EXECUTIVE SUMMARY
LAKE HATTIE OUTLET WORKS
LEVEL II STUDY

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EXECUTIVE SUMMARY

Lake Hattie is located 15 miles west of Laramie and serves as an irrigation water storage reservoir. Throughout its history Lake Hattie has experienced significant sediment deposition in its southeastern corner. Unfortunately the outlet structure is located in this corner of the lake and has experienced continual operational problems due to this sediment. Over the years many efforts have been made to remove sediment from around the outlet structure and improve the dam’s operation. In 1990 Lake Hattie’s outlet pipes were cleaned and a new intake structure was built which included slide gates mounted on the face of the dam. Since that time no significant improvements have been made to the slide gates or outlet pipes. In the past 13 years sediment has continued to be deposited on and around the control gates as well as in the downstream canal. Periodically members of the Pioneer Canal-Lake Hattie Irrigation District (PCLHID) have removed some of sediment in attempts to open the slide gates. However, the efforts of the PCLHID members have not kept up with the rate of the incessant sediment deposition. As a result the outlet pipes and downstream canal have become blocked with sediment and the slide gates on the face of the dam are currently buried and inoperable.

In order to find a more permanent solution to keep the dam operational the PCLHID in cooperation with the Wyoming Water Development Commission (WWDC) commissioned this Level II Study with the stated purpose to “evaluate the feasibility of revising the operations and rehabilitating the outlet works of Lake Hattie Reservoir.” This work has been completed by a design team headed by WWC Engineering and the complete study findings are published in the Final Report: Lake Hattie Outlet Works, Level II Study.

As part of this study the sources of the sediment were analyzed along with the methods of sediment movement. Erosion along the southern shoreline cause by wind and wave action was identified as one of the major contributing sediment sources. It was concluded that the sediment sources were too wide spread to economically be stabilized. Rather WWC’s recommends that any rehabilitation efforts be focused on improving the area immediately surrounding the outlet.

Through the course of this study two design objectives were identified: 1) reduce the sediment deposition in the immediate vicinity of the outlet structure, and 2) modify the control gates to allow for their continued operation even in the presence of moderate sediment buildup. It is important to note that there is no known design alternative which will completely prevent
future sediment deposition. Slowing the buildup of sediment around the outlet structure will reduce the amount of annual maintenance required but alone it will not provide a complete solution. Modifying the control gates is also not a complete solution. Sediment will still need to be removed from the new gates in order to prevent the outlet pipe and downstream canal from again becoming blocked with sediment.

Even though neither is an independent solution, a combination of these designs may greatly reduce the dam’s current maintenance requirements. Less sediment deposition will require less costly cleanings and modified gates will ensure the dam remains operational between cleanings. In order to meet both of these objectives WWC recommends: 1) a diversion wall be constructed to slow the arrival of sediment at the outlet structure, 2) a sand pump be purchased and used for regular sediment removal, and 3) an intake “silo” structure with vertical gates be installed over two of the existing outlet pipes. (Cost estimates of each of these design alternatives are attached.)

The diversion wall should be constructed parallel to the face of the dam and extend from the southern shoreline a few hundred feet to the north. This diversion wall will have an intake sill connecting the north end of the wall to the face of the dam. This arrangement will prevent direct sediment deposition on the outlet structure and force water to be withdrawn from an area to the north where there is currently less sediment. This should greatly reduce the amount of sediment arriving at the outlet structure.

A sand pump should be purchased and used to regularly remove sediment that does build up around the control gates and transport it to a designated disposal site. This disposal site must be located so that the sediment will not be blown or washed back into the lake.

An intake “silo” structure with multiple vertical gates should be constructed directly over two of the existing slide gates in order to make the control gates operable even in moderate sedimentation conditions.
Through proper operation of the multiple gates water could be withdrawn from higher in the lake where there is less suspended sediment. This will reduce the deposition in the outlet pipes and the downstream canal.

WWC recommends that all three of these design alternatives be constructed as soon as possible. However, this may not be economically feasible. If this is the case, the PCLHID in cooperation with the WWDC must prioritize the design objectives recognizing the tradeoffs with each alternative. Regardless of the design alternative selected, a program of regularly removing sediment from around the outlet structure must be identified and initiated in order for the dam to continue functioning properly.

