CENTRAL RIVERS POWER MA, LLC
c/o William P. Short III
44 West 62nd Street, P.O. Box 237173
New York, New York 10023-7173
(917) 206-0001; (201) 970-3707
w.shortiii@verizon.net

March 6, 2020

(Via E-Mail Only)

Low Impact Hydropower Institute
Shannon Ames, Executive Director
329 Massachusetts Avenue, Suite 2
Lexington, Massachusetts 02420

Re: Application of Dwight Project for Certification by the Low Impact Hydropower Institute

Dear Ms. Ames:

Per Pat McIlvanie's Low Impact Hydropower Recertification Stage I Review (the "Review")[1] for Dwight Project (the "Project" or the "Facility"), Central Rivers Power MA, LLC submits its answers on the open items mentioned in the Review.

Please identify when Central Rivers purchased the Dwight Project, as well as a dated listing of the various names the organization has used in association with the ownership of the Project (e.g. EP Energy Massachusetts.

The current Project[2] was constructed in 1920 and was purchased in 1932 by Turners Falls Power and Electric Company, a predecessor of Western Massachusetts Electric Company ("WMECO"). On the following page is a chronology of the various parties that have owned Dwight Project since WMECO sold its interest in the Project to Consolidated Edison Energy Massachusetts, Inc. ("CEEMI") in the mid-1999.[3] The new name of the current owner and operator of the Dwight Project is Central Rivers Power MA, LLC.

[1] See Attachment 44 to this letter.
[2] It appears that the Project is not the first dam at or near the site of the current dam. The historical record indicates that dams spanning the Chicopee River at or near the present site of the dam date to the 1820s.
[3] See Attachments 45 through 57.

Date of Transfer	Transferor:	Transferee:	Note:
7/24/1999	Western Massachusetts Electric Company	Consolidated Edison Energy Massachusetts, Inc.	See FERC Order dated June 30, 1999
5/8/2008[4]	Consolidated Edison Energy Massachusetts, Inc.	North American Energy Alliance Massachusetts, LLC	See letter dated June 9, 2008
1/1/2012[5]	North American Energy Alliance Massachusetts, LLC	EP Energy Massachusetts, LLC	See FERC Order dated March 13, 2012
2/26/2016[6]	EP Energy Massachusetts, LLC	Essential Power Massachusetts, LLC	See FERC Order dated March 1, 2016
4/13/2017	Essential Power Massachusetts, LLC	Nautilus Hydro, LLC[7]	See FERC Order dated January 5, 2017 See FERC Notice of Transfer dated June 27, 2017
7/18/18	Nautilus Hydro, LLC[8]	Central Rivers Power MA, LLC	See FERC Order Amending Licenses and Exemptions To Change Licensee And Exemptee Names issued July 18, 2018

Please provide a copy of Articles 1-9 of the license exemption as they are not included in the exemption order provided.

Standard Articles 1-9 of the license exemption are provided as Attachment 58.

Please provide a link to the 1999 and 2001 license exemption amendments to facilitate public review of the application.

Copies of FERC Order Amending Exemptions, dated December 29, 1999 and FERC Order Amending Exemptions, dated November 8, 2001 are attached as attachments to this letter.[9]

Also, please provide a copy of the Development Plan filing made on July 30, 1999 (this filing could not be found on FERC's eLibrary.) The Development Plan appears to include the original Conditions established by the resource agencies, and, therefore, is needed to understand references made to resource agency Conditions identified in other referenced documents, such as Att #17.

A copy of the Development Plan could not be located in the files of Central Rivers. However, the lack of this document may be not be particularly relevant. The Development Plan

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[4] This is a name change and not a transfer.
[5] This is a name change and not a transfer.
[6] This is a name change and not a transfer.
[7] HSE Hydro AC, LLC acquired Nautilus Hydro, LLC on June 22, 2017.
[8] On or about June 20, 2018, HSE Hydro AC, LLC renamed Nautilus Hydro, LLC Central Rivers Power MA, LLC. Central Rivers Power MA, LLC is now the owner and operator of Dwight Project.
[9] See Attachments 59 and 60.

