

October 11, 2024

Mr. Kurt Beilharz, PLA, ISA
Assistant Director
Town of Prosper – Parks and Recreation
409 E First Street
Prosper, Texas 75078

RE: Raymond Park Pond Assessment Report
Prosper, TX
WPM PROJECT: C04-24012-00

Dear Mr. Beilharz:

Walter P Moore has completed our assessment of the dam and pond at Raymond Park in Prosper, Texas. This assessment was conducted in accordance with the contract dated September 10, 2024.

Introduction / Executive Summary

Raymond Community Park is a new park under construction at the northwest corner of the Coit Road and East 1st Street in the Town of Prosper, Texas. The Raymond Park Pond is located along the northern edge of the new park with an approximate surface area of 3 acres and volume of 11.5 acre feet. The pond is retained by an earth fill embankment dam that is approximately 20 feet tall and is jointly owned by the Town of Prosper and the Parkside Homeowners Association (HOA) to the north.

A significant portion of the downstream side of the earth fill dam has eroded and washed away which damaged the pond outfall structure. The severity of the scour and observed seepage from the exposed soil caused concern and generated the request for Walter P Moore to perform this assessment.

Walter P. Moore performed the site investigation on September 13th and found the dam to be in generally good condition except for the noted scour damage around the culvert outfall and downstream side of the dam. The following is a summary of our findings:

- The Raymond Park Pond is excluded from Texas Dam Safety Jurisdiction and not registered with the State of Texas.
- The dam is structurally stable and is within acceptable factors of safety for bearing and sliding.
- Observed seepage appeared consistent with expected rates for silty clay soils.
- Seepage and scour damage can change rapidly. Routine monitoring is recommended until the following improvements are implemented
 - Remove all trees and woody vegetation from the earthen embankment as soon as possible.
 - Re-construct the downstream face of dam to reduce seepage rates and improve structural stability.

Three different repair recommendations are provided with construction cost estimates ranging from approximately \$120,000 to \$180,000. This range is for construction cost only and do not include engineering design, testing and other services that may be required to complete the project. Walter P Moore greatly appreciates the opportunity to help the Town of Prosper with this assessment. We are available to answer related questions and provide additional information as required.

Field Observation – Inspection Results

Assessment Approach

Walter P. Moore performed a site condition assessment of the Raymond Park Pond Dam, Outfall and Overflow Structures. The Dam Inspection Form provided by the Texas Commission on Environmental Quality Dam Safety Program (TCEQ) was followed to document existing conditions. The following resources and information provided by the Town of Prosper helped with the assessment as well.

- Bathymetric Survey prepared by DredgeSmart August, 2024
- Parkside Subdivision As-Built Plans by JBI Partners September, 2017
- Flood Study Wilson Creek Tributary 15 by Hydrolink Engineering August, 2016
- Raymond Community Park Geotechnical Investigation by Alliance Geotechnical Group November, 2022

It should be noted the geotechnical investigation was prepared for structural design requirements affiliated with the park improvements under construction and only provided soil types and basic properties found near the pond.

Walter P Moore conducted the site assessment on Friday September 13, 2024. Weather conditions were sunny and favorable throughout the inspection. The water level in the pond was observed to be approximately 2' below normal pool, presumably due to lack of recent rainfall events. The dry conditions helped improve access to the upstream embankment and outflow structures. Site observations were conducted that included field measurements of the crest, outfall structures and scour damage as well as photographs of the same, and seepage evaluation.

Crest of Embankment

Walter P Moore found the embankment crest to be in generally good condition overall. It was well vegetated and measured approximately 20 feet in width. There were no visible signs of settlement or movement along the crest, especially in the area of the scour damage on the downstream embankment. A small depression was located at the northwest end, likely caused by animal activity or tree root disturbance, see Picture 3. Additionally, a large tree was located at the boundary between the spillway and the dam. Please note, trees and woody vegetation on the earth embankments were identified throughout this assessment due to risks associated with their root structures affecting seepage, potentially removing large amounts of mass if blown over and generally making routine inspection and maintenance practices on dams more difficult.



