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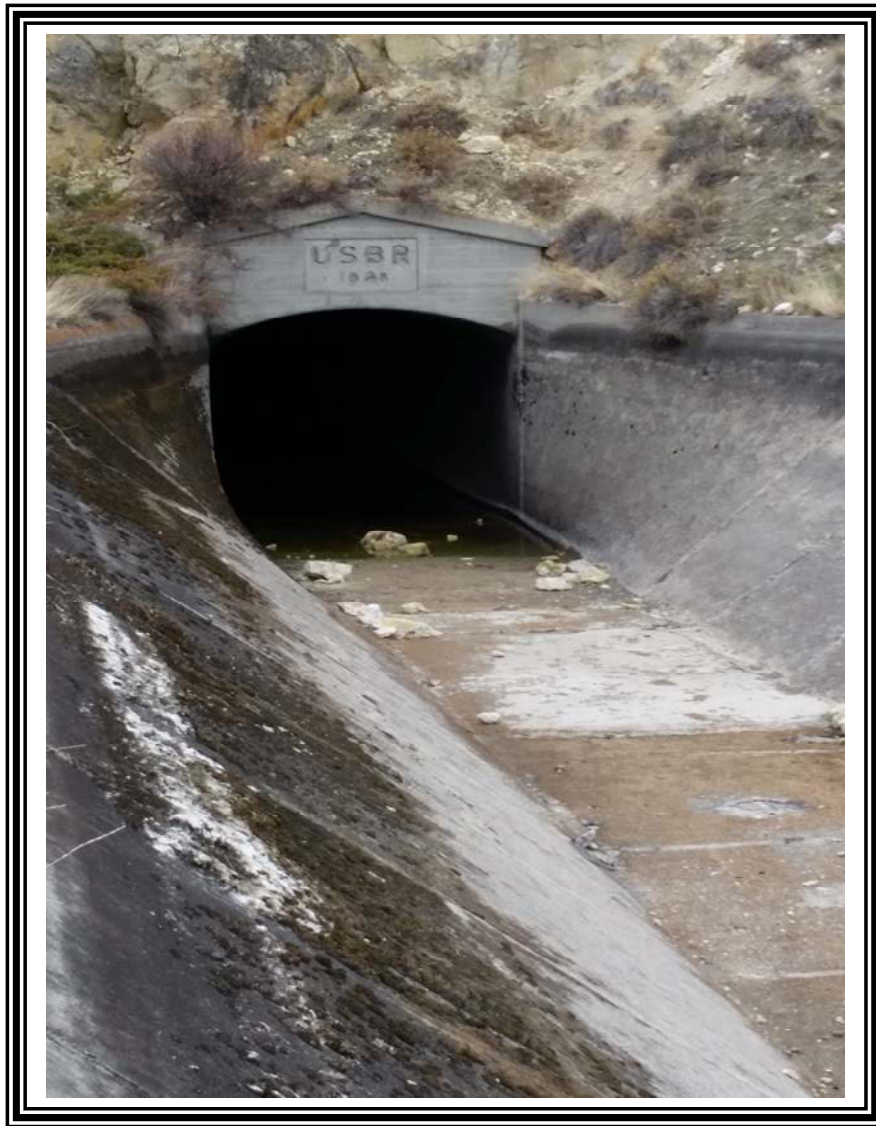
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Funding for WRDS and the creation of this electronic document was provided by the Wyoming Water Development Commission
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HEART MOUNTAIN CANAL REHABILITATION LEVEL II STUDY

JULY 2016

EXECUTIVE SUMMARY



Prepared for
WYOMING WATER DEVELOPMENT COMMISSION

Prepared by
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HEART MOUNTAIN CANAL REHABILITATION LEVEL II STUDY

EXECUTIVE SUMMARY

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JOB NUMBER: 15108.00

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A. PURPOSE

Wyoming Water Development Commission (WWDC) contracted with Engineering Associates (EA) in June 2015 to complete a study for Heart Mountain Irrigation District for the Canal Liner directly downstream of the Rattlesnake Mountain Tunnel.

