Limited Dam Safety Inspection Report

Pascoag Reservoir Upper Dam

Pascoag, Rhode Island

Town of Burrillville, RI

Job No. 1018649 Nov 16,2006

Prepared by Jacques Whitford, Lincoln, RI

5.0 RECOMMENDATIONS

Based on our visual observations as part of this Limited Safety Inspection, the current condition of this dam is considered to be as follows:

Outlet Works Structure	Good
Spillway	Poor to Fair
Raceway	Fair to Good
Earth Dam Embankment	Poor

The current Hazard Rating designation for the Pascoag Reservoir Upper Dam (RI #016, Federal #RI00304) is "High", based on the 2005 State of Rhode Island Annual Report to the Governor on the Activities of the Dam Safety Program.

To insure the long term performance of the Pascoag Reservoir Upper Dam and appurtenances, the following recommendations should be implemented under the supervision of a registered engineer:

- **Outlet Works Structure: The outlet works structure sluice gate appeared to operate freely at the time of the inspection. It is our understanding that frequent adjustments are made to maintain the reservoir levels following a specified criteria. However, such criteria do not appear consistent with the requirements set forth by the state in regards to the hydraulic capacity and safety of the dam. The 36-inch diameter outlet pipe should be inspected to determine the competency of the wall thickness and joints.**

A limited view of the trash racks below the wood plank decking revealed that a small amount of debris had collected on the trash racks. The trash racks should be cleaned on a regular basis and records kept of each cleaning and the material removed. The trash racks, inlet and outlet structures should be inspected on a regular basis.

- **Spillway and Raceway: Previous hydrology and hydraulic studies indicate that the spillway and outlet structure are substantially under-sized and insufficient to handle a design storm event. For this reason, limits have been set on the maximum allowable height of the reservoir level since the 1930's. Based on the observed water levels at the time of the site visit, and conversations with the dam operator, these limits are not currently being adhered to.**

The current dam spillway condition differs from the original dam design, in that a portion of the top course of cut stone masonry along the spillway crest has been dislodged and is resting in the raceway. Stone blocks still remain at the east and west training wall. The raceway contains loose stone block that should be removed or placed in such a fashion as to not impede the flow of water through the raceway. In addition, the concrete slab apron immediately upstream of the spillway appears to have broken up and also been dislodged. The hydraulic capacity of the dam would need to be increased by repairing and widening the existing spillway and possibly constructing an additional emergency spillway. Proper analysis and design is necessary to determine the extent of repair and reconstruction.

It is recommended that the observed scour within portions of the raceway downstream of the spillway be repaired with suitable fill and/or stone. The raceway should be cleared of vegetation and obstructions that are not beneficial for erosion protection, from the spillway to the surface of

the waterline at Union Pond, in order to improve hydraulic capacity.

In the interim, it is recommended that the reservoir water levels be maintained at the limits set forth as mandated by state authorities.

- **Embankment: The embankment was constructed with timber sheet pilings and sand/gravel. The timber sheets are presumably decomposed, and the sand/gravel embankment material is considered highly subject to surficial and sub-surficial erosion (piping). The upstream and downstream embankment slopes appear irregular and to have steepened over time from the effects of erosion. Rip rap on the upstream slope has appeared to have settled and collapsed into the reservoir and is not effective in high water conditions. Various points along the embankment crest (vertical alignment) appear to be lower than the remainder of the embankment crest elevation. Seepage was observed to be prevalent throughout the downstream slope, including possibly**

new seepage near the west abutment. The downstream masonry retaining wall located on the left side of raceway appears to be bowing out and is in need of repair.

The earthen embankment on the right side of the raceway is exhibiting signs of erosion and should receive some erosion protection. The wet laid cut stone masonry spillway and training walls of the dam spillway and outlet works are missing mortar/grout and are in need of re-pointing.

At a minimum, immediate improvements should include clearing and grubbing of vegetation, re-shaping the embankment with proper fills and methods, and repairing/replacing of slope armor and the left retaining wall are needed. Re-grading of slopes and crest of the embankment at the east and west ends of the abutments may require work to be completed on the abutting properties. Foot traffic should be limited from the slopes and crest of the dam. Burrowing animals should be eradicated and the observed burrows filled.

