

1 **Q. Re: Rocky Pond Plant Refurbishment (p. 2 of 81, Schedule B) - Please provide for the**  
2 **past five years details of problems that have been experienced with regard to de-**  
3 **watering the penstock.**

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5 **A. 1.0 Introduction**  
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7 De-watering of deteriorated woodstave penstocks creates a number of risks with which  
8 Newfoundland Power has experience.<sup>1</sup> A brief overview of this experience follows as does  
9 specific experience over the past 5 years with the Rocky Pond penstock.  
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11 **2.0 Overview**  
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13 **2.1 Leaks Generally**

14 As woodstave penstocks age, general deterioration of the wood will cause leakage. For a  
15 number of years, there has been some leakage of the Rocky Pond woodstave penstock. In  
16 recent years, this leakage has become more significant, particularly following de-watering of  
17 the penstock.  
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19 Because older woodstave penstocks tend to leak following de-watering, the frequency of de-  
20 watering is minimized to the extent possible. The condition of the Rocky Pond woodstave  
21 penstock is such that the facility has been operated for some time with a view to avoiding  
22 de-watering unless it is absolutely essential. However, there are circumstances when de-  
23 watering is unavoidable.  
24

25 When a leak in the penstock is too large to patch with the pipe under pressure, the penstock  
26 must be de-watered before the leak can be repaired. Similarly, if a leak were to occur in the  
27 surge tank, including the external riser, the leak could not be repaired without de-watering  
28 the penstock.  
29

30 When the penstock is de-watered, the woodstaves begin to dry out. As the woodstaves dry  
31 out, they tend to shrink, especially along the springline where the structural strength of the  
32 wood has been reduced due to crushing. This shrinkage increases the tendency of the  
33 already-damaged woodstaves to leak.  
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35 Because of the extent of deterioration of the Rocky Pond penstock, the likelihood that the  
36 penstock will require de-watering to repair leaks is increased.  
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38 **2.2 Turbine Inspection and Maintenance**

39 The penstock at Rocky Pond would need to be de-watered if a problem developed that  
40 required inspection or repair of the turbine assembly.  
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42 In normal circumstances, the scroll case where the turbines are located can be de-watered by  
43 closing the main valves. This would not require de-watering of the penstock. At Rocky

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<sup>1</sup> Newfoundland Power's experience with the risks associated with de-watering deteriorated woodstave penstocks covers a number of installations and includes that gained with the Rattling Brook penstock that was replaced in 2007.

Pond, however, the main valves leak so badly that it is not possible to de-water the scroll case in this way. Consequently, if a problem develops in the turbine assembly, the only way to safely access the area is to de-water the penstock. This presents continuing operational limitations to routine plant maintenance.

### **2.3 Other Aspects**

De-watering puts physical stress on the penstock. When the penstock is full, internal water pressure helps the penstock to maintain its shape. When the internal pressure is reduced, the weight of the wood staves and the external pressure from the steel bands tend to distort the penstock's shape. This extra movement of the wood also contributes to leakage when the penstock is re-watered.

Winter de-watering can bring different physical forces to bear on the penstock. Freezing temperatures tend to lessen drying and shrinkage, however, variable winter weather conditions can result in material changes to physical stresses. The weight of snow and ice loads also puts additional external pressure on the penstock.

Deep snow and icing conditions can make it difficult to repair penstock leaks promptly. If the drainage of leaking water away from the penstock is blocked by deep snow, the resulting ice around the pipe could physically damage the penstock. If this were to occur, the penstock would have to be de-watered until conditions improved.

### **3.0 Specific Experience**

Since 2003, there have been three instances in which the penstock had to be either completely or partially de-watered.

#### **3.1 2005 Leak Repairs**

In July 2005, the penstock was de-watered for approximately 3 days to repair areas of significant leakage along the entire penstock. Upon re-watering some additional leakage was encountered.

#### **3.2 2005 Wicket Gate Bushing Replacement**

In December of 2005 the entire penstock was de-watered for one day to allow the repairs to the main valve to facilitate the replacement of the wicket gate bushings on the turbine. Once the main valve was repaired the penstock was re-watered and work on the turbine proceeded. Upon re-watering of the penstock a major blowout occurred. The major blowout consisted of a 15 ft long section of woodstave being blown out just upstream of the powerhouse. As a result the penstock was de-watered again for approximately 3 days to complete the repair.

#### **3.3 2008 Penstock Leak**

In March 2008 the entire penstock was dewatered to repair a significant leak just upstream of the powerhouse. The penstock was de-watered for approximately 2 days to complete the repair. Upon re-watering of the penstock significant leakage was encountered.