cited in the FERC Order Amending Exemptions, dated December 29, 1999 appears to have never been implemented due to the change in legislative treatment of the utility-owned generation assets ("Electric Deregulation"). WMECO, since it was divesting of its hydro-electric generating stations, elected to defer the decision to install these generation improvements to the new owner. The new owner, CEEMI, elected not to proceed with the generation improvements mentioned in the FERC Order Amending Exemptions, dated December 29, 1999. Instead, CEEMI opted to make other improvements outlined in FERC Order Amending Exemptions, dated November 8, 2001. For Dwight Project, the only change to the facility was installing a new nameplate on each generator, raising the Project's nameplate from 1,440 KW (480 KW per generator) to 1,464 KW (488 KW per generator) to reflect the actual generating capability of each generator.

Also, please provide copies of or links to any agency approvals needed for the 2016 site rehabilitation work to bring the units back on-line (see requests below).

Other than FERC, no agency approvals for the 2016 site rehabilitation work were sought. All of the work to return the Project to service was performed in the power canal near the penstocks, the penstocks themselves or inside the powerhouse. No work took place at the headgates or the tailrace.

Clarifying information is needed to help understand the power generating equipment changes, and their timing, at the Project as there appear to be conflicts in what is described as "no project upgrades" on Table B-1 under Power Plant Characteristics and items identified in several attachments.

Other than installing new nameplates on each generator of the Project, no project upgrades were made. The proposed minimum flow generator at the Dwight dam was never installed.

It is also difficult to follow what past proposed facility upgrades or changes were later eliminated or modified. For example, Att. # 16 discusses a planned 6% increase in generation capacity at Dwight referencing the 1999 Development Plan for the site. It is also unclear if the proposed transformer replacement approved by the 1999 license amendment was implemented.

Attachments 16 and 17 were attached in the Project's LIHI application since they contained information of the agency approvals of the Project's minimum flow (258 cfs) and maximum drawdown (0.25 feet). FERC Order Amending Exemptions, dated December 29, 1999 and FERC Order Amending Exemptions, dated November 8, 2001 were not mentioned in the Project's LIHI application since they dealt either with proposed generation improvements that did not occur or with correcting the nameplate of the Project, respectively. Neither latter Order dealt with the issue of the Project's minimum flow or maximum drawdown.

A summary of past proposed changes and identification of which were implemented and eliminated should be provided. Finally, work done to bring the units back on-line in 2016 should be described. Also see note below regarding "new facilities" defined as capacity changes since August 1998.

Attached are various correspondence on the penstock failure, subsequent repair and return to service.[10] The first set of correspondence deals with informing FERC of the rupture of the Project's penstock #2 on October 10, 2013. The second set of correspondence deals are various engineering correspondence dealing with the Project's repairs. The third set of correspondence pertains to the completion of repairs to the Project.

The FERC order dated August 3, 2012 approving the Minimum Flow and Impoundment Fluctuation Monitoring Plan (Flow Plan) states that the flashboards have been permanently removed yet Table B-1 and elsewhere in the application it states "there are 2.3 feet-high wooden flashboards" and mentions use of flashboard notches for passing minimum flows. Please clarify by describing historical measures for passing minimum flow and currently used measures for passing this flow. Also please denote approximately when the current measures were initiated.

The Project's flashboards have been permanently removed. However, it cannot be determined when the Project's flashboards were removed given the use of flashboards is mentioned in the FERC Order Amending Exemption, dated November 8, 2001[11] but not mentioned in Minimum Flow and Impoundment Fluctuation Monitoring Plan, dated February 20, 2012.[12] Inaccurate references to the flashboards will be corrected in the Application.

The Project's current draw dawn limit is maintained at a minimum of five inches above the dam crest. This drawdown requirement replaced a draw down requirement issued by USFWS in its letter of January 27, 2000 of 258 cfs (or inflow, if less), 0.25 feet drawdown when boards are up and no fluctuation when the boards are down."[13]

This latter requirement replaced the original USFWS requirement outlined in its letter dated July 31, 1992, which mandated "a minimum flow or 258 cubic feet per second, or inflow [if less] to the project, whichever is less, shall be consecutively released at the project dam to the bypassed reach. The exemptee shall operate the project to limit drawdown of the project impoundment to no more than one foot below the dam crest, except for system operating emergencies or annual energy audits."

