



Wale

Strut

Stud

Lagging

PHOTO A-6 OUTLET PIPE



Alaska Department of Natural Resources
Dam Safety and Construction Unit

Field Inspection Report
Mahoona Dam AK00207
6/10/2011



PHOTO A-7
RIGHT EMBANKMENT SECTION



Alaska Department of Natural Resources
Dam Safety and Construction Unit

Field Inspection Report
Mahoona Dam AK00207
6/10/2011



PHOTO A-8
SPILLWAY UPSTREAM VIEW

Field Inspection Report
Mahoona Dam AK00207
6/10/2011



Alaska Department of Natural Resources
Dam Safety and Construction Unit



PHOTO A-9
SPILLWAY DOWNSTREAM VIEW

Field Inspection Report
Mahoona Dam AK00207
6/10/2011



Alaska Department of Natural Resources
Dam Safety and Construction Unit



Seepage

PHOTO A-10

SPILLWAY UNDERCUTTING

Field Inspection Report
Mahoona Dam AK00207
6/10/2011



Alaska Department of Natural Resources
Dam Safety and Construction Unit



PHOTO A-11
SPILLWAY SLAB UNDERCUTTING

Field Inspection Report
Mahoona Dam AK00207
6/10/2011



Alaska Department of Natural Resources
Dam Safety and Construction Unit



Alaska Native Tribal Health Consortium
Division of Environmental Health & Engineering
3900 Ambassador Drive, Suite 301
Anchorage, Alaska 99508
Phone: (907) 729-3500 Fax: (907) 729-4090

MEMORANDUM

DATE: September 27, 2012

FROM: Director Engineering Services

SUBJECT: Ouzinkie Dam Replacement Conceptual Alternatives

TO: FOR THE RECORD

BACKGROUND

The dam in Ouzinkie is a composite wood, steel, concrete and earth fill structure that is used to increase the water storage capacity of Mahoona Lake. The dam, designed by Scott Thompson of Focus Engineering Corporation in 1986, was constructed below the outlet of Mahoona Lake to divert water to a 125kW hydro-electric turbine. The turbine supplies the community with a source of low cost electrical power. The dam/lake also serves as the community's primary water source. Ownership of the dam and hydro-electric turbine was transferred to the City of Ouzinkie (City) in 1993.

On June 10, 2011 Mr. Charles Cobb and Mr. Chandler Engle from the State of Alaska, Department of Natural Resources, Dam Safety and Construction Unit conducted a field inspection of the Mahoona Dam. The inspection team was accompanied by the Mayor of Ouzinkie, the Honorable Dan Clarion, during the inspection. Concerns were noted about the structural integrity of the wooden supports and degradation of the dam face in the field inspection report.

R&M Consultants, Inc. (R&M) was retained by the City to conduct periodic safety inspections of the Mahoona Lake dam. On September 15, 2011, Mr. John Magee and Mr. Matt Morrow from R&M inspected the Mahoona Lake dam subsequent to a significant rainfall event that caused some flooding in the community. According to verbal reports, the dam spillway had become clogged with debris and the dam filled to a water level above the normal operating point. This event stressed the wooden supports resulting in additional damage to the already compromised wooden structure. On September 27, 2011 R&M issued a letter to the City noting that "the structure has been further evaluated and confirmed to be deteriorated to the point where operation at full reservoir level is unwise". The state concurred with R&M's findings and condemned the dam.

ALTERNATIVES

A competing proposal to build a new concrete/rock fill dam and raise the lake water level offers some promise but may have some drawbacks. It includes building a new larger dam and constructing dikes around low lying areas of the lake shore. Given the expense of the proposed project, it will be difficult to obtain the amount of funding that is required in the current economic environment. In addition, raising the water level in the lake can have a negative impact on source water quality due to decaying organic material in the inundation zone. This expected increase in organic contaminants will also increase the cost and complexity of treating water for the community. The salient features of the proposed project are as follows:

1. Construction of a much larger dam
2. Demolition of all existing dam structures
3. Construction of dikes around low areas of the lake
4. Does not consider access to lake that is cut off due to a rock outcrop

