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18 October, 2017

Project No: 60285876 Task #3

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Dear Ben:

Re: Gardom Pond Dam Evaluation – North Pender Island
Low Level Outlet Investigation, October 2017

1. Introduction

On October 4th, 2017, Capital Regional District Regional Parks (CRD) and AECOM conducted an inspection of the existing Low Level Outlet's piping and fittings located in a concrete chamber on the downstream side of Gardom Pond Dam. The purpose of the investigation was to examine the overall condition of the various pipes and fittings within the outlet's concrete chamber and to confirm if there were immediate concerns with corrosion or spalling of any of the outlets infrastructure. A photograph summary is attached from the site inspection.

2. Background

The low level outlet control is located in a concrete chamber at the downstream end of the pipe, which houses two control valves (100 mm dia. and 50 mm dia.). The 50 mm dia. valve is understood to have provided local irrigation flows, which daylights approximately 15 m south of the dam and is no longer required (Photo #1&#2). Having control valves at the downstream end of the pipe instead of the upstream end of the pipe subjects the entire pipe to full reservoir water pressure at all times. This is not a recommended method of design as it is possible for water from the reservoir to travel along the pipe eroding material from the dam over time resulting in a potential breaching of the dam. In addition, failure of any of the low level piping within the chamber could result in erosion of soils at the toe of the dam, potentially leading to a dam breach.

3. Observations

We note that the observations and discussions below are based solely on qualitative observations of surfaces of piping and fittings within the low level outlet's concrete chamber and excludes any internal assessments and/or detailed corrosion investigations. The scope of this inspection was strictly to provide an initial assessment of the overall condition of the low level outlet's piping and to identify any potential issues that may need to be addressed as a priority prior to the dam being decommissioned in 2018.

3.1 Initial Site Observations:

Outlet Configuration: The low level outlet within the concrete chamber has been constructed with two control valves as follows:

1) Reservoir's Low Level Outlet: Consist of a 150 mm steel flanged pipe spool that is embedded in the wall of the concrete chamber, followed by a 150 mm x 100 mm x 100 mm reducing tee and the reservoir's main 100 mm control valve is located on the tee branch. Downstream of the main control valve the outlet's piping is 100 mm in diameter and appears to be PVC piping.

2) Irrigation Outlet: Consists of a 100 mm X 50 mm flange adapter, a short 50 mm diameter pipe spool approximately 100 mm in length, followed by a 50 mm gate control valve located on the through leg of the tee. Downstream of the irrigation valve the outlet's piping is 50 mm in diameter and appears to be PVC piping.

Standing Water: Within the low level outlet concrete chamber, standing water to an approximate depth of 250 mm was observed. The outlet's fittings and valves were approximately 75 mm above the water as they are elevated on blocking.

Deposit Buildup: The various piping and fittings within the chamber were covered to an approximate depth of 10 mm in a light brown silt like material with reddish brown mottling (Photo #2 and #3). The material was also noted to be stratified in nature.

The build-up on the various components within the chamber was carefully removed to identify any underlying corrosion or spalling and to assess the overall conditions of the outlet (Photo #4). Some of the material removed appeared to be larger thin layers that may have been former protective coatings applied during manufacturing, but this was generally indeterminable.

3.2 Piping and Fittings:

We note that the internal integrity of the various piping and fittings are not known, which have likely been filled with water under pressure since the dam's construction.

Low Level Outlet: The fittings, valve bodies, pipe flanges and related hardware had a reddish brown discolouration, which may be indicative of corrosion of iron base metals, but no significant pitting, scarring, or spalling of the surface base metals was noted (Photos #9&10). Overall the fittings and valve bodies appear to be in sound condition, despite the surfaces having become somewhat weathered since construction over 35 years ago.

