Maine Statewide Bacteria TMDL: 2013 Freshwater Addendum

Report #: DEPLW-1254

August, 2014

Contact: Melissa Evers, Environmental Specialist
melissa.evers@maine.gov or (207) 215-3879

Maine Department of Environmental Protection - Created by: Killeen, August 2013 - Data Sources: MEGIS, MDEP
INTRODUCTION .................................................................................................................................................. 3
PUBLIC PARTICIPATION .................................................................................................................................... 5

1. DUCK BROOK, ARUNDEL .................................................................................................................................. 8
   1.1 Background .................................................................................................................................................. 8
   1.2 Bacteria Data Summary & Percent Reduction Calculations ........................................................................ 9
   1.3 Recommended Future Strategies ................................................................................................................ 13

2. GOOSEFARE BROOK, SACO .......................................................................................................................... 15
   2.1 Background ................................................................................................................................................ 15
   2.2 Bacteria Data Summary & Percent Reduction Calculations ........................................................................ 16
   2.3 Recommended Future Strategies ................................................................................................................ 20

3. WEST BRANCH SHEEPSCOT RIVER .............................................................................................................. 22
   3.1 Background ................................................................................................................................................ 22
   3.2 Bacteria Data Summary & Percent Reduction Calculations ........................................................................ 24
   3.3 Recommended Future Strategies ................................................................................................................ 27

REFERENCES .................................................................................................................................................... 29

APPENDIX A: DUCK BROOK BACTERIA SAMPLING PROJECT REPORTS
APPENDIX B: GOOSEFARE BROOK BACTERIA SAMPLING PROJECT REPORTS
APPENDIX C: WEST BRANCH OF THE SHEEPSCOT RIVER, SVCA WATER QUALITY
MONITORING PROGRAM, 2012 SEASON REPORT
APPENDIX D: PUBLIC COMMENTS & RESPONSE TO THE MAINE STATEWIDE
BACTERIA TMDL: 2013 FRESHWATER ADDENDUM, AUGUST 2013 DRAFT

List of Tables
Table 1: Summary information for bacteria impaired streams (Maine DEP 2012 Integrated Water Quality
Monitoring and Assessment Report Appendices). ................................................................................................. 3
Table 2. Maine Water Quality Criteria for Classification of Fresh Surface Waters (38 MSRA §465) .................... 4
Table 3. Synopsis of Streams Impaired by Bacteria Contamination [Maine 2012 Listing Category 5B] Maine Water
Quality Criteria for Classification of Fresh Surface Waters (38 MSRA §465) and TMDL Calculations ............... 5
Table 1.1: 2011 and 2012 sampling results for Duck Brook ............................................................................... 12
Table 2.1: 2011 and 2012 sampling results for Goosefare Brook ................................................................. 19
Table 3.1: Annual geometric means for the West Branch Sheepscot River ....................................................... 24
Table 3.2: Sampling results for the West Branch Sheepscot River ................................................................. 25
List of Figures

Figure 1: Streams covered by this TMDL that are impaired by bacteria (Category 5-B of the Maine DEP 2014 Integrated Water Quality Monitoring and Assessment Report Appendices) ................................................................. 7
Figure 1.1: Map of the Kennebunk River & the Duck Brook watershed, with surrounding towns ......................... 8
Figure 1.2: Duck Brook near the mouth, by the Eastern Trail ................................................................................. 9
Figure 1.3: Forest and natural vegetation dominates the watershed ................................................................. 9
Figure 1.4: Comparison of 2012 wet and dry samples to indicate potential pollutant sources ............................... 10
Figure 1.5: Duck Brook stream network, sampling site locations and 2012 results .............................................. 11
Figure 2.1: Map of the larger Goosefare Brook watershed, with coastal and beach connections ....................... 15
Figure 2.2: Goosefare Brook, site SGS15. ................................................................................................................ 16
Figure 2.3: Forests and development dominate the watershed ................................................................................. 16
Figure 2.4: Comparison of 2012 wet and dry samples to indicate potential pollutant sources ............................... 17
Figure 2.5: Goosefare Brook stream network, sampling site locations and 2012 results ........................................ 18
Figure 3.1: West Branch of the Sheepscot River ...................................................................................................... 22
Figure 3.2: SVCA Volunteer at West Branch Sheepscot. ....................................................................................... 23
Figure 3.3: Forests and agriculture dominate the watershed ............................................................................... 23
Figure 3.5: West Branch Sheepscot River network, sampling site locations and 2012 results .............................. 26
INTRODUCTION
This Addendum to the USEPA approved 2009 Maine Statewide Bacteria TMDL (Total Maximum Daily Loads) Report (http://www.maine.gov/dep/water/monitoring/tmdl/tmdl2.html) contains the information to develop TMDLs for three streams listed for bacteria impairment. This report:

- Contains the watershed specific information necessary to add bacteria TMDLs to the existing 2009 TMDL Report
- References the basic background information and required TMDL elements from the 2009 TMDL Report
- Covers four 303D listed stream segments (Table 1) and are depicted in Figure 1

Table 1: Summary information for bacteria impaired streams (Maine DEP 2012 Integrated Water Quality Monitoring and Assessment Report Appendices).