The application denotes "normal pond elevation" is El. 78.8 feet which is the same as the maximum surface elevation. Yet footnote 2 references use of flashboards which would suggest a higher maximum surface elevation. On the other hand, the Flow Plan states "a pond level of El. 77.0'; 5 inches above the permanent spillway crest level" is maintained as normal operation. Please correct these data to reflect current practices and limits.

The Application will be corrected with the maximum surface elevation of 77.0' being used throughout the Application.

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[10] See Attachments 61 through 76.
[11] See Attachment 60.
[12] See Attachment 18 of the Application.
[13] The MDFW accepted the USFWS conditions for Dwight as their conditions in their letter, dated February 15, 2000, to CEEMI.

The application did not include the information required for "new facilities" defined as capacity changes since August 1998, which possibly were made after this date, although this data is somewhat confusing, and clarification has been requested. These requirements are identified on page 47 and Section 2.0 of the current LIHI Handbook. This information must demonstrate that the changes did not worsen conditions for resources assessed by LIHI criteria.

As discussed above, there are ***no new*** generation ***facilities*** installed at the Project since 1920, only new nameplates for each of the generators.

Please clarify the drawdown limits followed as the application states "no more than one foot below the dam crest" yet the Minimum Flow and Impoundment Fluctuation Monitoring Plan (Flow Plan) states "impoundment draw down is limited to a minimum of five inches above the dam crest"

The Project's current draw down limit is maintained at a minimum of five inches above the dam crest. This drawdown requirement replaced a draw down requirement issued by USFWS in its letter of January 27, 2000 of 258 cfs (inflow, if less), 0.25 feet draw down when boards are up and no fluctuation when the boards are down.

This latter requirement replaced the original USFWS requirement outlined in its letter dated July 31, 1992, which mandated "a minimum flow or 258 cubic feet per second, or inflow to the project, whichever is less shall be consecutively released at the project dam to the bypassed reach. The exemptee shall operate the project to limit drawdown of the project impoundment to no more than one foot below the dam crest, except for system operating emergencies or annual energy audits."

Please confirm how minimum flows are released and monitored to the bypass. There is reference to a "minimum flow gate" (pg. 19 and Att #21) while elsewhere in the application and Flow Plan it states minimum flows are only passed directly over the spillway. If a minimum flow gate is used, then please provide the documentation that shows that "USFWS accepted the calculation sheets of the minimum flow gate settings in lieu of six months of minimum flow data and a one-day empirical test results" (see application pg 19).

Minimum flows are released over the dam's spillway. The 258 cfs flow release is controlled by maintaining a headpond level five inches above the crest of the spillway. All flows pass directly into the bypass reach. There is a no mention of a minimum flow gate at the dam since none was ever installed.

An impoundment level of five inches above the crest of the spillway is continuously monitored through the use of an electronic pressure transducer located on the south shoreline, slightly upstream of the canal gatehouse. Documentation of compliance with the impoundment limits is supplied by electronic recording of the impoundment level in addition to instantaneous visual displays in the canal gatehouse. The canal headgates are controlled by a Programmable Logic Controlling (PLC) device located within the canal gate house that adjust the headgate opening based upon pond level, canal level and unit operational status. The pond level control is proportional–integral–derivative (PID) based and is programmed to maintain a pond level of El.

77.0'; 5 inches above the permanent spillway crest level. As the pond level increases, the system increases unit load and/or brings additional units online. As the pond level falls, load is decreased and units are taken offline. The PLC continually monitors pond level and records the pond level using a strip chart as the primary recording mechanism. The sensitivity of the measurement is +/- 0.01 ft. As a secondary monitoring system, a data logger records the pond elevations every 15 minutes. The flashboards on the dam at Dwight have been removed, the minimum flow release is provided by overtopping the dam. The project's turbines operate in an automatic mode using impoundment level controls which curtail operation when the lower impoundment level limits are reached and do not resume operation until impoundments levels are reestablished within the operable limits.

The application should be edited to clarify the release method. To avoid confusion, the application should not address items specific only to Red Bridge.