It was also observed that the pressurized joints and flange-flange connections on the low level outlet did not show signs of present or former leaks

Irrigation Outlet:

The 50 mm pipe spool showed signs of surface spalling with underlying surface oxidation consisting of visible surface scarring and pitting. Despite this noted surface oxidation, the exposed pipe threads on the end of the pipe spool were still visible and were generally intact (Photo #7). .

It was also observed that the pressurized joints and flange-flange connections on the low level outlet did not show signs of present or former leaks

4. Conclusion:

The surficial qualitative assessment of the Low Level Outlet's piping and fittings identified the short 50 mm irrigation outlet pipe spool, located between the 150 mm reducing tee and the 50 mm gate valve, to have visual signs of metal corrosion; with characteristics of spalling, scarring and pitting of the pipe's surface. The full extent and depth of the identified corrosion within the base metal and the potential risk of failure is not determinable from our qualitative assessment.

We note this 50 mm diameter piping is pressurized upstream of the gate valve as a result of the dam's static water elevation and the extent of internal corrosion is not known, if any. To verify the pipe's integrity quantitatively would require further specialized investigations. This would incur additional consulting costs and may require the reservoir to be drained to conduct any pipe testing.

To address corrosion concerns attributed to the 50 mm dia. irrigation pipe spool, the pipe segment would ideally be replaced. However, the irrigation pipe is pressurized within the chamber with no means to isolate the pipe segment and the reservoir would need to be drained to conduct the replacement work. This is a significant endeavour and concerns have been raised on the operational integrity of the low level's 100 mm control valve that we understand has not be operated in a number of years.

To provide a measure of protection against possible failure of the 50 mm diameter spool piece was discussed with CRD staff. It would involve capping the irrigation outlet pipe downstream of the 50 mm diameter gate valve and encasing the irrigation outlet and main outlet tee in concrete. Refer to attached Figure #1. It should be reconized that this is a short term solution that should provide a cost effective solution to mitigate the potential risks of the irrigation pipe failing by corrosion until the dam is scheduled to be decommissioned in 2018.

The surficial observations of the remaining piping and fittings within the low level outlet's concrete chamber did not identify apparent corrosion or spalling of noted concern.

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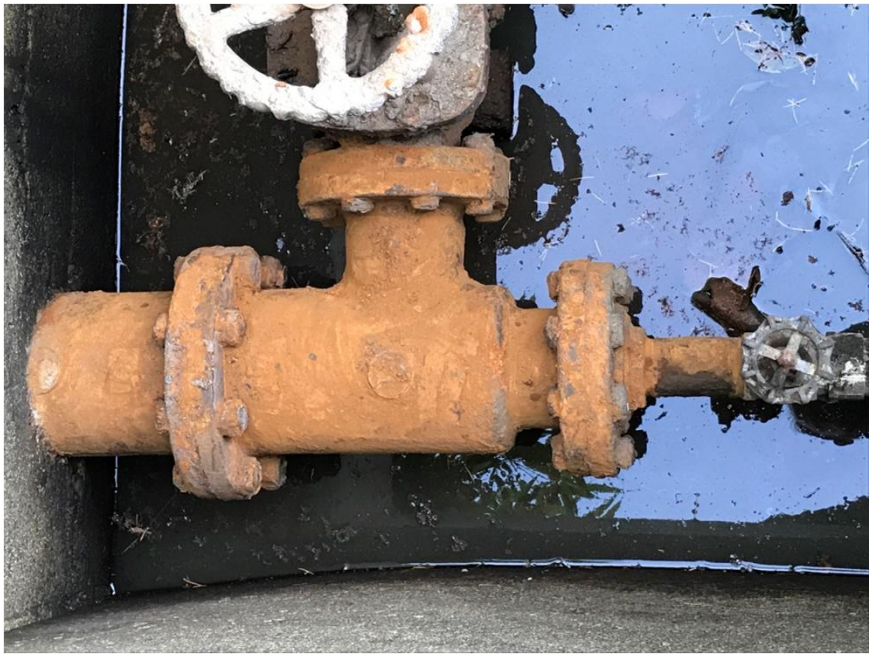
DH/
Attch.

