Stream Barrier Survey Report

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Wells National Estuarine Research Reserve

PROJECT PARTNERS

This project was made possible by funding from the Maine Outdoor Heritage Fund and the Wells National Estuarine Research Reserve (WNERR). This and other stream barrier survey work in York County is accomplished through the dedication of numerous volunteers and partners. Thank you to all those individuals and organizations that have made this work possible.

Maine Outdoor Heritage Fund

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This project could not have been undertaken successfully without the time, dedication and support of many key individuals.

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WNERR intern Alex van Boer spent many hours identifying potential stream barriers from GIS data and aerial photos. He also spent a great deal of time developing survey maps, assisting with development of survey material, collecting data, and entering it into the database. Thanks to Alex for all of his hard work.

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Finally, thanks to Michelle Dionne, WNERR research director, for supporting this and other stream habitat restoration projects over the years. Michelle had great enthusiasm for this work felt it was vital to the recovery native fish populations and stream ecosystems as a whole. Michelle passed away during completion of this project. Her passion and expertise is sorely missed.

Cover Photograph

Trout Unlimited volunteer Steve Heinz surveys a culvert at the crossing of Day Hill Rd. and an unnamed tributary to Branch Brook in Wells, ME.

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Volunteers take measurements at a golf course cart path.

SUMMARY

This report describes the results of a stream barrier survey conducted by the Wells National Estuarine Research Reserve (WNERR) in 2012. Staff and volunteers with Trout Unlimited visited 110 potential stream barriers at road, railroad, and trail crossings, and dams. We identified 66 stream barriers including 5 dams, and 61 crossings. Over 50% of sites visited create barriers to movement of fish and aquatic organisms. Sites were given rankings based on the severity of the barrier they create. Priority restoration sites were identified based on many factors including ecological benefit, long term economic benefit, and the unique circumstances of each site.

OVERVIEW

In 2012 the Wells National Estuarine Research Reserve (WNERR) received funding through the Maine Outdoor Heritage Fund to conduct a survey of stream barriers in the Merilland River, Branch Brook, Kennebunk River, and Shorey's Brook watersheds. Surveys were planned by WNERR staff and carried out with volunteer support from members of the Sebago Chapter of Trout Unlimited (TU). Survey teams followed USFWS protocols for surveying road crossings, dams, and natural barriers. WNERR survey data was added to the USFWS Gulf of Maine Coastal Program barrier database

for Maine. In November, WNERR hosted a stream crossing stakeholder workshop, with presentations on road crossing ecology, best management practices, permitting, barrier survey and prioritization. Participants included municipal road managers and conservation commission members, state and federal agencies, and non-governmental organizations. WNERR has developed a list of priority crossings, based on survey data, habitat distribution, and difficulty of replacement. This list will be used to guide ongoing stream barrier removal efforts.

Background

The U.S. Fish and Wildlife Service Gulf of Maine Coastal Program (GOMCP) maintains a growing database of road-stream crossing barriers in the state of Maine. Surveys have been conducted in the Penobscot River, Sheepscot River, Saco River, and other drainages. Survey data is used to identify barriers removal projects with high ecological value or economic value, opportunity collaboration, or high chance of success. WNERR staff utilize USFWS protocols for surveying road-stream crossings, dams, and natural barriers (Abbott, 2008), and survey data is added to the USFWS barrier database.

WNERR and partner organizations are engaged in several habitat connectivity restoration projects in the small coastal watersheds of York County. These include head of tide dam removals in the Kennebunk River (Goff Mill Brook), Merriland River, and Shorey's Brook, and rehabilitation of a fish ladder at the head of tide dam on Branch Brook. To maximize the success of these restoration efforts, barrier surveys were carried out in each of these watersheds.

Habitat Connectivity

To complete their life cycles, fish and other aquatic organisms must have access to all habitats needed for basic life functions during each stage of development, growth, and reproduction. Fish require access to spawning and nursery habitat, and must move throughout river systems to locate food and escape harmful environmental conditions including low water levels, low oxygen levels, and high water temperature. Crossing structures which are undersized, blocked, or perched, prevent aquatic species from moving through them. Stream crossings can also alter nearby stream conditions by mobilizing sediments with increased water velocity. Scour pools may form at crossing outlets, which can eventually lead to lower water levels and create a perched outlet. Backwaters created by perched or blocked inlets cause sediment to accumulate and cover the natural stream substrate.