A less expensive and equally viable alternative is to replace the existing wood dam with a concrete faced rock fill structure, removal of the rock out crop that is restricting access to water in Mahoonah Lake and construction of an access road to the dam site. With this alternative some of the existing rock, concrete and steel structures can be reused/renovated and construction of dikes in other areas of the lake will not be required. The location for this proposed alternative has proven to be a successful for the existing dam structure and because geotechnical and hydraulic conditions are known; the efforts, risks and costs associated with engineering design will be substantially reduced. Some salient features of this proposal are as follows:

1. Existing viable concrete and steel structures will be renovated and reused
2. Will not require extensive geotechnical or engineering investigations
3. Will take advantage of existing lake storage capacity
4. Will construct a year around access to the dam for maintenance (existing trail limits access)

Replacement of the penstock and hydro-electric turbine is also recommended. The penstock is aging due to exposure to ultraviolet radiation and the brittle and fragile piping materials are exposed on the ground surface and are therefore subject to damage from falling trees or other similar hazards. The existing hydro-electric turbine is also aging and is not optimally sized for the water source or diesel electric generator capacity. Replacement of the existing hydro-electric turbine with modern and more efficiently sized equipment will improve utilization of the lake source and by carefully matching hydro-electric generator capacity with diesel generator capacity, will allow greater efficiency in the operation of Ouzinkie's overall electrical power production system.

CONCLUSIONS/RECOMMENDATIONS

The proposed scope of work for the recommended alternative would include demolition of the existing wood dam structure and the construction of a new concrete faced rock fill dam in the same location. The existing abutments, spillway and steel sheet pile cut off wall will be renovated and integrated into the new structure and the rock out crop that is restricting flow from the lake will be removed. The project will consist of the following scope; funded, designed and constructed in three phases:

1. 5,400 linear feet of access road improvements
2. Demolition of the existing wood dam structure
3. Clearing and grubbing of the existing dam site for rock dike placement
4. Placement of new piping, valves and trash rack
5. Construction of 2' wide by 4' deep concrete cutoff wall/foundation (about 160 feet long) including rock excavation
6. Placement of 1,400 cubic yards of rock/dike fill
7. Construction of a concrete slab top and dam face tied to the cut off wall
8. Repair and modifications to the existing concrete spillway
9. Excavation of a 4' wide trench through the rock outcrop
10. Penstock replacement (Phase II)
11. Hydro-electric turbine replacement/upgrade (Phase III)

Estimated Costs:

Access Road Improvements	\$510,000
Rock out crop excavation	\$200,000
Dam Demolition and Construction	<u>\$950,000</u>
Phase I Total	\$1,660,000
Penstock Replacement (Phase II)	\$900,000
Turbine Replacement (Phase II or III)	\$700,000

John A. Warren, P.E.
Director Engineering Services



Alaska Native Tribal Health Consortium

Division of Environmental Health and Engineering

3900 Ambassador Drive • Suite 301 • Anchorage, Alaska 99508 • Phone: (907) 729-3600 • Fax: (907) 729-4090 • www.anthc.org

MEMORANDUM

DATE: October 10, 2012

FROM: Director Engineering Services

SUBJECT: Replacement of Failing Water Source – Ouzinkie, Alaska

TO: FOR THE RECORD

Mahoonah Lake serves as Ouzinkie's water supply and is necessary for meeting the community's needs for both sanitation and electrical power production. The wooden dam that impounds the lake was constructed over twenty five years ago to serve as a source of hydroelectric power. Over the years, access to the lake source has allowed expansion of the community water and sewer systems and has thus fueled the growth of the community. Because of limited access to the dam site and due to the nature of construction materials that were used, the wooden dam has deteriorated over time and has now become a safety hazard for the community and threatens to eliminate the source of water and low cost electrical power the community needs to sustain its existence. Following is a summary of estimated costs to replace the failing infrastructure:

Design and Engineering:

