td>3.0</td>
<td>no</td>
</tr>
<tr>
<td>Tree/Shrub Establishment</td>
<td>2.2</td>
<td>2.2</td>
<td>ac</td>
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<td>Upland Wildlife Habitat Management</td>
<td>2.2</td>
<td>2.2</td>
<td>ac</td>
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<tr>
<td>Wetland Enhancement</td>
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<tr>
<td>Wetland Wildlife Habitat Management</td>
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<td>2.2</td>
<td>ac</td>
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<tr>
<td>CANYON</td>
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<td></td>
<td></td>
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<tr>
<td>Agricultural Energy Management Plan, Headquarters - Written</td>
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<td>Conservation Crop Rotation</td>
<td>37.0</td>
<td>37.0</td>
<td>ac</td>
</tr>
<tr>
<td>Cover Crop</td>
<td>18.2</td>
<td>0.1</td>
<td>ac</td>
</tr>
<tr>
<td>Forage Harvest Management</td>
<td>35.6</td>
<td>35.6</td>
<td>ac</td>
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<td>Practice Description</td>
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<td>Sum of Applied Amount</td>
<td>Applied Units</td>
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<tr>
<td>Integrated Pest Management (IPM)</td>
<td>36.9</td>
<td>36.9</td>
<td>ac</td>
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<tr>
<td>Irrigation System, Micro-irrigation</td>
<td>37.4</td>
<td>37.4</td>
<td>ac</td>
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<tr>
<td>Irrigation System, Surface and Subsurface</td>
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<td>35.6</td>
<td>ac</td>
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<tr>
<td>Irrigation Water Conveyance, Corrugated Metal Pipeline</td>
<td>30.6</td>
<td>67.0</td>
<td>ft</td>
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<tr>
<td>Irrigation Water Conveyance, Ditch and Canal Lining, Plain Concrete</td>
<td>30.6</td>
<td>755.0</td>
<td>ft</td>
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<tr>
<td>Irrigation Water Management</td>
<td>92.8</td>
<td>92.8</td>
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<tr>
<td>Nutrient Management</td>
<td>91.6</td>
<td>73.5</td>
<td>ac</td>
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<tr>
<td>Nutrient Management Plan - Written</td>
<td>37.4</td>
<td>1.0</td>
<td>no</td>
</tr>
<tr>
<td>Prescribed Grazing</td>
<td>7.9</td>
<td>7.9</td>
<td>ac</td>
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<tr>
<td>Seasonal High Tunnel System for Crops</td>
<td>18.2</td>
<td>2,178.0</td>
<td>sq ft</td>
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**ELMORE**

<table>
<thead>
<tr>
<th>Practice Description</th>
<th>Sum of Land Unit</th>
<th>Sum of Applied Amount</th>
<th>Applied Units</th>
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<tbody>
<tr>
<td>Conservation Crop Rotation</td>
<td>109.2</td>
<td>109.2</td>
<td>ac</td>
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<tr>
<td>Prescribed Grazing</td>
<td>995.2</td>
<td>770.4</td>
<td>ac</td>
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<tr>
<td>Residue and Tillage Management, Reduced Till</td>
<td>4.2</td>
<td>4.2</td>
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**Practices in the Sand Hollow Creek watershed**

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<th>Sum of Applied Amount</th>
<th>Applied Units</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>Above Ground, Multi-Outlet Pipeline</td>
<td>62.4</td>
<td>760.0</td>
<td>ft</td>
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<td>Anionic Polyacrylamide (PAM) Application</td>
<td>58.4</td>
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<tr>
<td>Comprehensive Nutrient Management Plan</td>
<td>10.0</td>
<td>1.0</td>
<td>no</td>
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<td>Conservation Crop Rotation</td>
<td>522.1</td>
<td>516.7</td>
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<tr>
<td>Cover Crop</td>
<td>57.1</td>
<td>57.1</td>
<td>ac</td>
</tr>
<tr>
<td>Forage Harvest Management</td>
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<td>459.0</td>
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<tr>
<td>Irrigation Pipeline</td>
<td>163.1</td>
<td>12,956.0</td>
<td>ft</td>
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<td>Irrigation Reservoir</td>
<td>4.7</td>
<td>0.4</td>
<td>ft</td>
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<td>Irrigation System, Microirrigation</td>
<td>329.6</td>
<td>304.1</td>
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<td>45.7</td>
<td>20.0</td>
<td>ft</td>
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<tr>
<td>Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic</td>
<td>162.3</td>
<td>9,025.0</td>
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<td>Irrigation Water Conveyance, Pipeline, Steel</td>
<td>112.8</td>
<td>348.0</td>
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<td>588.7</td>
<td>579.6</td>
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<td>Nutrient Management</td>
<td>814.3</td>
<td>848.7</td>
<td>ac</td>
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<td>Prescribed Grazing</td>
<td>31.3</td>
<td>31.3</td>
<td>ac</td>
</tr>
<tr>
<td>Pumping Plant</td>
<td>158.4</td>
<td>7.0</td>
<td>no</td>
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<tr>
<td>Sprinkler System</td>
<td>353.5</td>
<td>295.3</td>
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<tr>
<td>Structure for Water Control</td>
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<tr>
<td>Subsurface Drain</td>
<td>18.8</td>
<td>720.0</td>
<td>ft</td>
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<tr>
<td>Underground Outlet</td>
<td>93.7</td>
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<td>Upland Wildlife Habitat Management</td>
<td>25.0</td>
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**GEM**

<table>
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<tr>
<th>Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic</th>
<th>74.5</th>
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<td>Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic</td>
<td>74.5</td>
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<td>Irrigation Water Management</td>
<td>74.5</td>
<td>74.5</td>
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<tr>
<td>Nutrient Management</td>
<td>74.5</td>
<td>74.5</td>
<td>ac</td>
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<tr>
<td>Pumping Plant</td>
<td>74.5</td>
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<td>no</td>
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<td>Sprinkler System</td>
<td>74.5</td>
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<td>ac</td>
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<tr>
<td>Structure for Water Control</td>
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**PAYETTE**

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<th>40.1</th>
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<td>Irrigation Pipeline</td>
<td>112.8</td>
<td>5,135.0</td>
<td>ft</td>
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<td>Irrigation Regulating Reservoir</td>
<td>56.3</td>
<td>1.0</td>
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<td>Irrigation Water Management</td>
<td>196.6</td>
<td>163.7</td>
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<td>Nutrient Management</td>
<td>131.7</td>
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<table>
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<th>Sum of Applied Amount</th>
<th>Applied Units</th>
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<tbody>
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<td><strong>ADA</strong></td>
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<tr>
<td>Conservation Crop Rotation</td>
<td>63.3</td>
<td>63.3</td>
<td>ac</td>
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<td>Surface Roughening</td>
<td>63.3</td>
<td>63.3</td>
<td>ac</td>
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<td><strong>CANYON</strong></td>
<td></td>
<td></td>
<td></td>
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<td>0.8</td>
<td>0.8</td>
<td>ac</td>
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<td>Cover Crop</td>
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</tr>
<tr>
<td>Fence</td>
<td>80.0</td>
<td>6,193.0</td>
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<td>97.3</td>
<td>ac</td>
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<td>Integrated Pest Management (IPM)</td>
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<td>5.8</td>
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<td>3,333.0</td>
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<td>Irrigation System, Microirrigation</td>
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<td>13.8</td>
<td>ac</td>
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<td>Irrigation System, Surface and Subsurface</td>
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<td>4.2</td>
<td>fac</td>
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<tr>
<td>Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic</td>
<td>5.7</td>
<td>1,030.0</td>
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</tr>
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<td>Practice Description</td>
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<td>Applied Amount</td>
<td>Units</td>
</tr>
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<td>----------------</td>
<td>-------</td>
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<tr>
<td>Livestock Pipeline</td>
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<td>36.7</td>
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<tr>
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<tr>
<td>Upland Wildlife Habitat Management</td>
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### Practices in the Indian Creek watershed

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<tbody>
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<td></td>
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<tr>
<td>Forage and Biomass Planting</td>
<td>6.8</td>
<td>6.8</td>
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<tr>
<td>Irrigation System, Microirrigation</td>
<td>1.6</td>
<td>1.6</td>
<td>ac</td>
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<tr>
<td>Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic</td>
<td>14.5</td>
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<tr>
<td>Nutrient Management</td>
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<td>70.7</td>
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<tr>
<td>Pumping Plant</td>
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<td>1.0</td>
<td>no</td>
</tr>
<tr>
<td>Seasonal High Tunnel System for Crops</td>
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<td>1.0</td>
<td>sq ft</td>
</tr>
<tr>
<td>Sprinkler System</td>
<td>13.4</td>
<td>12.6</td>
<td>ac</td>
</tr>
<tr>
<td>Structure for Water Control</td>
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<td>1.0</td>
<td>no</td>
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<td>ELMORE</td>
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### Practices in the Dry Creek watershed

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<thead>
<tr>
<th>Practice Description</th>
<th>Acres</th>
<th>Applied Amount</th>
<th>Units</th>
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<tbody>
<tr>
<td>ADA</td>
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<tr>
<td>Channel Bank Vegetation</td>
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<td>Channel Bed Stabilization</td>
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<td>Conservation Cover</td>
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<td>Dam, Diversion</td>
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</tr>
<tr>
<td>Practice</td>
<td>Sum of Land Unit Acres</td>
<td>Sum of Applied Amount</td>
<td>Applied Units</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>------------------------</td>
<td>-----------------------</td>
<td>---------------</td>
</tr>
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<td>Tree/Shrub Site Preparation</td>
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<tr>
<td>Field Border</td>
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<tr>
<td>Forage and Biomass Planting</td>
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<tr>
<td>Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic</td>
<td>14.9</td>
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<td>Irrigation Water Management</td>
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<td>Windbreak/Shelterbelt Establishment</td>
<td>18.1</td>
<td>6,160.0</td>
<td>ft</td>
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</table>

<table>
<thead>
<tr>
<th>Practices in the Boise River-Snake River watershed</th>
<th>Sum of Land Unit Acres</th>
<th>Sum of Applied Amount</th>
<th>Applied Units</th>
</tr>
</thead>
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<tr>
<td><strong>CANYON</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Conservation Cover</td>
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<td>Conservation Crop Rotation</td>
<td>317.8</td>
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<td>ac</td>
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<tr>
<td>Fence</td>
<td>71.4</td>
<td>2,550.0</td>
<td>ft</td>
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<td>Forage and Biomass Planting</td>
<td>5.0</td>
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<td>ac</td>
</tr>
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<td>ft</td>
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<td>Irrigation Regulating Reservoir</td>
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<tr>
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<td>Mulching</td>
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<td>Retrofit watering facility for wildlife escape</td>
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<td>Seasonal High Tunnel System for Crops</td>
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<td>sq ft</td>
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<td>Sediment Basin</td>
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<td>no</td>
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<tr>
<td>Solar powered electric fence charging systems</td>
<td>127.4</td>
<td>6.0</td>
<td>no</td>
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<tr>
<td>Sprinkler System</td>
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<td>Structure for Water Control</td>
<td>323.1</td>
<td>20.0</td>
<td>no</td>
</tr>
<tr>
<td>Tree/Shrub Establishment</td>
<td>40.5</td>
<td>0.3</td>
<td>ac</td>
</tr>
</tbody>
</table>
Upland Wildlife Habitat Management | 82.0 | 10.8 | ac
---|---|---|---
Wetland Enhancement | 34.5 | 5.7 | ac
Wetland Wildlife Habitat Management | 53.8 | 19.5 | ac

*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.

**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 1960’s and early 1970’s. Since first obtaining a land application permit at the site in the 1980’s, the site has been operating under a zero surface water discharge requirement. In 1998, upgrades at the Simplot site included (H. Haminishi, pers. comm., 2013):

- Flood irrigation 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 2000 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 holding pond was built (28 MG) that allowed periods during the winter to hold water (during very severe weather) and to hold water during summer harvest of crops.
- A silt recovery system was installed to remove significantly more silt during the washing of the potato, 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:

- Wastewater flow has been reduced from 1,474 MGY in 1995, to 637 MGY in 2012, to 551 MGY in 2013.
- In 2009, a double cropping system was installed for the land that has nearly doubled the nutrient uptake (both nitrogen and phosphorus) as well as significantly increase ash (TDS) 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:

- 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.

**City of Meridian**

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

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

**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:

- City of Boise
- City of Caldwell
- City of Nampa
- City of Star
- City of Wilder
- Darigold

**4.1 Water Quality Monitoring**

A combination of one time, ongoing, regularly-scheduled, and event-specific water quality monitoring occurs in the lower Boise River (see Appendix B – Data Sources). These monitoring efforts include, but are not limited to DEQ BURP sampling, synoptic sampling events of 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, 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 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 the DEQ and the LBWC, has collected and published other biological data throughout the lower Boise River subbasin, including aquatic growth (periphyton and phytoplankton). Some of their published 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)

5 Total Maximum Daily Load(s)

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 in this TMDL: 1) a target concentration of $\leq 0.07 \text{ mg/L}$ 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 specific to supporting beneficial uses in the lower Boise River.

The Mason Creek TP allocations were developed to help achieve the lower Boise River targets, which DEQ believes are sufficiently stringent to result in full beneficial use support in the creek.
The Sand Hollow Creek TP allocations were developed to help achieve the SR-HC target, and to be commensurate with other lower Boise River tributaries, which DEQ believes are sufficiently stringent result in full beneficial support in the creek.

5.1.1 PROJECTED CONDITIONS

The TMDL targets are designed to achieve full support of designated or existing beneficial uses in the lower Boise River, Mason Creek, and Sand Hollow Creek. Because identifying the impairment or support of beneficial uses is based on multiple lines of evidence, it is difficult to directly measure or compare to the narrative water quality standards. The daily 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 beneficial uses of contact recreation and aesthetics, aquatic life, and wildlife habitats. At the same the time 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 are structured to recognize multiple factors within the watershed:

1. The lower Boise River, Mason Creek, and Sand Hollow Creek have 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.
2. Watershed hydrology dynamics are not simple (e.g., upstream reservoirs, irrigation diversions, return flows and drains).
   a. Flow is highly managed throughout the watershed.
   b. Water quality conditions vary seasonally.
   c. Water quality conditions vary with spatial extent (e.g., location in the watershed).
3. Phosphorus sources have different locational impacts.
4. Phosphorus is moving through the watershed; it may take years before nonpoint source phosphorus load reductions are observed downstream.
5. Phosphorus and benthic algae are not toxics and should not be managed as such.
6. Limited exceedances (depending on magnitude, duration, and frequency) may be acceptable so long as they do not impair beneficial uses.
7. TP has multiple components, including labile and refractory, and may not be equally bioavailable for algal growth.
8. Algal biomass may be influenced by human and environmental factors other than TP, alone (e.g., flow, water temperature, other nutrients).
9. Algal species composition is variable.
10. Supporting reuse, offsets, trading, and other innovative approaches may further improve water quality over meeting the targets, alone.
11. 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.

12. The concepts of seasonal conditions and limited exceedances are supported by a number of references including EPA guidance, use in other TMDLs including the SR-HC TMDL, the fact that the phosphorus and periphyton are not toxic, and responses vary with conditions and time (Appendix B).

5.1.2 Target Selection (Lower Boise River)

These surrogate targets are intended to protect beneficial uses and are translated into other forms for setting allocations and limits in permits. 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.

Snake River-Hells Canyon TMDL Target Compliance

- **May 1 – September 30:** TP concentrations (or TP load equivalent) ≤ 0.07 mg/L (instantaneous maximum, not to be exceeded), *in the lower Boise River near Parma to comply with the 2004 Snake River-Hells Canyon TMDL.*

The final SR-HC TMDL was approved by EPA in September 2004 (DEQ 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 – September 30 (IDEQ and ODEQ 2004; p. ii):

> “Site-specific chlorophyll a and total phosphorus targets (less than 14 ug/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.”

Therefore, consistency with the SR-HC TMDL requires achieving the seasonal ≤ 0.07 mg/L TP target at the mouths of the lower Boise River and Sand Hollow Creek near Parma (although not explicitly stated; Figure 33).
Achieving this concentration target at the mouths of the lower Boise River and Sand Hollow Creek 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 less than or equal to $0.07 \text{ mg/l TP}$ (instantaneous maximum, not to be exceeded), which in turn should support the $< 14 \mu\text{g/L}$ chlorophyll a as a mean growing season limit with a nuisance threshold of $30 \mu\text{g/L}$ with exceedance threshold of no greater than 25 percent for the Snake River.
Also, the loading analysis for this TP TMDL, results in TP concentrations and loading that achieve the mean monthly periphyton (nuisance algae) target in the lower Boise River. 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, the lower Boise River, Sand Mason Creek, and Sand Hollow Creek.

**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 2.2.5), and for remaining consistent with the concentration limits in the SR-HC TMDL. The following metrics and rationale were selected as appropriate TP allocation periods for the lower Boise River:

- **Mean Monthly Benthic Chlorophyll a Target**
  - **Magnitude** - Mean monthly benthic chlorophyll a of ≤ 150 mg/m².
  - **Location** – Within impaired AUs of the main stem lower Boise River.
  - **Duration**
    - May 1 – September 30
      - May 1 – September 30 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
      - October 1 – April 30 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/m² 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.
    - The allowable exceedance frequency is set at once in 10 years based on mean monthly values observed over a rolling 10-year period.
These target criteria are similar to those developed and implemented for waters in Montana (MDEQ 2008), Minnesota (MPCA 2013) and Colorado (CDPHE 2013), and corresponds with scientific literature values that support contact recreation and cold water aquatic life (see Section 2.2.5).

5.1.3 Target Selection (Mason Creek)

The target selection for Mason Creek is developed in the same manner as load allocations for the other major tributaries to the lower Boise River. These load allocations will help the lower Boise River achieve the May 1 – September 30 SR-HC TMDL TP target, while also achieving the nuisance aquatic growth targets (translated into a TP target) in the lower Boise River. These allocations are further expected to fully support beneficial uses in Mason Creek through TP load reductions that are consistent with those of Sand Hollow Creek, the lower Boise River, EPA Gold Book recommended TP value of 0.1 mg/L (EPA 1986), and should translate in nuisance aquatic growth reductions sufficient to fully support beneficial uses. In addition, subsequent monitoring of Mason Creek, along with DEQ’s ongoing statewide effort to identify nutrient and nuisance aquatic growth relationships in wadeable streams, should provide further insight into achieving full beneficial use in Mason Creek and other lower Boise River tributaries. An adaptive management approach, as part of the 5-year review, will help to determine if subsequent changes to load allocations will be necessary to fully support beneficial uses in Mason Creek.

5.1.4 Target Selection (Sand Hollow Creek)

The target selection for Sand Hollow Creek, a tributary to the Snake River, is developed to help achieve the May 1 – September 30 target in the Snake River as identified in the SR-HC TMDL (DEQ and ODEQ 2004). These allocations are further expected to fully support beneficial uses in Sand Hollow Creek through TP load reductions that are consistent with those of the Mason Creek, the lower Boise River, EPA Gold Book recommended TP value of 0.1 mg/L (EPA 1986), and should translate in nuisance aquatic growth reductions sufficient to fully support beneficial uses. In addition, subsequent monitoring of Sand Hollow Creek, along with DEQ’s ongoing statewide effort to identify nutrient and nuisance aquatic growth relationships in wadeable streams, should provide further insight into achieving full beneficial use in Sand Hollow Creek. An adaptive management approach, as part of the 5-year review, will help to determine if subsequent changes to load allocations will be necessary to fully support beneficial uses in Sand Hollow Creek.

5.1.5 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 includes maintaining and evaluating the long-term water-quality dataset on the lower Boise River near Parma. Monitoring results from the lower Boise River near Parma 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 (NSIP).
Additionally, monitoring activities beginning 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 on line 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 lower Boise River subbasin. This effort will help to ascertain the effectiveness and impacts of TP load reductions on both achieving the May – September \( \leq 0.07 \) mg/L TP target near Parma, as well as achieving the \( \leq 150 \) 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, Mason Creek, and Sand Hollow Creek. In other words, it is the amount of TP these waterbodies 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 includes variability in target measurement.

The TP load capacity values for the lower Boise River, Mason Creek, and Sand Hollow Creek §303(d)-listed AUs are based on the following assumptions: DEQ expects 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 the council submit an Adaptive Management Plan to DEQ to provide guidance for both allocation 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 of $\leq 0.07$ mg/L May 1 – September 30

The TP load capacities developed for the lower Boise River near Parma, Mason Creek, and Sand Hollow Creek are based on the instream loads:

- TP concentration and TP load equivalent of $\leq 0.07$ mg/L are maintained at the mouth of the lower Boise River and Sand Hollow Creek throughout the critical season (May 1–September 30), and

- That support beneficial uses in the lower Boise River, Mason Creek, and Sand Hollow Creek.

A load duration approach, along with a simplified mass balance excel spreadsheet model were utilized to assess existing May-September TP loads relative to the $\leq 0.07$ mg/L TP target (see Tables and Figures in Section 5.2.1, and Table 30).

Additionally, May-September TP loading into the lower Boise River were estimated utilizing available data for each of the various point and non-point 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 timeframe due to reuse, uptake, and infiltration, etc. It is unclear, currently, the extent of these processes and the long-term persistence of TP in the watershed.

The TP loading scenario that achieves both conditions in the lower Boise River corresponds to the 90th percentile low flow conditions (Table 23, Figures 31-33) 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).

The allocations for the lower Boise River from May 1 – September 30 are designed to achieve the SR-HC TMDL $\leq 0.07$ mg/L TP target, by utilizing a combination of the USGS mass balance models and duration curves. The USGS mass balance model and report (Etheridge 2013) are available online: http://pubs.usgs.gov/sir/2013/5220/. The duration curves are developed in reference to An Approach for Using Load Duration Curves in the Development of the TMDLs (EPA 2007), which is available online: http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/2007_08_23_tmdl_duration_curve_guide_aug2007.pdf. According to the duration curve reference document:

"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."

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 loading, and load reductions required to achieve the SR-HC TMDL TP water quality target, are
calculated under different flow conditions. The difference between existing loading and the TP target of \( \leq 0.07 \) mg/L is used to calculate the loading reductions required.

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

1. 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.
2. 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.
3. 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). benefits

However, it is important to note that under all flow conditions except the 90\(^{th}\) percentile low flows, the TP load and waste load allocations are more stringent than necessary to achieve \( \leq 0.07 \) mg/L TP near Parma. These extra reductions were required to also achieve the mean monthly benthic chlorophyll a target of \( \leq 150 \) mg/m\(^2\) within the TP-impaired AUs of the lower Boise River (see Section 5.1.2 and 5.4.3).

40 CFR §130.7(c)(1) requires TMDLs to take into consideration 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 the USGS gage 13213000 as recorded at the Boise River near Parma for the period 1987 through 2012 are shown in Figure 20. The period 1987 through 2012 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 34). 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 10\(^{th}\), 40\(^{th}\), 60\(^{th}\), and 90\(^{th}\) percentiles.

The flows for the four tiers and the TP target concentration of \( \leq 0.07 \) mg/L were used along with a standard conversion factor to calculate the load capacity for phosphorus (load = concentration \( \times \) flow \( \times \) 5.39; Hammer 1986) in the lower Boise River near Parma (Table 23). Additionally, the load capacity for phosphorus was also calculated for the flow that occurred during the USGS August 2012 synoptic sample (Table 21), which was equivalent to the 69\(^{th}\) percentile. The estimation of load capacity for the lower Boise River at Parma relative to the sources upstream in the watershed is described in Section 5.4.
Mean flow conditions were used to estimate existing pollutant loads and allocations for Mason and Sand Hollow Creeks.
Table 23. TP loads and capacities for May 1 – September 30 presented as daily averages. They are calculated for: 1) the Boise River near Parma; 2) Mason Creek, a Boise River tributary, and: 3) Sand Hollow Creek, a Snake River tributary.