As discussed above, the release method of the minimum flow is maintained by maintaining five inches of flow (or inflow, if less) over the crest of the dam. The application has been edited to clarify the release method and not address items specific only to Red Bridge.

A clarified explanation requested under the Bypass ZOE should also satisfy this missing data by defining how these flows are released.

A discussion on the minimum flows and how these minimum flows are maintained has been discussed previously in this letter.

To prove "no or De Minimis impact" the application must describe and demonstrate how Project operations satisfy current applicable water quality standards, including designated uses. Absent current water quality data, this explanation must be supported with a letter from the appropriate agency(ies) confirming Project operations do not impact applicable standards. As the waters are listed as "impaired" the agency letter must also state that the facility is not a cause of the impairment. On pg 26 of the application it states that the "USEPA [US FWS] and MDEP found that the Project does not contribute to any degradation of the water quality of the Chicopee River," however supporting documentation is not attached. Referenced Att # 23 is a request letter to the MDEP and not MDEP or USEPA [US FWS] findings.

Attached is a letter from the MDEP on the Project's water quality.[14] The MDEP states that *e. coli* is present in the vicinity of the Project but that the Project does not cause or contribute to violations of the state Water Quality Standards due to water chemistry.

At the same time that the MDEP was asked to opine on water quality, the USFWS was sent a similar e-mail inquiry. As of the date of this letter, no confirmation of the Project's water quality from the USFWS has not been received. A follow-up letter has been sent to USFWS requesting again this information.[15]

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[14] See Attachment 77, Massachusetts Department of Environmental Protection Letter, Dated November 22, 2019.
[15] See Attachment 78, Central Rivers Letter to United States Fish & Wildlife Service, Dated March 6, 2020.

Currently there is no upstream passage at the Project and anadromous species are noted to have been observed at the dam and blocked from moving upstream. The only option to pass this criterion would be application of Standard C-2 supported by a written agency(ies) recommendation(s) addressing upstream passage needs for diadromous species. Both MDFW and USFWS recommendations should be provided. Should the agency recommendation(s) require upstream passage, a proposed schedule of when the fish passage facilities would be designed and installed must be provided.

Both the MDFW and USFWS have been asked for their recommendation on both upstream and downstream fish and eel passage at the Project. Only the MDFW has responded. That response is attached.[16] A follow-up letter has been sent to USFWS requesting again this information.

No information has been provided describing why the facility does not impose a downstream passage barrier for American eel considering both physical obstruction and increased mortality relative to natural downstream movement. Also, no information was provided whether the riverine species found typically move between riverine environments and if they do, why the facility does not contribute adversely to the sustainability of these populations or to their access to habitat necessary for successful completion of their life cycles.

While the current Dwight dam may be considered to impose a downstream passage barrier to the American eel, upstream dams with no eel passage make such a requirement an improvement with limited environmental benefit. The Applicant supplied a list of the five upstream dams on the Chicopee River (with the possible exception of Collins, the fifth dam on the Chicopee River) none of these facilities have installed downstream fish or eel passage or are subject to a pending formal requirement issued by the agencies that such eel passage must be installed. As previously mentioned, the minimum flow requirement of 258 cfs mandates a flow of 5 inches of water over the crest of Dwight dam at all times that the Project's turbines are operating. Arguably, when the Project is operating, there is adequate flow over the entire length of the dam to facilitate downstream eel passage. Finally, the Applicant has agreed to the imposition of downstream eel passage as a condition to its Exemption From License should the applicable agencies agree formally to impose, for example, downstream eel passage and a final, non-appealable determination has been made.

Separately, letters have been sent to the USFWS and MDFW[17] formally requesting, among other things, a list of riverine fish present in the Dwight impoundment and whether the riverine species found typically move between riverine environments, i.e., Dwight impoundment to the Chicopee Falls impoundment and vice-a-versa. If riverine species do move between these two impoundments, does the Project contribute adversely to the sustainability of these populations or to their access to habitat necessary for successful completion of their life cycles?

While a 2016 published list of known federally endangered species was attached, this is not a formal finding by the USFWS stating that there are no endangered or threatened plant or animal species

[16] See Attachment 79, Massachusetts Division of Fisheries and Wildlife Letter, Dated August 21, 2019.
[17] See Attachment 80, Central Rivers Letter to Massachusetts Division of Fisheries and Wildlife Letter, Dated March 6, 2020.

found in the Project area, which must be provided. A formal USFWS Information for Planning and Conservation (IPaC) Trust Resources Report should be obtained.