ANTHC Contribution of Technical Resources	\$167,000 (approx. value)
Alaska Industrial Development and Export Authority Loan	<u>\$167,000</u>
Total Estimated Design and Engineering Cost	\$334,000

Dam Construction:

Access road	\$592,000
Dam replacement	<u>\$1,004,000</u>
Total Estimated Dam Construction Cost	\$1,596,000

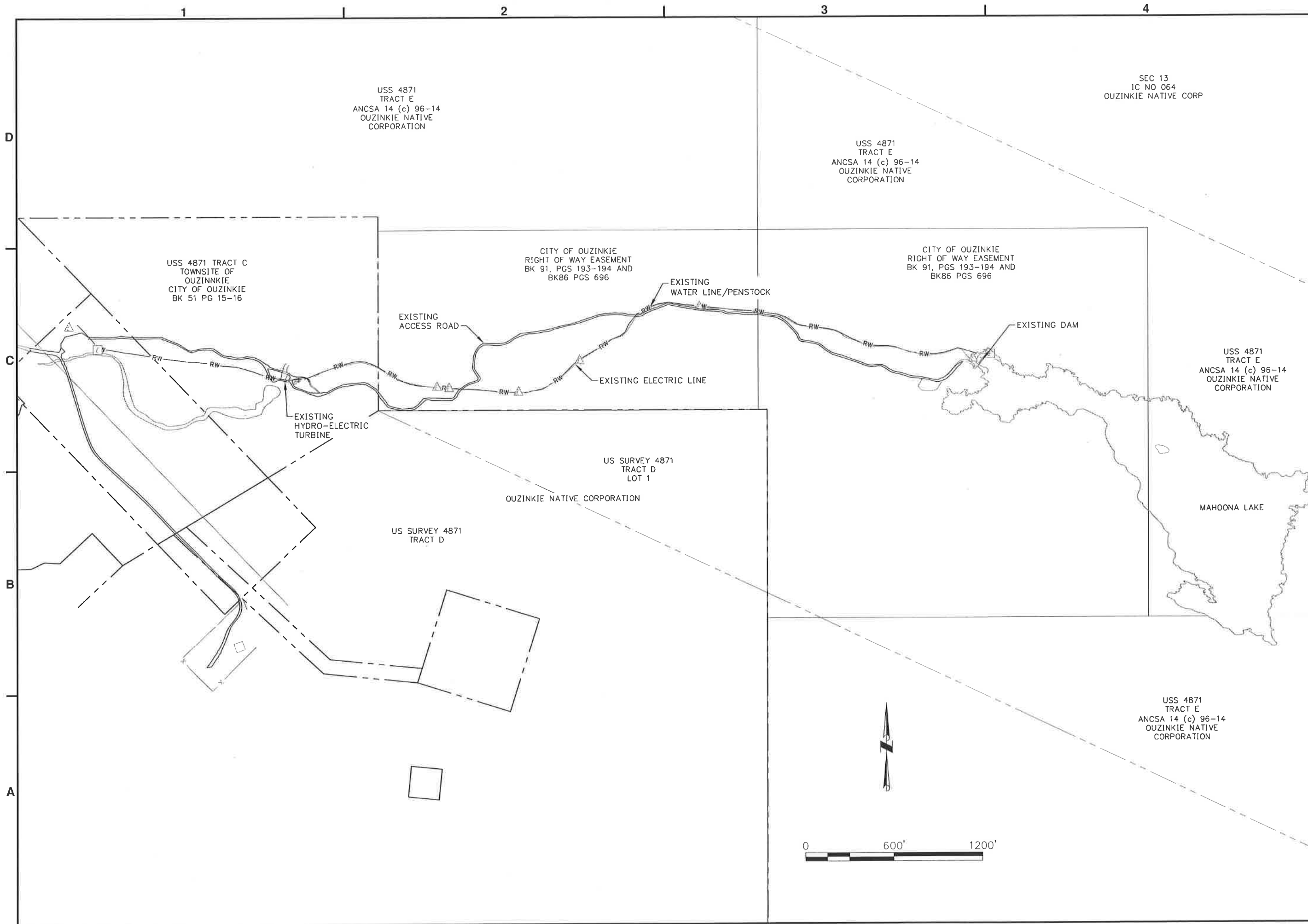
Penstock and Turbine Construction:

Penstock replacement	\$989,000
Turbine upgrades	<u>\$989,000</u>
Total Estimated Penstock and Turbine Construction Cost	\$1,978,000

Grand Total Estimated Project Cost	\$3,908,000
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A handwritten signature in blue ink, appearing to read "John A. Warren", is written over the printed name and title.