<table>
<thead>
<tr>
<th>Stream Segment</th>
<th>Town</th>
<th>County</th>
<th>Segment ID</th>
<th>Assessment Unit (HUC 10)</th>
<th>Water Quality Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duck Brook</td>
<td>Arundel</td>
<td>York</td>
<td>ME0106000301_622R03</td>
<td>0106000301</td>
<td>B</td>
</tr>
<tr>
<td>Goosefare Brook</td>
<td>Saco</td>
<td>York</td>
<td>ME0106000106_612R01</td>
<td>0106000105</td>
<td>B</td>
</tr>
<tr>
<td>West Branch Sheepscot</td>
<td>Windsor</td>
<td>Kennebec</td>
<td>ME0105000305_528R02</td>
<td>0105000304</td>
<td>AA</td>
</tr>
</tbody>
</table>

These streams are listed for bacterial impairments on Maine’s 303D list of impaired waters, which is included in Maine DEP’s 2012 Integrated Water Quality Monitoring and Assessment Report. TMDLS are required under the US Clean Water Act for all impaired waters on the 303D list and these will be added to the existing 2009 Bacteria TMDLs.

The purpose of a TMDL is to calculate the amount of pollutant receiving water can assimilate without exceeding water quality standards or designated uses, listed in Table 2. These TMDLs set a goal of meeting bacteria water quality criteria for all sources in order to meet water quality standards throughout the affected waterbodies. Potential sources and pathways are listed below.

Maine DEP adopted the concentration-based TMDL approach because it is the most useful format for guiding both remediation and protection efforts in the impaired watersheds. A concentration target is readily understandable to the public, and allows interested citizens and/or watershed groups to determine easily whether any particular source is exceeding its allocation. Measured bacteria concentrations in each of the impaired watersheds are used to determine the percent reduction needed to attain water quality standards.
Table 2. Maine Water Quality Criteria for Classification of Fresh Surface Waters (38 MSRA §465)

<table>
<thead>
<tr>
<th>FRESHWATERS</th>
<th>BACTERIA (E. Coli) NUMERIC CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS AA</td>
<td>AS NATURALLY OCCURS¹</td>
</tr>
<tr>
<td>CLASS A</td>
<td>AS NATURALLY OCCURS¹</td>
</tr>
</tbody>
</table>
| CLASS B     | Between May 15th and Sept. 30th.  
                *E. coli* of human and domestic animal origin² shall not exceed a geometric mean of 64/100mL or an instantaneous level of 236/100mL |
| CLASS C     | Between May 15th and Sept. 30th.  
                *E. coli* of human and domestic animal origin² shall not exceed a geometric mean of 126/100mL or an instantaneous level of 236/100mL |

¹ Defined in 38 MRSA §466(2): “As naturally occurs” means conditions with essentially the same physical, chemical and biological characteristics as found in situations with similar habitats free of measurable effects of human activity.” In practice, the Class GPA (Lakes) standard for ‘*E. coli* of human or domestic animal origin shall not exceed a geometric mean of 29/100mL or an instantaneous level of 194/100mL may be used as a surrogate target if a freshwater’s ‘natural’ bacteria levels are unknown.

² This means that all *E. coli* of wildlife origin meet existing water quality standards.

This document provides (1) justification for the impaired listing status and need for the TMDL, (2) calculations for the percent reductions from existing data needed to meet the concentration-based target, and (3) details regarding sources of bacteria in the impaired watersheds. Table 3 is a stream specific summary of the relevant numbers and TMDL calculations developed in this report. For information regarding the regulatory requirements of TMDLs, Maine’s water quality standards, waterbody assessment approach, target concentrations, loading allocations and source specific implementation recommendations please see the 2009 Maine Statewide Bacteria TMDL (Total Maximum Daily Loads) Report.

**Bacteria Pollutant Sources-**

Humans- Sewers & Septic’s
- Pets & Domestic animals
- Wildlife

Pathways-
- Illicit discharges
- Surface runoff through stormwater
- Subsurface drainage
- Direct deposit

Clockwise from upper left: sewer lines, humans and pets, domestic animals, residential runoff
PUBLIC PARTICIPATION

This draft was made available for a public review beginning in October 29, 2013 and lasting until December 4, 2013. A public hearing was scheduled for November 5, 2013 at 2:30 in DEP’s Response Training Room, 4 Blossom Lane, Augusta. Notice of this hearing was placed in regional newspapers and stakeholders were notified via email. Email to stakeholders also contained notification of the public review draft and was distributed to the following interested parties and watershed stakeholder organizations:

- Sheepscot Valley Conservation Association
- York County Soil and Water Conservation District
- Kennebec County Soil and Water Conservation District
- Wells National Estuarine Research Reserve
- Maine Department of Marine Resources
- Maine Department of Transportation
- Maine Turnpike Authority
- Maine Healthy Beaches Program
- Conservation Law Foundation, Maine Office
- City of Saco
- Towns of China, Windsor, Whitefield, Arundel & Old Orchard Beach
- MS4 Area Stormwater Groups

The public hearing was held on November 5, 2013 and no stakeholders or members of the general public attended.