<table>
<thead>
<tr>
<th>Water Body1</th>
<th>Flow2 (cfs)</th>
<th>Flow Rank (%)</th>
<th>Current Load3</th>
<th>Load Capacity3</th>
<th>Target TP Load Reductions (lbs/day as a monthly average [%])</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>TP Conc. (mg/L)</td>
<td>TP Load (lbs/day)</td>
<td>Target TP Conc. (mg/L)</td>
</tr>
<tr>
<td>Lower Boise River near Parma – (AU 001_06)</td>
<td>3268</td>
<td>10th</td>
<td>0.21</td>
<td>3747</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td></td>
<td>912</td>
<td>40th</td>
<td>0.31</td>
<td>1531</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td></td>
<td>705</td>
<td>60th</td>
<td>0.31</td>
<td>1190</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td>USGS August Synoptic Sample4</td>
<td>624</td>
<td>69th</td>
<td>0.30</td>
<td>1010</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td></td>
<td>383</td>
<td>90th</td>
<td>0.36</td>
<td>738</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td>Mason Creek – (AU 006_02)</td>
<td>148</td>
<td>Mean</td>
<td>0.41</td>
<td>322</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td>(Tributary to the lower Boise River)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Hollow – (AU 017_06)</td>
<td>141</td>
<td>Mean</td>
<td>0.4</td>
<td>303</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td>(Tributary to the Snake River)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 All assessment units (AUs) begin with ID170501.

2 Lower Boise River – based on a data from May 1 – September 30, 1987 through 2012 and duration curves with water quality targets.
Mason Creek – based on USGS and ISDA mean data from May 1 – September 30, 1995 through 2012.

3 Lower Boise River - load capacities are calculated and applied near Parma, using duration curves.
Mason Creek and Sand Hollow Creek – mean load capacities are calculated and applied as instream conditions.

4 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.

Figure 34. Flow duration curve for the lower Boise River near Parma from May 1 – September 30, 1987-2012.
Figure 35. Long-term TP concentrations for the lower Boise River in relation 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 36. Long-term TP loads for the lower Boise River in relation to the TP load equivalent target of $\leq 0.07$ 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 5544 lbs/day associated with an 80.5th percentile flow on September 21, 1988.
5.2.2 TP Load Capacity to Achieve the Mean Monthly Benthic Chlorophyll-a Target of \( \leq 150 \text{ mg/m}^2 \)

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 Lower Boise River Total Phosphorus AQUATOX 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. There are multiple combinations of TP inputs from sources that 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 37 shows the results of USGS benthic chlorophyll a sampling between 1995 and 2013. These results reflect a range of elevated periphyton at several locations between 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 being observed the remainder of the year.
Figure 37. 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 Boise River and Mason Creek TP Loads (May 1 – September 30)

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).

NPDES-Permitted Wastewater, Industry, and Fish Hatchery Facilities

Point source contributions were calculated from facility-supplied data and/or discharge monitoring reports (DMR) from May 1 – September 30, 2012, as available (Table 24). 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 in turn are more dependent on factors such as population, service area, etc.

NPDES-Permitted Municipal Stormwater and Non-Stormwater

Existing stormwater (wet weather) TP contributions were derived from data provided by the LBWC stormwater workgroup (Appendix E) through several workgroup meetings and correspondence (Table 17). These data were developed for May 1 – September 30 for MS4-permitted and non-permitted 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, there is a large degree of uncertainty in the assumed loading. This known uncertainty will be addressed during implementation planning through additional monitoring and further characterization of stormwater.

Few non-stormwater (dry weather) data have been collected in the subbasin (Appendix E). Non-stormwater (dry weather) flows and loads can originate from a variety of sources, including but not limited to agricultural water supply returns, shallow ground water, urban/suburban sources (e.g. lawn watering), and other unmeasured sources. Further, non-stormwater (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 analyses.
For stormwater (wet weather) and non-stormwater (dry weather), it is assumed that loadings remain relatively independent of various Boise River flow conditions, and in turn are more dependent on factors such as population, service area, specific storm events, etc.

**Nonpoint Source Tributary, Ground Water, and Unmeasured**

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 25). This long-term data was 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). This data represents the best and most current ground water and unmeasured flow data for the lower Boise River.

It should be noted that shallow ground water that drains into and discharges with the tributaries and drains is not included in groundwater and unmeasured sources. This is particularly true 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.

**Additional Assumptions**

Lower Boise River TP inputs do not translate directly into TP loads at Parma. Instead, TP inputs relative to TP loadings 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, and the interrelationships among the complex plumbing, water re-use, 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 (e.g. 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 utilized to estimate lower Boise River TP concentrations or loads near Parma under
adjusted flows scenarios. This is 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 utilizing 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 24. Current permitted May 1 – September 30 point source TP discharge to the lower Boise River and its tributaries.

<table>
<thead>
<tr>
<th>Source</th>
<th>NPDES Permit No.</th>
<th>Main stem RM or Receiving Water</th>
<th>Mean Discharge (MGD)</th>
<th>Design Flow (MGD)</th>
<th>Mean TP Conc. (mg/L)</th>
<th>Permitted TP Conc. (mg/L)</th>
<th>Mean TP Load (lbs/day)</th>
<th>Permitted TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River - Main stem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lander</td>
<td>ID-002044-3</td>
<td>RM 50.0</td>
<td>12.71</td>
<td>15.0</td>
<td>2.10</td>
<td>0.07/monthly avg, 0.0931/weekly avg</td>
<td>222.7</td>
<td>8.7/monthly avg, 11.6/weekly avg</td>
</tr>
<tr>
<td>West Boise</td>
<td>ID-002398-1</td>
<td>RM 44.2</td>
<td>16.10</td>
<td>24.0</td>
<td>4.47</td>
<td>0.07/monthly avg, 0.084/weekly avg</td>
<td>600.5</td>
<td>14/monthly avg, 16.8/weekly avg</td>
</tr>
<tr>
<td>Middleton</td>
<td>ID-002183-1</td>
<td>RM 27.1</td>
<td>0.57</td>
<td>1.83</td>
<td>3.23</td>
<td>No Limit</td>
<td>15.4</td>
<td>No Limit</td>
</tr>
<tr>
<td>Caldwell</td>
<td>ID-002150-4</td>
<td>RM 22.6</td>
<td>7.90</td>
<td>8.50</td>
<td>2.37</td>
<td>No Limit</td>
<td>156.2</td>
<td>No Limit</td>
</tr>
<tr>
<td>IDFG-Eagle³</td>
<td>NPDES Aquaculture Permit</td>
<td>RM 41.8</td>
<td>2.95</td>
<td>4.25</td>
<td>0.02</td>
<td>No Limit</td>
<td>0.6</td>
<td>No Limit</td>
</tr>
<tr>
<td>Boise River –Tributaries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avimor⁵</td>
<td>In Application</td>
<td>Dry Creek</td>
<td>In Application</td>
<td>0.42</td>
<td>No Discharge Currently</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Star</td>
<td>ID-002359-1</td>
<td>Lawrence Kennedy Canal (Mill Slough/Boise River)</td>
<td>0.63</td>
<td>1.85</td>
<td>1.85</td>
<td>No Limit</td>
<td>9.7</td>
<td>No Limit</td>
</tr>
<tr>
<td>Meridian⁴</td>
<td>ID-002019-2</td>
<td>Fifemile Creek (Fifteenmile Creek)</td>
<td>5.87</td>
<td>10.2</td>
<td>1.26</td>
<td>No Limit</td>
<td>61.6</td>
<td>No Limit</td>
</tr>
<tr>
<td>Sorrento Lactalis</td>
<td>ID-002803-7</td>
<td>Mason Creek</td>
<td>0.7</td>
<td>1.52</td>
<td>0.03</td>
<td>0.07/monthly avg, 0.14/daily max</td>
<td>0.2</td>
<td>0.29/monthly avg, 0.58/daily max</td>
</tr>
<tr>
<td>Nampa</td>
<td>ID-002206-3</td>
<td>Indian Creek</td>
<td>10.51</td>
<td>18.0</td>
<td>4.97</td>
<td>No Limit</td>
<td>435.8</td>
<td>No Limit</td>
</tr>
<tr>
<td>Kuna</td>
<td>ID-002835-5</td>
<td>Indian Creek</td>
<td>0.47</td>
<td>3.5</td>
<td>0.04</td>
<td>0.07/monthly avg, 0.105/weekly avg</td>
<td>0.2</td>
<td>1.1/monthly avg, 1.65/weekly avg</td>
</tr>
<tr>
<td>IDFG-Nampa³</td>
<td>IDG-130042 NPDES Aquaculture Permit</td>
<td>Wilson Drain and Pond (Indian Creek)</td>
<td>17.85</td>
<td>19.38</td>
<td>0.06</td>
<td>No Limit</td>
<td>8.8</td>
<td>No Limit</td>
</tr>
<tr>
<td>Darigold</td>
<td>ID-002495-3</td>
<td>RM 22.6</td>
<td>0.22</td>
<td>1.70</td>
<td>0.31</td>
<td>No Limit</td>
<td>0.6</td>
<td>No Limit</td>
</tr>
<tr>
<td>Source</td>
<td>NPDES Permit No.</td>
<td>Main stem RM¹ or Receiving Water</td>
<td>Mean Discharge (MGD)²</td>
<td>Design Flow (MGD)</td>
<td>Mean TP Conc. (mg/L)³</td>
<td>Permitted TP Conc. (mg/L)</td>
<td>Mean TP Load (lbs/day)²</td>
<td>Permitted TP Load (lbs/day)²</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------</td>
<td>----------------------------------</td>
<td>-----------------------</td>
<td>-------------------</td>
<td>-----------------------</td>
<td>--------------------------</td>
<td>--------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>(unmeasured drain)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notus ⁵</td>
<td>ID-002101-6</td>
<td>Conway Gulch</td>
<td>No May-Sep Discharge</td>
<td>0.11</td>
<td>No May-Sep Discharge</td>
<td>0.07/monthly avg 0.14/weekly avg</td>
<td>No May-Sep Discharge Currently</td>
<td>0.064/monthly avg 0.128/weekly avg</td>
</tr>
<tr>
<td>Wilder</td>
<td>ID-0020265</td>
<td>Wilder Ditch Drain</td>
<td>0.07</td>
<td>0.25</td>
<td>6.02</td>
<td>No Limit</td>
<td>3.3</td>
<td>No Limit</td>
</tr>
<tr>
<td>Greenleaf ⁵</td>
<td>ID-002830-4</td>
<td>West End Drain</td>
<td>No May-Sep Discharge</td>
<td>0.24</td>
<td>No May-Sep Discharge</td>
<td>0.07/monthly avg 0.105/weekly avg</td>
<td>No May-Sep Discharge Currently</td>
<td>0.14/monthly avg 0.21/weekly avg</td>
</tr>
<tr>
<td>ConAgra (XL4Star) ⁵</td>
<td>ID-000078-7</td>
<td>Indian Creek</td>
<td>No May-Sep Discharge</td>
<td>0.48</td>
<td>No May-Sep Discharge</td>
<td>No Limit</td>
<td>No Limit</td>
<td>No Limit</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>76.54</strong></td>
<td></td>
<td><strong>111.23</strong></td>
<td><strong>2.37</strong></td>
<td></td>
<td></td>
<td><strong>1515.48</strong></td>
<td></td>
</tr>
</tbody>
</table>

¹ River Miles as identified by USGS in the Lower Boise River Mass Balance Report (Etheridge 2013). Darigold discharges to an unmeasured drain that discharges into the lower Boise River at or near RM 22.6.
² Calculated from May 1 – September 30, 2012 using data provided by facilities and/or DMR data.
³ 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.
⁴ Meridian – 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.
⁵ 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.
Figure 38. Current stormwater (wet weather) TP concentrations.
Table 25. Current May 1 – September 30 tributary TP discharge to the Lower Boise River.

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Lower Boise River Receiving River Mile (RM)</th>
<th>Mean Discharge (cfs)</th>
<th>Mean TP Concentration (mg/L)</th>
<th>Mean TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eagle Drain</td>
<td>42.7</td>
<td>36.3</td>
<td>0.11</td>
<td>22.3</td>
</tr>
<tr>
<td>Dry Creek</td>
<td>42.5</td>
<td>6.5</td>
<td>0.16</td>
<td>5.6</td>
</tr>
<tr>
<td>Thurman Drain</td>
<td>41.9</td>
<td>15.0</td>
<td>0.11</td>
<td>8.6</td>
</tr>
<tr>
<td>Fifteenmile Creek</td>
<td>30.3</td>
<td>131.7</td>
<td>0.31</td>
<td>222.2</td>
</tr>
<tr>
<td>Mill Slough</td>
<td>27.2</td>
<td>104.9</td>
<td>0.21</td>
<td>118.2</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>27.0</td>
<td>36.1</td>
<td>0.23</td>
<td>44.0</td>
</tr>
<tr>
<td>Mason Slough</td>
<td>25.6</td>
<td>13.0</td>
<td>0.22</td>
<td>15.4</td>
</tr>
<tr>
<td>Mason Creek</td>
<td>25.0</td>
<td>147.6</td>
<td>0.41</td>
<td>322.1</td>
</tr>
<tr>
<td>Hartley Gulch</td>
<td>24.4</td>
<td>39.2</td>
<td>0.27</td>
<td>57.4</td>
</tr>
<tr>
<td>Indian Creek</td>
<td>22.4</td>
<td>100.6</td>
<td>0.50</td>
<td>271.6</td>
</tr>
<tr>
<td>Conway Gulch</td>
<td>14.2</td>
<td>44.8</td>
<td>0.41</td>
<td>99.7</td>
</tr>
<tr>
<td>Dixie Drain</td>
<td>10.5</td>
<td>232.6</td>
<td>0.38</td>
<td>477.2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>908.4</strong></td>
<td><strong>Mean = 0.34</strong></td>
<td><strong>1664.4</strong></td>
</tr>
</tbody>
</table>

| Tributary Loads excluding POTW TP Loads\(^3\) | May 1 – Sept 30 | 853.5 | Mean = 0.25 | 1144.3 |

1 River Miles as identified by USGS in the lower Boise River Mass Balance Report (Etheridge 2013).
3 Tributary flows and loads were calculated by subtracting POTW flows, loads, and concentrations.

Table 26. Current May 1 – September 30 ground water/unmeasured and background TP discharge to the Lower Boise River.

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Mean Flow (cfs)(^1)</th>
<th>Mean TP Conc. (mg/L)</th>
<th>Mean TP Load (lbs/day as a monthly average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground water &amp; unmeasured(^1)</td>
<td>-1390 to 485</td>
<td>0.21</td>
<td>-1573 to 562</td>
</tr>
<tr>
<td>Background(^2)</td>
<td>37 to 317</td>
<td>0.018</td>
<td>68 to 317</td>
</tr>
</tbody>
</table>

1 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 10\(^{th}\) percentile high flow conditions, as the flows and loads are absorbed into near-river terrestrial zones.

2 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 27 and Figure 39.
**Table 27. 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).**

<table>
<thead>
<tr>
<th>Parma Flow</th>
<th>Current Background TP Inputs(^1)</th>
<th>Current NPDES POTW and Industry TP Inputs(^2)</th>
<th>Current Fish Hatchery TP Inputs(^3)</th>
<th>Current Tributary TP Inputs w/o NPDES Flows and Loads(^4)</th>
<th>Current Ground Water TP Inputs(^5)</th>
<th>Current Dry Weather Stormwater TP Inputs (Tribs/Ground Water)(^6,7)</th>
<th>Current Wet Weather Stormwater TP Inputs(^6,7)</th>
<th>Current Total TP Inputs</th>
<th>TP Inputs Reaching Parma</th>
<th>Current Parma TP Load</th>
<th>Parma TP Load Reduction Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\text{lbs/day})</td>
<td>(\text{mg/L})</td>
<td>(\text{lbs/day})</td>
<td>(\text{mg/L})</td>
<td>(\text{lbs/day})</td>
<td>(\text{mg/L})</td>
<td>(\text{lbs/day})</td>
<td>(\text{mg/L})</td>
<td>(\text{lbs/day})</td>
<td>(\text{mg/L})</td>
<td>(\text{lbs/day})</td>
<td>%</td>
</tr>
<tr>
<td>3268</td>
<td>0.018</td>
<td>317</td>
<td>86.3</td>
<td>3.24</td>
<td>1506</td>
<td>32</td>
<td>0.05</td>
<td>9</td>
<td>852</td>
<td>0.25</td>
<td>1144</td>
</tr>
<tr>
<td>912</td>
<td>0.018</td>
<td>88</td>
<td>86.3</td>
<td>3.24</td>
<td>1506</td>
<td>32</td>
<td>0.05</td>
<td>9</td>
<td>852</td>
<td>0.25</td>
<td>1144</td>
</tr>
<tr>
<td>705</td>
<td>0.018</td>
<td>68</td>
<td>86.3</td>
<td>3.24</td>
<td>1506</td>
<td>32</td>
<td>0.05</td>
<td>9</td>
<td>852</td>
<td>0.25</td>
<td>1144</td>
</tr>
<tr>
<td>624</td>
<td>0.015</td>
<td>50</td>
<td>84.0</td>
<td>3.18</td>
<td>1440</td>
<td>NA</td>
<td>0.06</td>
<td>9</td>
<td>888</td>
<td>0.18</td>
<td>880</td>
</tr>
<tr>
<td>383</td>
<td>0.018</td>
<td>37</td>
<td>86.3</td>
<td>3.24</td>
<td>1506</td>
<td>32</td>
<td>0.05</td>
<td>9</td>
<td>852</td>
<td>0.25</td>
<td>1144</td>
</tr>
</tbody>
</table>

\(^1\) 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.

\(^2\) POTW and industrial discharge data are calculated for May 1 – September 30, 2012, represented in Table 24. The USGS August 2012 synoptic sample data represent only POTW contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).

\(^3\) Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 24.

\(^4\) 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).

\(^5\) The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1315) under various river flow scenarios (Alex Etheridge, pers. comm. 2014). The USGS August 2012 synoptic identified ground water flows as 485 cfs with 0.21 mg/L concentration (Etheridge 2013).

\(^6\) Non-stormwater (dry weather) contributions were derived from data provided by the LBWC stormwater workgroup (Appendix E). Current non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water/unmeasured discharge.

\(^7\) Stormwater (wet weather) contributions were derived from data provided by the LBWC stormwater workgroup (Appendix E). These flows and loads represent specific precipitation (storm) events and were not captured as part of the USGS August 2012 synoptic sample (Etheridge 2013).

\(^*\) 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 lbs/day.
Figure 39. Current TP loads in the lower Boise River from May 1 – September 30, based on average 90th percentile low flow conditions.

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s.
* Non-stormwater (dry weather; DWx) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
5.3.2 Boise River and Mason Creek TP Loads (October 1 – April 30)

Background

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

NPDES-Permitted Wastewater, Industry, and Fish Hatchery Facilities

Point source contributions were calculated from facility-supplied data and/or DMRs from October 1 – April 30, 2012-2013 (Error! Reference source not found.). 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 in turn are more dependent on factors such as population, service area, etc.

NPDES-Permitted Municipal Stormwater and Non-Stormwater

Existing stormwater (wet weather) TP contributions were derived from data provided by the LBWC stormwater workgroup (Appendix E) through several workgroup meetings and correspondence. These data were developed for October 1 – April 30 for MS4-permitted and non-permitted 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.

Few non-stormwater (dry weather) data have been collected in the subbasin (Appendix E). During the October 1 through April 30 time period Non-stormwater (dry weather) flows and loads can come from a variety of sources, including but not limited to shallow ground water, urban/suburban sources (e.g. construction discharges), and other unmeasured sources. Agricultural returns and lawn watering typically occur during April. Further, non-stormwater (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 analyses.

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

Nonpoint Source Tributary, Ground Water, and Unmeasured

Agricultural and other nonpoint source tributary contributions were calculated from available USGS and ISDA data for October 1 – April 30 from 1983 through 2013 (Table 29). This long-term data was 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, 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). This data represents the best and most current ground water and unmeasured flow data for the lower Boise River.
Table 28. Current permitted October 1 – April 30 point source TP discharge to the lower Boise River.

