Executive Summary Report

UPPER HANOVER REHABILITATION PROJECT
LEVEL II

Wyoming Water Development Commission

NELSON ENGINEERING
P.O. Box 1599        Jackson, Wyoming

November 1990
SECTION I
EXECUTIVE SUMMARY

1. INTRODUCTION

The Upper Hanover Irrigation District operates its canal in Washakie County, near Worland, Wyoming. The Upper Hanover Canal is approximately 35 miles long from its point of diversion near Winchester to its northerly end near the Washakie-Big Horn County line. It diverts from the Big Horn River, which is controlled by Boysen Reservoir.

Upper Hanover Canal serves as carrier for three other irrigation districts, Bluff, Upper Bluff and Highland Hanover. To accommodate these districts, the upper 13.5 miles of Upper Hanover Canal were redesigned and reconstructed about 1956. The Upper Hanover Canal serves 24,600 acres of irrigated land as follows:

- Upper Hanover Canal: 13,135 Acres
- Bluff Canal (carrier): 3,490 Acres
- Upper Bluff Canal (carrier): 1,430 Acres
- Highland Hanover Canal (carrier): 6,545 Acres

Water supply is adequate for the growing season and the District has the opportunity to purchase stored water from Boysen Reservoir. Maximum diversion has been 574 cfs through the 1987 water year.

This report was authorized in June 1990 by Wyoming Water Development Commission and Upper Hanover Irrigation District. The study objective is to identify repairs and rehabilitation of the canal and its structures. Other studies utilized include:

- "WaSage Creek Watershed, Worland, Wyoming, Preliminary Report, March 1985"
- "Wyoming Cooperative Irrigation Water Conservation Study, Upper Hanover Canal Report, Washakie County, Wyoming, April 1985"
- "Northern Washakie County Flood Control Study Level I, November 1988"
2. DESIGN CRITERIA AND DESIGN CONSIDERATIONS

Criteria has been established so that a degree of capacity, quality or functional capability expected of each segment of canal or canal structure is stated. By equating existing features and designing new features to these criteria, the entire system is upgraded to a determined standard.

Conveyance features, which carry the flow of the canal, are sized to carry design flow plus 20 percent extra flow while maintaining the desired freeboard. Protective structures, such as crossing culverts, underpass or overpass for drainage, are sized to carry a flood flow of hydrologically-predicted quantity either over or under the canal. As the canal becomes smaller and potential damage from loss becomes less, the flood flow intensity is reduced.

Criteria has also been written to reflect anticipated loading, (live load, materials of construction loads and impact loads) for all structures, and the anticipated quality of materials to be utilized in the work.

3. SPECIAL PROBLEMS

3.1 Flood Protection

Three special flood prone areas were investigated and alternative plans prepared to protect the canal from excessive inflow or washout. These areas are:

A. From the drainage at about Station 530+00 (above the Dye Wasteway) to Station 670+00, Nowater Wasteway. The wasteway at 540+00 cannot pass flood flow, enlargement of the wasteway is not feasible, therefore, flood routing or an additional wasteway is required.

B. From the Sand Knoll drainage, about Station 914+06 to the Sage Creek crossing about Station 994+67. The entire area needs community-wide planning for flood control and routing.

C. From the third drainage preceding Durkee Draw wasteway, about Station 1480+00 to the new proposed wasteway at 1684+95. The entire reach needs study to correctly waste and route flood flows to protect the canal and adjoining lands.
Alternative solutions to these three problem areas were developed and the two best alternative solutions presented. The best solution for 'A' is an additional wasteway, the best for 'B' is a new underpass at Sand Knoll drainage crossing coupled with flood control and a new structure at Sage Creek; and, the best solution for 'C' is a new wasteway and waste channel improvements at Durkee Draw. The Construction Cost Summary reflects utilization of these alternatives.

3.2 Surge Protection
When Highland Hanover Pump Station No. 2 shuts down, a surge of up to 120 cfs is sent down the Upper Hanover Canal. The wasteway designated to protect from this situation has an estimated capacity of 55 cfs and is, therefore, undersized. A new wasteway is recommended. The extent of participation in the cost of this wasteway is subject of negotiation between Upper Hanover District and Highland Hanover District.

4. CONCEPTUAL DESIGN

4.1 Items Included
At the end of the Phase I portion of this study, the items to be included were narrowed to twenty-five. They were renumbered and listed as follows:

1) COTTONWOOD CREEK WASTEWAY, STATION 84+96
   Proposed Work - Clean and epoxy patch areas of spalled concrete.

2) BIG HORN RIVER FLUME, STATION 158+11
   Proposed Work - Clean, sandblast and paint the superstructure truss. Clean, repair and patch the flume lining. Replace any weak or defective carrier bars for the flume section. Clean and paint the flume section. Replace any broken or weak members of the wooden bridge deck.

3) UNDERPASS FROM SCHEUERMANN, STATION 195+00
   Proposed Work - We recommend removal of the existing deteriorated pipe underpass and fill and regrade the upland side of the canal.