A USFWS Information for Planning and Consultation (IPaC) Report for the Project is attached.[18] It shows that there may be 12 Birds of Conservation Concern (plus the Bald Eagle) in the Project Area. While the mere presence of such migratory birds is a potential concern, the Applicant has no plans to alter any habitant for migratory birds within the Project Area. If its plans should change, the Applicant intends to inform the USFWS of its plans and request appropriate guidance.

A review of the Project Area by Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the "Division") for information regarding state-listed rare species in the vicinity of the Dwight Project was performed. Based upon the information provided, the Division determined that at this time that none of the Dwight Project sites -- Impoundment ZoE, Bypassed Reach ZoE and Tailrace Reach ZoE – are mapped as Priority or Estimated Habitat.[19] Thus, the Applicant believes that there may not be any Priority or Estimated Habitat for migratory birds in the Project Area.

While the 1992 exemption states that FERC found no cultural or historic resource protection concerns, there was no evidence that this was also the SHPO's opinion. The survey of the facility for eligibility for National Register listing requested as noted in Exhibit E could not be located. Wording in license exemption Article 12 and 13 ("…within the historic Dwight Generating Station") suggest that at least some aspect of the Project is an eligible or listed National Register property. Thus, to understand the historical significance of the Project, at a minimum documentation must be provided that identifies what aspects of the Project are either eligible or listed National Register properties. Likewise, documentation of SHPO consultation for the changes to the project since the Project has been owned by Central Rivers must be provided to demonstrate compliance with these requirements and this LIHI criterion.

A report prepared by Massachusetts Historical Commission ("MHC") in the late 1970s on the Dwight Manufacturing Area (the western half of the Project)[20] identified the Project's powerhouse either as eligible for or listed in National Register of Historical Properties Places. The report does not identify the Project's penstocks, power canal or tailrace in the Dwight Manufacturing Area either as eligible for or listed in National Register of Historical Properties. However, there is a one-page piece of paper prepared by MHC, apparently on behalf of Northeast Utilities, dated January 1990, which states that the entire Project should be eligible for inclusion in the National Register. Given no record otherwise, it appears that the Dwight area has not been added to the National Register.

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[18] See Attachment 81, USFWS IPaC Report for Dwight Project.
[19] See Attachment 40 of the Application.
[20] See Attachment 82, Massachusetts Historical Commission Report on Dwight Manufacturing Company, Prepared October 2018.

Reports prepared by the MHC in the early 1980s on the Ames Manufacturing Company Area (the eastern half of the Project).[21] [22] does not identify the Project's powerhouse, penstocks, power canal, tailrace, gate house or dam either as eligible for or listed in National Register of Historical Properties Places. There is a one-page piece of paper prepared by MHC, apparently on behalf of Northeast Utilities, dated January 1990, which states that the entire Project should be eligible for inclusion in the National Register. It appears that the Ames property was added to the National Register sometime between December 21, 1981 and June 23, 1983.

To summarize, it appears that the Dwight area is eligible for registration in the National Register while the Ames area is registered with the National Register. Thus, it appears that entire Dwight Project is eligible for registration in the National Register; however, only the east portion actually is.

A review of the Central River files showed that the Applicant has not consulted with the Massachusetts Historical Commission (SHPO) on changes to the Project since the Project was owned by the Applicant (late June 2017). Since June 27, 2018 the Applicant has not undertaken any disturbance to its lands or buildings except for certain repairs of its power canal for damages caused by the City of Chicopee.

Please review each of these answers. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Sincerely yours,

______/S/______.

attachments

cc: Patricia McIlvaine (e-mail only)
Maryalice Fischer (e-mail only)
Michael Mann (e-mail only)
Kevin Telford (e-mail only)
Ryan McQueeney (e-mail only)
Randall Osteen (e-mail only)

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[21] See Attachment 83, Massachusetts Historical Commission Report on Ames Manufacturing Company, Prepared November 30, 1978.