John A Warren, P.E.
Director
Engineering Services



Division of Environmental
Health and Engineering
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BAR IS ONE INCH ON
ORIGINAL DRAWING. IF NOT
ADJUST SCALES ACCORDINGLY

**OUZINKIE, AK
OWNERSHIP STATUS**

INIT	DESCRIPTION	DATE	MRK

PLAN SET: N/A
PROJ MGR: N/A
PROJ ENG: JW
TUS ENG: N/A
DRAWN BY: SH

SHEET TITLE

OWNERSHIP STATUS

Preliminary Engineering Report

**for the
Replacement of the Water Transmission Line
in
Ouzinkie, Alaska**

**Steven Forthun, PE
Alaska Native Tribal Health Consortium**

May 18, 2007

Preliminary Engineering Report

Water Transmission Line Investigation - Ouzinkie, Alaska

Steven Forthun, PE - ANTHC, DEHE – May 18, 2007

Background

At the request of the City of Ouzinkie, the Alaska Native Tribal Health Consortium (ANTHC) recently examined the condition of the Ouzinkie water supply line from the reservoir to the hydroelectric generating plant. The City of Ouzinkie's only current water source is from the penstock at the hydroelectric plant. Any disruption of water flow in the penstock may cause a serious water supply problem for the City.

The Ouzinkie hydroelectric project was originally constructed in the 1980's. The project consisted of the construction of a dam, an approximately 6000' long, 18" diameter PVC penstock, a hydroelectric generator, and a power transmission line. Soon after installation of the hydro project, the city tapped the penstock and extended a water line to the city water plant.

Findings

During a field examination of the transmission line on May 10, 2007, a Sr. Civil Engineer at ANTHC noticed certain deficiencies in the transmission line that are serious enough to warrant replacement. An 18-inch PVC non-pressure sewer pipe meeting ASTM F679 was installed as the transmission line (see Pictures #1). ASTM F679 says, "The requirements of this specification are intended to provide pipe and fittings suitable for **nonpressure** drainage of sewer and surface water." Picture #2 shows the pipe is clearly marked ASTM F679. The pipe was poorly covered during construction and has jacked and been pushed through time (see Picture #3). Exposed pipe can be crushed by falling trees as shown in a near miss (see Picture #4).