This is the notification message that was distributed:

PUBLIC NOTICE FOR COMMENTS ON BACTERIA TMDLs on 3 streams to be added to the USEPA approved 2009 Maine Statewide Bacteria TMDL (Total Maximum Daily Loads) Report (http://www.maine.gov/dep/water/monitoring/tmdl/tmdl2.html). In
Maine Statewide Bacteria TMDL: 2013 Freshwater Addendum

accordance with Section 303(d) of the Clean Water Act, and regulations in 40 CFR Part 130, the Maine Department of Environmental Protection has prepared the Maine Statewide Bacteria TMDL: 2013 Freshwater Addendum report for waters that exceed Maine’s water quality bacteria standards. This TMDL report contains recent monitoring results and the watershed specific information necessary to add bacteria TMDLs to the existing 2009 TMDL Report. Below is summary information for the streams from Maine DEP’s 2012 Integrated Water Quality Monitoring and Assessment Report Appendices (303(d) list) (http://www.maine.gov/dep/water/monitoring/305b/).

<table>
<thead>
<tr>
<th>Streams</th>
<th>Town</th>
<th>County</th>
<th>Segment ID</th>
<th>Stream Length miles</th>
<th>Water Quality Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duck Brook</td>
<td>Arundel</td>
<td>York</td>
<td>ME0106000301_622R03</td>
<td>8.6</td>
<td>B</td>
</tr>
<tr>
<td>Goosefare Brook</td>
<td>Saco</td>
<td>York</td>
<td>ME0106000106_612R01 ME0106000106_612R01_01</td>
<td>6.0</td>
<td>B</td>
</tr>
<tr>
<td>West Branch Sheepscot</td>
<td>Windsor</td>
<td>Kennebec</td>
<td>ME0105000305_528R02</td>
<td>2.3</td>
<td>AA</td>
</tr>
</tbody>
</table>

This is the 30 day notice for public review of the report, which is posted at DEP’s website: (http://www.maine.gov/dep/comment/index.html) and the comment period will end on December 4, 2013. Direct comments or questions to Melissa Evers, Maine DEP, State House Station #17, Augusta, ME 04333, phone 207-215-3879, or via email: melissa.evers@maine.gov.

A public hearing is scheduled for November 5, 2013 at 2:30 in DEP’s Response Training Room, 4 Blossom Lane, Augusta (more information at http://www.maine.gov/dep/calendar.html).

All public comments and responses will be submitted to EPA as part of the final TMDL submittal documents and posted on DEP’s web page ‘TMDL approved by EPA’ at http://www.maine.gov/dep/water/monitoring/tmdl/tmdl2.html.
Figure 1: Streams covered by this TMDL that are impaired by bacteria (Category 5-B of the Maine DEP 2014 Integrated Water Quality Monitoring and Assessment Report Appendices).
1.1 Background

Duck Brook is a Class B stream located in Arundel, a rural residential town close to the southern Maine coast. Duck Brook was first listed as impaired for *E. Coli* bacteria contamination in the Maine DEP *2012 Integrated Water Quality Monitoring and Assessment Report*. Duck Brook flows into the Kennebunk River, which then empties onto Gooch’s Beach in Kennebunk (Figure 1.1). Both the Kennebunk River\(^1\) and Gooch’s Beach\(^2\) have bacterial impairments and Duck Brook was identified as a potential contributor to the problem by the

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\(^1\)The Kennebunk River was first listed for “bacteria-only” impairment in Maine’s 2004 305(b) report and remains on the 303 (d) list of impaired waters.

\(^2\)Gooch’s Beach has been closed during the summer on a number of occasions due to bacterial count exceedances.
Maine Healthy Beaches (MHB) program in 2008. DEP sampled Duck routinely in 2011 and 2012 to document the extent of bacterial contamination and narrow down the location of potential sources. Sampling results are presented in section 1.2 of this report.

The Duck Brook watershed is dominated by forested lands and is defined by drainage divides resulting from natural topography. The watershed has 6.0% impervious surface nested within a land cover mosaic of: 8% developed residential area; 72% coniferous, deciduous, or mixed forest vegetation; 7% agriculture area as characterized by pastures, crops, or fields; 3% wetland cover; and 10% is classified as other with herbaceous plants and shrubs (Figure 1.3). These patterns of land use indicate that bacterial sources are likely from failing residential septic or agriculture activities.

![Figure 1.2: Duck Brook near the mouth, by the Eastern Trail.](image1)

![Duck Brook Watershed Land Useage](image2)

![Figure 1.3: Forest and natural vegetation dominates the watershed.](image3)

### 1.2 Bacteria Data Summary & Percent Reduction Calculations

**Data Summary**

Bacteria data for the Duck Brook watershed were collected by Maine DEP staff working with Americorps and Volunteers with the Volunteer River Monitoring Program (VRMP) during 2011.
and 2012. The sampling approach was designed to determine the distribution of bacteria within watershed’s network of tributaries (Figure 1.5) and diagnose the location of pollutant sources. The mainstem and all major tributaries were sampled to estimate the relative bacteria loads within the watershed and detect potential hot spots of pollution. Samples were collected during both wet (storm flow) and dry (base flow) weather to characterize the natural variability of runoff conditions found over the season. A detailed description of the sampling approach, results summary and analysis can be found in the project reports in Appendix A.