<table>
<thead>
<tr>
<th>Source</th>
<th>NPDES Permit No.</th>
<th>Main stem RM(^1) or Receiving Water</th>
<th>Current Flow (MGD)(^2)</th>
<th>Design Flow (MGD)(^2)</th>
<th>Mean TP Conc. (mg/L)(^2)</th>
<th>Permitted TP Conc. (mg/L)(^2)</th>
<th>Mean TP Load (lbs/day)(^2)</th>
<th>Permitted TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boise River - Main stem</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lander</td>
<td>ID-002044-3</td>
<td>RM 50.0</td>
<td>12.24</td>
<td>15.0</td>
<td>1.77</td>
<td>No Limit</td>
<td>180.8</td>
<td>No Limit</td>
</tr>
<tr>
<td>West Boise</td>
<td>ID-002398-1</td>
<td>RM 44.2</td>
<td>14.65</td>
<td>24.0</td>
<td>4.94</td>
<td>No Limit</td>
<td>603.3</td>
<td>No Limit</td>
</tr>
<tr>
<td>Middleton</td>
<td>ID-002183-1</td>
<td>RM 27.1</td>
<td>0.41</td>
<td>1.83</td>
<td>4.37</td>
<td>No Limit</td>
<td>14.9</td>
<td>No Limit</td>
</tr>
<tr>
<td>Caldwell</td>
<td>ID-002150-4</td>
<td>RM 22.6</td>
<td>5.78</td>
<td>8.5</td>
<td>2.21</td>
<td>No Limit</td>
<td>106.6</td>
<td>No Limit</td>
</tr>
<tr>
<td>IDFG-Eagle</td>
<td>NPDES General Aquaculture Permit</td>
<td>RM 41.8</td>
<td>2.20</td>
<td>4.25</td>
<td>0.02</td>
<td>No Limit</td>
<td>0.4</td>
<td>No Limit</td>
</tr>
<tr>
<td><strong>Boise River - Tributaries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aivimor</td>
<td></td>
<td>In Application</td>
<td>Dry Creek</td>
<td>In Application</td>
<td>0.42</td>
<td>No Discharge Currently</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Star</td>
<td>ID-002359-1</td>
<td>Lawrence Kennedy Canal (Mill Slough/Boise River)</td>
<td>0.49</td>
<td>1.85</td>
<td>1.34</td>
<td>No Limit</td>
<td>5.5</td>
<td>No Limit</td>
</tr>
<tr>
<td>Meridian(^3)</td>
<td>ID-002019-2</td>
<td>Fifemile Creek (Fifteenmile Creek)</td>
<td>5.18</td>
<td>10.2</td>
<td>0.90</td>
<td>No Limit</td>
<td>38.7</td>
<td>No Limit</td>
</tr>
<tr>
<td>Sorrento Lactalis</td>
<td>ID-002803-7</td>
<td>Mason Creek</td>
<td>0.60</td>
<td>1.52</td>
<td>0.02</td>
<td>0.07/monthly avg 0.14/daily max</td>
<td>0.1</td>
<td>0.29/monthly avg 0.58/daily max</td>
</tr>
<tr>
<td>Nampa</td>
<td>ID-002206-3</td>
<td>Indian Creek</td>
<td>9.91</td>
<td>18.0</td>
<td>5.13</td>
<td>No Limit</td>
<td>424.1</td>
<td>No Limit</td>
</tr>
<tr>
<td>Kuna</td>
<td>ID-002835-5</td>
<td>Indian Creek</td>
<td>0.49</td>
<td>3.5</td>
<td>3.34</td>
<td>No Limit</td>
<td>13.8</td>
<td>No Limit</td>
</tr>
<tr>
<td>IDFG-Nampa(^3)</td>
<td>IDG-130042 NPDES General Aquaculture Permit</td>
<td>Wilson Drain and Pond (Indian Creek)</td>
<td>21.52</td>
<td>19.38</td>
<td>0.07</td>
<td>No Limit</td>
<td>12.7</td>
<td>No Limit</td>
</tr>
<tr>
<td>Darigold</td>
<td>ID-002495-3</td>
<td>RM 22.6 (unmeasured)</td>
<td>0.27</td>
<td>1.7</td>
<td>0.20</td>
<td>No Limit</td>
<td>0.4</td>
<td>No Limit</td>
</tr>
<tr>
<td>Source</td>
<td>NPDES Permit No.</td>
<td>Main stem RM&quot; or Receiving Water</td>
<td>Current Flow (MGD)&quot;</td>
<td>Design Flow (MGD)</td>
<td>Mean TP Conc. (mg/L)&quot;</td>
<td>Permitted TP Conc. (mg/L)</td>
<td>Mean TP Load (lbs/day)&quot;</td>
<td>Permitted TP Load (lbs/day)</td>
</tr>
<tr>
<td>------------</td>
<td>------------------</td>
<td>----------------------------------</td>
<td>---------------------</td>
<td>-------------------</td>
<td>-----------------------</td>
<td>--------------------------</td>
<td>-------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Notus</td>
<td>ID-002101-6</td>
<td>Conway Gulch</td>
<td>0.06</td>
<td>0.11</td>
<td>4.60</td>
<td>No Limit</td>
<td>2.2</td>
<td>No Limit</td>
</tr>
<tr>
<td>Wilder</td>
<td>ID-0020265</td>
<td>Wilder Ditch Drain</td>
<td>0.19</td>
<td>0.25</td>
<td>2.23</td>
<td>No Limit</td>
<td>3.6</td>
<td>No Limit</td>
</tr>
<tr>
<td>Greenleaf</td>
<td>ID-002830-4</td>
<td>West End Drain</td>
<td>0.06</td>
<td>0.24</td>
<td>0.06</td>
<td>No Limit</td>
<td>0.03</td>
<td>No Limit</td>
</tr>
<tr>
<td>ConAgra (XL4Star)</td>
<td>ID-000078-7</td>
<td>Indian Creek</td>
<td>No Oct-Apr Discharge Currently</td>
<td>0.48</td>
<td>No Oct-Apr Discharge Currently</td>
<td>No Limit</td>
<td>No Oct-Apr Discharge Currently</td>
<td>No Limit</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>74.04</td>
<td>111.23</td>
<td>2.28</td>
<td></td>
<td>1407.14</td>
<td></td>
</tr>
</tbody>
</table>

1 River Miles as identified by USGS in the Lower Boise River Mass Balance Report (Etheridge 2013). Darigold discharges to an unmeasured drain that discharges into the lower Boise River at or near RM 22.6.
2 Calculated from October 1 – April 30, 2012 using data provided by facilities and/or DMR data.
3 Meridian – Permitted flow was 7 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 flows is 10.2 (mgd) and is used for allocations.
4 The Avimor and ConAgra facilities did not discharge from October 1 – April 30. However, new NPDES permits allow October 1 – April 30 discharge.
Table 29. Current October 1 – April 30 tributary TP discharge to the Lower Boise River.

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Lower Boise River Receiving River Mile (RM)</th>
<th>Mean Discharge (cfs)²</th>
<th>Mean TP Conc. (mg/L)³</th>
<th>Mean TP Load (lbs/day)³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eagle Drain</td>
<td>42.7</td>
<td>11.7</td>
<td>0.16</td>
<td>9.8</td>
</tr>
<tr>
<td>Dry Creek</td>
<td>42.5</td>
<td>14.6</td>
<td>0.13</td>
<td>9.9</td>
</tr>
<tr>
<td>Thurman Drain</td>
<td>41.9</td>
<td>8.2</td>
<td>0.14</td>
<td>6.1</td>
</tr>
<tr>
<td>Fifteenmile Creek</td>
<td>30.3</td>
<td>58.0</td>
<td>0.34</td>
<td>104.9</td>
</tr>
<tr>
<td>Mill Slough</td>
<td>27.2</td>
<td>56.0</td>
<td>0.20</td>
<td>60.3</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>27.0</td>
<td>21.4</td>
<td>0.33</td>
<td>37.5</td>
</tr>
<tr>
<td>Mason Slough</td>
<td>25.6</td>
<td>5.8</td>
<td>0.36</td>
<td>11.1</td>
</tr>
<tr>
<td>Mason Creek</td>
<td>25.0</td>
<td>67.7</td>
<td>0.25</td>
<td>92.6</td>
</tr>
<tr>
<td>Hartley Gulch</td>
<td>24.4</td>
<td>10.7</td>
<td>0.31</td>
<td>17.9</td>
</tr>
<tr>
<td>Indian Creek</td>
<td>22.4</td>
<td>167.7</td>
<td>0.57</td>
<td>516.9</td>
</tr>
<tr>
<td>Conway Gulch</td>
<td>14.2</td>
<td>22.1</td>
<td>0.19</td>
<td>22.6</td>
</tr>
<tr>
<td>Dixie Drain</td>
<td>10.5</td>
<td>114.5</td>
<td>0.31</td>
<td>191.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>558.2</strong></td>
<td><strong>Mean = 0.36</strong></td>
<td><strong>1081.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Tributary Loads excluding POTW TP Loads**³  
498.6  Mean = 0.22  579.9

¹ River Miles as identified by USGS in lower Boise River Mass Balance Report (Etheridge 2013).
³ Tributary flows and loads were calculated by subtracting POTW flows, loads, and concentrations.
Table 30. Current October 1 – April 30 ground water/unmeasured and background TP discharge to the lower Boise River.

<table>
<thead>
<tr>
<th></th>
<th>Mean Flow (cfs)</th>
<th>Mean TP Conc. (mg/L)</th>
<th>Mean TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground water &amp; unmeasured(^1)</td>
<td>133 to 180</td>
<td>0.15</td>
<td>108 to 146</td>
</tr>
<tr>
<td>Background(^2)</td>
<td>1,293</td>
<td>0.018</td>
<td>125</td>
</tr>
</tbody>
</table>

\(^1\) Ground water and unmeasured mean flows are estimated from the October and March 2012-2013 USGS synoptic sampling and mass balance (Etheridge 2013), and the water balance used for the AQUATOX model.

\(^2\) Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data (see Section 3.2.2). The actual background loading (lbs) is variable depending on the river inflow from upstream, groundwater, and tributary/drain sources.
Figure 40. Current TP loads in the lower Boise River from October 1 – April 30, based on January 2012 through April 2013 modeling.

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s.
* Non-stormwater (dry weather; DWx) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
5.3.3 Sand Hollow TP Loads (May 1 – September 30)

Table 31 and Table 32 present May 1 – September 30 point source and nonpoint source discharge, TP concentrations, and TP loadings into Sand Hollow Creek, a tributary to the Snake River.

Table 31. Current permitted May 1 – September 30 point source TP discharge to Sand Hollow (a tributary to the Snake River).

<table>
<thead>
<tr>
<th>Source</th>
<th>NPDES Permit No.</th>
<th>Receiving Water</th>
<th>Mean Discharge (MGD)</th>
<th>Design Flow (MGD)</th>
<th>Mean TP Conc. (mg/L)</th>
<th>Permitted TP Conc. (mg/L)</th>
<th>Mean TP Load (lbs/day)¹</th>
<th>Permitted TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parma</td>
<td>ID-002177-6</td>
<td>Sand Hollow</td>
<td>0.09</td>
<td>0.68</td>
<td>0.21</td>
<td>No Limit</td>
<td>0.15</td>
<td>No Limit</td>
</tr>
</tbody>
</table>

¹ Calculated from May 1 – September 30, 2012-2013 using data provided by facilities and/or DMR data.

Table 32. Current May 1 – September 30 nonpoint source TP discharge to Sand Hollow (a tributary to the Snake River).

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Receiving Water</th>
<th>Mean Discharge (cfs)</th>
<th>Mean TP Conc. (mg/L)</th>
<th>Mean TP Load (lbs/day)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonpoint, ground water, background, and other unmeasured</td>
<td>Sand Hollow (Snake River)</td>
<td>140.8</td>
<td>0.4</td>
<td>302.6</td>
</tr>
</tbody>
</table>

¹ From ISDA and USGS for data available data from 1998 – 2013. This includes TP loading from the Parma POTW.
Figure 41. Current TP loads in Sand Hollow Creek May 1 – September 30, based on average daily total TP inputs of approximately 301 lbs/day.
5.3.4 Sand Hollow TP Loads (October 1 – April 30)

Table 33 and Table 34 present October 1 – April 30 point source and nonpoint source discharge, TP concentrations, and TP loadings into Sand Hollow Creek, a tributary to the Snake River.

Table 33. Permitted October 1 – April 30 point source TP discharge to Sand Hollow (a tributary to the Snake River).

<table>
<thead>
<tr>
<th>Source</th>
<th>NPDES Permit No.</th>
<th>Receiving Water</th>
<th>Mean Discharge (MGD)¹</th>
<th>Design Flow (MGD)</th>
<th>Mean TP Conc. (mg/L)¹</th>
<th>Permitted TP Conc. (mg/L)</th>
<th>Permitted TP Load (lbs/day)¹</th>
<th>Permitted TP Load (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parma</td>
<td>ID-002177-6</td>
<td>Sand Hollow (Snake River)</td>
<td>0.13</td>
<td>0.68</td>
<td>0.12</td>
<td>No Limit</td>
<td>0.1</td>
<td>No Limit</td>
</tr>
</tbody>
</table>

¹ Calculated from October 1 – April 30, 2012-2013 using data provided by facilities and/or DMR data.

Table 34. October 1 – April 30 nonpoint source TP discharge to Sand Hollow (a tributary to the Snake River).

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Receiving Water</th>
<th>Mean Discharge (cfs)</th>
<th>Mean TP Conc. (mg/L)¹</th>
<th>Mean TP Load (lbs/day)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonpoint, ground water, background, and other unmeasured</td>
<td>Sand Hollow (Snake River)</td>
<td>63.6</td>
<td>0.33</td>
<td>113.3</td>
</tr>
</tbody>
</table>

¹ From ISDA and USGS for data available data from 1998 – 2013. This includes TP loading from the Parma POTW.
Current TP Loads in Sand Hollow Creek
(October 1 - April 30)

Figure 42. Current TP loads in Sand Hollow Creek from October 1 – April 30, based on average daily total TP inputs of approximately 113 lbs/day.
5.4 Load and Wasteload Allocations

The load and wasteload allocations include a margin of safety to take into account seasonal variability and uncertainty. Uncertainty arises in selection of water quality targets, load capacity, and estimates of 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.

A detailed approach was used for the analysis and selection of 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). Considerations included equitable cost, cost effectiveness, and credit for prior efforts, but all within the ceiling of remaining 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 vs. ground water and unmeasured). The projected implementation timeframes are identified in section 5.5.1, and will be further evaluated in the subsequent implementation plan.

5.4.1 Boise River and Mason Creek TP Allocations to Achieve the SR-HC TMDL Target of ≤ 0.07 mg/L May 1 – September 30

- May 1 – September 30: TP concentrations 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 in order 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/m² in the impaired AUs lower Boise River. Tables 38-44, Figure 43, and Figure 44 outline sector-wide and specific allocations that achieve both targets. As with the current loading estimates, there are several assumptions identified in the load and wasteload analyses to help achieve the May 1 – September TP and periphyton targets.

Background

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, ≤ 0.07 mg/L TP target near Parma and the ≤ 150 mg/m² mean monthly periphyton target, this sector received load allocations of 37 to 317 lbs/day (0.018 mg/L) TP for various flow conditions (0% reduction).

---

4 Note: Given the complexity of the LBR managed watershed, through the implementation process and the TMDL 5-year review, WLAs and LAs established in this TMDL may be reevaluated as additional data become available.
NPDES-Permitted Wastewater, Industry, 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 in turn are more dependent on factors such as population, service area, etc.

To achieve the May 1 – September 30, ≤ 0.07 mg/L TP target near Parma and the ≤ 150 mg/m² mean monthly periphyton target, this sector received wasteload allocations of 73 lbs/day (0.1 mg/L) TP for all flow conditions (95% reduction).

NPDES Permitted Municipal Stormwater and Non-Stormwater

Stormwater (wet weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E) through several meetings and correspondence. It should be noted that 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. Further, these TP wasteload and load allocations may need to be adjusted to reflect MS4 boundary and land use changes in the lower Boise River subbasin.

Non-stormwater (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 in order help achieve the May 1 – September 30 TP target of ≤ 0.07 mg/L near Parma. Stormwater (wet weather) and non-stormwater (dry weather) allocations are for MS4-permitted and non-permitted areas. And it is assumed that these loadings remain relatively independent of various Boise River flow scenarios, and in turn 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 ≤ 150 mg/m² mean monthly periphyton target, stormwater (wet weather) load and wasteload allocations represent a 42% load reduction from current understanding of baseline loads. Non-stormwater (dry weather) allocations represent 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. 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

- Non-stormwater (dry weather) in MS4-permitted areas:
  - Average daily wasteload allocations\(^5\) as an 84% TP load reduction equivalent to 0.07 mg/L under current flow conditions

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\(^5\) To the extent that non-stormwater (dry weather) discharges are the result of exempt non-point source activities (i.e., irrigation flows and pass-through) they are assigned a load allocation.
• Non-stormwater (dry weather) in non-MS4 permitted areas:
  o Average daily load allocations as an 84% TP load reduction equivalent to 0.07 mg/L under current flow conditions

Stormwater (wet weather) and non-stormwater (dry weather) 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 lower Boise River subbasin.

The plumbing of MS4 systems is intricate, and the exact quantity of the non-stormwater inputs is presently unknown. However, MS4 permittees have provided initial estimates for the percentage of their non-stormwater discharge that originates from nonpoint-sources (Table 35). These estimates should be refined through monitoring and mapping in future permit cycles and as part of the TMDL implementation.

Table 35. Estimates for the percentage of non-stormwater (dry weather) MS4 discharge attributable to NPDES-Exempt Agricultural flows. These estimates are very approximate, and are based on professional judgment, rather than hard data. See Table 16 for a list of all authorized non-stormwater discharges.

<table>
<thead>
<tr>
<th>Facility</th>
<th>NPDES Permit No.</th>
<th>Non-Stormwater (dry-weather) Discharge Attributable to NPDES-Exempt Agricultural Flows (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise/Ada County MS4</td>
<td>IDS-028185 &amp; IDS-027561</td>
<td>50%</td>
</tr>
<tr>
<td>Non-permitted¹</td>
<td>Kuna and Star</td>
<td>100%</td>
</tr>
<tr>
<td>Canyon Hwy Dist #4 MS4</td>
<td>IDS-028134</td>
<td>100%</td>
</tr>
<tr>
<td>ITD District #3</td>
<td>IDS-028177</td>
<td>100%</td>
</tr>
<tr>
<td>Middleton MS4</td>
<td>IDS-028100</td>
<td>?²</td>
</tr>
<tr>
<td>Nampa MS4</td>
<td>IDS-028126</td>
<td>99%</td>
</tr>
<tr>
<td>Nampa Hwy District MS4</td>
<td>IDS-028142</td>
<td>0%</td>
</tr>
<tr>
<td>Caldwell MS4</td>
<td>IDS-028118</td>
<td>98%</td>
</tr>
<tr>
<td>Non-permitted¹</td>
<td>Notus-Parma MS4 (former MS4 IDS-028151)</td>
<td>100%</td>
</tr>
<tr>
<td>Non-permitted¹</td>
<td>Greenleaf, Notus, Parma, Wilder</td>
<td>100%</td>
</tr>
<tr>
<td>Industrial Facilities</td>
<td>Multi-Sector General Permit</td>
<td>0%</td>
</tr>
<tr>
<td>Construction Activities</td>
<td>Construction General Permit</td>
<td>0%</td>
</tr>
<tr>
<td>Confined Animal Feeding Operations</td>
<td>IDG010000</td>
<td>0%</td>
</tr>
</tbody>
</table>

¹ The “Non-permitted” 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.
² Estimates have not been received for these MS4 systems at the time of release for this draft TMDL.
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 vs Load**
  - It is generally understood that 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 to 45 percent of influent phosphorus loads, and 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. 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 an source of such flows, including to confirm whether such groundwater and/or irrigation water flows are indeed uncontaminated.
  - 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, but not all, entities in the lower Boise River watershed, have active stormwater management programs and policies, such as onsite retention and other low impact development or area-wide green infrastructure practices), which when fully implemented across the watershed, are the primary mechanisms for managing stormwater and reducing pollutant loadings 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 (wet weather) 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.
    - 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.
  - 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 at this time how the loads from these discrete events impact periphytic growth.
• Permittees and Non-Permittees
  o In situations where a stormwater (wet weather) or non-stormwater (dry weather) source is not currently regulated by a permit but may become part of a permitted area in the future, the allocation is currently expressed load allocation. The load allocation could later be deemed a wasteload allocation if the stormwater (wet weather) or non-stormwater (dry weather) discharge for the source were required to obtain NPDES permit coverage or become annexed into an existing MS4.
  o Therefore, MS4 discharges occurring within jurisdictions within Ada County which do not meet the federal MS4 definition and therefore are not regulated by NPDES permits (e.g. Meridian, Eagle, unincorporated urbanized Ada County, and Southwest Boise) are authorized under existing NPDES permits and managed by the existing MS4 permittees in those areas and therefore are not assigned specific wasteload allocations. These specific Ada County jurisdictional areas are included as load allocation in the TMDL because these jurisdictions must use their existing regulatory authority over private and municipal properties to require, onsite retention and other low impact development or area-wide green infrastructure practices to mitigate potential sources of stormwater runoff.

• Non-Stormwater (Dry Weather)
  o In this TMDL analysis, the non-stormwater (dry weather) flows and loads are implicitly measured as a subcomponent of the tributary and ground water/unmeasured discharge.
  o Non-stormwater (dry weather) 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.
  o Due to non-stormwater (dry weather) being estimated as an inherent component of tributaries and ground water/unmeasured 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.
  o The non-stormwater (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, reuse, dry weather inspections, and public education.

Nonpoint Source Tributary, Ground Water, and Unmeasured

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 of ≤ 0.07 mg/L near Parma and the ≤ 150 mg/m² mean monthly periphyton target, this sector received allocations of 310 lbs/day (0.07 mg/L) TP for all flow conditions (73% reduction).

Ground water and unmeasured flows were calculated from the 2012 August synoptic sampling effort in the lower Boise River 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, ≤ 0.07 mg/L TP target near Parma and the ≤ 150 mg/m² mean monthly periphyton target, this sector received allocations of -524 to 183 lbs/day (0.07 mg/L) TP for various flow conditions (67% reduction).

**Additional Assumptions**

Because the USGS mass balance model does not account for varying flow and TP relationships in the subbasin, upon recommendation from the USGS model developer (Alex Etheridge, pers. comm. 2014), the USGS mass balance model was not utilized to set TP allocations near Parma under adjusted flows scenarios. The USGS mass balance model was used, however, for initial sensitivity analysis of TP concentration inputs under twelve scenarios. The analysis was insightful for narrowing the range of potential load and wasteload allocations under current conditions (Etheridge 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 timeframe.

As such, the load duration approach and simplified mass balance excel spreadsheet model was utilized to assess May-September TP load allocations relative to the ≤ 0.07 mg/L TP target (see Tables 40, 41 and Figures 43, 44). Because under current and historical conditions, it was estimated that 23% of the total TP loading into the lower Boise River reaches Parma from May-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 utilized the same 23% multiplier to estimate the proportion of total TP loading expected to reach Parma from May-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.
Table 36. TP loads, capacities, and water quality targets for May 1 – September 30, presented as daily averages. These are calculated for: 1) the Boise River near Parma; 2) Mason Creek, a lower Boise River tributary, and: 3) Sand Hollow, a Snake River tributary.

<table>
<thead>
<tr>
<th>Water Body</th>
<th>Flow² (cfs)</th>
<th>Flow Rank (%)</th>
<th>Current Load²</th>
<th>Load Capacity³</th>
<th>Water Quality Targets³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>TP Conc. (mg/L)</td>
<td>TP Load (lbs/day)</td>
<td>Target TP Conc. (mg/L)</td>
</tr>
<tr>
<td>Lower Boise River near Parma – (AU 001_06)</td>
<td>3268</td>
<td>10th</td>
<td>0.21</td>
<td>3747</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td></td>
<td>912</td>
<td>40th</td>
<td>0.31</td>
<td>1531</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td></td>
<td>705</td>
<td>60th</td>
<td>0.31</td>
<td>1190</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td>USGS August Synoptic Sample⁴</td>
<td>624</td>
<td>69th</td>
<td>0.30</td>
<td>1010</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td></td>
<td>383</td>
<td>90th</td>
<td>0.36</td>
<td>738</td>
<td>≤ 0.07</td>
</tr>
<tr>
<td>Mason Creek – (AU 006_02)</td>
<td>148 Mean</td>
<td>0.41</td>
<td>322</td>
<td>≤ 0.07</td>
<td>56</td>
</tr>
<tr>
<td>(Tributary to the lower Boise River)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Hollow – (AU 017_06)</td>
<td>141 Mean</td>
<td>0.4</td>
<td>303</td>
<td>≤ 0.07</td>
<td>53</td>
</tr>
<tr>
<td>(Tributary to the Snake River)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ All assessment units (AUs) begin with ID17050114.
² Lower Boise River – based on a data from May 1 – September 30, 1987 through 2012 and duration curves with water quality targets.
³ Mason Creek – based on USGS and ISDA mean data from May 1 – September 30, 1995 through 2012.
⁵ Lower Boise River - load capacities and water quality targets are applied near Parma, using duration curves.
⁶ Mason Creek and Sand Hollow Creek – mean load capacities and water quality targets calculated and applied as instream conditions.
⁷ 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.
Table 37. 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 wastewater allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits. The green highlight represents data derived from the USGS August 2012 mass balance model for the lower Boise River (Etheridge 2013). See Section 5.4.1 for further description of the TP allocation development.