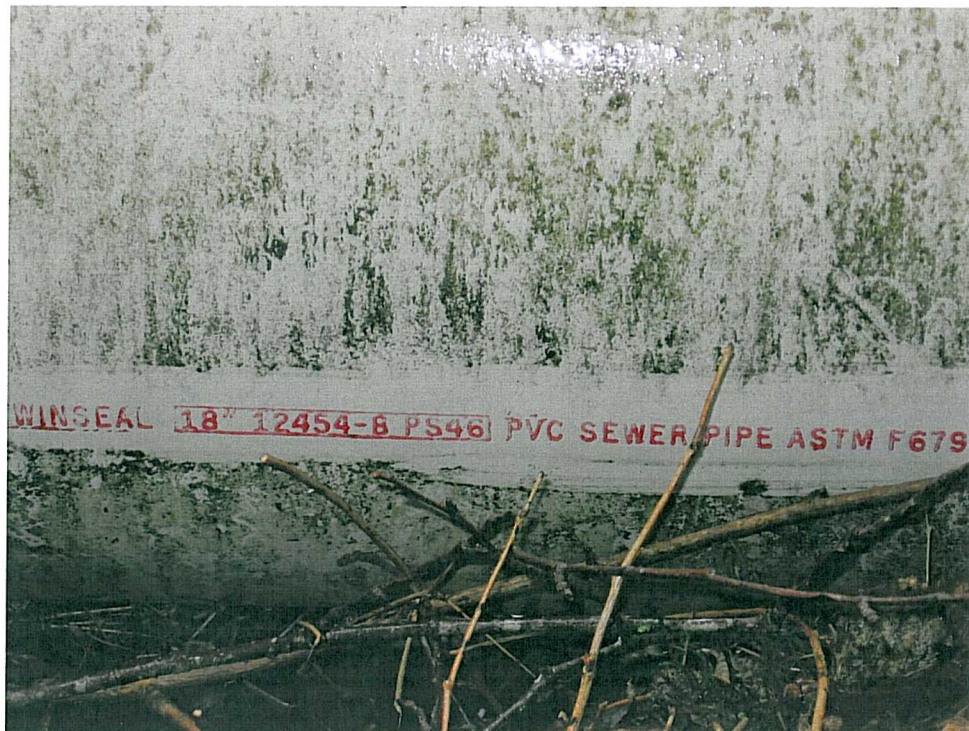
Recommendations

Though the transmission line has performed adequately over the last 20 years, ANTHC recommends replacing the pipeline. The suggested material is 20" HDPE, DR 11, butt fused connections. This pipe is rated for this water pressure application and has much better freeze/thaw characteristics. Proper installation practices should be followed to provide an adequate bury depth below the frost line and for protection of the pipe.

Other upgrades include air relief stations along the pipeline, a bypass line at the hydro plant, proper main line valves at the upper and lower ends of the line, and adequate pressure relief in case of a line surge.



Picture #1 - 18" PVC Pipe Section Near the Hydroelectric Plant



Picture #2 – 18" PVC Sewer Pipe



Picture #3 – Exposed Transmission Pipe



Picture #4 – Tree Across Transmission Line

Conclusions

Failure of the Ouzinkie water transmission line should be expected in the near future. The transmission pipe material was never meant for a pressure application. Inadequate cover was provided over the pipe during installation. Any pressure surge in the line at this point may rupture of pipeline. The City of Ouzinkie should take the necessary steps to secure funding and replace the line as soon as possible.

Architectural (A Sheets)																					0	\$	-
Plumbing (P Sheets)																					0	\$	-
Process (D Sheets)																					0	\$	-
Mechanical (M Sheets)						24															24	\$	2,903.42
Electrical (E Sheets)																					0	\$	-
Design Review	4		16	4							8	4									36	\$	4,056.55
95% Design Labor Subtotal	21	8	142	64	0	24	0	0	0	0	55	310	4	0	0	0	0	0	0	0	628	\$	63,780.43
A/E Subcontracts																						\$	-
Expenses																						\$	500.00
95% SUBTOTAL																						\$	64,280.43
100% Design																							
Design management	16	12								8	16											\$	6,309.56
A/E Contract Administration																						\$	-
General (G Sheets)	1		4	4							2	8										\$	1,944.17
Survey (V Sheets)	1		2	4																		\$	815.21
Geotechnical (B Sheets)	1		2	6								2										\$	1,201.55
Civil (C Sheets)	8		60	80							20	80										\$	25,780.70
Structural (S Sheets)	6		32	60							16	40										\$	16,103.23
Architectural (A Sheets)																						\$	-
Plumbing (P Sheets)																						\$	-
Process (D Sheets)																						\$	-
Mechanical (M Sheets)						24																\$	2,903.42
Electrical (E Sheets)								24														\$	2,903.42
Design Review	2	2	16	4						8	8											\$	4,508.18
100% Design Labor Subtotal	35	14	116	158	0	24	0	24	0	16	62	130	0	0	0	0	0	0	0	0	0	\$	62,469.44
A/E Subcontracts																						\$	-
Expenses																						\$	2,900.00
100% SUBTOTAL																						\$	65,369.44
Engineering Permits																							
Fire Marshall																					0	\$	-
ADEC																					0	\$	-
Misc Permits	4	2	40	20														24	24	114	\$	12,149.01	
Eng. Permits Labor Subtotal	4	2	40	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	24	114	\$	12,149.01
Expenses																						\$	15,000.00
Eng. Permits SUBTOTAL																						\$	27,149.01
LABOR TOTALS	171	62	638	342	0	104	0	24	0	31	210	788	20	100	180	20	0	0	30	28	2,169	\$	290,889.23
NON-LABOR TOTALS																						\$	43,150.00
TOTAL PROJECT FEE																						\$	334,039.23