The instantaneous bacteria standard for Duck Brook is 236/100mL per sample while the geometric mean standard is 64/100mL for combined samples. All sampling results are reported as the 'most probable number (MPN) per 100mL', which is prescribed by the IDEXX testing method used for the project. The sampling results presented in Table 1.1 and Figure 1.4 indicates the stream is impaired for bacteria with concentrations that exceed the geometric mean standard at many sites throughout the watershed. Samples collected during storm events can be used to detect sources of pollution, such as agriculture, while low flow conditions are better suited for detecting sources of pollution, from malfunctioning septic systems or leaking sewer lines. These principles are examined in Figure 1.4 which compares wet and dry samples for 2012 sites to indicate the origin of potential pollutant sources.

Figure 1.4: Comparison of 2012 wet and dry samples to indicate potential pollutant sources.
Figure 1.5: Duck Brook stream network, sampling site locations and 2102 results.
### Table 1.1: 2011 and 2012 sampling results for Duck Brook

#### Bacteria Results Summary of Duck Brook

<table>
<thead>
<tr>
<th>MPN/100mL</th>
<th>2011 DUCK BROOK MAIN STEM</th>
<th>TRIBUTARIES</th>
<th>Flow &amp; Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eastern Trail</td>
<td>Limerick Rd</td>
<td>Downing Rd</td>
</tr>
<tr>
<td></td>
<td>SKEDK02</td>
<td>SKEDK03</td>
<td>SKEDK12</td>
</tr>
<tr>
<td></td>
<td>SF: May 18</td>
<td>138</td>
<td>236</td>
</tr>
<tr>
<td></td>
<td>BF: June 16</td>
<td>124</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td>BF: July 12</td>
<td>130</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>BF: August 4</td>
<td>169</td>
<td>76</td>
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<td></td>
<td>BF: August 31</td>
<td>140</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>SF: September 8</td>
<td>1553</td>
<td>1733</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Geometric Mean</td>
<td>208</td>
<td>167</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>MPN/100mL</th>
<th>2012 DUCK BROOK MAIN STEM</th>
<th>TRIBUTARIES</th>
<th>Flow &amp; Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eastern Trail</td>
<td>Limerick Rd</td>
<td>Downing Rd</td>
</tr>
<tr>
<td></td>
<td>SKEDK02</td>
<td>SKEDK03</td>
<td>SKEDK12</td>
</tr>
<tr>
<td></td>
<td>SF: May 17</td>
<td>55</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>SF: June 13</td>
<td>366</td>
<td>249</td>
</tr>
<tr>
<td></td>
<td>BF: June 19</td>
<td>-</td>
<td>-</td>
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<td></td>
<td>BF: July 9</td>
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<td>BF: July 23</td>
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<td>BF: July 24</td>
<td>64</td>
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<td>SF: August 13</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>SF: August 14</td>
<td>411</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>BF: August 14</td>
<td>111</td>
<td>46</td>
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<tr>
<td></td>
<td>BF: August 21</td>
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<td>SF: August 29</td>
<td>112</td>
<td>-</td>
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<tr>
<td></td>
<td>SF: September 5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>BF: September 11</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geometric Mean</td>
<td>83</td>
<td>60</td>
</tr>
</tbody>
</table>

SF= Storm Flow, BF= Base Flow, MPN=Most Probable Number

- **Exceeds Instantaneous Standard of 236/100mL**
- **Meets Geometric Mean of 64/100mL**
- **Slightly Exceeds Geometric Mean Criteria**
- **Exceeds Geometric Mean Criteria**
- **Extreme Exceedance Geometric Mean Criteria**
**TMDL Calculations**

Bacteria concentrations are required to meet water quality standards for the entire sampling period, which means combining wet and dry samples. This TMDL estimates the bacteria reduction needed for the waterbody to comply with water quality standards by applying a simple percent load reductions calculation. These determinations are made for geometric mean values because it is unlikely that a stream would be listed for impairment based on a single maximum instantaneous sample. In general, TMDLs compute a single reduction for an impaired segment and the most downstream mainstem site has been is chosen for the purpose of calculating reductions. Choosing one site will simplify future compliance monitoring because the intensive sampling approach conducted during this project may not be feasible in the future. All data collected at the downstream Eastern Trail site during 2011 and 2012 were combined to calculate an overall geometric mean and used to compute the 48% reduction in bacteria concentration needed to achieve TMDL goals.

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**REDUCTIONS TO ACHIEVE BACTERIA WATER QUALITY STANDARDS**

- **TMDL GOAL-CLASS B STANDARD= 64/100ML GEOMETRIC MEAN**
- **2011 & 2012 DUCK BROOK SAMPLES= 123/100ML GEOMETRIC MEAN**
- **48 % IN REDUCTION BACTERIA LOADS TO ACHIEVE TMDL GOALS**

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**1.3 Recommended Future Strategies**

Restoration of bacterially impaired streams begins with an assessment of the location and the extent of potential contamination throughout the watershed. This sampling project identified a number of locations where sanitary surveys or an evaluation of agricultural practices are the next step towards eliminating sources. A systematic investigation of contaminated sites will either reveal a direct human or domestic animal source that can be remediated or substantiate that bacterial contamination is solely from wildlife sources and natural processes. These approaches to eliminating bacterial sources are further described in the 2009 TMDL Report and recommendations for Duck Brook are also found in the Appendix A reports. Based on observations made during 2011 and 2012 here are some specific recommendations:
• Investigate private septic systems for malfunctions by conducting sanitary surveys in the upper reach of Duck Brook, upstream of the site labeled SKEDK34 on Figure 1.5 and on residences along Tributary A near the Eastern Trail.