The scope of the study included:

1. Review of existing information.
2. Evaluation of the canal liner including visual inspection, ground penetrating radar (GPR), and non-destructive investigations.
3. Using hydraulic analyses to look at cross section design, slope, velocities, and water depths to verify the design capacity of the canal and look at options to use a closed-conduit system.
4. Develop multiple rehabilitation options.
5. Create conceptual designs and construction cost estimates for improvement options to the canal liner.
6. Investigate different project financing options for canal rehabilitation.



Figure 1

B. FINDINGS

EA evaluated the full length of the concrete liner visually, with ground penetrating radar, and non-destructive testing. The findings are:

- Visual Inspection

The concrete lined section of the HMID canal was visually inspected in dry condition from November, 2015 to March, 2016 and during the irrigation season from July, 2015 to September, 2015. During the dry inspection, large cracks, exposed rebar, and deteriorating concrete were located at numerous locations. 95 concrete panels on the west side of the liner and 87 concrete panels on the east side of the liner have extensive cracking.



Figure 2

- Ground Penetrating Radar

Jorgensen Geotechnical conducted a site investigation along the concrete liner section of the Heart Mountain Canal. The site investigation consisted of two separate site visits. The first site visit occurred on November 10th and 11th, 2015 and the second site investigation was completed on January 5th, 2016. The site investigation included visual observations of the surrounding ground conditions and a Ground Penetrating Radar (GPR) survey of the concrete lined canal section.

When using the GPR, any anomaly found was marked in the field with spray paint and then surveyed and recorded with GPS. During this mapping with the GPR, the bedding planes of the bedrock were visible in multiple locations. See the report found in Appendix A of the Final Report for the complete information on the GPR investigation.

A total of nine possible void areas were identified by correlation with other investigation efforts. Other anomalies that were not identified as possible void areas could be the result of large boulders, small voids, reflection of rebar, change in material composition, or change in material moisture content.



Figure 3

- Non-destructive Investigation

After using the ground penetrating radar method, EA decided to use another non-destructive exploration approach to evaluate the current physical conditions of the canal liner. This method used a 4-pound sledge hammer and a chain to conduct sounding tests. Sounding involves striking the concrete surface and interpreting the sound produced. Solid concrete will produce a ringing sound, while concrete that is delaminated, spalled, or has separation from the base material will produce a flat or hollow sound. Subgrade voids will also produce a flat or hollow sound. Sounding of vertical areas is best achieved by using a hammer or steel rod. A steel chain was drugged over the floor of the canal. Results from the hammer and chain tests located twenty-nine sections of the wall and floor of the liner with suspected hollow areas.



Figure 4

C. RECOMMENDATIONS

With the amount of cracking, poor subgrade, and overall age of the existing liner, another major failure is definitely likely. It is the recommendation of this study that the existing liner should be completely removed and replaced. Trying to “Band-Aid” the existing liner will only postpone the inevitable replacement.

If the total construction cost of this project is a concern due to funding availability, Option 3 (concrete liner replacement) should be utilized. The total costs for construction, design engineering, permitting and mitigation, legal fees, and construction engineering is \$2,001,874.38. A breakdown of the costs is listed below:

OPTION 3

HMID Canal Reconstruction - Full Liner Replacement

Probable Cost of Project Components:	Qty	Unit	Cost
Mobilization	1	LS	\$ 80,000.00
Contract Bond	1	LS	\$ 127,100.00
Remove 1862 FT Existing Channel	1	LS	\$ 120,000.00
Fill material - road base with cement mix	4000	CY	\$ 140,000.00
Canal Lining - 4,000 PSI	1862	LF	<u>\$ 931,000.00</u>
 Total Cost of Project Components			 \$ 1,398,100.00
 Probable Consultant Fees:			
Preparation of Final Design and Specifications (10%)			<u>\$ 176,859.65</u>
Permitting and Mitigation (0%)			<u>\$ -</u>
Legal Fees (0%)			<u>\$ -</u>
Acquisition of Access and Rights of Way (0%)			<u>\$ -</u>
 Total Cost of Project Components			 <u>\$ 1,398,100.00</u>
 Construction Costs Subtotal #1			<u>\$ 1,398,100.00</u>
Engineering Costs = CCS#1 x 10%			<u>\$ 139,810.00</u>
Subtotal #2			<u>\$ 1,537,910.00</u>
Contingency = Subtotal #2 x 15%			<u>\$ 230,686.50</u>
Construction Cost Total			<u>\$ 1,768,596.50</u>
 Project Cost Total 2016			<u>\$ 1,945,456.15</u>
Project Cost Total 2017 (2.9% increase)			<u>\$ 2,001,874.38</u>
Project Cost Total 2018 (5.8% increase)			<u>\$ 2,058,292.61</u>
 WWDC Loan - Year 2017	33%	\$	660,618.54
WWDC Grant - Year 2017	67%	\$	1,341,255.83