Follow-up inspections are warranted at an increased frequency. At a minimum, monthly inspections are recommended until such time there is sufficient data to confirm that the dam conditions are stable, at which time, the inspection frequency may be reduced as appropriate. These inspections should include deflection, water level, and seepage monitoring at key locations. Such monitoring will first require installation of surveyed monitoring points, seepage monitoring devices, and piezometers.

A topographic survey of the earth embankment and appurtenances should be conducted and current drawings developed to assist in analysis, design and repair of the dam. Permanent survey monuments should be installed along the crest of the dam to assist in monitoring the horizontal and vertical movements of the embankment.

A stability analysis with subsurface exploration is recommended to evaluate the overall stability and hydraulic competency of the embankment, identify the cause(s) of apparent embankment vertical misalignment, and present the appropriate scope of repairs or improvements.

Vegetation: All weeds, vines and other miscellaneous vegetation should be removed from the raceway, abutments, crest, and upstream and downstream embankments, as necessary. Remove all small trees, including stumps and roots, and repair with suitable fill as part of the above-mentioned re-grading;

Other Concerns and Liabilities: Equipment access to the dam embankment is currently only possible from the west abutment. Access to the majority of the dam east of the spillway and outlet works will require drawing down the reservoir and constructing temporary ramps, precluding the ability to make emergency repairs.

It appears that the east and west abutments extend beyond the dam property lines. Cooperation from the property owners will be needed to complete the necessary improvements, modifications and maintenance to the dam embankment.

A comprehensive regular maintenance and inspection schedule and an Emergency Action Plan, that will be updated regularly, must be implemented. Inspection of the Pascoag Reservoir Upper Dam should continue as per the State of Rhode Island Dam Safety Regulations.

In addition to the engineering, repairs, and reconstruction, staffing and budgeting for the long-term maintenance of the dam should be considered.

Lowering the reservoir levels as required will impact the homeowners/seasonal tenants.

If the Owner is to consider this dam for future use as flood control for the safety of the downstream residences and businesses, a hydrology and hydraulics analysis is recommended to insure that the dam and its appurtenances are sufficient to function in the appropriate design storm event. This includes an evaluation of the existing 36 inch outlet pipe and its ability to effectively draw down the impoundment for purposes of future maintenance and flood control.

Based on our observations, it appears that the embankment has experienced sufficient erosion and continuing seepage problems to warrant a stability analysis, including an appropriate geotechnical subsurface exploration. Continued future erosion, scour, or other loss of embankment material will reduce the local and global stability of the embankment and spillway section.

In summary, the dam was not designed with sufficient hydraulic capacity. Further, the 140±-year old dam appears to be beyond its effective service life in terms of its intended serviceability at the time of its design. The dam is anticipated to be even further sub-standard in terms of present-day requirements. Considering the high hazard classification, substantial additional inspection, investigation, engineering, repair, and reconstruction are warranted at this time.

A qualified engineer should be consulted during planning of any repairs to the Pascoag Reservoir Upper Dam. Any structural repairs or substantial alterations require notification to, and approval from, RIDEM.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of The Town of Burrillville and their respective assigns and designees. This report is not intended for the use or reliance of other (third) parties, without the express consent of Jacques Whitford and The Town of Burrillville Any use which a third party makes of this report, or any reliance on decisions made based on this report, is the responsibility of such third parties. Further, the findings of this study apply only to the specific site and project described in this report. These findings are inapplicable to other sites. The Limited Safety Inspection Report provides recommendations, and is not intended or suitable for use as a technical specification or to determine quantities.

Information of the conditions presented herein is based on observations made of readily observable features during the course of these services. Portions of the dam embankment, spillway, and outlet works were masked by vegetation, structures, and/or the impoundment. Further, conditions can and do change with time and environmental conditions.

Jacques Whitford should be retained to observe repairs to assess whether the intent of these recommendations is followed, and whether or not other appropriate and/or cost-effective solutions may be warranted based on the actual conditions encountered. Should any conditions at the site at any point during the project be encountered that differ from those summarized in the report, Jacques Whitford should be notified immediately in order to permit reassessment of these conditions and the recommendations contained in the report.