Gardom Pond Dam
Low Level Outlet Chamber Inspection
Photo Album
October 2017

Photograph #1: Low Level Outlet Chamber and Housing Located on downstream face of Gardom Pond Dam

Photograph #2 – Top View: Low Level Outlet Chamber Infrastructure Deposit build-up partially removed

Photograph #3: Deposit Build-Up
Typical samples collected from top of fittings & piping



Photograph #4- Top view: Low Level Outlet Fittings
Deposit build-up removed

Photograph #5 – Bottom View: 50 mm dia. Irrigation Feed
Deposit build up and suspect spalling

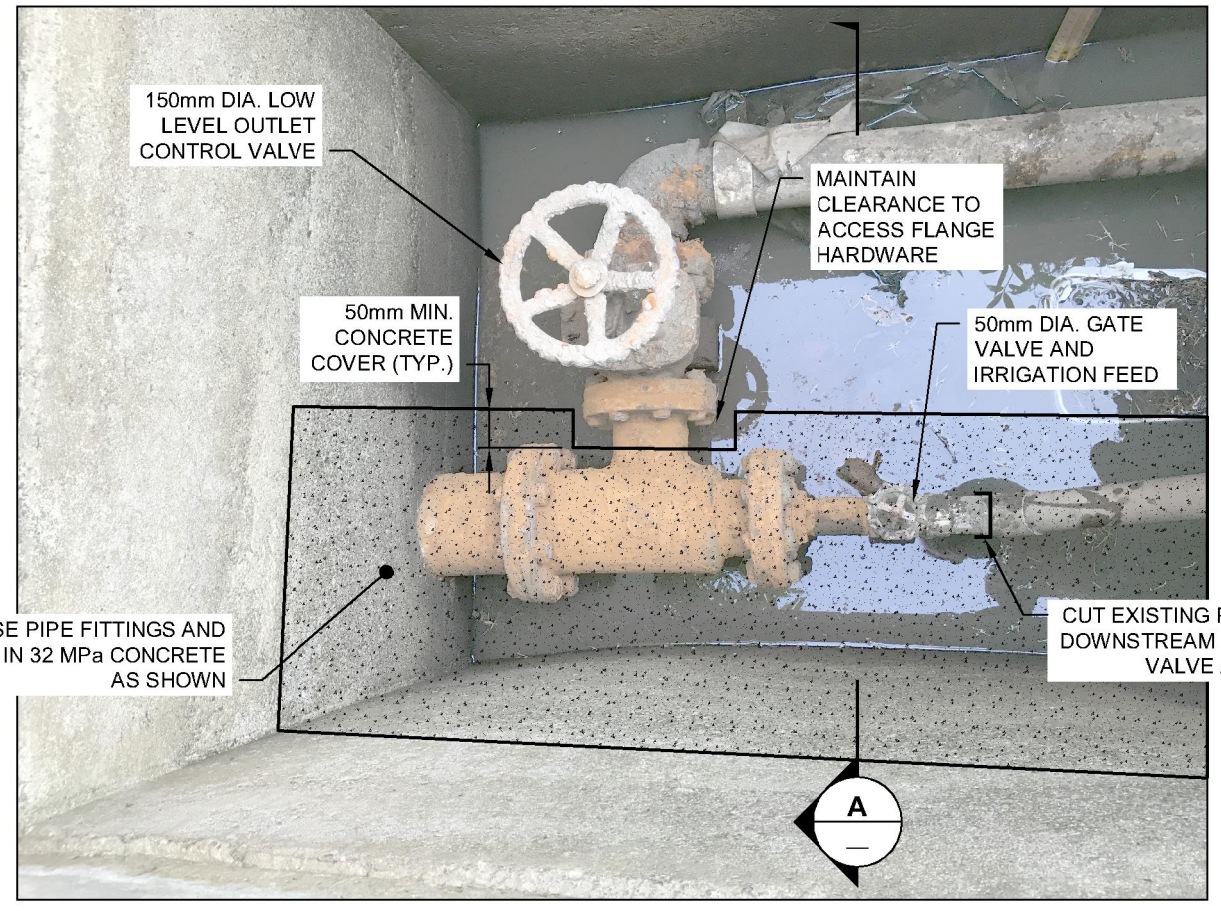
Photograph #6: 50 mm dia. Irrigation feed
View of samples collected from pipe spool