Picture 1: Crest of embankment looking north



Picture 2: Crest of embankment looking south



Picture 3: Depression on northwest side of crest



Picture 4: Large tree between spillway and dam

Exhibit 1: Crest of Embankment

Upstream Embankment

The upstream embankment was well-vegetated and in fair condition overall, with an approximate 3H:1V slope. Bank erosion was observed near the normal pool water surface elevation, presumably from long-term wave action. No signs of embankment settling, or movement were observed, especially near the scour damage on the downstream embankment.



Picture 5. Upstream embankment looking north



Picture 6. Upstream embankment looking south



Picture 7. End of upstream embankment



Picture 8. Pond outfall structures

Exhibit 2: Upstream Embankment

Downstream Embankment

The northern side of the downstream embankment was shared with the pond service spillway and was protected by PVC coated gabion mattress lining the spillway. The embankment along the service spillway was approximately 200 feet in length with an average slope of 4:1. Minor tears in the gabion mattress were observed and are included in the repair recommendations at the end of this report.

The eastern side of the downstream embankment was approximately 100 feet in length, with an approximate average slope of 2:1, and was covered with trees and dense, woody vegetation. Erosion was observed at the toe of the outfall structure along the east side of the downstream embankment. The erosion was severe and caused by stormwater flow from the outfall structure. The outfall was perched midway up the downstream embankment which allowed stormwater flow to free fall into a scour hole filled with concrete and rock rubble riprap. The depth of the scour hole measured up to 3 feet deep, below the top of the riprap in the middle area. Walter P Moore observed seepage coming out of the eroded surface of the embankment beneath the outfall structure where the scour penetrated the farthest into the earth fill embankment.



Picture 9. Vegetation east side of embankment



Picture 10. Gabion spillway north of embankment



Picture 11. Erosion at toe of culvert downstream embankment



Picture 12. View east downstream of embankment

Exhibit 3: Downstream Embankment

Seepage on Downstream Slope

Minor seepage was observed running on the eroded surface on the downstream side of the earth embankment. There was a distinct line of saturation approximately 2'-3' below the box culvert outfall structure, which was about 25% up the total embankment height. The seepage appeared on the surface approximately 4' below the line of saturation and was clear. It did not appear to contain silt or sediment. The seepage also appeared to be coming out uniformly from the lowest and most eroded area of the downstream embankment with no concentrated flow coming from one location more than any other.



Picture 13. Seepage observation



Picture 14. Saturation line 3' below culvert

Exhibit 4: Seepage Observation

Downstream Hazard Conditions

The channel downstream was about 22' wide and was surrounded by large trees and woody brush. The tributary flowed under Coit Road through an 8' diameter culvert that was shown to be over topped by approximately 3' in the 100-year flood study prepared by Hydrolink for the Parkside Subdivision. Downstream from Coit Road, the tributary flowed between homes located on both sides of the channel and then into a SCS reservoir. This reach of the channel was identified as an Unstudied Zone A Special Flood Hazard area (FIRM Panel 235, Map Number 48085C0235J, dated June 2, 2009). Hydraulic modeling of Wilson Creek Tributary 15 was not included in the scope of this assessment. Hydraulic modeling of Wilson Creek Tributary 15 can be performed if requested for additional fee to determine potential dam breach impacts or to better delineate the downstream flood risks associated with the 100 Year Floodplain or other desired storm event.

Service Inlet Structure

The primary service inlet structure was a concrete box inlet with no top. It was connected to a 6'x3' box culvert that drained through the earth embankment. The concrete inlet structure was in fair condition. However, the top of the inlet had rough top edges and rebar protruding from them. There was no grate or cover to help screen or prevent debris from entering the opening and obstructing the pipe.

There were two PVC standpipes just north of the concrete inlet box. One was a 16-inch diameter pipe and the other was a 6-inch diameter pipe with a cap on it. The 16-inch pipe reduced down to a 6-inch PVC pipe approximately 4 feet below ground. The inner 6-inch pipe measured approximately 10 feet deep and was filled with mud and holding water, indicating that it was likely clogged and not draining properly. Based on information provided by Town Staff, the 16" PVC pipe was the original service inlet structure for the pond until the 6'x3' box culvert was constructed by the prior owner, sometime within the last 15 to 20 years based on available aerial imagery.