Anadromous fish, are those that migrate from the ocean to freshwater to reproduce, and are particularly susceptible to the effects of stream barriers. One stream barrier at the head of tide can completely cut off access to all freshwater habitat for sea run fish. The three watersheds surveyed by WNERR are known to have small populations of many anadromous species, including alewife, blueback herring, Atlantic tomcod, sea lamprey, rainbow smelt, and sea-run brook trout (Aman, 2011) (Aman, Thornton, van Boer, &

Dionne, 2012) (Aman, 2012). Potential to benefit anadromous species was considered when compiling our list of stream barrier replacement priorities.

Project Area

Stream barrier surveys were conducted in the Merriland River, Branch Brook, Little River (MBLR) and Kennebunk River drainages, and in Shorey's brook, a tributary of the Salmon Falls River. See Table 1 for watershed area, stream miles, towns, and potential barriers. Sites were surveyed in the towns of Arundel, Eliot, Kennebunk, Kennebunkport, Lyman, Sanford, South Berwick, and Wells. Kennebunk was the only town with survey sites in more than one watershed.

TABLE 1. WATERSHEDS SURVEYED

Watershed	Total Area (mi^2)	Perennial Stream Miles	Watershed Towns	Potential Barriers
MBLR	31.3	52.5	3	71
Kennebunk River	59.4	83.8	4	66
Shorey's Brook	2	4.0	2	12

SURVEY PLANNING

WNERR recruited a Maine Conservation Corps Environmental Educator (EE), Clancy Brown, to assist with survey planning and lead survey and outreach activities. Under supervision of the project leader, the EE identified and mapped potential stream barriers. The EE developed survey material, recruited volunteers, led and scheduled field data collection, and managed data entry.

Road-Stream crossing sites were identified using road and stream data obtained from the Maine Office of GIS. We utilized aerial photographs and local knowledge to identify potential barrier sites at private or abandoned road crossings, trail crossings, dams, and natural barriers such as beaver dams or waterfalls, were identified. Additional sites were identified and surveyed in the field as teams discovered them. A total of 152 potential barriers were identified prior to the survey (Figure 1), and 3 sites were identified in the field.