• Assess the impact of domestic animal waste from properties with livestock. Survey drainage ditches in the Laura Lane neighborhood for potential runoff from horse pastures.
2. Goosefare Brook, Saco

2.1 Background

Goosefare Brook is a Class B stream situated in the city of Saco with a small segment in the town of Old Orchard Beach in York County, Maine. Goosefare Brook was first listed as impaired for *E. Coli* bacteria contamination in the Maine DEP 2012 Integrated Water Quality Monitoring and Assessment Report. Goosefare Brook originates in Saco Heath and flows directly to coastal waters with the potential to impact several adjacent beaches, including; Old Orchard Beach, Ocean Park, Kinney Shores and Bay View (Figure 2.1). The beaches of Ocean Park, Bay View and Kinney Shores have all had swimming advisories or closures in the past and the Maine Healthy Beaches (MHB) program has identified Goosefare Brook and its tributaries as a potential contributor to the problem. Bear Brook, in Figure 2.1, is a lower

**BACTERIA TMDL SUMMARY**

**Waterbody Facts**

- **Segment ID:** ME0106000106_612R01
  ME0106000106_612R01_01
- **Town:** Saco & Old Orchard Beach, ME
- **County:** York
- **Impaired Segment Length:**
  ME0106000106_612R01=0.6 miles
  ME0106000106_612R01_01=5.54 miles
- **Classification:** Class B
- **Direct Watershed:** 9.46 mi²
- **Major Drainage Basin:** Saco Bay
- **Potential Sources:** Sanitary Systems- both Residential Septics and Municipal Sewerage, Agriculture, Pet Wastes, Wildlife

Figure 2.1: Map of the larger Goosefare Brook watershed, with coastal and beach connections.
tributary to Goosefare that is also impaired for bacteria, but was covered by the 2009 TMDL Report and therefore not included in this report. DEP sampled the upper freshwater portion of the watershed, identified in Figure 2.1 and 2.5, in 2011 and 2012 to document the extent of bacterial contamination and narrow down the location of potential sources. Sampling results are presented in section 2.2 of this report.

In 2012 the Goosefare Brook watershed was also included in the Maine Impervious Cover Total Maximum Daily Load Assessment (TMDL) for Impaired Stream. Goosefare was identified as having 17% impervious cover, from the combination of residential, commercial and highway development. This impervious surface is nested within a land cover mosaic of: 42% developed area, 45% mixed forest vegetation and 7% wetland cover (Figure 2.3 and 2.5). These patterns of landuse indicate that bacterial sources are likely from failing residential septic, leaky sewer pipes, illicit connections to storm drains or domestic animals.

2.2 Bacteria Data Summary & Percent Reduction Calculations

Data Summary

Bacteria data for the Goosefare Brook watershed were collected by Maine DEP staff working with Americorps and Maine Healthy Beaches staff during 2011 and 2012. In 2011 the sampling approach was designed to: determine the distribution of bacteria within watershed’s network...
of tributaries (Figure 2.5), estimate the relative bacteria loads within the watershed and detect potential hot spots. In principle, source elimination should follow the flow of water, beginning in the upstream reaches, which then contribute clean water to downstream reaches. In 2012 DEP focused sampling in the upper portion of the watershed to narrow down the potential the location of pollutant sources discovered in 2011. Two tributaries that were found to meet water quality standards in 2011 were dropped from sampling in 2012. Samples were collected during both wet (storm flow) and dry (base flow) weather to characterize the natural variability of runoff conditions found over the season. A detailed description of the sampling approach, results summary and analysis can be found in the project reports in Appendix B.

The instantaneous bacteria standard for Goosefare Brook is 236/100mL per sample while the geometric mean standard is 64/100mL for combined samples. All sampling results are reported as the ‘most probable number (MPN) per 100mL, which is prescribed by the IDEXX testing method used for the project. The sampling results presented in Table 2.1 and Figure 2.4 indicates the stream is impaired for bacteria with concentrations that exceed the geometric mean standard at most sites. Samples collected during storm events can be used to detect sources of pollution that wash off during a storm, while low flow conditions are better suited for detecting sources of pollution, from malfunctioning septic systems or leaking sewer lines. Figure 2.4 compares wet and dry samples for 2012 sites and shows high values during storm events and moderate exceedances during base flow. This likely indicates discharges from both human sewerage and some contributing nonpoint sources as well, such as domestic animals.