Picture 15. Concrete inlet structure no top grate



Picture 16. 16" PVC inlet structure

Exhibit 5: Service Inlet Structure

Service Outlet Structure

The 6'x3' box culvert outfall was located approximately one third of the way up the downstream embankment. The downstream embankment beneath the box culvert was completely eroded and scoured out. There was broken concrete riprap remaining on the embankment and lying beneath the outfall in the scour hole.

Walter P Moore found a 6-inch PVC pipe exposed, and unsupported through the middle of the scour hole beneath the 6'x3' box culvert. Walter P Moore could not confirm, but expected this PVC pipe connected to the PVC service inlet structure above in the pond and was visible for approximately 30 feet before it disappeared beneath the concrete riprap. The location of the downstream outfall and end of the 6" PVC pipe was not found and would have required jetting and cleaning to locate and inspect it any further. It was considered inoperable and abandoned for this assessment.



Picture 17. View east downstream from crest



Picture 18. Scour hole at toe of box culvert



Picture 19. Box culvert reinforcement exposed at downstream end



Picture 20. PVC pipe exposed in concrete riprap

Exhibit 6: Service Outlet Structure

Emergency/ Service Spillway

The service spillway was armored with a PVC coated gabion mattress and had a trapezoidal shape, with a depth of 18 inches, a bottom width of 12 feet, and an overall top width of 32 feet. At the upstream end, the gabion was damaged, and rocks were falling out. Walter P Moore also noted locations along the spillway where erosion had occurred along the edges, exposing the filter fabric beneath the riprap. Based on the spillway as-builts and information provided in the bathymetric survey, this service spillway is set at approximately the same elevation as the primary service outlet and was designed to handle the 100-year storm without allowing water to overtop the crest.



Picture 21. Service spillway view looking downstream



Picture 22. PVC gabion mattress damage upstream end of service spillway



Picture 23. Damaged gabion wire on service spillway



Picture 24. Minor erosion along service spillway

Exhibit 7: Emergency/ Service Spillway

Study Results

Soil Composition and Geotechnical Investigation

According to the Natural Resources Conservation Service Collin County Soils Map, the Raymond Park Pond is within the Austin Silty Clay region. A geotechnical investigation report conducted by Alliance Geotechnical Services for The Raymond Community Park in November 2022 identified brown and tan calcareous clay soils over relatively shallow weathered limestone.

Dam Classification

In accordance with the criteria outlined by Texas Administrative Code section 299.1(a), the height and storage capacity of the dam currently do not fall under Texas Dam Safety Jurisdiction. Walter P Moore contacted TCEQ Dam Safety Section and reviewed the list of registered dams to confirm this dam was not registered with Texas Dam Safety Jurisdiction and registration was not required.

Earth Embankment Assessment

The TCEQ Design and Construction Guidelines for Dams indicates that for the small, low-hazard earth embankment dams with upstream and downstream slopes flatter than or equal to 3 Horizontal to 1 Vertical, a stability analysis is not required. The upstream earth embankment of the dam was in good condition with adequate vegetation cover, the average slope was estimated to be 4H:1V or flatter. However, the downstream slope has experienced erosion, resulting in a vertical drop, with the remaining of the slope at approximately 2H:1V.

Walter P Moore assessed dam stability against sliding and bearing capacity using soil properties identified in the November 2022 Geotechnical investigation performed for the park. TCEQ design guidelines recommend a factor of safety of 1.5 against sliding and 3.0 for bearing capacity. Despite the erosion observed on the downstream embankment, the stability against sliding exceeds TCEQ recommendations. The bearing capacity of the foundation versus the overburden stress from dam slightly exceeded the TCEQ recommended factor of safety. Global stability was not included in the scope of this assessment since it would not have been necessitated.

While Walter P Moore considered the dam to be within the recommended design guidelines, additional erosion and scour could lower the factor of safety. Additionally, trees and brush on the downstream embankment contribute to increased risk of seepage and loss of embankment if they are knocked over by severe winds or undermined by erosion and scour. Walter P Moore recommends repairing the downstream embankment and removing all trees and brush as soon as possible to ensure the dam's long-term stability. All recommended repair options discussed later in this report provide a 3H:1V slope on the downstream embankment, consistent with the TCEQ design guidelines.