FIGURE 1 POTENTIAL STREAM BARRIER SITES

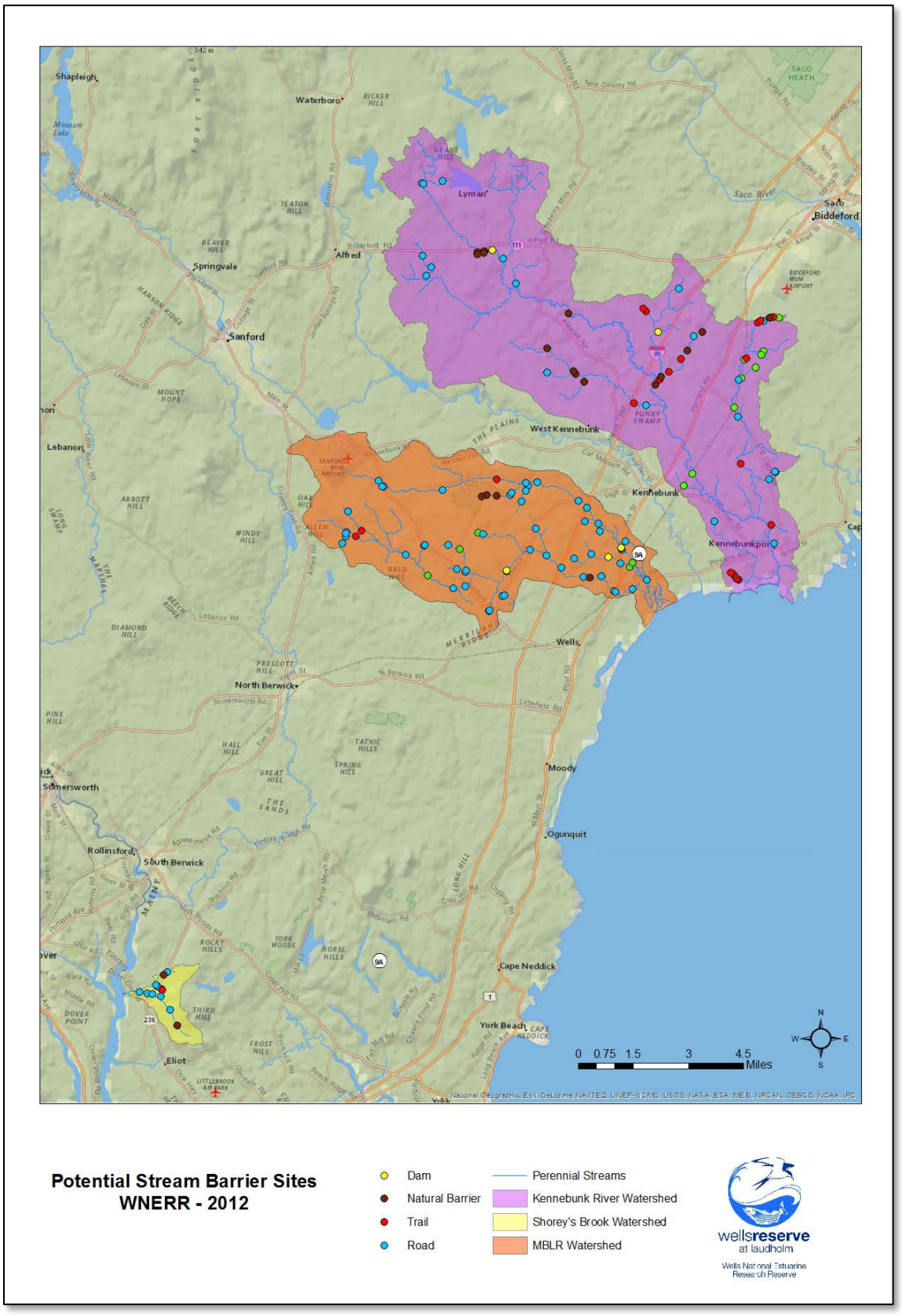


TABLE 2. STREAM BARRIER SURVEY SITES

	# of Sites	% of Sites
Potential Barriers		
Trails	24	16%
Dams	6	4%
Natural Barriers	19	13%
Railroad Crossings	16	11%
Road Crossings	84	55%
Additional Sites	3	2%
Total Pre Survey Sites	**152**	**100%**

WNERR staff, interns, and volunteers with the Sebago Chapter of TU, attended a pre-survey training session and project orientation. Staff and volunteers were organized into teams of 2 or 3 people. Each field day, survey teams were assigned a set of crossings to visit. Teams were provided with site maps, site indexes, and road maps to help locate survey sites. Each team carried surveying equipment, safety kits, and cameras.

A survey team takes measurements at a road crossing.

SURVEY RESULTS

All public road crossings were surveyed, as well as most crossings on private roads, trails, and railways. Roads were given priority because they could be easily accessed and accounted for the majority of site surveyed. Other potential barriers were surveyed as time and personnel allowed. No potential natural barrier sites were visited.

TABLE 3. STREAM BARRIER SURVEY SITE STATUS

	# Sites	% of Sites
Surveyed	72	47%
Unsurveyed Sites:		
Bridge Adequate for Passage	19	12%
Inaccessible	2	1%
Site Does Not Exist	9	7%
Total Span < 18 Inches	8	5%
Total Sites Visited	110	72%
Sites Not Visited	42	28%

Of the 66 non-dam sites surveyed, 31 (47%) exhibited multiple factors that would limit passage of fish and other aquatic organism. Table 3 shows the frequency of factors creating complete or partial barriers to fish and aquatic organisms. Increased stream velocity was the most common stream barrier characteristic.

TABLE 4. CROSSING CONDITION

	# Sites	% of Sites
Blocked Inlets	12	18%
Severely Blocked Inlets (≥75% of inlet)	6	9%
Inlet Drop	6	9%
Perched Inlet	10	15%
Perched Outlet	13	20%
High Velocity indicators		
Lack of Crossing Substrate	32	49%
Tailwater Scour Pool	37	56%

A majority of surveyed crossing structures showed signs of high velocity water. In addition to making it harder for weak swimming organisms to pass the crossing, higher flows can result in the formation of scour pools downstream which can lead to perched outlets as sediment below them is removed.

Private road crossing on an unnamed tributary to Branch Brook. All three culverts at this crossing have perched outlets.