<table>
<thead>
<tr>
<th>Parma Flow</th>
<th>Background TP Allocations1 (per day as monthly average)</th>
<th>NPDES WWTF and Industry TP Allocations2 (per day as monthly average)</th>
<th>Fish Hatchery TP Allocations3 (per day as monthly average)</th>
<th>Tributary TP Allocations w/o NPDES Flows and TP Loads4 (per day as monthly average)</th>
<th>Ground Water TP Allocations2 (per day as monthly average)</th>
<th>Dry Weather Stormwater TP Allocations (Accounted for in Tribs)5 (per day as monthly average)</th>
<th>Wet Weather Stormwater TP Allocations (per day as monthly average)</th>
<th>TP Input Allocations (per day as monthly average)</th>
<th>TP Inputs Reaching Parma</th>
<th>Parma TP Load w/ Allocations (per day as monthly average)</th>
<th>Parma TP Load Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
<td>(cfs) (mg/L) (lbs)</td>
</tr>
<tr>
<td>3268</td>
<td>0.018</td>
<td>317</td>
<td>135.6</td>
<td>0.10</td>
<td>73</td>
<td>37</td>
<td>0.10</td>
<td>20</td>
<td>822</td>
<td>0.07</td>
<td>310</td>
</tr>
<tr>
<td>912</td>
<td>0.018</td>
<td>88</td>
<td>135.6</td>
<td>0.10</td>
<td>73</td>
<td>37</td>
<td>0.10</td>
<td>20</td>
<td>822</td>
<td>0.07</td>
<td>310</td>
</tr>
<tr>
<td>705</td>
<td>0.018</td>
<td>68</td>
<td>135.6</td>
<td>0.10</td>
<td>73</td>
<td>37</td>
<td>0.10</td>
<td>20</td>
<td>822</td>
<td>0.07</td>
<td>310</td>
</tr>
<tr>
<td>624</td>
<td>0.015</td>
<td>50</td>
<td>120.0</td>
<td>0.10</td>
<td>65</td>
<td>34</td>
<td>0.10</td>
<td>18</td>
<td>888</td>
<td>0.07</td>
<td>335</td>
</tr>
<tr>
<td>383</td>
<td>0.018</td>
<td>37</td>
<td>135.6</td>
<td>0.10</td>
<td>73</td>
<td>37</td>
<td>0.10</td>
<td>20</td>
<td>822</td>
<td>0.07</td>
<td>310</td>
</tr>
</tbody>
</table>

1 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). Long-term median data and the USGS 2012-2013 synoptic data (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L.
2 POTW and industrial discharge data are based on facility design flows, represented in Table 24. The USGS August 2012 synoptic sample data represent only POTW contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).
3 Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 24.
4 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 tributary flows by removing the contributions from only the Meridian and Nampa facilities (Etheridge 2013).
5 The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1315) under various river flow scenarios (Alex Etheridge, pers. comm. 2014). The USGS August 2012 synoptic identified ground water flows as 485 cfs with 0.21 mg/L concentration (Etheridge 2013).
6 Non-stormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E), 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. Non-stormwater (dry weather) 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.
7 Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Appendix E), 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).

* Note: 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.
Figure 43. TP allocation targets (orange markers and labels) for the lower Boise River near Parma, relative to current TP loads (blue markers and labels) and the TP target load equivalent of < 0.07 mg/L (red line). The green markers and labels represent the loads derived from the USGS August 2012 synoptic sampling event (Etheridge 2013).
Figure 44. TP concentration targets (orange markers and labels) for the lower Boise River near Parma, relative to Current TP concentrations (blue markers and labels) and TP target concentration of < 0.07 mg/L (red line). The green markers and labels represent the current load derived from the USGS August 2012 synoptic sampling event (Etheridge 2013).
Table 38. 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, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

<table>
<thead>
<tr>
<th>Table 38.</th>
<th>Average Daily Background TP$^1$</th>
<th>Average Daily NPDES POTW and Industry TP$^2$</th>
<th>Average Fish Hatchery TP$^3$</th>
<th>Average Tributary (w/o NPDES Flows and Loads) TP$^4$</th>
<th>Average Ground Water and Unmeasured TP$^5$</th>
<th>Average Non-Stormwater Dry Weather TP$^6$</th>
<th>Average Stormwater Wet Weather TP$^7$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current TP Conc. (mg/L)</td>
<td>0.018</td>
<td>3.27</td>
<td>0.05</td>
<td>0.25</td>
<td>0.21</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Current TP Load (lbs/day)</td>
<td>37</td>
<td>1506</td>
<td>9</td>
<td>1144</td>
<td>450</td>
<td>394</td>
<td>71</td>
</tr>
<tr>
<td>Target TP Conc. (mg/L)</td>
<td>0.018</td>
<td>0.1</td>
<td>0.1</td>
<td>0.07</td>
<td>0.07</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>TP Allocation (lb/day as a monthly average)</td>
<td>37</td>
<td>73</td>
<td>20</td>
<td>310</td>
<td>150</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Percent Reduction (%)</td>
<td>0%</td>
<td>-95%</td>
<td>110%</td>
<td>-73%</td>
<td>-67%</td>
<td>84%</td>
<td>42%</td>
</tr>
</tbody>
</table>

$^1$ 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.

$^2$ POTW and industrial discharge data are based on facility design flows, represented in Table 24.

$^3$ Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 24.

$^4$ Tributary data (Table 25) were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.

$^5$ 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.

$^6$ Non-stormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 17 and Appendix E) 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. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

$^7$ Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 17 and Appendix E) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.
Current vs. Projected TP Loads in the Lower Boise River
(May 1 - September 30)

Figure 45. Current vs. projected TP loads for the lower Boise River from May 1 – September 30.

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

* Non-stormwater (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. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
Table 39 identifies facility-specific point source TP wasteload allocations, T identifies stormwater load and wasteload allocations, Table 41 and Table 42 identify the nonpoint source load allocations for the lower Boise River tributaries, natural background, ground water and unmeasured.

Table 39. 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, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

<table>
<thead>
<tr>
<th>Point Source</th>
<th>Current Flow (MGD)</th>
<th>Design Flow (MGD)</th>
<th>Current TP Conc. (mg/L)</th>
<th>Current TP Load (lbs/day)</th>
<th>Average TP Allocation(^1) (lbs/day as a monthly average)</th>
<th>Average TP Load Reduction(^1) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boise River - Main stem</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lander Street</td>
<td>12.71</td>
<td>15</td>
<td>2.10</td>
<td>222.7</td>
<td>12.5</td>
<td>-94%</td>
</tr>
<tr>
<td>West Boise</td>
<td>16.10</td>
<td>24</td>
<td>4.47</td>
<td>600.5</td>
<td>20.0</td>
<td>-97%</td>
</tr>
<tr>
<td>Middleton</td>
<td>0.57</td>
<td>1.83</td>
<td>3.23</td>
<td>15.4</td>
<td>1.5</td>
<td>-90%</td>
</tr>
<tr>
<td>Caldwell</td>
<td>7.90</td>
<td>8.5</td>
<td>2.37</td>
<td>156.2</td>
<td>7.1</td>
<td>-96%</td>
</tr>
<tr>
<td>IDFG Eagle</td>
<td>2.95</td>
<td>4.25</td>
<td>0.02</td>
<td>0.6</td>
<td>3.6</td>
<td>+500%</td>
</tr>
<tr>
<td><strong>Boise River – Tributary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avimor – Dry Creek</td>
<td>No Discharge Currently</td>
<td>0.42</td>
<td>No Discharge Currently</td>
<td>0.35</td>
<td>No Discharge Currently</td>
<td></td>
</tr>
<tr>
<td>Star – Lawrence-Kennedy Canal</td>
<td>0.63</td>
<td>1.85</td>
<td>1.85</td>
<td>9.7</td>
<td>1.5</td>
<td>-84%</td>
</tr>
<tr>
<td>Meridian – Fivemile Creek</td>
<td>5.87</td>
<td>10.2</td>
<td>1.26</td>
<td>61.6</td>
<td>8.5</td>
<td>-86%</td>
</tr>
<tr>
<td>Meridian – Boise River</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorrento Lactalis – Purdham Drain</td>
<td>0.7</td>
<td>1.52</td>
<td>0.03</td>
<td>0.2</td>
<td>1.3</td>
<td>+738%</td>
</tr>
<tr>
<td>Nampa – Indian Creek</td>
<td>10.51</td>
<td>18.0</td>
<td>4.97</td>
<td>435.8</td>
<td>15.0</td>
<td>-97%</td>
</tr>
<tr>
<td>Kuna – Indian Creek</td>
<td>0.47</td>
<td>3.5</td>
<td>0.04</td>
<td>0.2</td>
<td>2.9</td>
<td>+1766%</td>
</tr>
<tr>
<td>IDFG Nampa – Indian Creek</td>
<td>17.85</td>
<td>19.38</td>
<td>0.06</td>
<td>8.8</td>
<td>16.2</td>
<td>+84%</td>
</tr>
<tr>
<td>Darigold – unmeasured drain</td>
<td>0.22</td>
<td>1.7</td>
<td>0.31</td>
<td>0.6</td>
<td>1.4</td>
<td>+149%</td>
</tr>
<tr>
<td>Notus – Conway Gulch</td>
<td>No Discharge Currently</td>
<td>0.11</td>
<td>No Discharge Currently</td>
<td>0.09</td>
<td>No Discharge Currently</td>
<td></td>
</tr>
<tr>
<td>Wilder – Wilder Ditch Drain</td>
<td>0.07</td>
<td>0.25</td>
<td>6.02</td>
<td>3.3</td>
<td>0.21</td>
<td>-94%</td>
</tr>
<tr>
<td>Greenleaf – West End Drain</td>
<td>No Discharge Currently</td>
<td>0.24</td>
<td>No Discharge Currently</td>
<td>0.20</td>
<td>No Discharge Currently</td>
<td></td>
</tr>
<tr>
<td>Point Source</td>
<td>Current Flow (MGD)</td>
<td>Design Flow (MGD)</td>
<td>Current TP Conc. (mg/L)</td>
<td>Current TP Load (lbs/day)</td>
<td>Average TP Allocation¹ (lbs/day as a monthly average)</td>
<td>Average TP Load Reduction¹ (%)</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------</td>
<td>-------------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
<td>-------------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>ConAgra (XL 4 Star) – Indian Creek</td>
<td>No Discharge Currently</td>
<td>0.48</td>
<td>No Discharge Currently</td>
<td>No Discharge Currently</td>
<td>0.40</td>
<td>No Discharge Currently</td>
</tr>
<tr>
<td>Total</td>
<td>76.5</td>
<td>111.2</td>
<td>2.37</td>
<td>1515.5</td>
<td>92.8</td>
<td>-94%</td>
</tr>
</tbody>
</table>

¹ The WLAs and load reductions are estimates that achieve the ≤ 0.07 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 lower Boise River mean monthly periphyton target (see Section 5.4.3).
² 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 are 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.
³ Point source allocations can be met through trading or offset as detailed in regulations and guidance documents, such as the revised DEQ Water Quality Trading Guidance Document and the Lower Boise Trading Framework.
Table 40. Point source stormwater (wet weather) and non-stormwater (dry weather) TP allocations for MS4-permitted and non-permitted 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.

<table>
<thead>
<tr>
<th>Permit Holder/Jurisdiction</th>
<th>NPDES Permit Number</th>
<th>MS4 Permit Type</th>
<th>Permitted Areas</th>
<th>Non-Permitted Areas</th>
<th>Oct-April Current stormwater Wet Weather Avg TP Load ( \times 5.39 \times 0.57 )</th>
<th>Oct-April Current non-stormwater Dry Weather Avg TP Load ( \times 5.39 \times 0.16 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ada County</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boise/Garden City</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>87</td>
<td>84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boise</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>83</td>
<td></td>
<td></td>
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<tr>
<td>Garden City</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>4</td>
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<tr>
<td>Ada County Highway District</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>82</td>
<td></td>
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<tr>
<td>Boise State University</td>
<td>IDS027561</td>
<td>Phase I</td>
<td></td>
<td>0.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ada County Drainage District 3</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>8</td>
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<tr>
<td>ITD, District 3</td>
<td>IDS027561</td>
<td>Phase I</td>
<td></td>
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<tr>
<td><strong>Total Area Boise/Garden City Phase I Permit</strong></td>
<td></td>
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<td>87</td>
<td>0.31</td>
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<tr>
<td>Ada County Highway District</td>
<td>IDS028185</td>
<td>Phase II</td>
<td>62</td>
<td>84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meridian</td>
<td></td>
<td></td>
<td>24</td>
<td>28</td>
<td></td>
<td></td>
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<tr>
<td>Eagle</td>
<td></td>
<td></td>
<td>12</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urbanized Ada County (unincorporated)</td>
<td></td>
<td></td>
<td>-</td>
<td>26</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td><strong>Total Area Ada County Phase II Permit</strong></td>
<td></td>
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<td>62</td>
<td>0.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kuna</td>
<td>NA</td>
<td></td>
<td></td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Star</td>
<td>NA</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Ada County Incorporated Non-Permitted Area</strong></td>
<td></td>
<td></td>
<td>44</td>
<td>0.16</td>
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<tr>
<td><strong>Canyon County</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Caldwell</td>
<td>IDS028118</td>
<td>Phase II</td>
<td>17.5</td>
<td>4.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nampa</td>
<td>IDS028126</td>
<td>Phase II</td>
<td>25</td>
<td>6.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middleton</td>
<td>IDS028100</td>
<td>Phase II</td>
<td>2.3</td>
<td>2.9</td>
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<td></td>
</tr>
<tr>
<td>Urbanized Canyon County (unincorporated)</td>
<td></td>
<td></td>
<td>-</td>
<td>24.8</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ITD, District 3</td>
<td>IDS028177</td>
<td>Phase II</td>
<td>8</td>
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<td></td>
</tr>
<tr>
<td>Nampa Highway District #1</td>
<td>IDS028134</td>
<td>Phase II</td>
<td>8.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notus-Parma Highway District #1</td>
<td>IDS028151</td>
<td>Phase II</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Area Canyon County Phase II Permits</strong></td>
<td></td>
<td></td>
<td>70</td>
<td>0.25</td>
<td></td>
<td>84% Load Reduction = ( Q \times C \times 5.39 \times 0.16 )</td>
</tr>
<tr>
<td>Greenleaf</td>
<td>NA</td>
<td></td>
<td></td>
<td>0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notus</td>
<td>NA</td>
<td></td>
<td></td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parma</td>
<td>NA</td>
<td></td>
<td></td>
<td>1.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilder</td>
<td>NA</td>
<td></td>
<td></td>
<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Canyon County Incorporated Non-Permitted Area</strong></td>
<td></td>
<td></td>
<td>17</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1 Urbanized Area based on 2010 Census; which may differ from the MS4 permitted areas which are based on 2003 Decennial Census data
2 Ada County Assessor 7/9/14
3 Canyon County Assessor 5/28/14
4 Area data from NPDES Permit Factsheets (2000 Census)
5 Area ratio= the area contribution of each MS4 Permit relative to the total service area for MS4s
6 Stormwater (wet wetather) allocations represent a 43% average TP load reduction on average across all permitted and non-permitted MS4 areas. The gross current TP load estimate is 107 lbs/day, with a reduction to 61 lbs/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).
7 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.
8 Non-stormwater (dry weather) allocations represent an 84% TP load reduction on average across all permitted and non-permitted 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 lbs/day, with a reduction to 7 lbs/day (non-stormwater (dry weather) 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).
9 It is DEQ’s intent to include in the MS4 wasteload allocation, only that non-storm water that is categorized as allowable under the MS4 NPDES permit, and to treat other non-storm water flow as a nonpoint source. If the other non-storm water flow can be identified and quantified by the MS4, it will be treated under this TMDL as a nonpoint source (see Table 38). Further, this TMDL does not excuse the responsibility of the MS4 owner or operator to comply with the terms of the applicable NPDES permit.
10 The October-April 84% reduction for non-stormwater dry weather is an estimated average across all MS4s. The actual percent reduction would be based on the current loading for each individual MS4.

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

*The “Non-permitted” 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.
Figure 46. Current vs. projected stormwater (wet weather) TP concentrations (year-round).
Table 41. 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.

<table>
<thead>
<tr>
<th>Tributary</th>
<th>Boise River Receiving River Mile (RM)</th>
<th>Flow (cfs)</th>
<th>Current TP Conc. (mg/L)</th>
<th>Current TP Load (lbs/day)</th>
<th>Target TP Conc. (mg/L)</th>
<th>Average TP Allocation¹ (lbs/day as a monthly average)</th>
<th>Average TP Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eagle Drain</td>
<td>42.7</td>
<td>36.3</td>
<td>0.11</td>
<td>22.3</td>
<td>0.070</td>
<td>13.7</td>
<td>-39%</td>
</tr>
<tr>
<td>Dry Creek²</td>
<td>42.5</td>
<td>6.5</td>
<td>0.16</td>
<td>5.6</td>
<td>0.073</td>
<td>2.6</td>
<td>-54%</td>
</tr>
<tr>
<td>Thurman Drain</td>
<td>41.9</td>
<td>15.0</td>
<td>0.11</td>
<td>8.6</td>
<td>0.070</td>
<td>5.7</td>
<td>-34%</td>
</tr>
<tr>
<td>Fifteenmile Creek³</td>
<td>30.3</td>
<td>131.7</td>
<td>0.31</td>
<td>222.2</td>
<td>0.074</td>
<td>52.3</td>
<td>-76%</td>
</tr>
<tr>
<td>Mill Slough⁴</td>
<td>27.2</td>
<td>104.9</td>
<td>0.21</td>
<td>118.2</td>
<td>0.071</td>
<td>40.1</td>
<td>-66%</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>27.0</td>
<td>36.1</td>
<td>0.23</td>
<td>44.0</td>
<td>0.070</td>
<td>13.6</td>
<td>-69%</td>
</tr>
<tr>
<td>Mason Slough</td>
<td>25.6</td>
<td>13.0</td>
<td>0.22</td>
<td>15.4</td>
<td>0.070</td>
<td>4.9</td>
<td>-68%</td>
</tr>
<tr>
<td>Mason Creek⁵</td>
<td>25.0</td>
<td>147.6</td>
<td>0.41</td>
<td>322.1</td>
<td>0.070</td>
<td>56.1</td>
<td>-83%</td>
</tr>
<tr>
<td>Hartley Gulch</td>
<td>24.4</td>
<td>39.2</td>
<td>0.27</td>
<td>57.4</td>
<td>0.070</td>
<td>14.8</td>
<td>-74%</td>
</tr>
<tr>
<td>Indian Creek⁶</td>
<td>22.4</td>
<td>100.6</td>
<td>0.50</td>
<td>271.6</td>
<td>0.089</td>
<td>48.3</td>
<td>-82%</td>
</tr>
<tr>
<td>Conway Gulch⁷</td>
<td>14.2</td>
<td>44.8</td>
<td>0.41</td>
<td>99.7</td>
<td>0.070</td>
<td>16.9</td>
<td>-83%</td>
</tr>
<tr>
<td>Dixie Drain⁸</td>
<td>10.5</td>
<td>232.6</td>
<td>0.38</td>
<td>477.2</td>
<td>0.070</td>
<td>87.9</td>
<td>-82%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>908.4</strong></td>
<td><strong>0.34</strong></td>
<td><strong>1664.4</strong></td>
<td><strong>0.073</strong></td>
<td><strong>356.7</strong></td>
<td></td>
<td><strong>-79%</strong></td>
</tr>
</tbody>
</table>

¹ 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.
² Dry Creek TP load allocation includes the design flow and TP contributions from Avimor POTW: 0.1 mg/L May 1 – September 30.
³ Fifteenmile Creek TP load allocation includes the design flow and TP contributions from Meridian POTW: 0.1 mg/L May 1 – September 30.
⁴ Mill Slough TP load allocation includes the design flow and TP contributions from Star POTW: 0.1 mg/L May 1 – September 30.
⁵ Mason Creek TP load allocation includes the design flow and TP contributions from Sorrento Lactalis: 0.1 mg/L May 1 – September 30.
⁶ Indian Creek TP 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.
⁷ Conway Gulch TP load allocation includes the design flow and TP contributions from Notus POTW: 0.1 mg/L May 1 – September 30.
⁸ Dixie Drain TP load allocation includes the design flow and TP contributions from Wilder and Greenleaf POTWs: 0.1 mg/L May 1 – September 30.
Table 42. 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\(^1\). DEQ intends that load allocations are to be expressed as monthly averages.

<table>
<thead>
<tr>
<th></th>
<th>Mean Flows (cfs)</th>
<th>Current TP Conc. (mg/L)</th>
<th>Current TP Load (lbs/day)</th>
<th>Target TP Conc. (mg/L)</th>
<th>Average TP Allocation (lbs/day as a monthly average)(^1)</th>
<th>Average TP Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground water &amp; unmeasured(^2)</td>
<td>-139 to 485</td>
<td>0.21</td>
<td>-1573 to 562</td>
<td>0.07</td>
<td>-524 to 150</td>
<td>-67%</td>
</tr>
<tr>
<td>Background(^3)</td>
<td>383 to 3268</td>
<td>0.018</td>
<td>37 to 317</td>
<td>0.018</td>
<td>37 to 317</td>
<td>0%</td>
</tr>
</tbody>
</table>

\(^1\)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.

\(^2\)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.

\(^3\)Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data (see Section 3.2.2).

5.4.2 Boise River and Mason Creek TP Allocations to Achieve the Mean Benthic Chlorophyll-a Target

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 (DEQ 2014a).

DEQ reduced the number of TP reduction scenarios through consultation with the Lower Boise Watershed Council, EPA and other interested stakeholders to the following:

1. Existing Conditions (the calibrated model)

2. Scenario 1 + 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; non-stormwater (dry weather) TP loads at 84% reduction.

4. Scenario 2 + 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; non-stormwater (dry weather) TP loads at 84% reduction

6. Scenario 3 + 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; non-stormwater (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 the evaluation of point sources at 0.5 and 1.0 mg/L seasonally (October-April) as requested by interested stakeholders. DEQ’s determination was that these concentrations cased additional exceedances of the Snake River-Hells Canyon 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 with additional descriptions outlined in Table 43, while Table 44, Table 45, and Table 46 summarize the model results for the final TMDL allocation scenario. The TMDL Scenario 3 and TP allocation structure, specifically:

- Achieves the mean monthly benthic chlorophyll a target of ≤ 150 mg/m² in the impaired AUs of the lower Boise River. Multiple lines of evidence indicate that the TMDL phosphorus reductions are sufficient 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 in model segment 10 and September in segment 11, these are likely due to growth of low nutrient diatoms which can proliferate under low nutrient and other habitat conditions. These rationales are further discussed in the Model Report (DEQ 2014a).

- 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).

**Final AQUATOX Model Scenario and TMDL Allocation Structure**

**NPDES-Permitted Wastewater, Industry, and Fish Hatchery Facilities**
- 0.1 mg/L TP from May 1 – September 30
- 0.35 mg/L TP from October 1 – April 30
- IDFG Eagle and Nampa fish hatchery facilities: 0.1 mg/L TP year-round

All of the point source targets were modeled to address facility design flows and loads. The IDFG Eagle fish hatchery facility, along with Lander, West, 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 49 were included in the model simulation by externally calculating the additional TP loading contributions to the tributaries or ground water/unmeasured segments to which they discharge under design flow conditions.

**NPDES-Permitted Stormwater and Non-Stormwater**
- Stormwater (wet weather) = 42% TP reduction year-round
All NPDES-permitted MS4s and non-permitted areas identified in Table 17 were included in the model simulation by externally calculating the (wet weather) TP loading to ground water/unmeasured segments to which they discharge. Stormwater (wet weather) 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 (wet weather) TP concentrations in the model would result in higher non-storm 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.

- Non-stormwater (dry weather) = 84% TP reduction year-round

The non-stormwater (dry weather) flows and loads are implicitly measured as subcomponent 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. Due non-stormwater (dry weather) being estimated as an inherent component of tributaries and ground water/unmeasured 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.