Once repaired, the embankment should be maintained and inspected on a regular basis. Preventing trees and brush from growing on the embankment will facilitate future dam inspections and maintenance and extend the overall life of the structure.

Seepage Observation

A distinct line of saturation was visible in the eroded downstream embankment and a slow trickle of seepage was observed near the bottom of the scoured section. The seepage did not appear to contain sediment or silt and it surfaced uniformly from the lower section of the eroded area. No seepage appeared heavier in one location than any other. The rate of seepage was observed to be minor and within the acceptable range of hydraulic conductivity parameters associated with silty clay materials. It should be noted that seepage can vary based on numerous factors and can rapidly change in severity. Routine monitoring of the rate of seepage and erosion should be performed until recommended improvements are completed that will reduce seepage rates and improve the overall structural integrity of the dam.

During the site visit on September 13, the water surface elevation of the pond was observed to be around 1.5'-2' below the normal pool level. Subsequent observation by Town's staff on September 30 showed an increase of about 6 to 8 inches because of recent storm events. While this seemed low for the amount of rain recorded in the area, given the number of ponds upstream of this pond and the preceding dry soil conditions, this increase in volume appeared reasonable. Walter P Moore recommends additional monitoring of the pond, especially with higher water levels, to make sure there are not significant water loss or larger seepage concerns that could not be observed during the September 13, 2024 pond assessment.

Overflow Structures

The Flood Study Wilson Creek Tributary 15 by Hydrolink indicated that the spillway constructed with the Parkside neighborhood was capable of handling fully developed 100-year flows without overtopping the dam and conservatively did not include the 6'x3' box culvert outfall capacity through the earth embankment. One of the repair options considered in this report recommended abandoning the 6'x3' box culvert since the service spillway is set at approximately the same elevation and can handle the fully developed 100-yr flood condition. This option was prepared as the least cost option for consideration and is discussed more fully in the recommendation section.

The concrete inlet box was in fair condition and only lacked a better inlet top to help prevent large debris from entering the 6'x3' box culvert through the earth embankment. Keeping the concrete inlet in service provides additional storm conveyance capacity and could be set to help keep low flows from going through the service spillway unnecessarily. Two of the three repair options include adding a new inlet top to this structure and constructing new outfall structures on the downstream embankment, once backfilled and compacted.

The 16" PVC standpipe was the original service inlet structure for the pond until the 6'x3' box culvert was constructed. The PVC standpipe was filled with mud and holding water, indicating that it was likely clogged and not draining properly. Walter P Moore does not think the PVC standpipe serves its purpose anymore and the Town should consider capping and abandoning the pipe.