BARRIER RANKING

Each crossing structure surveyed was assigned a rank according to the severity of the stream barrier they create. This ranking enables us to prioritize sites for restoration. This ranking is meant to identify crossings with the most serious and fundamental structural deficiencies related to aquatic organism passage; it is not focused on one species, but does consider fish passage first, and other aquatic organisms second (Abbott 2009).

There were 35 crossings ranked as barriers, 21 crossings were ranked as moderate barriers, and 11 were ranked as not a barrier (Table 4). The barrier ranking was assigned if a site had a perched outlet or inlet, or was blocked 50% or more. Indicators of high stream velocity site photos were also considered when ranking. The moderate barrier ranking was given to sites with an inlet drop, inlet blocked 25%, or indicators of increased velocity. If a crossing did not exhibit any of these characteristics, it was ranked not a barrier.

FIGURE 2 BARRIER RANKING

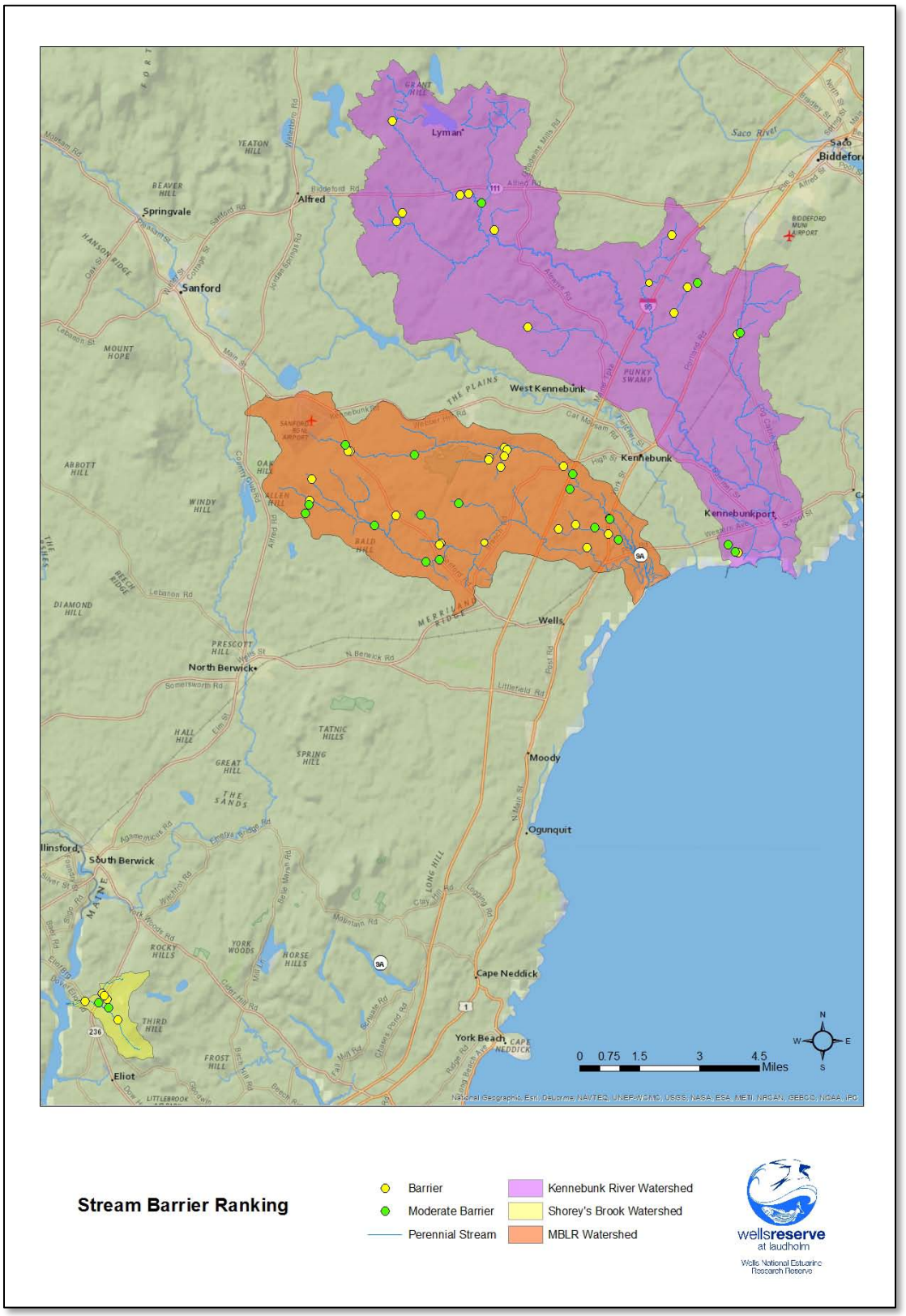


TABLE 5 BARRIER RANKING

	# of Sites	% of Sites
Barriers	40	56%
Moderate Barriers	21	29%
Not A Barrier	11	15%

All 5 dams surveyed were complete barriers to aquatic organisms moving upstream, due to lack of any functioning fish passage structure. In total 40 barriers were identified from the 72 surveyed, approximately 56%. See Figure 2 for a map of barrier ranking distribution across the three watersheds.

BARRIER REMOVAL PRIORITIES

While restoring stream connectivity at all stream barriers would be an ideal situation, it is not realistic or feasible given the added costs associated with well designed crossings, limited road maintenance budgets, and restoration funding. It is therefore necessary to focus restoration and maintenance activities at stream barriers that have the greatest potential for improving stream habitat conditions, or those where unique opportunities may facilitate barrier removal. We identified 5 priority sites out of 66 non-dam barriers (Table 5).