Ouzinkie Dam Design				
Design Cost Estimate - Expenses				
Estimated by: John Warren				
Date: 10/8/2012				
EXPENSE ITEM	UNITS	QUANTITY	UNIT COST	AMOUNT
Field Investigation				
Airline Airfare and Car Rental	each	3	\$ 800.00	\$ 2,400.00
Per Diem & Lodging	man days	6	\$ 100.00	\$ 600.00
Plumbing Materials	lump sum		\$ 1,000.00	\$ -
				\$ -
Subtotal				\$ 3,000.00
Conceptual Design Phase				
Title Search	job	1	\$ 250.00	\$ 250.00
Airline Airfare and Car Rental	trips		\$ 1,000.00	\$ -
Water Treatment Pilot Testing	job		\$ 20,000.00	\$ -
Per Diem & Lodging	nights		\$ 200.00	\$ -
Subtotal				\$ 250.00
35% Design Phase				
Mailing & expediting	job	1	\$ 250.00	\$ 250.00
Per Diem & Lodging	days	14	\$ 200.00	\$ 2,800.00
Airfare	trips	4	\$ 800.00	\$ 3,200.00
Subtotal				\$ 6,250.00
65% Design Phase				
Mailing & expediting	job	1	\$ 250.00	\$ 250.00
Per Diem & Lodging	days		\$ 200.00	\$ -
Airfare	trips		\$ 800.00	\$ -
Subtotal				\$ 250.00
95% Design Phase				
Mailing & expediting	job	1	\$ 500.00	\$ 500.00
Per Diem & Lodging	days		\$ 200.00	\$ -
Airfare	trips		\$ 1,000.00	\$ -
Subtotal				\$ 500.00
100% Design (Stamped Plans)				
Mailing & expediting	job	1	\$ 500.00	\$ 500.00
Per Diem & Lodging	days	4	\$ 200.00	\$ 800.00
Airfare	trips	2	\$ 800.00	\$ 1,600.00
Subtotal				\$ 2,900.00
Permitting Process				
Permit Fees (Plan Review, etc.)	Lump Sum		\$ 1,500.00	\$ -
ADEC Permit to Construct	Each		\$ 999.00	\$ -
Dam Safety	Each	1	\$ 15,000.00	\$ 15,000.00
Subtotal				\$ 15,000.00
Total Estimated Expenses				\$ 28,150.00



Division of Environmental
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ADJUST SCALES ACCORDINGLY

**OUZINKIE, AK
REPLACEMENT OF DAM,
PENSTOCK AND
HYDRO-ELECTRIC TURBINE**

MRK	DATE	DESCRIPTION	INIT

PLAN SET: OUZ-12-000
PROJ MGR: ---
PROJ ENG: JAW
TUS ENG: ---
DRAWN BY: ALH
SHEET TITLE

SITE PLAN

C-101

SHEET **1** OF **1**



R&M CONSULTANTS, INC.
9101 Vanguard Drive, Anchorage, Alaska 99507

(907) 522-1707, FAX (907) 522-3403, www.rmconsult.com

September 27, 2011

R&M No. 1764.01

The Honorable Dan Clarion, Mayor
City of Ouzinkie
P.O. Box 109
Ouzinkie, AK 99644

RE: Emergency Measures for stabilizing Mahoona Lake Dam

Dear Mayor Clarion:

Subsequent to the September 23 inspection of the Mahoona Lake Dam by John Magee and Matt Morrow as a follow-on from the Periodic Dam Safety inspection of September 15, 2011 the structure has been further evaluated and confirmed to be deteriorated to the point where operation at full reservoir level is unwise. We reported this to you in a telephone call on September 26 and to Mr. Charles Cobb, P.E. State Dam Safety Engineer as well. At that time we recommended the reservoir level be lowered two feet below the spillway crest level to reduce the hydraulic loading on the dam and discussed the need to return the low level outlet pipe to service by reinstalling the gate operating stem and removing the rubber bladder from the outlet pipe so the reservoir could be lowered and the level maintained as rainfall runoff flowed in over the next weeks. The reservoir levels must be closely monitored and the outlet gate operated whenever the level begins to rise above the noted maximum elevation.