The plumbing of MS4 systems is intricate, and the exact quantity of the non-stormwater inputs is presently unknown. However, MS4 permittees have provided initial estimates for the percentage of their non-stormwater discharge that originates from nonpoint-sources (see Table 35). These estimates should be refined through monitoring and mapping in future permit cycles and as part of the TMDL implementation.

Nonpoint Source Tributary, Ground Water, and Unmeasured

- 0.07 mg/L TP year-round

Agricultural and other nonpoint source tributaries, ground water, and unmeasured, including non-stormwater (dry weather), loads were set at the concentration equivalent of 0.07 mg/L TP year-round. However, agricultural tributaries and ground water/unmeasured segment loads were adjusted 0.07 mg/L, as appropriate, to account for TP contributions from NPDES-permitted facilities or stormwater (wet weather) loads (and Table 51).

Total Suspended Sediment
As described in more detail in the Model Report (DEQ 2014a) the total suspended sediment (TSS) data was represented as a 37% reduction. This reduction was used to approximate water quality conditions that could result from phosphorus-targeted BMPs, it was identified in the LBR sediment TMDL (DEQ 1999), and 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 available to substrate.

Other Forms of Organic Enrichment
As described in more detail 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. That is because, in order to more-accurately model phosphorus reduction scenarios, reductions in nitrogen and carbon must also be simulated. This is reasonable because watershed improvement projects that reduce phosphorus also control nitrogen and other forms of organic enrichment. The steps to build the import spreadsheet for simulating this reduction scenario included:

- Using the monthly average of historic water quality data at the same precision as historical data. This was necessary because of the uneven temporal scale of available water quality data. This allows more general application of the results. Non-detects 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. This 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 historic 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: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 are not being attained during a 5-year review or subsequent post-TMDL implementation monitoring under the significant year-round TP load reductions identified above.

This corresponds to knowledge that artificially a high width-to-depth ratio for freshwater streams is a known sign of impairment (Rosgen and Silvey 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
The 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 targets of < 150 mg/m². Even so, it is important to recognize that all models are mathematical approximations of the true system, with some uncertainty being an inherent component of model results. Through the 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.
Table 43. Summary of AQUATOX model inputs for the final TMDL allocation scenario.

<table>
<thead>
<tr>
<th>Input</th>
<th>Flow (mgd)</th>
<th>Total Phosphorus (mg/L; adjusted)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upstream Background</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boise River - Main stem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lander</td>
<td>2012-13 flows + loads for 15 mgd</td>
<td>May-Sept. 0.1 (0.12) Oct.-Apr. 0.35 (0.43)</td>
</tr>
<tr>
<td>West Boise</td>
<td>2012-13 flows + loads for 24 mgd</td>
<td>May-Sept. 0.1 (0.15) Oct.-Apr. 0.35 (0.57)</td>
</tr>
<tr>
<td>Middleton</td>
<td>2012-13 flows + loads for 1.83 mgd</td>
<td>May-Sept. 0.1 (0.3) Oct.-Apr. 0.35 (1.44)</td>
</tr>
<tr>
<td>Caldwell</td>
<td>2012-13 flows + loads for 8.5 mgd</td>
<td>May-Sept. 0.1 (0.11) Oct.-Apr. 0.35 (0.52)</td>
</tr>
<tr>
<td>IDFG Eagle</td>
<td>2012-13 flows + loads for 4.25 mgd</td>
<td>May-Sept. 0.1 (0.1) Oct.-Apr. 0.1 (0.14)</td>
</tr>
<tr>
<td><strong>Tributaries</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fifteenmile Creek – Meridian</td>
<td>2012-13 flows + loads for 10.2 mgd</td>
<td>May-Sept. 0.07 (0.074) Oct.-Apr. 0.07 (0.146)</td>
</tr>
<tr>
<td>Mill Slough – Star</td>
<td>2012-13 flows + loads for 1.85 mgd</td>
<td>May-Sept. 0.07 (0.071) Oct.-Apr. 0.07 (0.084)</td>
</tr>
<tr>
<td>Mason Creek – Sorrento</td>
<td>2012-13 flows + loads for 1.52 mgd</td>
<td>May-Sept. 0.07 (0.070) Oct.-Apr. 0.07 (0.080)</td>
</tr>
<tr>
<td>Indian Creek – Nampa</td>
<td>2012-13 flows + loads for 18.0 mgd</td>
<td>May-Sept. 0.07 (0.089) Oct.-Apr. 0.07 (0.132)</td>
</tr>
<tr>
<td>Kuna</td>
<td>2012-13 flows + loads for 3.5mgd</td>
<td></td>
</tr>
<tr>
<td>IDFG Nampa</td>
<td>2012-13 flows + loads for 19.38 mgd</td>
<td></td>
</tr>
<tr>
<td>ConAgra</td>
<td>2012-13 flows + loads for 0.48 mgd</td>
<td></td>
</tr>
<tr>
<td>Conway Gulch – Notus</td>
<td>2012-13 flows + loads for 0.11 mgd</td>
<td>May-Sept. 0.07 (0.070) Oct.-Apr. 0.07 (0.072)</td>
</tr>
<tr>
<td>Dixie Drain – Wilder</td>
<td>2012-13 flows + loads for 0.25 mgd</td>
<td>May-Sept. 0.07 (0.070) Oct.-Apr. 0.07 (0.072)</td>
</tr>
<tr>
<td>Greenleaf</td>
<td>2012-13 flows + loads for 0.24 mgd</td>
<td>May-Sept. 0.07 (0.070) Oct.-Apr. 0.07 (0.072)</td>
</tr>
<tr>
<td>All Other Tributaries</td>
<td>2012-13 flows</td>
<td>Year-round 0.070</td>
</tr>
<tr>
<td><strong>Ground Water and Unmeasured</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment 4 (Dry Creek) – Avimor</td>
<td>2012-13 flows + loads for 0.42 mgd</td>
<td>May-Sept. 0.03 Oct.-Apr. 0.05</td>
</tr>
<tr>
<td>Segment 10 – Darigold</td>
<td>2012-13 flows + loads for 1.7 mgd</td>
<td>May-Sept. 0.07 (0.07) Oct.-Apr. 0.07 (0.09)</td>
</tr>
<tr>
<td>All other Ground Water, Unmeasured, Non-Stormwater &amp; Stormwater</td>
<td>2012-13 flows</td>
<td>Year-round 0.07 mg/L TP + stormwater and non-stormwater loads</td>
</tr>
</tbody>
</table>

Sediment (TSS) 37% reduction in all segments

¹All 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 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, except TP loadings are adjusted for those tributaries and segments to account for increased TP loading attributed to POTW facilities and/or stormwater (wet weather) loads.
Table 44. Summary of final TMDL scenario results for TP targets in model segment 13 (near Parma).

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Total Phosphorus</th>
</tr>
</thead>
</table>
| May 1 – September 30 | Mean TP = 0.06 mg/L  
Median TP = 0.06 mg/L  
Max TP = 0.12 mg/L |
| Seasonal average TP ≤ 0.07 mg/L at Parma, May 1 – September 30 |
| October 1 – April 30 | Mean TP = 0.08 mg/L  
Median TP = 0.09 mg/L  
Max TP = 0.20 mg/L |
| Seasonal average TP mg/L at Parma, October 1 – April 30 |

Table 45. Summary of TMDL scenario results for mean monthly periphyton chlorophyll a targets.

<table>
<thead>
<tr>
<th>Month</th>
<th>Mean Monthly Periphyton (mg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seg 9</td>
</tr>
<tr>
<td>January</td>
<td>1.1</td>
</tr>
<tr>
<td>February</td>
<td>14.0</td>
</tr>
<tr>
<td>March</td>
<td>15.8</td>
</tr>
<tr>
<td>April</td>
<td>1.7</td>
</tr>
<tr>
<td>May</td>
<td>0.7</td>
</tr>
<tr>
<td>June</td>
<td>0.7</td>
</tr>
<tr>
<td>July</td>
<td>0.7</td>
</tr>
<tr>
<td>August</td>
<td>0.6</td>
</tr>
<tr>
<td>September</td>
<td>7.9</td>
</tr>
<tr>
<td>October</td>
<td>68.8</td>
</tr>
<tr>
<td>November</td>
<td>87.3</td>
</tr>
<tr>
<td>December</td>
<td>50.4</td>
</tr>
</tbody>
</table>

Mean Monthly Periphyton > 150 mg/m² | 0%  | 8%   | 8%   | 0%   | 0%    |
### Table 46. Summary of TMDL scenario results for mean monthly TP concentrations.

<table>
<thead>
<tr>
<th>Month</th>
<th>Seg 9</th>
<th>Seg 10</th>
<th>Seg 11</th>
<th>Seg 12</th>
<th>Seg 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>0.09</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>February</td>
<td>0.08</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>March</td>
<td>0.06</td>
<td>0.08</td>
<td>0.07</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>April</td>
<td>0.05</td>
<td>0.06</td>
<td>0.06</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>May</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>June</td>
<td>0.04</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>July</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>August</td>
<td>0.06</td>
<td>0.07</td>
<td>0.07</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>September</td>
<td>0.07</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>October</td>
<td>0.09</td>
<td>0.10</td>
<td>0.10</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>November</td>
<td>0.09</td>
<td>0.11</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>December</td>
<td>0.10</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
</tr>
</tbody>
</table>

| Mean Monthly TP Concentration > 0.1 mg/L | 0% | 17% | 8% | 8% | 8% | 8% |

Figure 47 shows the relationships between mean monthly periphyton exceedances > 150 mg/m² and TP reductions under the seven model scenarios. It is clear that 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. That is, TP reductions beyond those modeled the final TMDL model scenario (Scenario 3) do not yield measureable improvements in periphyton reductions without further reductions in carbon (organic detritus, CBOD, 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, as shown in Table 44, 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.
Figure 47. Annual average periphyton in model segments 9-13 (the impaired AUs of the lower Boise River) under seven model scenarios. Further descriptions of each model scenario are available in the preceding paragraphs.

Figure 48 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 49 shows mean monthly periphyton in segments 9-13 under the final model scenario (Scenario 3) and TMDL allocations. This 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 48. 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/m².
Figure 49. Scenario 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/m².
Results for the model scenarios described above are reported on a model segment basis. When the results for the final model scenario and TMDL allocations—Scenario 3—are averaged according to the AUs, there are no exceedances of the mean monthly periphyton target (Figure 51 and Figure 53), a 30-day rolling average of periphyton target (Figure 52 and Figure 54), and the EPA Gold Book recommended value for TP\(^7\) are mostly attained (Figure 55, Figure 56).

Because the impaired AUs do not line up exactly with the model segments, a weighted average of the model segments within each AU was utilized to calculated periphyton and TP concentrations on an AU basis:

- **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%)

- **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%)

---

\(^7\) Although there is no specific phosphorus target in the lower Boise River outside of the May-September timeframe, a TP target of 0.10 mg/L should help to meet beneficial uses. The target for the lower Boise River from May 1 – September 30 near Parma is \(\geq 0.07\) mg/L TP.
Examination of 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 represents a 71% annual reduction in phosphorus. Alternatively, existing periphyton averages 101 mg/m² annually for the two listed AUs, whereas the annual average is 47 mg/m² for the TP reduction Scenario 3, 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.
Figure 50. 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/m².
Figure 51. 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/m².
Figure 52. 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/m².
Figure 53. 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/m².
Figure 54. 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/m².
Figure 55. 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 56. 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.
The following analyses, tables, and figures 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. The May 1 – September 30 TP allocations and load reductions that correspond with the final model scenario and are necessary to achieve the mean monthly periphyton target and the SR-HC TMDL May 1 – September 30 TP target of ≤ 0.07 mg/L are presented in Section 5.4.1.

Table 47. Gross load and wasteload allocations by sector for the lower Boise River, October 1 – April 30, presented as per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

<table>
<thead>
<tr>
<th></th>
<th>Average Daily Background TP (^1)</th>
<th>Average NPDES POTW and Industry TP (^2)</th>
<th>Average Fish Hatchery TP (^3)</th>
<th>Average Tributary (w/o NPDES Flows and Loads) TP (^4)</th>
<th>Average Ground Water and Unmeasured TP (^5)</th>
<th>Average Non-Stormwater Dry Weather TP (^6)</th>
<th>Average Stormwater Wet Weather TP (^7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current TP Conc. (mg/L)</td>
<td>0.018</td>
<td>3.32</td>
<td>0.07</td>
<td>0.22</td>
<td>0.15</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Current TP Load (lbs/day)</td>
<td>Flow Dependent</td>
<td>1394</td>
<td>13</td>
<td>580</td>
<td>127</td>
<td>44</td>
<td>107</td>
</tr>
<tr>
<td>Target TP Conc. (mg/L)</td>
<td>0.018</td>
<td>0.35</td>
<td>0.1</td>
<td>0.07</td>
<td>0.07</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>TP Allocation (lbs/day as a monthly average)</td>
<td>Flow Dependent</td>
<td>256</td>
<td>20</td>
<td>178</td>
<td>57</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Percent Reduction (%)</td>
<td>0%</td>
<td>-82%</td>
<td>+50%</td>
<td>-69%</td>
<td>-55%</td>
<td>-84%</td>
<td>-43%</td>
</tr>
</tbody>
</table>

\(^1\) 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). The actual background loading (lbs) is variable depending on the river inflow from upstream, groundwater, and tributary/drain sources.

\(^2\) POTW and industrial discharge data are based on facility design flows, represented in Error! Reference source not found.

\(^3\) Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in identified in Table 24 Error! Reference source not found.

\(^4\) Tributary data (Table 29) were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.

\(^5\) The USGS October 2012 and March 2013 mass balance models were used to estimate average ground water flows.

\(^6\) Non-stormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 31 and Appendix E) 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. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

\(^7\) Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 31 and Appendix E) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.
Table 48. Current projected TP loads for the lower Boise River from October 1 – April 30.

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s. Stormwater (wet weather) allocations represent a 43% TP load reduction on average across all MS4s.
* Non-stormwater (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. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
Table 49. Point source TP wasteload allocations for the lower Boise River subbasin, October 1 – April 30. Wasteload allocations are presented per day as monthly averages\(^1,2\). DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits. See Table 39 in Section 5.4.1 for detailed description of the May – September TP allocations and load reductions.

<table>
<thead>
<tr>
<th>Facility/ Source</th>
<th>NPDES Permit No.</th>
<th>Current Oct-Apr Average TP Load (lbs/day)</th>
<th>Oct-Apr Average TP Allocation (lbs/day as a monthly average) at TP Conc. = 0.35 mg/L</th>
<th>Oct-Dec Average TP Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River - Main stem</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lander Street WWTF</td>
<td>ID-002044-3</td>
<td>180.8</td>
<td>43.8</td>
<td>-76%</td>
</tr>
<tr>
<td>West Boise WWTF</td>
<td>ID-002398-1</td>
<td>603.3</td>
<td>70.1</td>
<td>-88%</td>
</tr>
<tr>
<td>Middleton</td>
<td>ID-002183-1</td>
<td>14.9</td>
<td>5.3</td>
<td>-64%</td>
</tr>
<tr>
<td>Caldwell</td>
<td>ID-002150-4</td>
<td>106.6</td>
<td>24.8</td>
<td>-77%</td>
</tr>
<tr>
<td>IDFG Eagle(^3)</td>
<td>IDG-000002</td>
<td>0.4</td>
<td>3.6</td>
<td>+714%</td>
</tr>
<tr>
<td>Boise River – Tributaries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avimor – Dry Creek</td>
<td></td>
<td><strong>In Application</strong></td>
<td><strong>No Discharge Currently</strong></td>
<td><strong>1.2</strong></td>
</tr>
<tr>
<td>Star – Lawrence-Kennedy Canal</td>
<td>ID-002359-1</td>
<td>5.5</td>
<td>5.4</td>
<td>-1%</td>
</tr>
<tr>
<td>Meridian – Fivemile Creek and Boise River</td>
<td>ID-002019-2</td>
<td>38.7</td>
<td>29.8</td>
<td>-23%</td>
</tr>
<tr>
<td>Sorrento Lactalis – Purdham Drain</td>
<td>ID-002803-7</td>
<td>0.1</td>
<td>4.4</td>
<td>+4333%</td>
</tr>
<tr>
<td>Nampa – Indian Creek</td>
<td>ID-002206-3</td>
<td>424.1</td>
<td>52.6</td>
<td>-88%</td>
</tr>
<tr>
<td>Kuna – Indian Creek</td>
<td>ID-002835-5</td>
<td>13.8</td>
<td>10.2</td>
<td>-26%</td>
</tr>
<tr>
<td>IDFG Nampa(^3) – Indian Creek</td>
<td>IDG-000002</td>
<td>12.7</td>
<td>16.2</td>
<td>+27%</td>
</tr>
<tr>
<td>Darigold – unmeasured drain</td>
<td>ID-002495-3</td>
<td>0.4</td>
<td>5.0</td>
<td>+1039%</td>
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<tr>
<td>Notus – Conway Gulch</td>
<td>ID-002101-6</td>
<td>2.2</td>
<td>0.32</td>
<td>-86%</td>
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<tr>
<td>Wilder – Wilder Ditch Drain</td>
<td>ID-0020265</td>
<td>3.6</td>
<td>0.73</td>
<td>-80%</td>
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<tr>
<td>Greenleaf – West End Drain</td>
<td>ID-002830-4</td>
<td>0.03</td>
<td>0.70</td>
<td>+2402%</td>
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</tbody>
</table>
### Facility/Source | NPDES Permit No. | Current Oct-Apr Average TP Load (lbs/day) | Oct-Apr Average TP Allocation (lbs/day as a monthly average) at TP Conc. = 0.35 mg/L | Oct-Dec Average TP Load Reduction (%)
---|---|---|---|---
ConAgra (XL 4 Star) – Indian Creek | ID-000078-7 | No Discharge Currently | 1.39 | No Discharge Currently
**Total** | | 1407.1 | 275.5 | -80%

1. The WLAs and load reductions are estimates that achieve the mean monthly periphyton target of \( \leq 150 \text{ mg/m}^2 \) in the lower Boise River and the May – September TP target of \( \leq 0.07 \text{ mg/L} \) near Parma.
2. 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.
3. 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.
4. Point source allocations can be met through trading or offset as detailed in regulations and guidance documents, such as the revised DEQ Water Quality Trading Guidance Document and the Lower Boise Trading Framework.
Table 54. Point source MS4 stormwater (wet weather) and non-stormwater (dry weather) TP wasteload allocations for the lower Boise River subbasin, October 1 – April 30. Wasteload allocations are presented 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. See T for complete description of the May – September TP allocations and load reductions.

<table>
<thead>
<tr>
<th>Permit Holder/Jurisdiction</th>
<th>NPDES Permit Number</th>
<th>MS4 Permit Type</th>
<th>Permitted Areas</th>
<th>Non-Permitted Areas</th>
<th>Area Ratio</th>
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<tr>
<td></td>
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<td></td>
<td>Urbanized Area¹</td>
<td>City Limits²,³ Area</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(mi²)</td>
<td>(mi²)</td>
<td></td>
</tr>
<tr>
<td>Ada County</td>
<td></td>
<td>Boise/Garden City IDS027561 Phase I</td>
<td>87</td>
<td></td>
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<td></td>
<td></td>
<td>Boise IDS027561 Phase I</td>
<td>83</td>
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<td>Garden City IDS027561 Phase I</td>
<td>4</td>
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<td></td>
<td>Ada County Highway District IDS027561 Phase I</td>
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<td></td>
<td>Boise State University IDS027561 Phase I</td>
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<td>Ada County Drainage District 3 IDS027561 Phase I</td>
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<td></td>
<td>ITD District 3 IDS027561 Phase I</td>
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<tr>
<td>Total Area Boise/Garden City Phase I Permit</td>
<td>IDS028185 Phase II</td>
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<td>84</td>
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<tr>
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<td>Urbanized Ada County (unincorporated)</td>
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<td>IDS027561 Phase II</td>
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<td>0.22</td>
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<tr>
<td>Kuna IDS027561 Phase I</td>
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<td></td>
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<tr>
<td>Star IDS027561 Phase I</td>
<td>NA</td>
<td>-</td>
<td>4</td>
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<tr>
<td>Total Ada County Incorporated Non-Permitted Area</td>
<td>44</td>
<td>0.16</td>
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<tr>
<td>Canyon County</td>
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<td>Caldwell IDS028118 Phase II</td>
<td>17.5</td>
<td>4.6</td>
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<td>Nampa IDS028126 Phase II</td>
<td>25</td>
<td>6.5</td>
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<td>Middleton IDS028130 Phase II</td>
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<td>2.9</td>
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<td>Urbanized Canyon County (unincorporated)</td>
<td>24.8</td>
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<td>ITD District 3 IDS028177 Phase II</td>
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<td>Canyon Highway District #4 IDS028174 Phase II</td>
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<td>Nampa Highway District #1 IDS028124 Phase II</td>
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<td>Notus-Parma Highway District #2 IDS028151 Phase II</td>
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<tr>
<td>Total Area Canyon County Phase II Permits</td>
<td>IDS028185 Phase II</td>
<td>70</td>
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<tr>
<td>Greenleaf IDS028126 Phase I</td>
<td>NA</td>
<td>-</td>
<td>0.8</td>
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<tr>
<td>Notus IDS028124 Phase I</td>
<td>NA</td>
<td>-</td>
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<tr>
<td>Parma IDS028151 Phase I</td>
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<td>-</td>
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<tr>
<td>Wilder IDS028177 Phase I</td>
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<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Canyon County Incorporated Non-Permitted Area</td>
<td>17</td>
<td>0.06</td>
<td>-84%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1Urbanized Area based on 2010 Census; which may differ from the MS4 permitted areas which are based on 2003 Decennial Census data
2Ada County Assessor 7/9/14
3Canyon County Assessor 5/28/14
4Area data from NPDES Permit Factsheets (2000 Census)
5Area ratio= the area contribution of each MS4 Permit relative to the total service area for MS4s
6Stormwater (wet weather) allocations represent a 43% average TP load reduction on average across all permitted and non-permitted MS4 areas. The gross current TP load estimate is 107 lbs/day, with a reduction to 61 lbs/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).
7Higher maximum daily stormwater (wet weather) target loads may exceed average daily loads and still allow MS4s to comply with the load and wasteload reductions.
8Non-stormwater (dry weather) allocations represent an 84% TP load reduction on average across all permitted and non-permitted 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 lbs/day, with a reduction to 7 lbs/day (non-stormwater (dry weather) 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).
9It is DEQ’s intent to include in the MS4 wasteload allocation, only that non-storm water that is categorized as allowable under the MS4 NPDES permit, and to treat other non-storm water flow as a nonpoint source. If the other non-storm water flow can be identified and quantified by the MS4, it will be treated under this TMDL as a nonpoint source (see Table 38). Further, this TMDL does not excuse the responsibility of the MS4 owner or operator to comply with the terms of the applicable NPDES permit.
10The October–April 84% reduction for non-stormwater dry weather is an estimated average across all MS4s. The actual percent reduction would be based on the current loading for each individual MS4.

Note: Stormwater (wet weather) and non-stormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E). DEQ intends that wasteload allocations are to be expressed as monthly average limits in NPDES
*The "Non-permitted" 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.
Table 50 Agricultural and other nonpoint source tributary TP load allocations for the lower Boise River subbasin. Load allocations are presented per day as monthly averages. DEQ intends that load allocations are to be expressed as monthly averages. See Table 41 in Section 5.4.1 for complete description of the May – September TP allocations and load reductions.