TABLE 6. RESTORATION PRIORITIES

Site ID	Jurisdiction	Ranking	Stream Name	Road Name	Road Type
11730	MDOT	Barrier	Shorey's Brook	Route 101	Paved
11665	Town of Wells	Barrier	Branch Brook	Day Hill Road	Paved
11664	MDOT	Barrier	Branch Brook	Route 9A	Paved
11655	Private	Barrier	Branch Brook	Abandoned	Unpaved
11692	Private	Barrier	Kennebunk River	off of Route 111	Trail

Priority site 11730 in Eliot is a round culvert at the crossing of Route 101 and Shorey's Brook. This crossing is maintained by the Maine Department of Transportation. The structure is a priority for replacement due to several factors. The culvert outlet is perched, and is located near the head of tide. This creates a complete barrier to upstream movement of sea run fish. A perched inlet creates a backwater upstream, and increased water velocity has created a large scour pool. A recent downstream dam removal has enabled sea-run fish such as river herring and rainbow smelt to reach the base of the Route 101 crossing. Removal of this barrier would open up 1.1 miles of stream habitat, which could facilitate the recovery of anadromous rainbow smelt, and other native species. The downstream dam removal has increased the tidal range at the head of tide. Sea level is projected to increase within the lifetime of any replacement structure, and should be considered when designing the next crossing. The culvert is currently failing and is scheduled for replacement by Maine DOT by 2017.

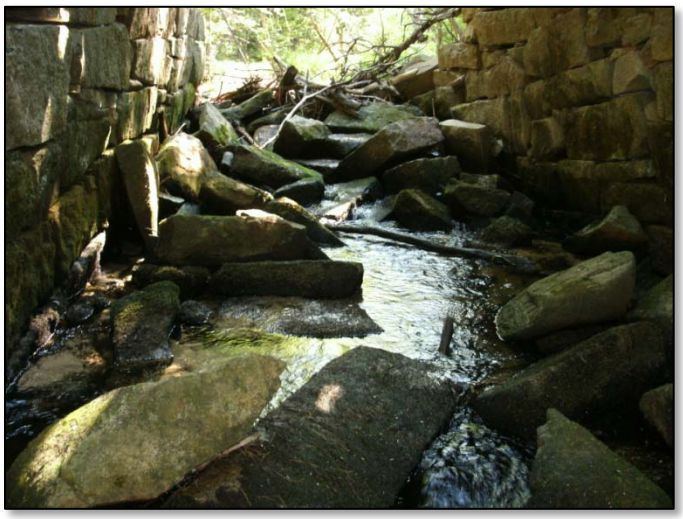
Failing culvert at the crossing of Route 101 and Shorey's Brook in Eliot.

We identified 3 priority sites in the Branch Brook watershed. Branch brook is home to a self sustaining population of wild eastern brook trout, as well as sea lamprey, and blueback herring.