The reason the reservoir level must be lowered is that a number of structural members are compromised due to splitting at bolt holes and, in one case in particular, a wale is broken at the point of intersection with a strut and stud at about mid-height of the dam. Probing the structural members with a carpenter's awl showed that many of the 8X8 and 6X6 structural members and the 3-inch face planks of the dam are rotted to some degree. In some cases the awl could be easily pushed into the structural member 4 inches with no resistance; this is also the case with the face planks on the lower portion of the face where the awl could be easily pushed into the 3-inch plank over 2 inches and could in fact have been pushed all the way through with little effort.

Accordingly, we recommend the following step be taken immediately to secure the structure for continued use and operation for a short time until remedial work can defined and be performed to essentially "shore-up" the structure so it can remain in use for about the next two years while plans are completed for either a major maintenance/replacement of the existing dam or construction of a new dam of more durable materials just downstream from the existing structure.

- 1- Reinstall the low level outlet control gate stem and return the gate to operable condition (this will likely require a diver and will require shutting down the penstock and water system tap from the penstock to prevent diver injury).
- 2- Lower the reservoir level to two feet below the spillway crest elevation and maintain the lake level at this elevation or lower until suitable repairs to the dam can be made.
- 3- Investigate the Penstock Gate Valve immediately upstream from the vacuum-relief valve at the vent and service the valve so it is operable.
- 4- Post warning of possible inundation/flood hazard at the creek road crossing at the water treatment plant.

5- Warn residents of possible flood if dam breaches.

6- Repair/shore-up critical structural members as soon as possible (strategy and plan to be developed).

Critical Action Plan- A plan for critical repairs to the dam sub structure must be developed immediately and materials procured for use in the repairs. Planning for the repairs includes consideration for outage of the water supply/penstock so as to define the maximum time that the water treatment plant can be out of service and over which power will be supplied by diesel generators.

A contractor or City force-account work force should be arranged for to effect the most critical immediate repairs to the structural members and face of the dam. The repairs should be done under the supervision of the engineer so that any problems discovered in the conduct of the repairs can be dealt with on the spot.

Remedial Repairs Action Plan - A plan for less critical remedial repairs intended to extend the life of the dam for about two years must be developed. This includes replacement/repairs to the dam including the face of the dam and supporting structure. The extent of the repair/replacement needs to be determined/designed ASAP, materials procured and the work performed by a contractor or City force-account personnel. Planning this work will include due consideration of outages on the water supply and hydropower plant.

We are available to discuss planning and a strategy to effect the critical and remedial repairs at your convenience. Please contact the undersigned at 907-646-9646 (cell 907-748-7781). Matt Morrow is out of town for the next several days at a remote site so will not generally be able to be involved in any discussions for the next 5 or 6 days.

In the meantime we are preparing the formal Periodic Safety Inspection report for the Mahoona Lake Dam.

Sincerely,
R&M Consultants, Inc.



John K. Magee, P.E.
Group Leader

Attachment: Photos from September 23, 2011 inspection

Cc:
Charles Cobb, P.E. DSCU
Matt Morrow, P.E.