Photograph #7 – Top view: 50 mm dia. Irrigation Feed
Deposits and scaling removed
Note presences of pipe threads and Teflon tape

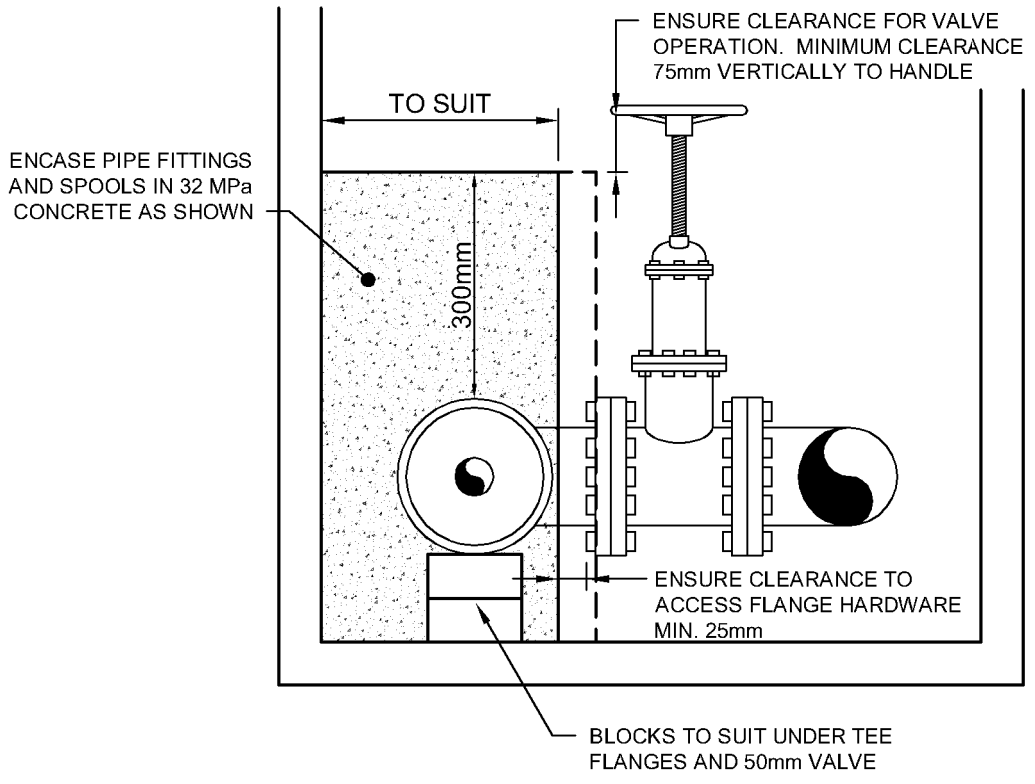
Photograph #8 – Top view: 150 mm Upstream flanges and hardware at concrete chamber wall interface

Photograph #9 – Top View: 150 mm Tee Fitting
Tee Body, flanges, Nuts & Bolts

Photograph #10 – Side View: 150 mm Low Level
Outlet Control Valve, flanges, nuts & bolts



LOW LEVEL OUTLET VALVE CHAMBER
N.T.S.



A — SECTION
N.T.S.

PROPOSED CONCRETE ENCASEMENT OF 50mm DIA. IRRIGATION OUTLET

GARDOM POND DAM
LOW LEVEL OUTLET - INSPECT. OCT 2017

Project No.: 60285876 Date: 2017-10-13