<table>
<thead>
<tr>
<th>Tributary</th>
<th>Boise River Receiving River Mile (RM)</th>
<th>Current Oct-Apr Average TP Load (lbs/day)</th>
<th>Oct-Apr Average Target TP Conc. (mg/L)</th>
<th>Oct-Apr Average TP Allocation (lbs/day as a monthly average)¹</th>
<th>Oct-Apr Average TP Load Reduction (%)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eagle Drain</td>
<td>42.7</td>
<td>9.8</td>
<td>0.070</td>
<td>4.4</td>
<td>-55%</td>
</tr>
<tr>
<td>Dry Creek²</td>
<td>42.5</td>
<td>9.9</td>
<td>0.083</td>
<td>6.5</td>
<td>-35%</td>
</tr>
<tr>
<td>Thurman Drain</td>
<td>41.9</td>
<td>6.1</td>
<td>0.070</td>
<td>3.1</td>
<td>-49%</td>
</tr>
<tr>
<td>Fifteenmile Creek³</td>
<td>30.3</td>
<td>104.9</td>
<td>0.146</td>
<td>45.7</td>
<td>-56%</td>
</tr>
<tr>
<td>Mill Slough⁴</td>
<td>27.2</td>
<td>60.3</td>
<td>0.084</td>
<td>25.4</td>
<td>-58%</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>27.0</td>
<td>37.5</td>
<td>0.070</td>
<td>8.1</td>
<td>-78%</td>
</tr>
<tr>
<td>Mason Slough</td>
<td>25.6</td>
<td>11.1</td>
<td>0.070</td>
<td>2.2</td>
<td>-80%</td>
</tr>
<tr>
<td>Mason Creek⁵</td>
<td>25.0</td>
<td>92.6</td>
<td>0.080</td>
<td>29.1</td>
<td>-69%</td>
</tr>
<tr>
<td>Hartley Gulch</td>
<td>24.4</td>
<td>17.9</td>
<td>0.070</td>
<td>4.0</td>
<td>-77%</td>
</tr>
<tr>
<td>Indian Creek⁶</td>
<td>22.4</td>
<td>516.9</td>
<td>0.132</td>
<td>119.4</td>
<td>-77%</td>
</tr>
<tr>
<td>Conway Gulch⁷</td>
<td>14.2</td>
<td>22.6</td>
<td>0.072</td>
<td>8.6</td>
<td>-62%</td>
</tr>
<tr>
<td>Dixie Drain⁸</td>
<td>10.5</td>
<td>191.3</td>
<td>0.072</td>
<td>44.3</td>
<td>-77%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1081.0</strong></td>
<td><strong>0.100</strong></td>
<td><strong>300.9</strong></td>
<td></td>
<td><strong>-72%</strong></td>
</tr>
</tbody>
</table>

¹ 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.
² Dry Creek TP 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.
³ Fifteenmile Creek TP 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.
⁴ Mill Slough TP 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.
⁵ Mason Creek TP 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.
⁶ Indian Creek TP 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.
⁷ Conway Gulch TP 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.
⁸ Dixie Drain TP 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.
Table 51. Agricultural and other nonpoint source ground water/unmeasured and natural background source TP load allocations for the lower Boise River. Load allocations are presented per day as monthly averages. DEQ intends that load allocations are to be expressed as monthly averages. See Table 42 in Section 5.4.1 for complete description of the May – September TP allocations and load reductions.

<table>
<thead>
<tr>
<th>Ground water &amp; unmeasured&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Oct-Apr Mean Flow (cfs)</th>
<th>Current Oct-Apr Average TP Conc. (mg/L)</th>
<th>Current Oct-Apr Average TP Load (lbs/day)</th>
<th>Oct-Apr Average Target TP Conc. (mg/L)</th>
<th>Oct-Apr Average TP Allocation (lbs as a monthly average)</th>
<th>Average TP Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>133 to 180</td>
<td>0.15</td>
<td>108 to 146</td>
<td>0.07</td>
<td>50 to 68</td>
<td>-53%</td>
</tr>
<tr>
<td>Background&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1,293</td>
<td>0.018</td>
<td>125</td>
<td>0.018</td>
<td>125</td>
<td>0%</td>
</tr>
</tbody>
</table>

<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data (see Section 3.2.2). The actual background loading (lbs) is variable depending on the river inflow from upstream, groundwater, and tributary/drain sources.
5.4.3 Sand Hollow TP Allocations to Achieve the SR-HC TMDL Target of ≤ 0.07 mg/L May 1 – September 30

Table 52 identifies point and nonpoint source May 1 – September 30 TP allocations for Sand Hollow Creek, a tributary to the Snake River. These load reductions will ensure that Sand Hollow Creek achieves the SR-HC TMDL target allocations for tributaries of 0.07 mg/L TP from May 1 – September 30.

Table 52. Point source wasteload and nonpoint source load allocations, May 1 – September 30, for Sand Hollow, a Snake River tributary. Load and wasteload allocations are presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

<table>
<thead>
<tr>
<th>Sand Hollow Creek</th>
<th>Current Flow (mgd/cfs)</th>
<th>Design Flow (mgd/cfs)</th>
<th>Current TP Conc. (mg/L)</th>
<th>Current TP Load (lbs/day)</th>
<th>Target TP Conc. (mg/L)</th>
<th>Average TP Allocation (lbs/day as a monthly average)</th>
<th>Average TP Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parma</td>
<td>0.09 mgd 0.14 cfs</td>
<td>0.68 mgd 1.05 cfs</td>
<td>0.21</td>
<td>0.15</td>
<td>≤ 0.07</td>
<td>0.4</td>
<td>+157%</td>
</tr>
<tr>
<td>Nonpoint, ground water and unmeasured</td>
<td>140.7 cfs</td>
<td>139.7 cfs</td>
<td>0.40</td>
<td>301.2</td>
<td>≤ 0.07</td>
<td>52.7</td>
<td>-83%</td>
</tr>
<tr>
<td>Total</td>
<td>140.8 cfs</td>
<td>140.8 cfs</td>
<td>0.399</td>
<td>301.4</td>
<td>≤ 0.07</td>
<td>53.1</td>
<td>-82%</td>
</tr>
</tbody>
</table>

1 The TP effluent limits identified in NPDES permits will depend on actual flows in Sand Hollow, and will fluctuate from year to year. It is expected that the point source facility will achieve the wasteload allocation targets with 2 permit cycles.

2 Nonpoint, ground water, and unmeasured are flows and loads from May 1 – September 30 (1983 – 2012), minus flows and loads from the POTW.
5.4.4 Sand Hollow TP Allocations October 1 – April 30

Table 53 identifies point and nonpoint source October 1 – April 30 TP allocations for Sand Hollow Creek, a tributary to the Snake River. These allocations will result in daily average instream TP concentrations of 0.075 mg/L within Sand Hollow Creek. The load reductions will ensure help ensure that beneficial uses are fully supported in Sand Hollow Creek. Further, these allocations are consistent with those for tributaries of the lower Boise River and will go beyond the irrigation-season (May 1 – September 30) targets to further benefit water quality conditions the SR-HC TMDL.

Table 53. Point source wasteload and agricultural and other nonpoint source load allocations, October 1 – April 30, for Sand Hollow, a Snake River tributary. Load and wasteload allocations are presented per day as monthly averages1. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

<table>
<thead>
<tr>
<th>Sand Hollow Creek</th>
<th>Current Flow (mgd/cfs)2</th>
<th>Design Flow (mgd/cfs)2</th>
<th>Current TP Conc. (mg/L)</th>
<th>Current TP Load (lbs/day)</th>
<th>Target TP Conc. (mg/L)</th>
<th>Average TP Allocation (lbs/day as a monthly average)</th>
<th>Average TP Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parma</td>
<td>0.13 mgd 0.20 cfs</td>
<td>0.68 mgd 1.05 cfs</td>
<td>0.12</td>
<td>0.1</td>
<td>0.35</td>
<td>1.99</td>
<td>+1426%</td>
</tr>
<tr>
<td>Nonpoint, ground water and unmeasured</td>
<td>63.4 cfs</td>
<td>62.6 cfs</td>
<td>0.33</td>
<td>113.2</td>
<td>0.07</td>
<td>23.6</td>
<td>-79%</td>
</tr>
<tr>
<td>Total</td>
<td>63.6 cfs</td>
<td>63.6 cfs</td>
<td>0.33</td>
<td>113.3</td>
<td>0.075</td>
<td>25.7</td>
<td>-77%</td>
</tr>
</tbody>
</table>
The TP effluent limits identified in NPDES permits will depend on actual flows in Sand Hollow, and will fluctuate from year to year. It is expected that the point source facility will achieve the wasteload allocation targets with 2 permit cycles.

Nonpoint, ground water, and unmeasured are flows and loads from May 1 – September 30 (1983 – 2012), minus flows and loads from the POTW.

Figure 58. Current vs. projected TP loads for Sand Hollow Creek from October 1 – April 30.

5.4.5 Margin of Safety

This TMDL and the SR-HC TMDL include several conservative implicit and explicit margins of safety (MOS). Therefore, this TMDL does not require additional modification:

1. An explicit 13% MOS was applied to the SR-HC TMDL ≤ 0.07 mg/L TP target, and was incorporated into the TP load capacity and allocations. The MOS was determined by the accuracy, representativeness of sampling techniques, and analytical methods. Applying this MOS to the initial 16 μg/L threshold value yielded a target of 14 μg/L chlorophyll a.

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 the assumption 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 watershed.

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, the relationship between the selected target and support of beneficial uses, and includes variability in target measurement.

5.4.6 Seasonal Variation

Achieving the SR-HC TMDL May 1 – September 30 Target

DEQ believes the May 1 – September 30 seasonal TP target ≤ 0.07 mg/L is protective of cold water aquatic life and contact recreation by achieving the SR-HC TMDL target of phytoplankton in the Snake River and reservoirs < 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 nuisance for contact recreation, as well as ecological impacts for cold water aquatic life, in the Snake River, the lower Boise River, Mason Creek, and Sand Hollow Creek. TP is neither a toxic nor results in immediate water quality impairment conditions. TP, along with many other water quality characteristics of the lower Boise River, exhibit seasonal variations in conditions as observed from May 1 – September 30. Incorporating seasonal variation within this TMDL provides for flexibility in managing sources and the river.

Achieving the Mean Monthly Benthic Chlorophyll a (Periphyton) 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/m² (indicator of nuisance algae) within impaired AUs of the lower Boise River (see Section 2.2.5).

DEQ asserts this target protects contact recreation and cold water aquatic life beneficial uses. The target also corresponds well with values established in the academic literature (see Section 2.2.5) and is similar to targets developed and implemented for waters in Montana (MDEQ 2008), Minnesota (MPCA 2013) and Colorado (CDPHE 2013).

5.4.7 Reasonable Assurance

The point source WLAs and nonpoint source LAs 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 a combination of cumulative effects from point source TP reductions, BMPs, nutrient management, and land conversion. Achieving such loading 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 DEQ’s 2008 Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008) asserts:

“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 is confident that the implementation of 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 cumulative 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 CWA 319 grant program. Since 1997, DEQ has allocated approximately 1.4 million dollars toward 319 grants in the lower Boise River subbasin for the implementation of BMPs to reduce and prevent pollutant runoff (e.g. sediment and nutrients) from reaching surface waters (see Section 4, Table 22). In addition to 319 grants, numerous projects have been completed within the lower Boise River subbasin through federal programs, such as the Conservation
Stewardship Program, Environmental Quality Incentives Program, and Wildlife Habitat Incentives Program (see Section 4, Table 23). 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. SWCC) 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 SWCC Conservation Commission. Idaho water quality standards, IDAPA 58.01.02.055, identify that water bodies not fully supporting beneficial uses:

…”shall require the development of TMDLs or other equivalent processes, as described under Section 303(d)(1) of the Clean Water Act.”

Whereas Idaho Statute 39-3610(1) states:

…”nothing in this section shall be interpreted as requiring best management practices for agricultural operations which are not adopted on a voluntary basis.”

Whereas Idaho Statute 39-3611(10) states:

“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…”

5.4.8 Reserve for Growth

Where applicable, states must include an allowance for future loading in their TMDL 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 \( \leq 0.07 \) mg/L near Parma, which also contributes to achieving the mean monthly periphyton target of \( \leq 150 \) 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, Mason Creek, or Sand Hollow Creek: (1) receive a mean monthly NPDES permit limit for TP of \( \leq 0.07 \text{ mg/L} \) May through September and \( < 0.10 \text{ mg/L} \) 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, or (4) no discharge, or (5) DEQ will accept studies and technical papers demonstrating the proposal to discharge meets the TMDL target. However, any changes to the TMDL would need to be granted through the 5-year review process and an addendum to the TMDL.

Alternatively, if a DEQ 5-year review of this TMDL and subbasin assessment indicates that TP reductions have led to (A) beneficial uses being fully supported, and (B) 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 \( \leq 0.07 \text{ mg/L} \) in the lower Boise River near Parma from May-September, and 2) achieving the mean monthly periphyton target of \( \leq 150 \text{ mg/m}^2 \) in the two impaired AUS of the lower Boise River.

### 5.5 Implementation Strategies

The implementation strategy outlines a pathway by which the SWCC and Ada and Canyon Soil and Water Conservation Districts 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 5.4.7) 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:

- TP reductions from point source facilities
  - 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
- MS4 permittees to map their system inputs and outfalls and identify any non-stormwater (dry weather) discharges nonpoint-source origin, and identify 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
Providing offset credits for reducing non-point 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 Lower Boise River Implementation Plan (DEQ 2008) could be appropriate for the current TMDL, while acknowledging the need to expand and revise the focus to appropriately address the specific needs of the AUs in this document given current conditions and knowledge. The 2003 Agricultural Implementation Plan will be updated to reflect reductions necessary to meet the load allocations as well as 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. DEQ anticipates that 2 permit cycles (10 years from the NPDES permit issuance) will be provided via 401 certification and justification to achieve their wasteload allocations. However, in consultation with DEQ, appropriate compliance schedules may be considered on a case-by-case basis for point source permits.

This TMDL, however, 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 the installation of voluntary measures, including but not limited to 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 and NPDES permitting, whereas, funding provided under section 319, water quality trading, and other funds, will be used to encourage voluntary projects to reduce nonpoint source pollution. Additionally, upon the development of the TMDL, it is expected that a lower Boise River trading framework will be
updated/developed and that trading may be utilized 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, as appropriate. 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 lower Boise River 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 (SWCC)** for grazing and agriculture—working in cooperation with local soil and water conservation districts, the Idaho State Department of Agriculture (ISDA), and the NRCS, the SWCC 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 for construction and maintenance of 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.
operations, concentrated animal feeding operations, and dairies to ensure compliance with NPDES requirements.

- **WAG** and other agencies for other activities—Idaho Statute 39-3616 states:
  
  "...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..."

- **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:

- Develop BMPs to achieve load allocations including incorporation of 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.

**Implementation Monitoring Strategy**

The objectives of a monitoring strategy should be to demonstrate long-term recovery, better understand natural variability, track implementation of projects and BMPs, 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 and Sand Hollow Creek near Parma; mean monthly chlorophyll-a (periphyton) targets of \( \leq 150 \text{ mg/m}^2 \) will be applied within the impaired AUs (ID17050114SW005_06b, and ID17050114SW001_06) of the lower Boise River. The implementation monitoring strategy should specifically focus on several aspects:

1. **May 1 – September 30**
   a. Measure TP concentration trends (mg/L) and loadings (lbs/day) in the lower Boise River near Parma relative to the SR-HC May 1 – September 30 TP allocation target of \( \leq 0.07 \) mg/L.
      i. Focus monitoring efforts on the various sources identified in this TMDL (e.g. POTWs, stormwater, tributaries and drains, and ground water/unmeasured).
   b. Identify TP concentration trends (mg/L) and TP load equivalents (lbs/day) in Mason Creek near the mouth relative to its allocation target identified in this TMDL for the May 1 – September 30 time period.
   c. Identify TP concentration trends (mg/L) and TP load equivalents (lbs/day) in Sand Hollow Creek near the mouth relative to the SR-HC May 1 – September 30 TP allocation target of \( \leq 0.07 \) mg/L.

2. **Mean Monthly Benthic Chlorophyll a \( \leq 150 \text{ mg/m}^2 \)**
   a. Identify TP concentration trends (mg/L) and loadings (lbs/day) in the lower Boise River relative TP allocation targets designed to help achieve the mean monthly benthic chlorophyll a (periphyton) target of \( \leq 150 \text{ mg/m}^2 \).
      i. Focus monitoring efforts on the various sources identified in this TMDL (e.g. POTWs, stormwater, tributaries and drains, and ground water/unmeasured).
   b. Measure mean monthly benthic chlorophyll a (periphyton) in the two lower Boise River AUs that are currently listed as impaired for TP in the 2012 Integrated Report (DEQ 2014c) in order to help determine the extent in 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 utilized to help to track progress toward meeting the TMDL objectives. All sampling and analyses would be conducted under DEQ, USGS, SWCC, or other scientifically-defensible and approved protocols.

**5.5.4 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 to pollutant sources 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 2010).

5.5.4.1 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 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 loading 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 the amount of 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 trading 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.

5.5.4.2 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.
5.5.4.3 Trading Authorization
Water quality trading is authorized in Idaho regulation (IDAPA 58.01.02.055). Trading should be implemented consistent with the Clean Water Act and other existing regulations, U.S. EPA’s water quality trading policy (EPA 2003), DEQ’s water quality trading guidance, and the Lower Boise Trading Framework. For water quality trading to be authorized, it must be specifically mentioned within a TMDL document.

After adoption of an EPA-approved TMDL, DEQ, in concert with the WAG, must develop a water quality trading framework document. The Lower Boise has an existing Trading Framework that DEQ is currently evaluating to revise ratios and policies consistent with this Lower Boise TP TMDL assumptions, and the Joint Regional Recommendations (JRR) for water quality trading. The JRR were developed pursuant to a joint effort between Idaho, Oregon, and Washington, with technical oversight from EPA Region 10, facilitated through a USDA-NRCS Conservation Innovation Grant awarded to the Willamette Partnership. The framework would mesh with the implementation plan for the watershed that is the subject of the TMDL. The elements of a trading document are described in DEQ’s water quality trading guidance (DEQ 2010).

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 $\leq 0.07$ mg/L in the Snake River (e.g. in the lower Boise River near Parma and at the mouth of Sand Hollow Creek near the Snake River), and 2) TP targets designed to help achieve the mean monthly benthic chlorophyll a (periphyton) target of $\leq 150$ mg/m$^2$ in the lower Boise River from May 1 – September 30 and October 1 – April 30. Achieving these targets is expected to result in full support cold water aquatic life and contact recreation beneficial uses in the lower Boise River, Mason Creek, and Sand Hollow Creek.
Table 544 provides a summary of assessment outcomes and recommended changes to the next Integrated Report.

Table 54. Summary of assessment outcomes.

<table>
<thead>
<tr>
<th>Assessment Unit Name</th>
<th>Assessment Unit Number</th>
<th>Pollutant</th>
<th>TMDL(s) Completed</th>
<th>Recommended Changes to Next Integrated Report</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise River – Middleton to Indian Creek</td>
<td>ID17050114SW005_06b</td>
<td>Total Phosphorus</td>
<td>Yes</td>
<td>List in Category 4a for Total Phosphorus</td>
<td>EPA-approved Total Phosphorus TMDL completed</td>
</tr>
<tr>
<td>Boise River – Indian Creek to Mouth</td>
<td>ID17050114SW001_06b</td>
<td>Total Phosphorus</td>
<td>Yes</td>
<td>List in Category 4a for Total Phosphorus</td>
<td>EPA-approved Total Phosphorus TMDL completed</td>
</tr>
<tr>
<td>Mason Creek – Entire Watershed</td>
<td>ID17050114SW006_02</td>
<td>Cause Unknown - Nutrients</td>
<td>Yes</td>
<td>List in Category 4a for Total Phosphorus</td>
<td>EPA-approved Total Phosphorus TMDL completed</td>
</tr>
<tr>
<td>Sand Hollow Creek – C-Line Canal to I-84</td>
<td>ID17050114SW016_03</td>
<td>Cause Unknown - Nutrients</td>
<td>Yes</td>
<td>List in Category 4a for Total Phosphorus</td>
<td>EPA-approved Total Phosphorus TMDL completed</td>
</tr>
<tr>
<td>Sand Hollow Creek – Sharp Road to Snake River</td>
<td>ID17050114SW017_06</td>
<td>Cause Unknown - Nutrients</td>
<td>Yes</td>
<td>List in Category 4a for Total Phosphorus</td>
<td>EPA-approved Total Phosphorus TMDL completed</td>
</tr>
</tbody>
</table>

In addition, data analysis for a 5-year review of the lower Boise River subbasin was completed in 2009 (DEQ 2009), and a TP implementation plan for the lower Boise River 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](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 C, including comments and DEQ responses. A distribution list is included in Appendix D.
References Cited


**GIS Coverages**

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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 uncertainty 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.
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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.

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

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<table>
<thead>
<tr>
<th>Unit</th>
<th>Waters</th>
<th>Aquatic Life</th>
<th>Recreation</th>
<th>Other</th>
</tr>
</thead>
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<tr>
<td>SW-4</td>
<td>Lake Lowell</td>
<td>WARM</td>
<td>PCR</td>
<td></td>
</tr>
<tr>
<td>SW-5</td>
<td>Boise River - river mile 50 (T04N, R02W, Sec. 32) to Indian Creek</td>
<td>COLD, SS</td>
<td>PCR</td>
<td></td>
</tr>
<tr>
<td>SW-6</td>
<td>Mason Creek - New York Canal to mouth</td>
<td>SCR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW-7</td>
<td>Fifteenmile Creek - Miller Canal to mouth</td>
<td>SCR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW-8</td>
<td>Tenmile Creek - Blacks Creek Reservoir Dam to Miller Canal</td>
<td>COLD</td>
<td>SCR</td>
<td></td>
</tr>
<tr>
<td>SW-9</td>
<td>Blacks Creek - source to and including Blacks Creek Reservoir</td>
<td>COLD</td>
<td>SCR</td>
<td></td>
</tr>
<tr>
<td>SW-10</td>
<td>Fivemile Creek - source to Miller Canal</td>
<td>COLD</td>
<td>SCR</td>
<td></td>
</tr>
<tr>
<td>SW-11a</td>
<td>Boise River - Diversion Dam to river mile 50 (T04N, R02W, Sec. 32)</td>
<td>COLD, SS</td>
<td>PCR, DWS</td>
<td></td>
</tr>
<tr>
<td>SW-11b</td>
<td>Boise River - Lucky Peak Dam to Diversion Dam</td>
<td>COLD</td>
<td>PCR, DWS</td>
<td></td>
</tr>
<tr>
<td>SW-12</td>
<td>Stewart Gulch, Cottonwood and Crane Creeks -source to mouth</td>
<td>COLD</td>
<td>PCR</td>
<td>DWS</td>
</tr>
<tr>
<td>SW-13</td>
<td>Dry Creek - source to mouth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW-14</td>
<td>Big/Little Gulch Creek complex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW-15</td>
<td>Willow Creek - source to mouth</td>
<td></td>
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<tr>
<td>SW-16</td>
<td>Langley/Graveyard Gulch complex</td>
<td></td>
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<tr>
<td>SW-17</td>
<td>Sand Hollow Creek - source to mouth</td>
<td>SCR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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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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 B1. Data sources for lower Boise River subbasin assessment.