Priority site 11664 is a concrete bridge and spillway at the crossing of Branch Brook and Route 9A in Kennebunk. This site is a priority due to its location on the mainstem of the brook. This crossing includes a small concrete spillway that essentially serves as a small dam, 0.27 m high. The crossing structure is a fairly substantial concrete box with a large amount of road fill above the crossing structure. It is likely that removal of this structure would be extremely expensive. However, if removal or some modifications could be made, it would open upstream access to 2.3 miles of mainstem habitat. When fish passage restoration is successful at the downstream dam operated by the Kennebunk, Kennebunkport, and Wells Water District (KKWWD), the Route 9A crossing will be the most downstream barrier on Branch Brook. This increases the benefit of barrier removal for anadromous species.

Priority site 11665 is a pipe arch culvert at the crossing of Branch Brook and Day Hill Road in Wells. This crossing is maintained by the Town of Wells. This crossing is a priority due to its location on the mainstem of the brook. The outlet of this crossing is perched 0.25 m above a large scour pool. Higher velocity water inhibits the movement of smaller fish species and other weaker swimmers. Removal of this barrier would open

upstream access to approximately 5 miles of upstream stream habitat for resident fish. Benefit from crossing replacement at this site would have limited benefit until passage is achieved at site 11664 and the KKWWD dam.



Granite blocks from collapsed bridge abutments block the stream channel at the crossing of Branch Brook and an abandoned road.

Priority site 11655 is a collapsed bridge on an abandoned road which crosses Branch Brook on privately managed land in Kennebunk. The site is a priority due to the fact that it is located on the mainstem of the brook. This site consists of an old bridge with granite block abutments that have partially collapsed, effectively blocking the stream channel. This site had the potential to be a relatively easy fix as the structure is no longer in use, and can be completely removed. Restoration of passage at this site would open upstream access to 1.9 miles of stream habitat for resident species. Benefits to anadromous species are currently limited by downstream barriers at sites 11665, 11664, and the KKWWD dam.

Priority site 11692 is a ford at the crossing of an ATV trail and the Kennebunk River near Route 111 in Lyman. This site is a priority due to the fact that it is located on the mainstem of the river. The crossing consists of a ford constructed of rip rap filled into the stream channel. Additionally, debris from a previous crossing structure and displaced rip rap have created a blockage downstream of the crossing. This site had the potential to be an easy fix, with the installation of an ATV bridge, which is why it is included as a priority. However, benefit to anadromous species is limited by two dams downstream. Installation of a bridge should be accompanied by removal of rip rap and debris, and banks stabilized to prevent the input of additional sediment which could alter habitat for resident aquatic species.

NEXT STEPS AND CONCLUSIONS

Barriers surveyed in 2012 for this project, with barriers identified during a previous survey of public road crossings in the Kennebunk River watershed (Aman & Pinkham, 2010) comprise the majority of stream barriers in the Kennebunk River, MBLR, and Shorey's Brook watersheds. WNERR has identified additional potential barriers in these and other nearby watersheds in York County. We intend to continue to work with our project partners to develop the inventory of stream barriers in these systems.

A Stream Barrier Inventory was created as a companion to this report (Appendix A). This document is intended as a quick reference guide to stream crossing barriers that have been surveyed by WNERR, and will be updated as new barriers are identified. These documents are available from the WNERR website, www.wellsreserve.org .

In November 2012, WNERR hosted a training workshop for stream crossing stakeholders. The workshop included an overview of stream crossing best management practices (BMP), stream crossing ecology and barrier impacts, and permitting, and an overview of stream surveys and priority sites developed by WNERR. Stakeholders were provided with printed information related to stream crossing replacement BMP, accessing technical assistance, and potential funding sources for stream barrier removal projects. The conference materials (Appendix B) were made available on the web, along PowerPoint presentations, and links to partner organization websites and info. These materials can be accessed online at:

http://www.wellsreserve.org/blog/489-wnerr_stream_barrier_inventory

WNERR will continue to conduct outreach to road managers by providing updated barrier information and work with them to identify potential restoration projects and funding sources.

Spang's Mill Dam and associated private road crossing on the Kennebunk River in Lyman.

As stream barriers are removed we expect to see an improvement in habitat conditions for resident and sea-run fish. Monitoring of habitat and fish populations should be conducted to evaluate the performance of restoration projects. This information should be used to inform future restoration projects.

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APPENDIX A. STREAM BARRIER INVENTORY

APPENDIX B. STREAM BARRIER STAKEHOLDER WORKSHOP MATERIALS