Figure 2.4: Comparison of 2012 wet and dry samples to indicate potential pollutant sources.
Figure 2.5: Goosefare Brook stream network, sampling site locations and 2012 results.
Table 2.1: 2011 and 2012 sampling results for Goosefare Brook

<table>
<thead>
<tr>
<th></th>
<th>GOOSEFARE BROOK MAINSTEM</th>
<th>TRIBUTARIES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Old Orchard Rd</td>
<td>Ocean Park Rd</td>
<td>Ross Rd</td>
</tr>
<tr>
<td>2011 MPN/100mL</td>
<td>SGS01</td>
<td>SGS04</td>
<td>SGS15</td>
</tr>
<tr>
<td>BF: May 24</td>
<td>99</td>
<td>103</td>
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<tr>
<td>BF: May 31</td>
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<td>291</td>
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<td>141</td>
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<td>64</td>
</tr>
<tr>
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<td>537</td>
<td>727</td>
<td>579</td>
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<td>Geometric Mean</td>
<td>248</td>
<td>178</td>
<td>184</td>
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<table>
<thead>
<tr>
<th>2012 MPN/100mL</th>
<th>Old Orchard Rd</th>
<th>Ocean Park Rd</th>
<th>Ross Rd</th>
<th>Industrial Park Way</th>
<th>Jenkins Rd</th>
<th>Trib C</th>
<th>Trib E</th>
</tr>
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<tbody>
<tr>
<td>SGS01</td>
<td>SGS04</td>
<td>SGS15</td>
<td>SGS32</td>
<td>SGS40</td>
<td>SGSUC01</td>
<td>SGSU01</td>
<td>Overall</td>
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<td>78</td>
<td>NS</td>
<td>84</td>
<td>36</td>
<td>30</td>
<td>107</td>
<td>52</td>
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<td>122</td>
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<td>158</td>
<td>64</td>
<td>41</td>
<td>1733</td>
<td>179</td>
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<td>120</td>
<td>345</td>
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<td>326</td>
<td>73</td>
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<td>NS</td>
<td>NS</td>
<td>99</td>
<td>-</td>
<td>-</td>
<td>91</td>
<td>30</td>
</tr>
<tr>
<td>BF: September 10</td>
<td>201</td>
<td>NS</td>
<td>192</td>
<td>72</td>
<td>59</td>
<td>179</td>
<td>261</td>
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<tr>
<td>SF: September 19</td>
<td>2420</td>
<td>NS</td>
<td>2420</td>
<td>2420</td>
<td>1966</td>
<td>1966</td>
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<tr>
<td>Geometric Mean</td>
<td>227</td>
<td>204</td>
<td>168</td>
<td>110</td>
<td>365</td>
<td>148</td>
<td>192</td>
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</table>

SF= Storm Flow, BF= Base Flow, MPN=Most Probable Number
Exceeds Instantaneous Standard of 236/100mL
NS= Not Sampled during this Season
Meets Geometric Mean of 64/100mL
Slightly Exceeds Geometric Mean Criteria
Exceeds Geometric Mean Criteria
Extreme Exceedance Geometric Mean Criteria
TMDL Calculations

Bacteria concentrations are required to meet water quality standards for the entire sampling period, which means combining wet and dry samples. This TMDL estimates the bacteria reduction needed for the waterbody to comply with water quality standards by applying a simple percent load reductions calculation. These determinations are made for geometric mean values because it is unlikely that a stream would be listed for impairment based on a single maximum instantaneous sample. In general, TMDLs compute a single reduction for an impaired segment and the most downstream mainstem site has been is chosen for the purpose of calculating reductions. Choosing one site will simplify future compliance monitoring because the intensive sampling approach conducted during this project may not be feasible in the future. All data collected at the downstream Old Orchard Road crossing, site SGS01, during 2011 and 2012 were combined to calculate an overall geometric mean and used to compute the 76% reduction in bacteria concentration needed to achieve TMDL goals.

REDUCTIONS TO ACHIEVE BACTERIA WATER QUALITY STANDARDS

- TMDL GOAL-CLASS B STANDARD= 64/100ML GEOMETRIC MEAN
- 2011 & 2012 GOOSEFARE BROOK SAMPLES= 239/100ML GEOMETRIC MEAN
- 73 % IN REDUCTION BACTERIA LOADS TO ACHIEVE TMDL GOALS

2.3 Recommended Future Strategies

Restoration of bacterially impaired streams begins with an assessment of the location and extent of potential contamination throughout the watershed. This sampling project identified a number of locations where sanitary surveys are the next step towards eliminating sources. A systematic investigation of contaminated sites will either reveal a direct human or domestic animal source that can be remediated or substantiate that bacterial contamination is solely from wildlife sources and natural processes. These approaches to eliminating bacterial sources are further described in the 2009 TMDL Report and specific recommendations for Goosefare Brook are also found in Appendix B reports. Based on observations made during 2011 and 2012 listed below are some specific recommendations:
Establish an Illicit Discharge Detection and Elimination (IDDE) Program for Goosefare Brook

- In its MS4 Permit, the City of Saco has included goals toward development of an IDDE Program and the city has made progress towards this objective. An effective IDDE Program should include the following essential elements:
  - Storm sewer system map with locations of outfalls and waters receiving discharge
  - Determine the integrity of sewer and stormwater conveyances by examining them using current engineering evaluation techniques such as cameras, dyes or smoke testing
  - Include remedial procedures and necessary actions
  - A plan to detect and address illicit discharges, including illegal dumping
  - An education program that informs public employees, businesses, and the general public of the hazards associated with illegal discharge and improper waste disposal

Focused Investigation of the Watershed

- Goosefare Brook’s watershed is relatively large, and could be subdivided into smaller watersheds to facilitate a thorough investigation of stream channels (mainstem and tributaries) which should include visual inspection of the water for color, odor, and obvious evidence of waste materials as well as to note any pipes, discharges, or unusual conditions.
  - Animal sources should be attributed to either domestic animals or to wildlife, especially in subwatersheds dominated by natural land cover.