[22] See Attachment 84, Massachusetts Historical Commission Nomination Report on Ames Manufacturing Company, Prepared April 28, 1983.

TABLE OF ATTACHMENTS

No.	Item
44	Low Impact Hydropower Recertification Stage I Review confidential
45	**WMECO Letter Dated August 11, 1999**[23]
46	**NAEA Letter Dated June 9, 2008**
47	**NAEA Letter Dated June 9, 2008**
48	**NAEA Letter Dated January 1, 2012**
49	**NAEA Letter Dated January 1, 2012**
50	**NAEA Letter Dated January 1, 2012**
51	**FERC Letter Dated February 15, 2012**
52	**Essential Power Letter Dated February 20, 2012**
53	**FERC Order Issued March 13, 2012**
54	**Essential Power Letter Dated December 2, 2015**
55	**FERC Order Issued March 1, 2016**
56	**FERC Notice Of Transfer Of Exemptions Dated June 27, 2017**
57	**FERC Order Amending Licenses And Exemptions To Change License And Exemptee Names Issued July 18, 2018**
58	Standard Terms And Conditions Of Exemption From Licensing
59	FERC Order Amending Exemption (Issued December 29, 1999)

[23] These Attachments (45-57) pertain of the various changes of name and ownership of the Project.

60 FERC Order Amending Exemptions (Issued November 8, 2001)

61 Essential Power Letter To FERC, Dated October 22, 2013[24]

62 Essential Power Letter To FERC, January 17, 2014

63 Essential Power Letter To FERC, Dated April 11, 2014

64 FERC Letter To Essential Power, Dated May 5, 2014

65 FERC Letter To Essential Power, Dated May 9, 2014

66 Essential Power Letter To FERC, Dated May 13, 2014

67 Essential Power Letter To FERC, Dated September 15, 2014

68 Essential Power Letter To FERC, Dated November 12, 2014

69 Kleinschmidt Letter To FERC, Dated December 23, 2014

70 Kleinschmidt Letter To FERC, Dated February 24, 2015

71 FERC Letter To Essential Power, Dated May 2, 2015

72 Kleinschmidt Letter To FERC, Dated July 24, 2015

73 FERC Letter To Essential Power, Dated October 21, 2015

74 Kleinschmidt Letter To FERC, Dated January 21, 2016

75 FERC Letter To Essential Power, Dated January 27, 2016

76 Essential Power Letter to FERC, Dated February 10, 2016

77 Massachusetts Department Of Environmental Protection Letter, November 29, 2019

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[24] These Attachments (61-76) pertain to the penstock failure and subsequent repair.

78 Central Rivers Letter To United States Fish & Wildlife Service, Dated March 6, 2020

79 Massachusetts Division of Fisheries and Wildlife Letter, Dated August 21, 2019

80 Central Rivers Letter To Massachusetts Division of Fisheries and Wildlife, Dated March 6, 2020

81 Massachusetts Historical Commission Report on Dwight Manufacturing Company, Prepared October 2018

82 Massachusetts Historical Commission Report on Ames Manufacturing Company, Prepared November 30, 1978

83 Massachusetts Historical Commission Nomination Report on Ames Manufacturing Company, Prepared April 28, 1983

Northeast Utilities System

107 Selden Street, Berlin, CT 06037

P.O. Box 270
Hartford, CT 06141-0270
(860) 665-5315
Fax (860) 665-6263

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FEDERAL ENERGY
REGULATORY
COMMISSION

August 11, 1999

William J. Nadeau
Vice President - Fossil/Hydro Engineering
and Operations

The Honorable David P. Boergers
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Subject: Transfer of Red Bridge (No. 10676-010), Putts Bridge (No. 10677-010), Indian Orchard (No. 10678-013), and Dwight (No. 10675-009) Projects

Dear Secretary Boergers:

Pursuant to 18 CFR § 4.106(i), this letter is to inform you of the transfer of the Red Bridge (No. 10676), Putts Bridge (No. 10677), Indian Orchard (No. 10678) and Dwight (No. 10675) Projects from Western Massachusetts Electric Company to Consolidated Edison Energy Massachusetts, Inc. effective July 24, 1999. The address of Consolidated Edison Energy Massachusetts, Inc. is c/o Consolidated Edison Energy, Inc., 701 Westchester Avenue, Suite 320 East, White Plains, New York 10604.