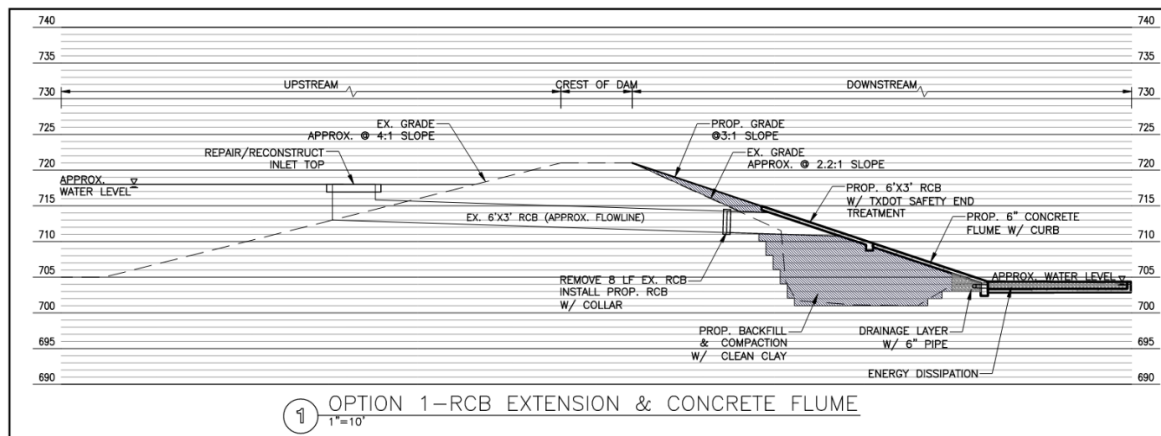
Recommendations

The dam is in overall good condition. However, the long-term stability of the dam is compromised by the significant erosion at the pond outfall structure and significant number of trees and woody vegetation on the downstream embankment. Observed seepage, though minor, was also concerning given how rapidly seepage conditions can change. We recommend all trees and woody vegetation be removed and the earthen embankment backfilled, compacted and regraded to a 3H:1V slope as soon as possible. The pond outfall structure should also be repaired, or potentially removed, to ensure the reconstructed downstream embankment is protected from stormwater leaving the pond. We suggest several options for repairing the downstream embankment, as detailed below. Additionally, it would be beneficial for the Town to implement a routine dam inspection and maintenance plan to help monitor for any sudden changes in conditions and ensure long-term operational integrity.

Downstream Bank Improvement Options

Walter P Moore presents three potential repair options to improve the downstream embankment. Each recommendation includes advantages and disadvantages, along with estimated construction costs.

Option 1: RCB Extension & Concrete Flume



This option will backfill, compact and regrade the downstream embankment to achieve a 3:1 slope. The existing upstream inlet box will be repaired and the 6'x3' box culvert will be extended with a safety end treatment and flow into a concrete flume down to an energy dissipation structure at the base of the dam. A subsurface drain is recommended to help control seepage at the toe of the reconstructed embankment.

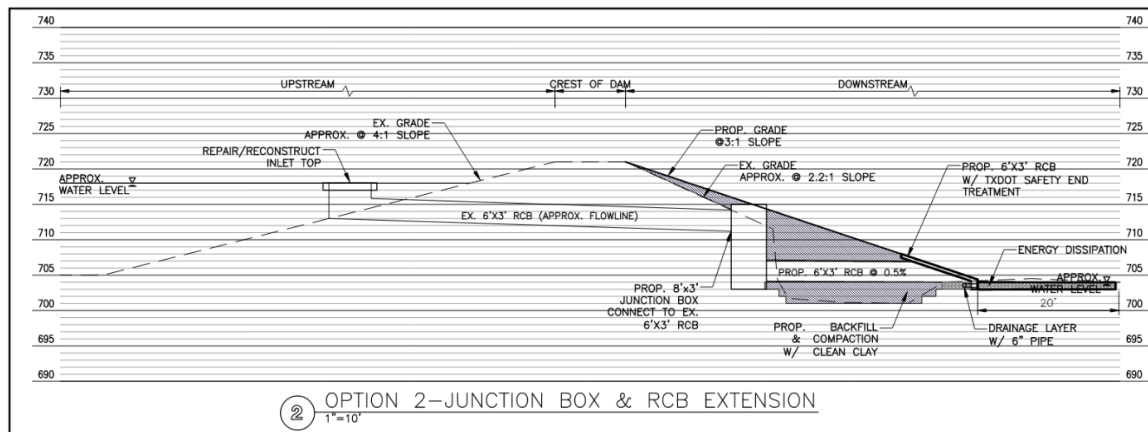
Option 1 benefits include:

- Providing a long-term solution to protect the downstream embankment and channel
- Least cost option keeping the 6'x3' box culvert outfall maintaining conveyance capacity

The cost for Option 1 is approximately \$149,500.00, as detailed below.

Raymond Park Pond Assessment- Option 1					
ITEM	DESCRIPTION	UNIT	Quantity	Unit Price	Total Cost
1	Mobilization	LS	1	\$ 15,000.00	\$ 15,000.00
2	Erosion Control	LS	1	\$ 3,000.00	\$ 3,000.00
3	Clearing and Grubbing	SY	650	\$ 10.00	\$ 6,500.00
4	Hydromulch and Seeding + Temporary Irrigation	SY	650	\$ 10.00	\$ 6,500.00
5	Remove Ex. RCB	LF	8	\$ 250.00	\$ 2,000.00
6	6'x3' Box Culvert	LF	10	\$ 700.00	\$ 7,000.00
7	Collar/ Water Stop	EA	1	\$ 4,000.00	\$ 4,000.00
8	Safety End Treatment for 6'x3'	EA	1	\$ 15,000.00	\$ 15,000.00
9	Repair/ Reconstruct Inlet Top	EA	1	\$ 2,000.00	\$ 2,000.00
10	6" Conc. Flume w/ Curb	CY	10	\$ 700.00	\$ 7,000.00
11	Energy Disipation Structure	CY	10	\$ 650.00	\$ 6,500.00
12	Backfill and Compaction W/ Clean Clay	CY	450	\$ 60.00	\$ 27,000.00
13	Drainage Layer	LF	60	\$ 150.00	\$ 9,000.00
14	Tree Removal	EA	6	\$ 1,500.00	\$ 9,000.00
OPTION 1 CONSTRUCTION COST					\$ 119,500.00
CONSTRUCTION CONTINGENCY					\$ 30,000.00
TOTAL					\$ 149,500.00