4) LOW CANAL BANK, STATION 264+30
   Proposed Work - Import fill to bring canal bank up 1 1/2 to 2 feet for approximately 200 lineal feet.
5) TIE DOWN CREEK FLUME, STATION 291+57

Proposed Work - We recommend clean and repair the concrete structure, especially the flume section; clean, straighten and riprap the channel of Tie Down Creek a minimum of 200 feet above and below the structure and construct riprap drop structure.

6) LOW CANAL BANK, STATION 292+00

Proposed Work - Import fill to bring the canal bank up 1 1/2 to 2 feet for approximately 2600 lineal feet.

7) WASTEWAY, STATION 342+28

Proposed Work - Check and repair all concrete surfaces, enlarge drop walls, rebuild drop wing walls, riprap the drop pool and shape discharge channel.

8) NEIBER DRAW FLUME, STATION 432+31

Proposed Work - We recommend clean and repair the concrete structure, especially the flume section; clean, straighten and riprap the channel of Neiber Draw a minimum of 200 feet above and below the structure and construct riprap drop structure.

9) DYE WASTEWAY, STATION 540+00

Proposed Work - As stated in Special Problems Area A.

10) UNDERPASS, STATION 584+10

Proposed Work - Build an underpass. This is not necessary if Item 9 above is constructed.

11) LOW CANAL BANK, STATION 616+00

Proposed Work - Import fill material to build up canal bank for approximately 1,000 LF.

12) NOWATER WASTEWAY, STATION 670+00

Proposed Work - Build a new wasteway of adequate capacity to protect Nowater Creek Siphon.

13) SIPHON WASTEWAY, STATION 721+12

Proposed Work - Build a new side spill wasteway with a piped drop to a stabilized channel at the level of Nowater Creek. The wasteway discharge channel will require riprap protection, and regrading and contouring to correct the erosion problems. Wasteway capacity should be designed for the surge resulting from loss of pumping capacity for Highland Hanover Unit No. 2, Auxiliary Pumps No. 5 and 6 and Coutis Lateral Pumps, or about 120 cfs.
14) CANAL REALIGNMENT AND LINING, STATION APPROX. 721+20 to 829+00

Proposed Work - Realign 1900 LF of canal form the siphon wasteway to relieve a section of sharp curvature. This work would also include lining the realigned canal reach to control seepage, and realign 1200 LF of canal from the sharp curve crossed by the Gyce Bridge. The work would also involve relocating and reconstructing the bridge and a bentonite lining to control seepage.

15) CHECK AND HIGH TURNOUTS, STATION 853+82

Proposed Work - No work is proposed.

16) SAND KNOLL DRAW UNDERPASS, STATION 914+06

Proposed Work - We recommend removal of the existing underpass pipe and construct a new concrete box underpass. The underpass should be designed to convey the Sand Knoll flood flows and provide 2-foot minimum cover at the bottom of the canal. This item has been included in the base package of this study.

17) SAGE CREEK UNDERPASS, STATION 994+67

Proposed Work - We recommend removal of the existing box culvert and construct a new enlarged concrete box underpass designed to convey the Sage Creek flood flows. The inlet channel would require cleaning and shaping. This item has been included in the base package of this study.

18) SLICK CREEK FLUME, STATION 1118+17

Proposed Work - Provide a well-graded concrete lined section for 2,000 feet from the flume outlet toward the Tensleep highway. This section should also include a ramp flume flow measuring device to provide added maintenance control of the canal.

19) GORST UNDERPASS, STATION 1257+73

Proposed Work - Replace the underpass.

20) ASSAY UNDERPASS, STATION 1389+80

Proposed Work - Replace this underpass.

21) CHECK STRUCTURE, STATION 1403+00

Proposed Work - Build a new check structure.

22) HERROD UNDERPASS, STATION 1447+92

Proposed Work - Build a new underpass.
23) DURKEE DRAW WASTEWAY, STATION 1516+52

Proposed Work - Build a new side spill wasteway to a pipe drop. Extend the pipe drop approximately 1,000 LF down the wasteway channel and rehabilitate the channel. Build two new drop structures in wasteway channel between the end of new pipe and where the channel becomes flatter.

24) SCHEUERMAN PIPELINE, STATION 1516+62

Proposed Work - Replace the pipeline with 36-inch diameter concrete pipe.

25) NEW WASTEWAY, STATION 1684+95

Proposed Work - Provide a new side spill wasteway structure. Provide new piped or lined wasteway channel to Lower Hanover. Provide grading to preclude flooding.

4.2 Drawings and Outline Specifications

Conceptual design drawings were prepared in sufficient detail to facilitate the desired accuracy of estimating probable construction cost. An outline of the sections of specifications and the support documents necessary to bid the project was prepared. These drawings and outline specifications present the project as a completed conceptual design.

