

## HYDROLOGY REPORT

The Drainage Basin Characteristics for [South Inlet Bridge #5375 in TWP 18 on Route 191 over the Southern Inlet](#) was provided by the Maine Department of Transportation Office of the Environment-Hydrology Section. The flows were computed using the 1999 USGS full regression equation. No other flow data is available such as gage data, existing studies, or reports from local residents. Therefore the hydrology data was used as provided and is as follows:

### Summary

Drainage Area = [4.875](#) square miles  
Ordinary High Water ( $Q_{1.1}$ ) = [43.1](#) cfs  
Design Discharge ( $Q_{50}$ ) = [229.4](#) cfs  
Check Discharge ( $Q_{100}$ ) = [264](#) cfs  
 $Q_{500}$  = [346.3](#) cfs

Reported By: [Michael Wight](#)  
Date: [October 19, 2009](#)

## **HYDRAULIC REPORT**

**(Existing and Proposed Bridge)**

South Inlet Bridge # 5375 is located in the unorganized township of [TWP 18 on Route 191 over the Southern Inlet](#). The existing bridge is an 18' span by 6'-3" rise steel plate arch on concrete footings supported on timber grillage. The opening area is approximately 82 square feet base on the spring line elevation. The upstream invert/streambed elevation based on survey is about 486.53'. The bridge is located in the swampy area with a flat stream slope. The stream is very slow moving. A beaver dam is located about 50' upstream and a timber snowmobile bridge is located immediately downstream of the bridge. Rocky Lake is located about 1.5 miles downstream. The typical difference in water levels between the lake and the bridge is only about 5' based on USGS topographic map. Tailwater conditions definitely govern at the bridge site.

The existing bridge was analyzed using a program called HY8 version 7.2. The existing opening was modeled as a single steel plate arch with an 18' span by 5'.75 rise with an opening area of 75 square feet. Tailwater is based on a constant water elevation of about 490.08'. The manager of the Marion transfer station says the current water level was about the average water level for the stream. The existing bridge is adequate in terms of hydraulics. The ratio of headwater depth to structure depth HW/D is about 0.72, which is well less than 0.9 HW/D design criteria. According to locals the road has never overtopped.

The bridge was built in 1951 therefore the current age is 58 years. Use of steel is allowed because the structure has lasted over 50 years. Aluminum culverts would require a concrete collar which would be difficult to build during the proposed 5 day road closure.

The first option considered was twin pipe arches. Twin 8.83' (106") span by 6.11' (73.3") rise steel pipe arches assuming no embedment provides equivalent hydraulics capacity compared to the existing. As a minimum the pipe arches should be embedded 6 inches. As a result of the embedment, the selected pipe size should be one size larger with a 9.32' (111.8") span by 6.25 (75.1") rise.

The second option considered was three pipes. Three 7' diameter corrugated steel or aluminum would provide the equivalent hydraulic capacity compared to the existing assuming no embedment. Practically speaking, the pipes should be embedded slightly and 7'-6" diameter pipes used. The channel opening would have to be widened about 11' to accommodate the 3 – 7.5' diameter pipes. This channel widen would mean additional wetland impacts and more time for construction. Debris would be more of a concern with three smaller opening versus two larger openings or a single opening.

The third option is a single rectangular concrete box culvert. Based on no embedment, a size of 14' span by 6' rise would be needed to provide equivalent

hydraulic capacity as the existing opening. To account for minimal embedment, a 14' span by 7' rise concrete box culvert should be used.

A fourth option is a single aluminum box culvert with a full metal invert with headwalls. Based on no embedment, a size of 15'-4" (15.33') span by 6'-5" (6.42') rise (structure # 30) would be needed to provide equivalent hydraulic capacity as the existing opening. To account for minimal embedment, a 15'-6" span by 7'-3" rise (structure #31) box culvert should be used.

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Note: All elevations based on an assumed elevation.