Option 2: Junction Box & RCB Extension



This option will backfill, compact and regrade the downstream embankment to achieve a 3:1 slope. Comparing to Option 1, this Option includes a junction box and an additional 6'x3' culvert with a flatter slope to dissipate the energy before exiting the pipe. A more traditional culvert outfall with riprap and less energy dissipation is required with this design. A subsurface drain is recommended to help control seepage at the toe of the reconstructed embankment. The area will then be backfilled with clean clay. The top of the box culvert upstream is suggested to be repaired.

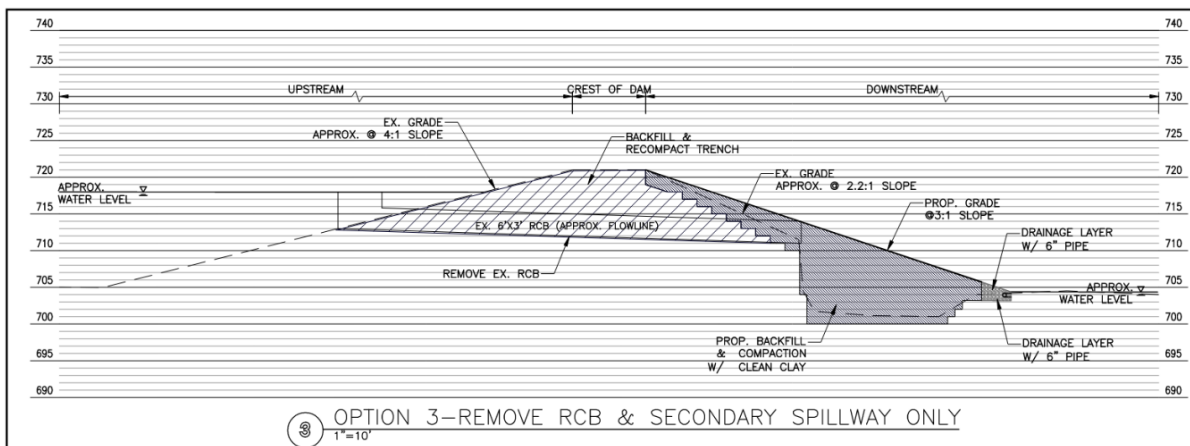
Option 2 benefits include:

- Providing a long-term solution to protect the downstream embankment and channel
- Keeps the 6'x3' box culvert outfall maintaining conveyance capacity
- Energy dissipation is controlled in the junction box allowing a more traditional culvert outfall at the base of the dam.

The cost for Option 2 is approximately \$172,500.00, as detailed below.

Raymond Park Pond Assessment- Option 2					
ITEM	DESCRIPTION	UNIT	Quantity	Unit Price	Total Cost
1	Mobilization	LS	1	\$ 15,000.00	\$ 15,000.00
2	Erosion Control	LS	1	\$ 3,000.00	\$ 3,000.00
3	Clearing and Grubbing	SY	650	\$ 10.00	\$ 6,500.00
4	Hydromulch and Seeding + Temporary Irrigation	SY	650	\$ 10.00	\$ 6,500.00
5	Connect RCB to Junction Box	EA	2	\$ 1,000.00	\$ 2,000.00
6	6'x3' Box Culvert	LF	30	\$ 700.00	\$ 21,000.00
7	Safety End Treatment for 6'x3'	EA	1	\$ 15,000.00	\$ 15,000.00
8	Repair/ Reconstruct Inlet Top	EA	1	\$ 2,000.00	\$ 2,000.00
9	Junction Box	CY	1	\$ 20,000.00	\$ 20,000.00
10	Energy Disipation Structure	CY	10	\$ 650.00	\$ 6,500.00
11	Backfill and Compaction W/ Clean Clay	CY	450	\$ 60.00	\$ 27,000.00
12	Drainage Layer	LF	60	\$ 150.00	\$ 9,000.00
13	Tree Removal	EA	6	\$ 1,500.00	\$ 9,000.00
OPTION 2 CONSTRUCTION COST					\$ 142,500.00
CONSTRUCTION CONTINGENCY					\$ 30,000.00
TOTAL					\$ 172,500.00