<table>
<thead>
<tr>
<th>Water Body</th>
<th>Type of Data</th>
<th>Data Source</th>
<th>Collection Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lander Street</td>
<td>Effluent Parameters</td>
<td>Kate Harris, City of Boise</td>
<td>2006 – 2013</td>
</tr>
<tr>
<td>West Boise</td>
<td>Effluent Parameters</td>
<td>Kate Harris, City of Boise</td>
<td>2006 – 2013</td>
</tr>
<tr>
<td>Middleton</td>
<td>Effluent Parameters</td>
<td>Brad Green, City of Middleton</td>
<td>2011 – 2013</td>
</tr>
<tr>
<td>Middleton</td>
<td>Effluent Parameters</td>
<td>Michael Moore, Analytical Laboratories</td>
<td></td>
</tr>
<tr>
<td>Caldwell</td>
<td>Effluent Parameters</td>
<td>Lee Van DeBogart, City of Caldwell</td>
<td>2012 – 2013</td>
</tr>
<tr>
<td>IDFG Eagle Hatchery</td>
<td>Flow</td>
<td>Jeff Heindel, IDFG</td>
<td>2003 – 2013</td>
</tr>
<tr>
<td>IDFG Eagle Hatchery</td>
<td>Effluent Parameters</td>
<td>Kate Harris, City of Boise</td>
<td>2007 – 2013</td>
</tr>
<tr>
<td>Darigold, Inc.</td>
<td>Effluent Parameters</td>
<td>Scott Algate, Darigold, Inc.</td>
<td>2012 – 2013</td>
</tr>
<tr>
<td>Avimor</td>
<td>Effluent Parameters</td>
<td>Jeremy Aulbach, Pharmer Engineering LLC</td>
<td>2012-2013</td>
</tr>
<tr>
<td>Star</td>
<td>Effluent Parameters</td>
<td>Ken Vose, Star Sewer and Water</td>
<td>2006 – 2013</td>
</tr>
<tr>
<td>Meridian</td>
<td>Effluent Parameters</td>
<td>Michael Kasch, HDR</td>
<td>2012 – 2013</td>
</tr>
<tr>
<td>Sorrento Lactalis</td>
<td>Effluent Parameters</td>
<td>Wendy York, Sorrento Lactalis</td>
<td>2012 – 2013</td>
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<tr>
<td>Nampa</td>
<td>Effluent Parameters</td>
<td>Matt Gregg, Brown and Caldwell</td>
<td>2012 – 2013</td>
</tr>
<tr>
<td>Kuna</td>
<td>Effluent Parameters</td>
<td>Tom Shaffer, City of Kuna</td>
<td>2012 – 2013</td>
</tr>
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<td>IDFG Nampa Hatchery</td>
<td>Effluent Parameters</td>
<td>DMR Data</td>
<td>2012 – 2013</td>
</tr>
<tr>
<td>IDFG Eagle Hatchery</td>
<td>Effluent Parameters</td>
<td>Kate Harris, City of Boise</td>
<td>2007 – 2013</td>
</tr>
<tr>
<td>Notus</td>
<td>Effluent Parameters</td>
<td>Mike Black, City of Notus</td>
<td>2007 – 2013</td>
</tr>
<tr>
<td>Wilder</td>
<td>Effluent Parameters</td>
<td>Wendy Burrows, City of Wilder</td>
<td>2012 – 2013</td>
</tr>
<tr>
<td>Greanleaf</td>
<td>Effluent Parameters</td>
<td>DMR Data</td>
<td>2012 – 2013</td>
</tr>
<tr>
<td>Parma</td>
<td>Effluent Parameters</td>
<td>Ken Steinhaus, City of Parma</td>
<td>2012 – 2013</td>
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<td>Years</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------</td>
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</tr>
<tr>
<td>Lower Boise River, Mason Creek, Sand Hollow Creek, and Lower Boise River Tributaries</td>
<td>Water Quality, Periphyton, Habitat, and Flow Parameters</td>
<td>Alex Etheridge, USGS</td>
<td>1983 – 2013</td>
</tr>
<tr>
<td>Lower Boise River Tributaries</td>
<td>Water Quality Parameters</td>
<td>Kirk Campbell, ISDA</td>
<td>1998 - 2008</td>
</tr>
<tr>
<td>Lower Boise River, Dixie Drain, and Point Sources</td>
<td>Water Quality, Periphyton, Habitat, and Flow Parameters</td>
<td>Kate Harris, City of Boise</td>
<td>1993 – 2013</td>
</tr>
</tbody>
</table>
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Appendix C. Public Participation and Public Comments

DEQ consulted and coordinated with the 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), Lower Boise Watershed Council (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 Month 2014, 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: http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx. The meetings and presentations include but are not limited to:

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
15. November 29, 2012 LBWC TAC
17. January 10, 2013 LBWC
18. January 16, 2013 BAG
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
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 WQ 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
99. July 30, 2014 LBWC TAC
100. August 11, 2014 LBWC Stormwater
101. August 19, 2014 LBWC Stormwater
102. August 22, 2014 Amalgamate 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

[Public comments and DEQ responses to be inserted following public comment period.]
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Footnote: The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.
Appendix D. Distribution List

Ben Cope and Bill Stewart, EPA

BOR Pacific Northwest Region and Snake River Office

Lower Boise Watershed Council, TAC, 319 TAC, and Workgroup Participants

¹The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.
The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.
Appendix E. Stormwater Information Provided to DEQ by the LBWC Stormwater Workgroup

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
- Michael Mieyr/Nampa
- Jack Harrison/ACHD and Middleton
- Ted Douglass/Nampa

¹The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.
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1The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.
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¹The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.
The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.
• **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 (IDOEQ 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.

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

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.

---

1The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.
Table 2 - Measured average runoff total phosphorus (TP) concentrations, estimated TP loads, and calculated daily average flows

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

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

<table>
<thead>
<tr>
<th>Stormwater</th>
<th>Permitted</th>
<th>Non-Permitted</th>
<th>Totals</th>
<th>Units</th>
<th>Note</th>
</tr>
</thead>
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<tr>
<td>Area</td>
<td>218</td>
<td>63</td>
<td>180,321</td>
<td>mi^2</td>
<td>Appendix A</td>
</tr>
<tr>
<td></td>
<td>139,704</td>
<td>40,617</td>
<td></td>
<td>ac</td>
<td></td>
</tr>
</tbody>
</table>

Baseline Loads

<table>
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<tr>
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<th>Permitted</th>
<th>Non-Permitted</th>
<th>Totals</th>
<th>Units</th>
<th>Note</th>
</tr>
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<tbody>
<tr>
<td>Wet Weather (WWx)</td>
<td>0.64</td>
<td>0.64</td>
<td>116</td>
<td>g/ac/d</td>
<td>Appendix B</td>
</tr>
<tr>
<td>Full Yr Load</td>
<td>90</td>
<td>26</td>
<td>116</td>
<td>kg/d</td>
<td></td>
</tr>
<tr>
<td></td>
<td>197</td>
<td>57</td>
<td>254</td>
<td>lb/d</td>
<td></td>
</tr>
<tr>
<td>Percent of area</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>138</td>
<td>40</td>
<td>178</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Weather (DWx)</td>
<td>3.68</td>
<td>3.68</td>
<td>1460</td>
<td>g/ac/d</td>
<td>Appendix C</td>
</tr>
<tr>
<td>Full Yr Load</td>
<td>514</td>
<td>149</td>
<td>1460</td>
<td>kg/d</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1131</td>
<td>329</td>
<td></td>
<td>lb/d</td>
<td></td>
</tr>
<tr>
<td>Percent of area</td>
<td>30%</td>
<td>30%</td>
<td>30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>339</td>
<td>99</td>
<td>438</td>
<td>lb/d</td>
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</tr>
</tbody>
</table>

Seasonal Periods

<table>
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<tr>
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<th>Totals</th>
<th>Units</th>
<th>Note</th>
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<tbody>
<tr>
<td>WWx season fraction</td>
<td>0.4</td>
<td>0.4</td>
<td>71</td>
<td>lb/d</td>
<td>Appendix D</td>
</tr>
<tr>
<td>May-Sep Wet Wx</td>
<td>55</td>
<td>16</td>
<td>71</td>
<td>lb/d</td>
<td></td>
</tr>
<tr>
<td>DWx season fraction</td>
<td>0.9</td>
<td>0.9</td>
<td>394</td>
<td>lb/d</td>
<td></td>
</tr>
<tr>
<td>May-Sep Dry Wx</td>
<td>305</td>
<td>89</td>
<td>394</td>
<td>lb/d</td>
<td></td>
</tr>
<tr>
<td>May-Sep Total</td>
<td>361</td>
<td>105</td>
<td>465</td>
<td>lb/d</td>
<td>(SR-HC Critical Period)</td>
</tr>
<tr>
<td>WWx season fraction</td>
<td>0.6</td>
<td>0.6</td>
<td>107</td>
<td>lb/d</td>
<td>Appendix D</td>
</tr>
<tr>
<td>Oct-Apr Wet Wx</td>
<td>83</td>
<td>24</td>
<td>107</td>
<td>lb/d</td>
<td></td>
</tr>
<tr>
<td>DWx season fraction</td>
<td>0.1</td>
<td>0.1</td>
<td>44</td>
<td>lb/d</td>
<td>(NON Critical Period)</td>
</tr>
<tr>
<td>Oct-Apr Dry Wx</td>
<td>34</td>
<td>10</td>
<td>44</td>
<td>lb/d</td>
<td></td>
</tr>
<tr>
<td>Oct-Apr Total</td>
<td>117</td>
<td>34</td>
<td>151</td>
<td>lb/d</td>
<td>(NON Critical Period)</td>
</tr>
</tbody>
</table>

Example Allocations

<table>
<thead>
<tr>
<th></th>
<th>% reduction</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-Sep Allocations</td>
<td>60%</td>
<td>Example for discussion</td>
</tr>
<tr>
<td></td>
<td>144</td>
<td>(SR-HC Critical Period)</td>
</tr>
<tr>
<td>Oct-Apr Allocations</td>
<td>60%</td>
<td>Example for discussion</td>
</tr>
<tr>
<td></td>
<td>47</td>
<td>(NON Critical Period)</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th></th>
<th>Permitted Area (ac)</th>
<th>Non-Permitted Area (ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ada</td>
<td>95,149</td>
<td>29,749</td>
</tr>
<tr>
<td>Canyon</td>
<td>44,555</td>
<td>10,868</td>
</tr>
<tr>
<td>Total</td>
<td>139,704</td>
<td>40,617</td>
</tr>
</tbody>
</table>

Appendix A provides more details on the areas for individual permittees or jurisdictions. Non-permitees 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

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

<table>
<thead>
<tr>
<th>Source</th>
<th>TP Conc. (mg/L)</th>
<th>TP Load Annual (g/ac/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACHD Phase I (Composite)</td>
<td>0.36</td>
<td>0.36</td>
</tr>
<tr>
<td>ACHD Phase II (Grab)</td>
<td>0.42</td>
<td>0.22</td>
</tr>
<tr>
<td>Nampa (Grab)</td>
<td>1.17</td>
<td>0.61</td>
</tr>
<tr>
<td>Caldwell (Grab)*</td>
<td>1.09</td>
<td>1.33</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>0.75</strong></td>
<td><strong>0.64</strong></td>
</tr>
</tbody>
</table>

* 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

<table>
<thead>
<tr>
<th>Dry Weather Data Summary</th>
<th>TP Conc.</th>
<th>TP Load Annual</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>(mg/L)</th>
<th>(g/ac/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACHD</td>
<td>0.095</td>
<td>2.4</td>
</tr>
<tr>
<td>Caldwell</td>
<td>0.146</td>
<td>5.0</td>
</tr>
<tr>
<td>Average of Average</td>
<td>0.12</td>
<td>3.68</td>
</tr>
</tbody>
</table>

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

**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 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.

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

<table>
<thead>
<tr>
<th>Statistic</th>
<th>May-Sep Period</th>
<th>Oct-Apr Period</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Days with Precipitation &gt;= 0.1in</td>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td>Average Maximum 1-Day Precipitation</td>
<td>1.6</td>
<td>1.1</td>
</tr>
<tr>
<td>Maximum 1-Day Precipitation</td>
<td>1.9</td>
<td>1.6</td>
</tr>
</tbody>
</table>

- **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**

---
1The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.
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://city.cityofcaldwell.com/StormWater
  - http://www.cityofnampa.us/stormwater/

  U.S. Census Bureau, 2010. [https://www.census.gov/cgi-bin/geo/shapefiles2010/main](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/)
  [http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?id1022](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**

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

Appendices

For

Lower Boise River

Stormwater Phosphorus Loads and Example Allocations

November 20, 2014

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

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

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

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

Figure 1b  Map of Canyon County stormwater management areas (prepared by ACHD, 7/3/2014)
The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.

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

<table>
<thead>
<tr>
<th>Permit Holder/Jurisdiction</th>
<th>NPDES Permit Number</th>
<th>MS4 Permit Type</th>
<th>Permitted Areas</th>
<th>Non-Permitted Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Urbanized Area²</td>
<td>City Limits² &amp; City Limits²</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acre (mi²)</td>
<td>Acre</td>
</tr>
<tr>
<td>Ada County</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boise/Garden City</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>87</td>
<td>55,773</td>
</tr>
<tr>
<td>Boise</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>4</td>
<td>2,720</td>
</tr>
<tr>
<td>Garden City</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>8</td>
<td>4,801</td>
</tr>
<tr>
<td>Ada County Highway District</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>87</td>
<td>55,773</td>
</tr>
<tr>
<td>Boise State University</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>0.24</td>
<td>153</td>
</tr>
<tr>
<td>Ada County Drainage District 3</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>8</td>
<td>4,801</td>
</tr>
<tr>
<td>ITD, District 3</td>
<td>IDS027561</td>
<td>Phase I</td>
<td>87</td>
<td>55,773</td>
</tr>
<tr>
<td><strong>Total Area Boise/Garden City Phase I Permit</strong></td>
<td>IDS028185</td>
<td>Phase II</td>
<td>72</td>
<td>44,376</td>
</tr>
<tr>
<td>Ada County Highway District</td>
<td>IDS028185</td>
<td>Phase II</td>
<td>18</td>
<td>11,619</td>
</tr>
<tr>
<td><strong>Total Area Ada County Phase I and II Permits</strong></td>
<td></td>
<td></td>
<td>100</td>
<td>66,985</td>
</tr>
<tr>
<td>Urbanized Ada County (unincorporated)</td>
<td></td>
<td></td>
<td>18</td>
<td>11,619</td>
</tr>
<tr>
<td><strong>Total Ada County Incorporated Non- Permitted Area</strong></td>
<td></td>
<td></td>
<td>118</td>
<td>78,603</td>
</tr>
<tr>
<td>Canyon County</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caldwell</td>
<td>IDS028118</td>
<td>Phase II</td>
<td>5.4</td>
<td>341</td>
</tr>
<tr>
<td>Nampa</td>
<td>IDS028126</td>
<td>Phase II</td>
<td>25</td>
<td>15,915</td>
</tr>
<tr>
<td>Middleton</td>
<td>IDS028100</td>
<td>Phase II</td>
<td>2.3</td>
<td>1,478</td>
</tr>
<tr>
<td>Urbanized Canyon County (unincorporated)</td>
<td></td>
<td></td>
<td>24.8</td>
<td>15,890</td>
</tr>
<tr>
<td>ITD, District 3</td>
<td>IDS028177</td>
<td>Phase II</td>
<td>8</td>
<td>5,120</td>
</tr>
<tr>
<td>Canyon Highway District #4³</td>
<td>IDS028134</td>
<td>Phase II</td>
<td>8</td>
<td>5,120</td>
</tr>
<tr>
<td>Nampa Highway District #1³</td>
<td>IDS028142</td>
<td>Phase II</td>
<td>8.5</td>
<td>5,440</td>
</tr>
<tr>
<td>Notus-Parma Highway District #2³</td>
<td>IDS028151</td>
<td>Phase II</td>
<td>2</td>
<td>1,280</td>
</tr>
<tr>
<td><strong>Total Area Canyon County Phase II Permits</strong></td>
<td></td>
<td></td>
<td>70</td>
<td>44,555</td>
</tr>
<tr>
<td>Greenleaf</td>
<td>NA</td>
<td></td>
<td>0.8</td>
<td>493</td>
</tr>
<tr>
<td>Notus</td>
<td>NA</td>
<td></td>
<td>0.4</td>
<td>246</td>
</tr>
<tr>
<td>Parma</td>
<td>NA</td>
<td></td>
<td>1.1</td>
<td>706</td>
</tr>
<tr>
<td>Wilder</td>
<td>NA</td>
<td></td>
<td>0.7</td>
<td>464</td>
</tr>
<tr>
<td><strong>Total Canyon County Incorporated Non- Permitted Area</strong></td>
<td></td>
<td></td>
<td>17</td>
<td>10,868</td>
</tr>
</tbody>
</table>

¹Ada County Assessor 7/9/14; ²Canyon County Assessor 5/28/14; ³Urbanized 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 are not in the corporate boundary within the 2010 Nampa Urbanized Area or the 2010 Boise Urbanized Area. 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 0.37 g/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.
The following tables summarize site information for ACHD monitoring locations.

### Table ACHD-1a Phase I monitoring sites

<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
<th>Drainage Area (ac)</th>
<th>Land Use</th>
<th>Receiving Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walnut</td>
<td>Boise, Id</td>
<td>567</td>
<td>58% low-density residential</td>
<td>Boise River</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15% high-density residential</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>26% open space</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.4% commercial/industrial</td>
<td></td>
</tr>
<tr>
<td>Koppels</td>
<td>Boise, Id</td>
<td>12</td>
<td>66% commercial/industrial</td>
<td>Boise River</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>34% transportation</td>
<td></td>
</tr>
<tr>
<td>Lucky</td>
<td>Boise, Id</td>
<td>105</td>
<td>100% low-density residential</td>
<td>Eagle Drain</td>
</tr>
<tr>
<td>Production</td>
<td>Boise, Id</td>
<td>25</td>
<td>100% commercial/industrial</td>
<td>Fivemile Creek</td>
</tr>
<tr>
<td>Franklin</td>
<td>Boise, Id</td>
<td>16</td>
<td>44% low-density residential</td>
<td>Ridenbaugh Canal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>56% transportation</td>
<td></td>
</tr>
</tbody>
</table>

### Table ACHD-1b Phase II monitoring sites

<table>
<thead>
<tr>
<th>Site:</th>
<th>Location:</th>
<th>Drainage Area (ac):</th>
<th>Land Use</th>
<th>Receiving Water:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edgewood</td>
<td>Eagle, Id</td>
<td>25</td>
<td>30% low-density residential</td>
<td>Eagle Drain</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42% residential rural</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>13% recreation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15% residential farmland</td>
<td></td>
</tr>
<tr>
<td>Chrisfield</td>
<td>Meridian, Id</td>
<td>12</td>
<td>100% low-density residential</td>
<td>Fivemile Creek</td>
</tr>
</tbody>
</table>

**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

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

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:

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

**MEAN**

n=15

0.36

Table ACHD 3 – Walnut (Phase I site) runoff and load data.
Table ACHD 4 – Koppels (Phase I site) runoff and load data.

<table>
<thead>
<tr>
<th>Site: Koppels</th>
<th>Receiving Water: Boise River</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location: Boise, Idaho</td>
<td>Drainage Area: 12 acres</td>
</tr>
</tbody>
</table>

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

**MEAN**

|               | n=15       | 0.31               |

**Table ACHD 4 – Koppels (Phase I site) runoff and load data.**
### Table 1: Lucky (Phase I site) runoff and load data.

**Site:** Lucky  
**Receiving Water:** Eagle Drain  
**Location:** Boise, Idaho  
**Drainage Area:** 105 acres  

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

**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

<table>
<thead>
<tr>
<th>Type of Sample</th>
<th>Date</th>
<th>Precipitation (in)</th>
<th>runoff volume (c.f)</th>
<th>runoff coefficient</th>
<th>Total Phosphorus (TP) (mg/l)</th>
<th>Runoff (in)</th>
<th>Runoff %</th>
<th>TP Load (lb/ac/d)</th>
<th>TP Load (g/ac/d)</th>
<th>TP Load Annual (g/ac/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Comp</td>
<td>10/19/2007</td>
<td>0.46</td>
<td>7260</td>
<td>0.45</td>
<td>0.32</td>
<td>0.125</td>
<td>27%</td>
<td>0.00904</td>
<td>4.11</td>
<td>0.45</td>
</tr>
<tr>
<td>Wet Comp</td>
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<td>0.77</td>
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<td>0.49</td>
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<td>11556</td>
<td>0.507</td>
<td>0.45</td>
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<td>0.02024</td>
<td>9.20</td>
<td>1.01</td>
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<td>0.13</td>
<td>23112</td>
<td>0.507</td>
<td>0.21</td>
<td>0.398</td>
<td>306%</td>
<td>0.01889</td>
<td>8.59</td>
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</tr>
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<td>4/29/2009</td>
<td>0.36</td>
<td>4830</td>
<td>0.507</td>
<td>0.68</td>
<td>0.083</td>
<td>23%</td>
<td>0.01278</td>
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<td>3933</td>
<td>0.507</td>
<td>0.32</td>
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<td>6464</td>
<td>0.507</td>
<td>0.2</td>
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<td>7648</td>
<td>0.507</td>
<td>0.21</td>
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<td>3936</td>
<td>0.507</td>
<td>0.55</td>
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<td>3328</td>
<td>0.507</td>
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<td>0.00285</td>
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<td>5616</td>
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<td>2070</td>
<td>0.502</td>
<td>0.32</td>
<td>0.036</td>
<td>45%</td>
<td>0.00258</td>
<td>1.17</td>
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<td>0.21</td>
<td>2277</td>
<td>0.502</td>
<td>0.33</td>
<td>0.039</td>
<td>19%</td>
<td>0.00292</td>
<td>1.33</td>
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</tr>
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<td>0.13</td>
<td>3312</td>
<td>0.502</td>
<td>0.18</td>
<td>0.057</td>
<td>44%</td>
<td>0.00232</td>
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<td>0.12</td>
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<td>3105</td>
<td>0.502</td>
<td>0.45</td>
<td>0.053</td>
<td>14%</td>
<td>0.00544</td>
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**MEAN**  

n=16  

0.38

Table ACHD 6 – Franklin (Phase I site) runoff and load data.
### Table ACHD 7 – Production (Phase I site) runoff and load data.