Sanitary Surveys for those portions of the watershed serviced by residential septic systems

- Survey properties for malfunctioning septics in areas with known high bacteria counts, such as Ross Rd. and Jenkins Rd.
3.1 Background

The West Branch of the Sheepscot River is Class AA river that originates in China and flows through Palermo, Windsor, and Somerville before joining the mainstem of the Sheepscot in Whitefield. West Branch Sheepscot was listed as impaired for *E. Coli* bacteria contamination in the Maine DEP 2012 *Integrated Water Quality Monitoring and Assessment Report* and the impaired segment flows from Rt.17 to the mouth. The West Branch Sheepscot River flows from the mouth of Branch Pond in Palermo, and then into the mainstem of the Sheepscot, which flows directly to the marine waters. The lower Sheepscot in Alna is also impaired for bacteria, but was covered by the 2009 TMDL Report and not included in this report. The Department of Marine Resources has closed shellfish harvest areas in the estuarine portion of
the Sheepscot, near the town of Wiscasset. It is unlikely that the impairments in the West Branch directly influence the marine receiving waters due to the distance and relatively small degree of bacterial exceedances.

The West Branch of the Sheepscot has been sampled for bacteria by volunteers with the Sheepscot Valley Conservation Association (SVCA) for the past 19 years. SVCA is the source of the data presented in this report. Sampling is conducted simply to determine compliance with water standards and results are presented in Section 3.2 of this report.

The West Branch Sheepscot watershed is dominated by forested lands and is defined by drainage divides resulting from natural topography. The watershed has a land cover mosaic of: 66% mixed forest vegetation, 21% agriculture, 11% wetland cover and 2% residential and road development (Figure 3.3). These patterns of landuse means that the bacterial sources are likely from domestic animals associated with agriculture, failing residential septic or wildlife. The West Branch watershed does have a few active dairy farms which are a potential source of bacteria.

![Figure 3.2: SVCA Volunteer at West Branch Sheepscot.](image)

![Figure 3.3: Forests and agriculture dominate the watershed.](chart)
3.2 Bacteria Data Summary & Percent Reduction Calculations

**Data Summary**

Bacteria data for the West Branch Sheepscot watershed were collected by Volunteers with the SVCA from 1994 to 2012. Data is collected under a DEP approved Quality Assurance Project Plan which enables DEP to accept SVCA data for inclusion in databases and to use this information for impairment or 303(d) listing decisions. SVCA’s monitoring makes no attempt to document the extent of bacterial contamination and narrow down the location of potential sources. Samples are collected on a set schedule with no distinction between wet (storm flow) or dry (base flow) sampling events, but over the course of the season both wet and dry conditions are usually encountered. Sampling locations and results are presented in Figure 3.5 and further descriptions can be found in the SVCA project report in Appendix C.

The bacteria standard for the West Branch Sheepscot is Class AA or ‘as naturally occurs’, which means the river should be consistent with bacteria levels found in waters free of measurable effects of human activity. There are no numeric criteria for monitoring results comparisons, but in practice the Class GPA (lakes) standard for *E. coli* may be used as a surrogate target if the ‘natural’ bacteria are unknown (Table 2). Therefore, for the purposes of this TMDL, the West Branch Sheepscot targets for bacteria of human and domestic animal origin should not exceed a geometric mean of 29/100mL or an instantaneous level of 194/100mL. The sampling results presented in Table 3.1 indicate the stream is impaired for bacteria with concentrations consistently exceeding the geometric mean standard at two sites.

The sampling results for 2012 in Table 3.2 and Figure 3.5 show the variability found for individual sampling events over the course of the season. The high values measured on June 5th were associated with a rain event, which confirms that bacteria are washed off during a runoff event. The middle sampling site has the highest geometric mean, which may be influenced by the two upstream tributaries that are also monitored by SVCA, identified as

<table>
<thead>
<tr>
<th>Year</th>
<th>Number/100mL</th>
<th>WEST BRANCH OF THE SHEEPSCOT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Howe Rd, Whitefield</td>
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<tr>
<td>Geometric Means</td>
<td></td>
<td>WB001-F</td>
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<tr>
<td>2007</td>
<td>43</td>
<td>37</td>
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<td>2008</td>
<td>64</td>
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<td>36</td>
<td>102</td>
</tr>
<tr>
<td>2012</td>
<td>45</td>
<td>71</td>
</tr>
</tbody>
</table>

- Meets Geometric Mean of 29/100mL
- Slightly Exceeds Geometric Mean Criteria
- Exceeds Geometric Mean Criteria
- Extreme Exceedance Geometric Mean Criteria
- Exceeds Instantaneous Standard of 194/100mL
Meadow Brook and Choate Brook on Figure 3.5. SVCA’s has consistently found elevated bacteria values on these small streams during the 19 years of sampling and they contribute a bacteria load to the West Branch.

