

## City of South Portland Trout Brook Culvert Improvements Study

*“DEP has designated Trout Brook as an impaired stream due to the impacts of surrounding development. They have also recognized that it has a high restoration potential because of the City’s ongoing efforts to improve water quality and stream habitat. One of the measures of a healthy stream includes the conditions to sustain the life cycles of cold-water fish species, including the trout that currently inhabit the brook’s lower reaches. Existing culverts inhibit and, in some cases, prevent fish upstream passage. Therefore, structural changes are needed for almost all culverts in the Trout Brook watershed. This will take time and money but we support the City’s efforts to achieve the worthy goal of enabling fish passage all the way to Sawyer Marsh.”*



**Small trout netted below Providence Ave culvert**

**Dan Hogan – South Portland Conservation Commission Chair**

### **PARTNERS**

Casco Bay Estuary Partnership, US Fish & Wildlife Service, Maine Department of Environmental Protection, South Portland Conservation Commission

### **ISSUE AREAS**

Fish passage; climate adaptation (decreased flooding risks)

### **PROJECT DESCRIPTION**

The City of South Portland and various project partners and stakeholders have a long history of working to restore the water quality and aquatic habitat of Trout Brook. From the extensive assessment work conducted by DEP since (at least) 1999 to more recent collaborations with the Casco Bay Estuary Partnership and the South Portland Conservation Commission, there is clear commitment and community support to help Trout Brook attain state water quality standards. DEP identified Trout Brook as having a high restoration potential and has provided numerous grants over the past decade to fund the development of [the 2012 Watershed Management Plan](#) (WMP) along with a variety of subsequent restoration projects in South Portland and Cape Elizabeth.

While all of these efforts have resulted in significant progress towards attaining compliance with water quality standards, much work remains. In addition to water quality and aquatic habitat improvements, a key recommendation in the 2012 WMP is to enhance stream connectivity by improving or restoring fish passage at several culverts. The US Fish & Wildlife Service (USFW) and Casco Bay Estuary Partnership (CBEP) completed the [Casco Bay Watershed Fish Barriers Priorities Atlas](#) in February 2012 that identified 4 culverts along Trout Brook representing severe fish passage barriers with other culverts in the South Portland portion of the watershed representing potential barriers. The Trout Brook Culvert Improvements Study provides a rational basis for the strategic and methodical replacement of culverts and ensures that unintended consequences will not occur as a result (e.g., flooding or stream channel impacts).

## **PROJECT SCOPE & APPROACH**

The study area extends approximately 6,200 feet along Trout Brook from its confluence with Casco Bay to a point approximately 300 feet upstream of the culvert crossing at Sawyer Road. The upper reach of the study area includes the portion of the stream extending approximately 2,000 feet from Fessenden Avenue to Sawyer Road at Sawyer Marsh. The study includes hydraulic evaluations of culverts for replacement at five locations. The lower reach of the study area includes the portion of the stream downstream of Fessenden Avenue extending approximately 4,000 feet to the confluence of Casco Bay. The study of this reach includes a more limited evaluation of the capacity of the culverts at four locations.

The scope of the study includes field inspections of the stream channel, a fish passage condition assessment, topographic/cross section surveys of the stream channel and culvert crossings and a hydrologic analysis of the tributary watershed with points of analysis at each crossing location. The evaluation includes modeling the increased flow rate in the stream channel due to increased culvert capacity and the corresponding reduction in impounded channel storage created by the currently undersized culverts and the associated changes in water surface elevation in the study reach based on the proposed alternatives. The analysis in the lower reach is limited to evaluating the capacity of the lower reach crossings from Cottage Road to Highland Avenue and does not include evaluating replacement for the lower reach culverts. The study also includes wetlands delineations near each culvert for use in future permitting.

## **RESULTS & RECOMMENDATIONS**

The results of the hydraulic evaluation generally indicate that culvert replacements should progress from downstream to upstream so that downstream capacity is increased to account for increased peak flows that may occur when upstream crossing capacity increases. Mid-stream crossings from Fessenden Avenue upstream to and including South Richland Street can be undertaken without significant increases in flooding at Broadway and Highland Avenue. This is primarily due the capacity of the culvert at Sawyer road, which maintains a reservoir effect in Sawyer Marsh. Maintaining this impoundment minimizes the impact of midstream crossing improvements on the downstream crossing at Broadway and Highland Avenue.

Mid-stream culvert replacements will provide significant local improvements to flooding conditions at the crossing locations and don't necessarily need to be sequential moving up stream. The impoundment at Sawyer Road and storage in Sawyer Marsh attenuate and generally control the flow rate downstream to Fessenden Avenue. The current study models can be readily modified to evaluate the impact of any proposed replacement sequence and should be performed as part of the final design process. It is recommended that the City determine priority for a replacement strategy with the following considerations.

### **Fish Passage First Strategy**

If improving fish passage is the primary consideration, it is recommended to address the crossing at Providence Avenue first and perform an interim improvement at Fessenden Avenue. The crossing at Providence Avenue is a significant hanging culvert/cascade condition at the downstream end. The culvert cannot be significantly lowered to match the stream channel due to sanitary sewers located below the existing crossing. An in-channel fish passage improvement, potentially including a stepped series of pools is required to address this cascade condition. The evaluation of the in-stream improvements is outside of the scope of this study, but appears feasible based on stream conditions and public ownership of the land

downstream of the culvert. When the most significant barrier at Providence is addressed it is recommended that a similar smaller scale interim in-stream improvement be considered at Fessenden Avenue and Boothby Avenue to address less significant hanging culvert conditions.

However, with the in-channel fish passage improvements and potential utility conflicts, the crossing at Providence Avenue is likely to be the most expensive crossing in the study area. Addressing other, lower cost locations may be a more practicable strategy.

### **Flooding First Strategy**

If alleviating flooding conditions in the mid-stream reach is the primary consideration, it is recommended to address the crossings at Fessenden Avenue first. Due to low crossing clearance and road elevations, this crossing exhibits extensive flooding and road overtopping in the baseline condition, 50-year storm. Sawyer Road also overtops and impacts upstream properties in the baseline condition 50-year storm. However, increasing capacity at Sawyer Road should not be considered until the capacity of downstream crossings is addressed.

### **Broadway Replacement**

It is recommended that the City begin planning for the replacement of the culvert at Broadway. Broadway is a state road and the culvert replacement is expected to be expensive with significant traffic implications. We recommend that the City begin planning for the replacement of this culvert potentially with shared funding from MDOT. The FEMA FIS study depicts Broadway overtopping in a 50-year storm and the Baseline condition analysis predicts overtopping in a 25-year event due to the increased storm intensity reflected in the 2015 design rainfall depths. Today's 25-yr storm depth is roughly equivalent to previous studies' 50-yr storm conditions.

### **NEXT STEPS AND OPPORTUNITIES**

The City will use the recommendations from the Trout Brook Culvert Improvements Study to inform Capital Improvement Plan (CIP) priorities. Grant funds from various local, state and federal sources will also be sought to supplement CIP funding for culvert upgrades and replacements. The City will also continue to work closely with project partners to ensure an optimal outcome for the implementation of the study's recommendation.

### **CONTACT**

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Financial assistance provided by the National Oceanic and Atmospheric Administration, U.S. Department of Commerce Grant CZM NA17NOS4190116 to the Maine Coastal Program. Coastal Community Grants are awarded and administered by the Maine Department of Agriculture, Conservation and Forestry Municipal Planning Assistance Program.