MAHOONA LAKE DAM STRUCTURAL INSPECTION PHOTOS BY MAGEE 092311



IMGP3410 13:14:29 2011:09:23



IMGP3411 13:16:07 2011:09:23



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IMGP3415 13:22:27 2011:09:23
4 of 18

MAHOONA LAKE DAM STRUCTURAL INSPECTION PHOTOS BY MAGEE 092311



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5 of 18

MAHOONA LAKE DAM STRUCTURAL INSPECTION PHOTOS BY MAGEE 092311



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6 of 18

MAHOONA LAKE DAM STRUCTURAL INSPECTION PHOTOS BY MAGEE 092311



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MAHOONA LAKE DAM STRUCTURAL INSPECTION PHOTOS BY MAGEE 092311



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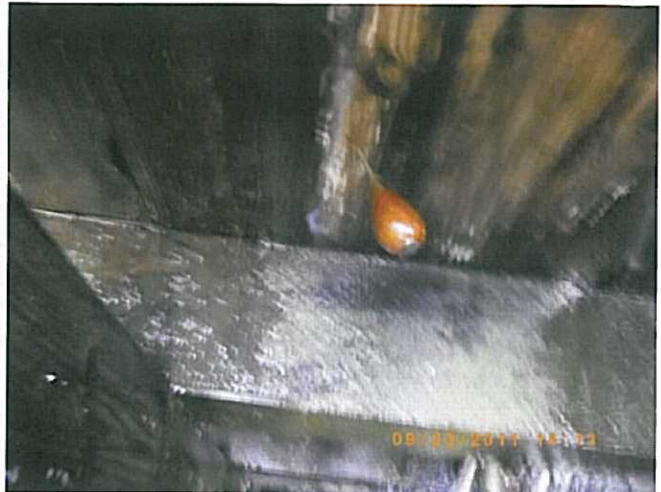


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8 of 18

MAHOONA LAKE DAM STRUCTURAL INSPECTION PHOTOS BY MAGEE 092311



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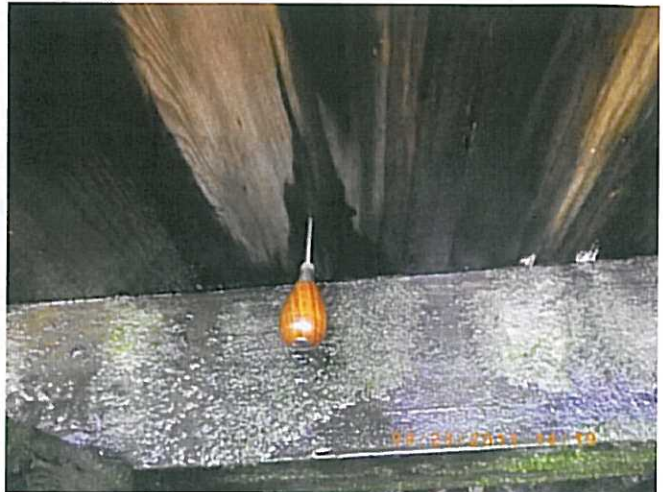


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MAHOONA LAKE DAM STRUCTURAL INSPECTION PHOTOS BY MAGEE 092311



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MAHOONA LAKE DAM STRUCTURAL INSPECTION PHOTOS BY MAGEE 092311



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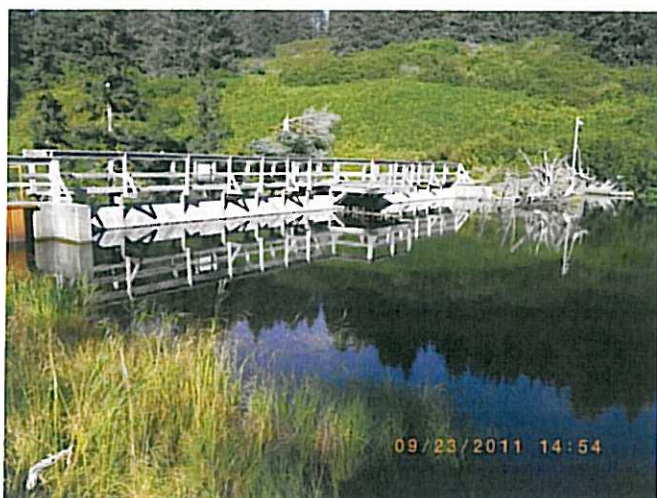
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