The current water level in Lake Hattie is very low (considerably below the control gates). This low water level provides a perfect opportunity for making the necessary improvements. At a bare minimum the existing control gates and outlet pipes should be cleaned and repaired prior to the diversion of any active storage volume to Lake Hattie.
Design Alternative: Diversion Wall

- This cost estimate assumes the diversion wall will be constructed of cast-in-place concrete. The final selection of building materials will be made based on constructability, durability, and long term costs.
- Since the soil bearing pressure of the lake bottom is unknown, a typical cantilevered retaining wall cross-section is assumed. This is probably a conservative assumption since the water levels should remain equal on both sides of the wall resulting in very little lateral pressure for the wall to resist.

*2002 RS Means Heavy Construction Cost Data, 16th Annual Edition* provides the following cost estimate:
Reinforced concrete cantilever, incl. excavation, backfill, & reinf.
6’ high, 33º slope embankment $183 / L.F.

Because of Lake Hattie’s remote location and the limited quantity of concrete needed this estimate assumes a cost of $250 / L.F. of retaining wall.

Construction Cost of Cast-In-Place Retaining Wall =

$250 / L.F. X 200 L.F. = $50,000

Additional Costs per WWDC Formula:

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<tr>
<th>Cost Category</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Construction Cost</td>
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<td>+ Final Design</td>
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<tr>
<td>Total Project Costs</td>
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**TOTAL PROJECT COSTS = $96,000**

- WWDC will participate in 50% of this total project cost thereby reducing PCLHID’s portion to **$48,000**.
- If PCLHID’s portion is financed for 30 years at 6% interest and distributed to all 10,400 Type A & Type N shares, the annual increase per share will be **$0.34**
Alternative: Sand Pump

- This cost estimate must include the cost of the equipment plus the operational costs for the next 30 years.
- The operation costs assume a continued steady sediment deposition rate of 500 cubic yards per year.

**Equipment & Operation Costs:**
1. Purchase a small floating sand pump = $8,000
2. Purchase a small boat for operators = $1,000
3. Fuel costs
   50 gal/year X $2.50 /gal X 30 year = $4,000
4. Wages for 2 operators
   $250 /day X 2 days/year X 30 years = $15,000
5. Offsite storage of sand pump & boat
   $1,000 /year X 30 years = $30,000
6. Initial cleaning and repairs to existing control gates and outlet pipes = $30,000

   **Equipment & Operation Costs =** $88,000

**Additional Costs per WWDC Formula:**

- Final Design = $2,000
- Permitting & Mitigation = $1,000
- Legal Fees = $1,000
- ROW & Easements = $10,000 (waste site)

   **Subtotal** = $14,000

   + Construction Engineering = $0
   $88,000

   + Contingencies (15%) = $13,000
   $101,000

   + Subtotal = $14,000
   **Total Project Costs =** $115,000

- WWDC will **NOT** participate in any of this total project cost since it is considered maintenance. WWDC also does NOT finance maintenance so the PCLHID will have to locate another loan source.
- If PCLHID’s portion is financed for 30 years at 6% interest and distributed to all 10,400 Type A & Type N shares, the annual increase per share will be **$0.80**
**Alternative: Intake “Silo” Structure**

- A pre-cast concrete rectangular “silo” is assumed to reduce the cost of onsite forming and reinforcing. However, the contractor may elect to form and cast the structure in place.
- All four (4) of the existing slide gates should be repaired even though the intake “silo” will only cover two (2) of the gates.

**Construction Costs:**

1. Clean & Repair all four existing slide gates and clean outlet pipes = $30,000
2. Pre-cast concrete rectangular “silo” delivered to site = $20,000
3. Modifications to existing concrete outlet structure + installation of “silo” = $30,000
4. 36” Canal Gates delivered $2,000 each × 6 canal gates = $12,000
5. Installation of Canal Gates = $2,000

**Construction Cost** = **$94,000**

**Additional Costs per WWDC Formula:**

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<th>Item</th>
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**TOTAL PROJECT COSTS = $163,000**

- WWDC will participate in 50% of this total project cost thereby reducing PCLHID’s portion to $81,500.
- If PCLHID’s portion is financed for 30 years at 6% interest and distributed to all 10,400 Type A & Type N shares, the annual increase per share will be $0.57