The observed bacteria values exceed Maine’s surrogate water quality standards for Class AA, but they meet Class B at the downstream site and for all sites combined (Table 3.2). The observed values may actually meet the ‘as naturally occurs’ standard, but it is unknown how the bacteria load splits between wildlife and human or domestic animal sources. All bacteria derived from wildlife would be considered a natural source and not contribute to the nonattainment status.

Table 3.2: Sampling results for the West Branch Sheepscot River

<table>
<thead>
<tr>
<th>Date</th>
<th>Howe Rd, Whitefield</th>
<th>Rt 105, Windsor</th>
<th>Water St, Palermo</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 22</td>
<td>34</td>
<td>64</td>
<td>2</td>
</tr>
<tr>
<td>June 5</td>
<td>313</td>
<td>166</td>
<td>29</td>
</tr>
<tr>
<td>June 19</td>
<td>34</td>
<td>272</td>
<td>7</td>
</tr>
<tr>
<td>July 3</td>
<td>73</td>
<td>172</td>
<td>5</td>
</tr>
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<td>July 17</td>
<td>99</td>
<td>66</td>
<td>77</td>
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<td>July 31</td>
<td>22</td>
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<tr>
<td>August 14</td>
<td>16</td>
<td>24</td>
<td>60</td>
</tr>
<tr>
<td>August 28</td>
<td>101</td>
<td>61</td>
<td>-</td>
</tr>
<tr>
<td>September 11</td>
<td>20</td>
<td>40</td>
<td>24</td>
</tr>
<tr>
<td>September 25</td>
<td>18</td>
<td>44</td>
<td>6</td>
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</table>

Geometric Mean: 45, 71, 15

Meets Geometric Mean of 29/100mL
Slightly Exceeds Geometric Mean Criteria
Exceeds Geometric Mean Criteria
Extreme Exceedance Geometric Mean Criteria
Exceeds Instantaneous Standard of 194/100mL
Figure 3.5: West Branch Sheepscot River network, sampling site locations and 2012 results.

Legend
- West Branch Sheepscot and Tributaries
- West Branch Sheepscot Watershed
- Choate Brook
- Meadow Brook

2012 Sample Sites
Overall Geometric Mean for E. coli
- <29/100mL
- 30/100mL - 64/100mL
- 65/100mL - 100/100mL

Maine Department of Environmental Protection - Created by: KNemmer, August 2013 - Data Sources: MEGIS, MDEP, SVCA
TMDL Calculations

This TMDL estimates the bacteria reduction needed for the waterbody to comply with water quality standards by applying a simple percent load reductions calculation. These determinations are made for geometric mean values because it is unlikely that a stream would be listed for impairment based on a single maximum instantaneous sample. In general, TMDLs compute a single reduction for an impaired segment and the two downstream sites that are in nonattainment were chosen for the purpose of calculating reductions. These sites have been consistently monitored in the past and are suitable to use for future compliance monitoring. All data collected at these sites during 2012 were combined to calculate an overall geometric mean and used to compute the 50% reduction in bacteria concentration needed to achieve TMDL goals.

3.3 Recommended Future Strategies

Restoration of bacterially impaired streams begins with an assessment of the location and extent of potential contamination throughout the watershed. The West Branch Sheepscot is a large watershed with sampling results over a long time period that should be considered in any future restoration planning effort. A systematic investigation of tributaries may reveal whether sources are the result of a direct human or domestic animal impact or substantiate that bacterial contamination is from wildlife sources and natural processes. Further approaches to eliminating bacterial sources are described in the 2009 TMDL Report. Here are specific recommendations to move beyond attainment monitoring and work to eliminate pollutant sources:

- **Focused Investigation of the Watershed**
  - The West Branch Sheepscot watershed is relatively large and should be subdivided into smaller watersheds to facilitate a thorough investigation of stream channels (mainstem and tributaries).
Conduct an intensive or diagnostic sampling strategy to narrow down the location of potential sources through an approach called ‘bracket sampling’ which focuses monitoring around known problem areas. Apply this strategy in upstream areas and move downstream systematically as sources are identified and eliminated.

- Determine the location between the upstream site, WB005-F and WB002-F where bacteria levels begin to rise and investigate nearby properties for bacterial sources.
- Sample in strategic locations within the Choate Brook and Meadow Brook watersheds to narrow down potential pollutant sources or determine bacteria are derived from natural sources.

**Sanitary Surveys**
- Survey properties for malfunctioning septics near areas with known high bacteria counts, such as the Rt. 105 sampling site.

**Bacteria Source Tracking**
- The relatively low bacteria values increase the likelihood that natural processes are a significant source of the observed values. Conduct a bacteria source tracking project to determine whether animal sources should be attributed to either domestic sources or to wildlife.
- This entails developing a comprehensive project that includes a combination of monitoring plans, landuse analysis, and applying Microbial Source Tracking (MST) methods. There are a variety of MST methods available; biochemical (antibiotic resistance analysis), molecular (DNA pattern comparisons or fingerprinting), chemical (test water for presence human waste constituents), and immunological (antigenic determinants shed in human and animals fecal matter).
REFERENCES


Maine Healthy Beaches Program 2013. Available at: http://www.mainecoastdata.org