Funding Agency	Interest	Years	Percentage of Eligible Funding	Grant/ Loan Amounts	Capital Recovery Factors	Annual Debt Service	Annual Debt Service Per Acre
WWDC Grant			67%	1,341,255.83	0	-	-
WWDC Loan 4% @ 20 Years	4%	20	33%	660,618.54	0.0735818	\$48,609.47	\$1.55
WWDC Loan 4% @ 40 Years	4%	40	33%	660,618.54	0.0505235	\$33,376.75	\$1.06
WWDC Loan 6% @ 40 Years	6%	40	33%	660,618.54	0.0664615	\$43,905.72	\$1.40
No Loan	0%	0	33%	660,618.54	0	\$0.00	\$0.00

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If sufficient funding is available, the rebuilding of this canal section should be completed utilizing Option 7 (9' x 18' box culvert). This is the most prudent option with the longest life span and would minimize future maintenance. The total costs including construction, design engineering, permitting and mitigation, legal fees, and construction engineering is \$7,716,469.71. A breakdown of the costs is listed below:

OPTION 7

HMID Canal Reconstruction - 9' x 18' Box Replacement

Probable Cost of Project Components:	Qty	Unit	Cost
Mobilization	1	LS	\$ 220,000.00
Contract Bond	1	LS	\$ 489,922.50
Remove 1400 FT Existing Channel	1	LS	\$ 80,000.00
Excavation	7500	CY	\$ 97,500.00
Bedding Gravel	2300	CY	\$ 69,000.00
Trench Foundation Material	1500	CY	\$ 30,000.00
Select Backfill - Grading W	4800	CY	\$ 144,000.00
9' x 18' box	1671	FT	\$ 4,135,725.00
Seeding/Fertilizer Type 1/Mulching	1.5	AC	\$ 3,000.00
Concrete Inlet Structure - 4,000 PSI	1	LS	\$ 60,000.00
Concrete Outlet Structure - 4,000 PSI	1	LS	\$ 60,000.00
Total Cost of Project Components			\$ 5,389,147.50
Probable Consultant Fees:			
Preparation of Final Design and Specifications (10%)			\$ 681,727.16
Permitting and Mitigation (0%)			\$ -
Legal Fees (0%)			\$ -
Acquisition of Access and Rights of Way (0%)			\$ -
Total Cost of Project Components			\$ 5,389,147.50
Construction Costs Subtotal #1			\$ 5,389,147.50
Engineering Costs = CCS#1 x 10%			\$ 538,914.75
Subtotal #2			\$ 5,928,062.25
Contingency = Subtotal #2 x 15%			\$ 889,209.34
Construction Cost Total			\$ 6,817,271.59
Project Cost Total 2016			\$ 7,498,998.75
Project Cost Total 2017 (2.9% increase)			\$ 7,716,469.71
Project Cost Total 2018 (5.8% increase)			\$ 7,933,940.67
WWDC Loan - Year 2017	33%		\$ 2,546,435.00
WWDC Grant - Year 2017	67%		\$ 5,170,034.71

Funding Agency	Interest	Years	Percentage of Eligible Funding	Grant/ Loan Amounts	Capital Recovery Factors	Annual Debt Service	Annual Debt Service Per Acre
WWDC Grant			67%	5,170,034.71	0	-	-
WWDC Loan 4% @ 20 Years	4%	20	33%	2,546,435.00	0.0735818	\$187,371.14	\$5.98
WWDC Loan 4% @ 40 Years	4%	40	33%	2,546,435.00	0.0505235	\$128,654.78	\$4.10
WWDC Loan 6% @ 40 Years	6%	40	33%	2,546,435.00	0.0664615	\$169,239.98	\$5.40
No Loan	0%	0	33%	2,546,435.00	0	\$0.00	\$0.00

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