Option 3: Remove RCB & Second Spillway Only



This option provides the lowest total cost by removing the entire existing 6'x3' culvert and outfall structure through the earth embankment. This would direct all emergency overflow through the service spillway to the north. The downstream slope will be backfilled, compacted and regraded to achieve a 3:1 slope.

Option 3 benefits include:

- Providing a long-term solution to protect the downstream embankment and channel
- Lowest estimated cost
- Pond outflows would no longer outfall on the downstream embankment

Option 3 however, reduces total conveyance capacity above the 100 year floodplain. Additionally all flows, including the day-to-day low flows, would pass through the emergency/service spillway. The flood study showed the spillway can handle the 100-year flood, however the potential for day-to-day low flows to saturate the gabion lined service spillway may lead to further erosion at the edges or underneath the gabion mattress.

The cost for Option 3 is approximately \$124,000.00 as detailed below.

Raymond Park Pond Assessment- Option 3					
ITEM	DESCRIPTION	UNIT	Quantity	Unit Price	Total Cost
1	Mobilization	LS	1	\$ 15,000.00	\$ 15,000.00
2	Erosion Control	LS	1	\$ 3,000.00	\$ 3,000.00
3	Clearing and Grubbing	SY	650	\$ 10.00	\$ 6,500.00
4	Hydromulch and Seeding + Temporary Irrigation	SY	650	\$ 10.00	\$ 6,500.00
5	Remove Ex. RCB	LF	60	\$ 250.00	\$ 15,000.00
6	Backfill and Compaction W/ Clean Clay	CY	450	\$ 60.00	\$ 27,000.00
7	Drainage Layer	LF	60	\$ 150.00	\$ 9,000.00
8	Trench for RCB Removal	LF	60	\$ 50.00	\$ 3,000.00
9	Tree Removal	EA	6	\$ 1,500.00	\$ 9,000.00
OPTION 2 CONSTRUCTION COST					\$ 94,000.00
CONSTRUCTION CONTINGENCY					\$ 30,000.00
TOTAL					\$ 124,000.00

Conclusion

In summary, Walter P Moore confirmed the Raymond Park Pond earth embankment to be in a stable condition with a low margin of factor of safety above the minimum recommended factor of safety. Walter P Moore recommends making repairs to the structure as soon as possible given the potential for erosion and seepage conditions to change rapidly and further reduce the factor of safety. All three repair options provided in this assessment are good options for consideration. Option 2 provides the best long-term condition by containing the energy dissipation within the enclosed junction box and culvert structure and it maintains the same outflow conveyance capacity. With cost always being a significant factor, Option 3 provides the least cost approach but could lead to additional service spillway maintenance needs in the future. It should be noted, the above cost estimates are for construction cost only and do not include engineering design, testing and other services that may be required to complete the project. Given the relatively small total construction cost and the potential need for additional geotechnical and flood plain modeling services, professional design expenses will be higher than a customary percentage of construction cost and should be considered when developing a total project cost for these repairs. We are happy to have further discussions with the Town to explain the options and address any questions or comments regarding this assessment and recommendations.

Sincerely,

Walter P. Moore and Associates, Inc.

James C Dulac

James Dulac, P.E.
Senior Engineer

INTERIM REVIEW ONLY

Document Incomplete: Not intended for permit or construction.

Engineer: JAMES C. DULAC, P.E.

P.E. Serial No.: 87691

Date: 10/04/2024

Walter P. Moore and Associates, Inc.
TBPELS Firm Registration No. 1856