5. COST ESTIMATES/FINANCIAL ANALYSIS

5.1 Opinion of Probable Cost

**UPPER HANOVER IRRIGATION DISTRICT**

**PROJECT COST SUMMARY**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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<tr>
<td>Prepare Final Design and Specifications</td>
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<tr>
<td>Permitting and Mitigation</td>
<td>8,500.00</td>
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<tr>
<td>Legal Fees</td>
<td>2,000.00</td>
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<tr>
<td>Access and Right-of-Way</td>
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Construction Cost 1,132,500.00
Construction Engineering 113,250.00
Subtotal 1,245,750.00
Contingencies 186,860.00

PROJECT CONSTRUCTION COST TOTAL $1,432,610.00
TOTAL PROJECT COST $1,514,110.00

5.2 Loan Repayment Participation
As a carrier for Upper Bluff, Bluff and Highland Hanover Canals, the Upper Hanover Irrigation District has a "Loan Repayment Participation Agreement" with those canal districts. Assessments for those districts plus Upper Hanover is on the following percentages:

From the Point of Diversion to Bluff Canal Diversion and for repayment of the diversion dam and headgate loan--

Upper Hanover 58.6%
Highland Hanover 22.5%
Bluff 13.2%
Upper Bluff 5.7%

100.0%

From Bluff Canal Diversion to below Highland Hanover No. 2 Diversion (actually the Siphon Wasteway, Sta. 721+12), the assessment percentages are as follows--

Upper Hanover 66%
Highland Hanover 34%

and are for repayment of the Nowater Siphon construction loan. The following two pages present a reorganization of project cost to reflect proportionate share to be borne by each District and a resulting assessment increase for each District.
<table>
<thead>
<tr>
<th>Project Name</th>
<th>Total Project</th>
<th>Big Horn River Bluff Canal to Highland</th>
<th>Below Highland</th>
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### Upper Hanover Rehabilitation Project

**Project Cost Responsibility Summary**

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<tr>
<th></th>
<th>Total Acreage Served</th>
<th>Upper Hanover</th>
<th>Highland Hanover</th>
<th>Bluff</th>
<th>Upper Bluff</th>
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<tr>
<td><strong>Total Project Cost</strong></td>
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<td>50% WWCD Loan</td>
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<td>Loan Repayment Factor Based on 4% Interest for 35 Years</td>
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<td>0.05358</td>
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#### Yearly Payment:

- **Yearly Payment**: $40,563.01  
- LESS: Maintenance Savings: $5,000.00

**Approximate Balance**:

- Upper Hanover: $35,563.01
- Highland Hanover: $30,536.91
- Bluff: $5,005.26
- Upper Bluff: $14.55

**Yearly Payment Per Assessed Acre**:

- Upper Hanover: $2.32
- Highland Hanover: $0.76
- Bluff: $0.00
- Upper Bluff: $0.00

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<th>4,693.74</th>
<th>2,750.53</th>
<th>1,056.09</th>
<th>619.57</th>
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<tbody>
<tr>
<td>Big Horn River to Bluff Canal</td>
<td>(100.00%)</td>
<td>(58.60%)</td>
<td>(22.50%)</td>
<td>(13.20%)</td>
<td>(5.70%)</td>
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<th>623,661.91</th>
<th>411,616.86</th>
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<td>Bluff Canal to Highland Hanover</td>
<td>(100.00%)</td>
<td>(66.00%)</td>
<td>(24.00%)</td>
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<th>925,754.35</th>
<th>885,754.35</th>
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<tbody>
<tr>
<td>Below Highland Hanover</td>
<td>(100.00%)</td>
<td>(100.00%)</td>
</tr>
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<table>
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<tr>
<th></th>
<th>757,055.00</th>
<th>650,060.37</th>
<th>106,550.57</th>
<th>309.79</th>
<th>133.77</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Bluff</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

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**Upper Bluff**

- 1430 acres

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**Upper Highland Hanover**

- 6545 acres

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**Bluff**

- 3490 acres

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**Hanover**

- 13126 acres

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**Total Acreage Served**: 24601 acres

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**Loan Repayment Factor Based on 4% Interest for 35 Years**: 0.05358  

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**Yearly Payment Per Assessed Acre**:

- Upper Hanover: $2.32
- Highland Hanover: $0.76
- Bluff: $0.00
- Upper Bluff: $0.00
6. **PERMITS**

A listing of permits and permissions was prepared. Permits, such as Corps of Engineers 404 and State Engineers permit should be applied for as necessary at the end of Phase I of Level III. Permissions, such as easements and rights-of-way should be secured prior to construction. An investigation of historic and cultural resources must be made and the project signed off by the State Historic Preservation Office prior to excavation on public land.

7. **RECOMMENDATIONS**

Upper Hanover Irrigation District has provided the initiative and leadership in sponsoring this Level II study. There are, however, three other irrigation districts that will be affected by work proposed herein. A vital first step is for Upper Hanover District to gain concurrence on the items to be built and payment to be shared with the other districts.

Nelson Engineering believes that the canal rehabilitated as presented in this report would be beneficial to the Upper Hanover Canal, but not all items presented herein are of equal benefit and desirability; therefore, further prioritization of these plans should be undertaken during subsequent levels of planning.