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<thead>
<tr>
<th>Type of Sample</th>
<th>Date</th>
<th>Precipitation (in)</th>
<th>Runoff Volume (cf)</th>
<th>Runoff Coefficient</th>
<th>Total Phosphorus (mg/l)</th>
<th>Runoff (in)</th>
<th>Runoff %</th>
<th>TP Load (lb/ac/d)</th>
<th>TP Load Day (g/ac/d)</th>
<th>TP Load Annual (g/ac/d)</th>
</tr>
</thead>
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<tr>
<td>Wet Comp</td>
<td>10/19/2007</td>
<td>0.46</td>
<td>14528</td>
<td>0.994</td>
<td>0.32</td>
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<td>35%</td>
<td>0.01158</td>
<td>5.26</td>
<td>0.58</td>
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<tr>
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<td>0.14</td>
<td>17696</td>
<td>0.994</td>
<td>0.29</td>
<td>0.195</td>
<td>139%</td>
<td>0.01278</td>
<td>5.81</td>
<td>0.64</td>
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<td>13702</td>
<td>0.994</td>
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<td>0.151</td>
<td>60%</td>
<td>0.00956</td>
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<td>17344</td>
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<td>0.17</td>
<td>0.191</td>
<td>147%</td>
<td>0.00734</td>
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<td>0.37</td>
</tr>
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<td>Type of Sample</td>
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<td>Precipitation (in)</td>
<td>runoff volume (cft)</td>
<td>runoff coefficient</td>
<td>Total Phosphorus (mg/l)</td>
<td>Total Suspended Solids (TSS) (mg/l)</td>
<td>E. Coli (MPN/100 ml)</td>
<td></td>
<td></td>
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</tr>
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<td>6.2</td>
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| WET MEAN       | n=17            | 0.563              |                      |                   |                        |                      |                    |

Table ACHD 8 – Chrisfield (Phase II site) runoff and concentration data.
<table>
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<tr>
<th>Date/Time</th>
<th>Precipitation (in)</th>
<th>run off volume (cfs)</th>
<th>run off coefficient</th>
<th>Total Phosphorus (TP) (mg/l)</th>
<th>Total Suspended Solids (TSS) (mg/l)</th>
<th>E. Coli (MPN/100ml)</th>
</tr>
</thead>
<tbody>
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<td>3/10/2011 18:15</td>
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<td>0.275</td>
<td>0.192</td>
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<td>0.1034</td>
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<td>0.275</td>
<td>0.0774</td>
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<td>0.184</td>
<td>18.8</td>
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<tr>
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<td>3,647</td>
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<td>816.4</td>
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<td>4,470</td>
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<td>0.477</td>
<td>156.0</td>
<td>3230</td>
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</table>

**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

<table>
<thead>
<tr>
<th>Site</th>
<th>Drainage Area (ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Creek</td>
<td>31.1</td>
</tr>
<tr>
<td>Mason Creek</td>
<td>7.8</td>
</tr>
<tr>
<td>Wilson Creek</td>
<td>3.6</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Monitoring Site</th>
<th>Area (ac)</th>
<th>Precip. (in)</th>
<th>Runoff Volume (in)</th>
<th>Runoff Fraction (Calc.)</th>
<th>TP Conc. (mg/L)</th>
<th>TP Load 24-hr (g/ac/d)</th>
<th>TP Load Annual (g/ac/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Ck</td>
<td>31.1</td>
<td>0.37</td>
<td>0.12</td>
<td>0.32</td>
<td>1.0</td>
<td>4.5</td>
<td>0.49</td>
</tr>
<tr>
<td>Mason Ck</td>
<td>7.8</td>
<td>0.37</td>
<td>0.07</td>
<td>0.19</td>
<td>1.4</td>
<td>2.3</td>
<td>0.25</td>
</tr>
<tr>
<td>Wilson Ck</td>
<td>3.6</td>
<td>0.37</td>
<td>0.13</td>
<td>0.35</td>
<td>1.1</td>
<td>9.8</td>
<td>1.08</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td><strong>0.61</strong></td>
</tr>
<tr>
<td>Date</td>
<td>Precipitation Amount (in)</td>
<td>Measured Runoff (cf)</td>
<td>Measured Runoff (in)</td>
<td>Calculated C-Factor</td>
<td></td>
<td></td>
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<td>----------------------</td>
<td>----------------------</td>
<td>---------------------</td>
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<tr>
<td><strong>Indian Creek</strong></td>
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</tr>
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<tr>
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<td>133</td>
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<td>0.12</td>
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</tr>
<tr>
<td>16-Oct-12</td>
<td>0.51</td>
<td>9984</td>
<td>0.09</td>
<td>0.17</td>
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</tr>
<tr>
<td>4-Dec-12</td>
<td>0.21</td>
<td>3026</td>
<td>0.03</td>
<td>0.13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-Feb-13</td>
<td>0.31</td>
<td>15769</td>
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<td>0.45</td>
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<td></td>
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</tr>
<tr>
<td>19-Apr-13</td>
<td>0.27</td>
<td>288</td>
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<td>0.01</td>
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<td></td>
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</tr>
<tr>
<td>19-Jun-13</td>
<td>0.39</td>
<td>26051</td>
<td>0.23</td>
<td>0.59</td>
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<tr>
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<td>2892</td>
<td>0.03</td>
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<td></td>
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<td></td>
</tr>
<tr>
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<td>12717</td>
<td>0.11</td>
<td>0.45</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Avg</strong></td>
<td></td>
<td>0.37</td>
<td>13412</td>
<td>0.12</td>
<td>0.32</td>
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<tr>
<td><strong>Mason Creek</strong></td>
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</tr>
<tr>
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<td>0.98</td>
<td>7621</td>
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</tr>
<tr>
<td>25-May-12</td>
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<td>78</td>
<td>0.00</td>
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<tr>
<td>16-Oct-12</td>
<td>0.51</td>
<td>1318</td>
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</tr>
<tr>
<td>4-Dec-12</td>
<td>0.21</td>
<td>192</td>
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<td>0.03</td>
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<td>19-Apr-13</td>
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<td>813</td>
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<td>1896</td>
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<td>24-Sep-13</td>
<td>0.25</td>
<td>1313</td>
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<tr>
<td><strong>Avg</strong></td>
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<td>1951</td>
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<td>0.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wilson Creek</strong></td>
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</tr>
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<td>4.73</td>
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<td>3413</td>
<td>0.26</td>
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</tr>
<tr>
<td>4-Dec-12</td>
<td>0.21</td>
<td>384</td>
<td>0.03</td>
<td>0.14</td>
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<td>1085</td>
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<td>662</td>
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</tr>
<tr>
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<td>2312</td>
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<td>0.71</td>
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</tr>
<tr>
<td><strong>Avg</strong></td>
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<td>1688</td>
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</table>
Table Nampa 4 - Nampa Loads

<table>
<thead>
<tr>
<th>Date</th>
<th>Meas. Runoff (cf)</th>
<th>TP (mg/L)</th>
<th>P Load/ event</th>
<th>P Load/ day</th>
<th>P Load/ yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Ck</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>49,850</td>
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<td>15.85</td>
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<td>0.65</td>
<td>0.2</td>
<td>0.40</td>
<td>0.04</td>
</tr>
<tr>
<td>16-Oct-12</td>
<td>9,984</td>
<td>1.05</td>
<td>10.1</td>
<td>8.39</td>
<td>0.92</td>
</tr>
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<td>0.25</td>
<td>0.3</td>
<td>0.10</td>
<td>0.01</td>
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<td>15,769</td>
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<td>2.6</td>
<td>0.65</td>
<td>0.07</td>
</tr>
<tr>
<td>19-Apr-13</td>
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<td>0.00</td>
</tr>
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<td>19-Jun-13</td>
<td>26,051</td>
<td>1.9</td>
<td>23.8</td>
<td>9.90</td>
<td>1.08</td>
</tr>
<tr>
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<tr>
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<td>4.0</td>
<td>0.83</td>
<td>0.09</td>
</tr>
<tr>
<td>Avg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Mason Ck</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>7,621</td>
<td>0.32</td>
<td>7.9</td>
<td>5.63</td>
<td>0.62</td>
</tr>
<tr>
<td>25-May-12</td>
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<td>2.75</td>
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<td>3.93</td>
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<td>1.25</td>
<td>6.3</td>
<td>5.26</td>
<td>0.58</td>
</tr>
<tr>
<td>4-Dec-12</td>
<td>192</td>
<td>0.35</td>
<td>0.1</td>
<td>0.03</td>
<td>0.00</td>
</tr>
<tr>
<td>22-Feb-13</td>
<td>2,411</td>
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<td>1.7</td>
<td>0.42</td>
<td>0.05</td>
</tr>
<tr>
<td>19-Apr-13</td>
<td>813</td>
<td>1.1</td>
<td>2.6</td>
<td>1.61</td>
<td>0.18</td>
</tr>
<tr>
<td>19-Jun-13</td>
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<td>0.87</td>
<td>0.10</td>
</tr>
<tr>
<td>22-Aug-13</td>
<td>1,919</td>
<td>4.5</td>
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</tr>
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<td>2.1</td>
<td>0.53</td>
<td>0.06</td>
</tr>
<tr>
<td>Avg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.3</td>
</tr>
<tr>
<td>Wilson Ck</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>25-Mar-12</td>
<td>2,783</td>
<td>1.9</td>
<td>37.3</td>
<td>26.43</td>
<td>2.90</td>
</tr>
<tr>
<td>25-May-12</td>
<td>618</td>
<td>0.95</td>
<td>11.7</td>
<td>23.41</td>
<td>2.57</td>
</tr>
<tr>
<td>16-Oct-12</td>
<td>3,413</td>
<td>0.78</td>
<td>22.1</td>
<td>18.42</td>
<td>2.02</td>
</tr>
<tr>
<td>4-Dec-12</td>
<td>384</td>
<td>0.28</td>
<td>0.3</td>
<td>0.07</td>
<td>0.01</td>
</tr>
<tr>
<td>22-Feb-13</td>
<td>2,867</td>
<td>1.35</td>
<td>9.6</td>
<td>2.41</td>
<td>0.26</td>
</tr>
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<td>1,072</td>
<td>1.1</td>
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<td>0.08</td>
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<td>22-Aug-13</td>
<td>662</td>
<td>1.65</td>
<td>0.0</td>
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<tr>
<td>24-Sep-13</td>
<td>2,312</td>
<td>1.4</td>
<td>6.7</td>
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<td>0.15</td>
</tr>
<tr>
<td>Avg</td>
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<td></td>
<td></td>
<td></td>
<td>1.1</td>
</tr>
</tbody>
</table>
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

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

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

<table>
<thead>
<tr>
<th>Monitoring Site</th>
<th>Area (ac)</th>
<th>Precip. Volume (in)</th>
<th>Runoff Volume (Est.) (in)</th>
<th>C-Factor (Est.)</th>
<th>TP Conc. (mg/L)</th>
<th>TP Load 24-hr (g/ac/d)</th>
<th>TP Load Annual (g/ac/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10th Ave</td>
<td>14.2</td>
<td>0.17</td>
<td>0.16</td>
<td>0.90</td>
<td>1.4</td>
<td>24.50</td>
<td>2.69</td>
</tr>
<tr>
<td>Skyway Dr</td>
<td>27.2</td>
<td>0.17</td>
<td>0.02</td>
<td>0.10</td>
<td>0.4</td>
<td>0.45</td>
<td>0.05</td>
</tr>
<tr>
<td>12th Avg</td>
<td>60</td>
<td>0.17</td>
<td>0.09</td>
<td>0.50</td>
<td>1.4</td>
<td>11.48</td>
<td>1.26</td>
</tr>
<tr>
<td>Average</td>
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<td></td>
<td></td>
<td></td>
<td><strong>1.1</strong></td>
<td><strong>1.33</strong></td>
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</table>
Table Caldwell 3 - Caldwell Stormwater Monitoring Site Data and Loads:

<table>
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<tr>
<th>Date</th>
<th>Total P</th>
<th>Est. Runoff cf</th>
<th>TP Load Event</th>
<th>Day</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10th Ave</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4/16/2012</td>
<td>1.33</td>
<td>6,038</td>
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<td>16.0</td>
<td>1.8</td>
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<td>5/3/2012</td>
<td>0.48</td>
<td>8,825</td>
<td>20.8</td>
<td>8.4</td>
<td>0.9</td>
</tr>
<tr>
<td>10/22/2012</td>
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<td>6,502</td>
<td>45.1</td>
<td>11.3</td>
<td>1.2</td>
</tr>
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<td>11/24/2012</td>
<td>2.63</td>
<td>13,934</td>
<td>134.9</td>
<td>73.1</td>
<td>8.0</td>
</tr>
<tr>
<td>3/20/2013</td>
<td>1.55</td>
<td>9,754</td>
<td>38.6</td>
<td>30.1</td>
<td>3.3</td>
</tr>
<tr>
<td>6/19/2013</td>
<td>1.53</td>
<td>12,076</td>
<td>126.3</td>
<td>36.8</td>
<td>4.0</td>
</tr>
<tr>
<td>9/22/2012</td>
<td>1.88</td>
<td>2,322</td>
<td>46.4</td>
<td>8.7</td>
<td>1.0</td>
</tr>
<tr>
<td>9/24/2013</td>
<td>1.25</td>
<td>4,645</td>
<td>39.7</td>
<td>11.6</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>C- Factor</strong> = 0.90</td>
<td>Avg</td>
<td>2.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **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   | 0.35    | 1,392          | 0.0           | 0.0 | 0.00   |
| 11/24/2012   | 0.36    | 2,984          | 0.0           | 0.0 | 0.00   |
| 3/20/2013    | 0.36    | 2,586          | 3.3           | 1.0 | 0.11   |
| 6/19/2013    | 0.29    | 497            | 0.8           | 0.2 | 0.02   |
| 9/22/2012    | 0.21    | 995            | 0.7           | 0.2 | 0.02   |
| **C- Factor** = 0.20 | Avg | 0.05 |

| **12th Ave** |         |                |               |     |        |
| 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    |
| 9/22/2012    | 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 |

**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

<table>
<thead>
<tr>
<th>Dry Weather Data Summary</th>
<th>TP Conc. (mg/L)</th>
<th>TP Load Annual (g/ac/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACHD</td>
<td>0.095</td>
<td>2.4</td>
</tr>
<tr>
<td>Caldwell</td>
<td>0.146</td>
<td>5.0</td>
</tr>
<tr>
<td>Average of Average</td>
<td>0.12</td>
<td>3.7</td>
</tr>
</tbody>
</table>

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;

(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

<table>
<thead>
<tr>
<th>Date</th>
<th>Discharge (cfs)</th>
<th>TP conc. (mg/L)</th>
<th>TP Load (g/ac/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/10/2011</td>
<td>0.28</td>
<td>0.095</td>
<td>2.59</td>
</tr>
<tr>
<td>4/4/2011</td>
<td>trickle, 0</td>
<td>0.097</td>
<td>0.00</td>
</tr>
<tr>
<td>5/7/2011</td>
<td>0.55</td>
<td>0.050</td>
<td>2.68</td>
</tr>
<tr>
<td>10/4/2011</td>
<td>0.77</td>
<td>0.082</td>
<td>6.18</td>
</tr>
<tr>
<td>12/27/2011</td>
<td></td>
<td>0.105</td>
<td>0.00</td>
</tr>
<tr>
<td>3/25/2012</td>
<td>0.064</td>
<td>0.097</td>
<td>0.60</td>
</tr>
<tr>
<td>5/2/2012</td>
<td>0.08</td>
<td>0.071</td>
<td>0.55</td>
</tr>
<tr>
<td>5/24/2012</td>
<td>1.05</td>
<td>0.082</td>
<td>8.38</td>
</tr>
<tr>
<td>10/15/2012</td>
<td>0.06</td>
<td>0.106</td>
<td>0.62</td>
</tr>
<tr>
<td>11/29/2012</td>
<td>0.121</td>
<td>0.118</td>
<td>1.40</td>
</tr>
<tr>
<td>2/21/2013</td>
<td>0.01</td>
<td>0.123</td>
<td>0.12</td>
</tr>
<tr>
<td>6/24/2013</td>
<td>0.55</td>
<td>0.075</td>
<td>4.04</td>
</tr>
<tr>
<td>11/15/2013</td>
<td>0.57</td>
<td>0.131</td>
<td>7.30</td>
</tr>
<tr>
<td>3/7/2014</td>
<td>trickle, 0</td>
<td>0.138</td>
<td>0.00</td>
</tr>
<tr>
<td>4/21/2014</td>
<td>0.17</td>
<td>0.076</td>
<td>1.27</td>
</tr>
<tr>
<td>5/8/2014</td>
<td>0.29</td>
<td>0.072</td>
<td>2.04</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>0.35</strong></td>
<td><strong>0.095</strong></td>
<td><strong>2.36</strong></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Date</th>
<th>Discharge (cfs)</th>
<th>TP (mg/L)</th>
<th>g/ac/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/28/2013</td>
<td>2.9</td>
<td>0.163</td>
<td>5.9</td>
</tr>
<tr>
<td>7/15/2013</td>
<td>2.8</td>
<td>0.150</td>
<td>5.1</td>
</tr>
<tr>
<td>7/26/2013</td>
<td>2.3</td>
<td>0.126</td>
<td>3.5</td>
</tr>
<tr>
<td>8/13/2013</td>
<td>3.1</td>
<td>0.144</td>
<td>5.4</td>
</tr>
<tr>
<td>Avg</td>
<td>2.8</td>
<td>0.146</td>
<td>5.0</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Month</th>
<th>Mean</th>
<th>High</th>
<th>Year</th>
<th>Low</th>
<th>Precipitation</th>
<th>Total Snowfall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in.</td>
<td>in.</td>
<td></td>
<td></td>
<td>&gt;= 0.01 in.</td>
<td>&gt;= 0.05 in.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;= 0.10 in.</td>
<td>&gt;= 1.00 in.</td>
</tr>
<tr>
<td>January</td>
<td>1.40</td>
<td>3.87</td>
<td>1970</td>
<td>0.12</td>
<td>1.13</td>
<td>6.2</td>
</tr>
<tr>
<td>February</td>
<td>1.07</td>
<td>3.70</td>
<td>1986</td>
<td>0.18</td>
<td>0.92</td>
<td>3.3</td>
</tr>
<tr>
<td>March</td>
<td>1.25</td>
<td>3.46</td>
<td>1989</td>
<td>0.17</td>
<td>1.60</td>
<td>1.6</td>
</tr>
<tr>
<td>April</td>
<td>1.20</td>
<td>3.04</td>
<td>1955</td>
<td>0.09</td>
<td>1.27</td>
<td>0.5</td>
</tr>
<tr>
<td>May</td>
<td>1.29</td>
<td>4.40</td>
<td>1998</td>
<td>0.00</td>
<td>1.77</td>
<td>0.1</td>
</tr>
<tr>
<td>June</td>
<td>0.84</td>
<td>3.41</td>
<td>1941</td>
<td>0.01</td>
<td>1.91</td>
<td>0.0</td>
</tr>
<tr>
<td>July</td>
<td>0.25</td>
<td>1.62</td>
<td>1982</td>
<td>0.00</td>
<td>0.94</td>
<td>0.0</td>
</tr>
<tr>
<td>August</td>
<td>0.28</td>
<td>2.37</td>
<td>1968</td>
<td>0.00</td>
<td>1.61</td>
<td>0.0</td>
</tr>
<tr>
<td>September</td>
<td>0.55</td>
<td>2.93</td>
<td>1986</td>
<td>0.00</td>
<td>1.73</td>
<td>0.0</td>
</tr>
<tr>
<td>October</td>
<td>0.81</td>
<td>2.59</td>
<td>2000</td>
<td>0.00</td>
<td>0.90</td>
<td>0.1</td>
</tr>
<tr>
<td>November</td>
<td>1.32</td>
<td>3.36</td>
<td>1988</td>
<td>0.14</td>
<td>0.78</td>
<td>2.0</td>
</tr>
<tr>
<td>December</td>
<td>1.42</td>
<td>4.23</td>
<td>1983</td>
<td>0.09</td>
<td>1.03</td>
<td>5.8</td>
</tr>
<tr>
<td>Annual</td>
<td>11.70</td>
<td>18.77</td>
<td>1983</td>
<td>6.64</td>
<td>1966</td>
<td>46.5</td>
</tr>
<tr>
<td>Winter</td>
<td>3.90</td>
<td>6.45</td>
<td>1969</td>
<td>1.31</td>
<td>1.13</td>
<td>15.3</td>
</tr>
<tr>
<td>Spring</td>
<td>3.75</td>
<td>7.11</td>
<td>1980</td>
<td>0.83</td>
<td>1.77</td>
<td>2.2</td>
</tr>
<tr>
<td>Summer</td>
<td>1.38</td>
<td>4.13</td>
<td>1941</td>
<td>0.08</td>
<td>1.91</td>
<td>0.0</td>
</tr>
<tr>
<td>Fall</td>
<td>2.68</td>
<td>4.99</td>
<td>1940</td>
<td>0.40</td>
<td>1.73</td>
<td>2.1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Station</th>
<th>Type</th>
<th>Land Use</th>
<th>Catchment Area (acres)</th>
<th>Receiving Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walnut</td>
<td>Dry</td>
<td>74% low-density residential</td>
<td>369</td>
<td>Boise River</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13% high-density residential</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8% open space</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5% commercial/industrial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lucky</td>
<td>Dry</td>
<td>100% low-density residential</td>
<td>233</td>
<td>Eagle Drain</td>
</tr>
<tr>
<td>Americana</td>
<td>Dry</td>
<td>34% Commercial/Industrial</td>
<td>615</td>
<td>Boise River</td>
</tr>
<tr>
<td></td>
<td></td>
<td>66% High density residential</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Americana</th>
<th>TP (mg/L)</th>
<th>Flow (cfs)</th>
<th>Load (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.15</td>
<td>0.37</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Area ac)</td>
<td>615</td>
<td>Load (g/ac/day)</td>
<td>0.26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Walnut</th>
<th>TP (mg/L)</th>
<th>Flow (cfs)</th>
<th>Load (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03</td>
<td>0.87</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Area ac)</td>
<td>369</td>
<td>Load (g/ac/day)</td>
<td>0.16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lucky</th>
<th>TP (mg/L)</th>
<th>Flow (cfs)</th>
<th>Load (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.16</td>
<td>0.44</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Area ac)</td>
<td>233</td>
<td>Load (g/ac/day)</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Table E3 - Average dry weather flows, concentrations and loads primarily associated with groundwater discharges.

<table>
<thead>
<tr>
<th>Average</th>
<th>TP (mg/L)</th>
<th>Flow (cfs)</th>
<th>Load (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.11</td>
<td>0.56</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Area (ac)</td>
<td>406</td>
<td>Load (g/ac/day)</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Table E4- DryWx:2 – ACHD Phase I data collected in 2006
<table>
<thead>
<tr>
<th>Date</th>
<th>TP (mg/L)</th>
<th>Flow (cfs)</th>
<th>Load (kg/d)</th>
<th>Date</th>
<th>TP (mg/L)</th>
<th>Flow (cfs)</th>
<th>Load (kg/d)</th>
<th>Date</th>
<th>TP (mg/L)</th>
<th>Flow (cfs)</th>
<th>Load (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>0.15</td>
<td>0.37</td>
<td>0.16</td>
<td>7/20/2006</td>
<td>0.03</td>
<td>0.92</td>
<td>0.06</td>
<td>7/20/2006</td>
<td>0.08</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>7/20/2006</td>
<td>0.05</td>
<td>1.66</td>
<td>0.19</td>
<td>7/20/2006</td>
<td>0.06</td>
<td>0.24</td>
<td>0.03</td>
<td>7/20/2006</td>
<td>0.09</td>
<td>0.42</td>
<td></td>
</tr>
<tr>
<td>7/26/2006</td>
<td>0.07</td>
<td>1.15</td>
<td>0.18</td>
<td>7/26/2006</td>
<td>0.05</td>
<td>0.37</td>
<td>0.04</td>
<td>7/26/2006</td>
<td>0.17</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>7/27/2006</td>
<td>0.05</td>
<td>1.20</td>
<td>0.15</td>
<td>7/27/2006</td>
<td>0.04</td>
<td>0.42</td>
<td>0.04</td>
<td>7/27/2006</td>
<td>0.15</td>
<td>0.45</td>
<td></td>
</tr>
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