If you have any questions, please contact Howard Person at (413) 536-9414.

Very truly yours,

WESTERN MASSACHUSETTS ELECTRIC COMPANY

William J. Nadeau

Mr. Anton J. Sidoti, Regional Director
Federal Energy Regulatory Commission
19 West 34th Street - Suite 400
New York, NY 10001

Mr. Mike Monahan
Federal Energy Regulatory Commission
19 West 34th Street - Suite 400
New York, NY 10001

FERC DOCKETED

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Mr. Alex Simon
Federal Energy Regulatory Commission
19 West 34th Street - Suite 400
New York, NY 10001

Mr. John Warner
U.S. Fish and Wildlife Service
Ralph Pill Marketplace, 4th Floor
22 Bridge Street
Concord, NH 03301-4901

Mr. Caleb Slater
Massachusetts Division of Fisheries and Wildlife
Field Headquarters
1 Rabbit Hill Road
Westboro, MA 01581

Mr. Mark Noyes
Consolidated Edison Energy, Inc.
111 Broadway
16th Floor
New York, NY 10006

Mr. John Labiak
Consolidated Edison Energy, Inc.
111 Broadway
16th Floor
New York, NY 10006

Mr. Brian Cray
Con Edison Company of New York
4 Irving Place
Legal Department
New York, NY 10003

ORIGINAL

AKIN GUMP
STRAUSS HAUER & FELD LLP
Attorneys at Law

BRUCE A. GRABOW
202.887.4256/fax: 202.887.4288
bgrabow@akingump.com

June 9, 2008

The Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, SE
Washington, D.C. 20426-0001

Re: **Dwight Project, Docket No. P-10675 – 014**
Red Bridge Project, Docket No. P-10676 – 017
Putts Project, Docket No. P-10677 – 014
Indian Orchard Project, Docket No. P-10678 – 017

NOTICE OF TRANSFER

Dear Secretary Bose:

On April 4, 2008, the Federal Energy Regulatory Commission ("Commission" or "FERC") authorized a transaction pursuant to which Consolidated Edison Development, Inc., *et al.* ("ConEd") disposed of, and North American Energy Alliance, LLC, *et al.* ("NAEA") acquired, certain jurisdictional facilities (the "Transaction").[1] On May 8, 2008, ownership of Consolidated Edison Energy Massachusetts, Inc. ("CEEMI"), a wholly-owned subsidiary of ConEd, was transferred to NAEA as part of the Transaction. CEEMI owns and operates, *inter alia*, certain hydroelectric generation facilities, including the Dwight Project, the Red Bridge Project, the Putts Project and the Indian Orchard Project (collectively, the "Projects"). The Commission previously issued orders exempting the Projects from the licensing requirements of Part I of the Federal Power Act ("FPA") (the "Exemption Orders").[2]

[1] *See Consolidated Edison Dev., Inc., et al.*, 123 FERC ¶ 61,022 (2008). The Transaction Order and the related FPA section 203 application provide additional details respecting ConEd, the Applicants, NAEA, and the Transaction. *See* Transaction Order; *Consolidated Edison Dev., Inc., et al.*, Joint Application Under Section 203 of the Federal Power Act for Authorization of Transactions and Request for Waivers and Expedited Consideration, filed Jan. 9, 2008, Docket No. EC08-36-000; *Consolidated Edison Dev., Inc., et al.*, Response to Deficiency Letter, Provision of Updated Information and Request for Shortened Comment Period, filed Mar. 10, 2008, Docket No. EC08-36-000.

[2] *See Western Mass. Elec. Co.*, 60 FERC ¶ 62,196 (1992) (granting Indian Orchard Project exemption from FPA Part I licensing requirements); *Western Mass. Elec. Co.*, Delegated Letter Order, issued Sept. 11, 1992, Project No. P-10675-001 (granting Dwight Project exemption from FPA Part I licensing requirements); *Western Mass. Elec. Co.*, 60 FERC ¶ 62,198 (1992) (granting Red Bridge Project exemption from FPA Part I licensing requirements); *Western Mass. Elec. Co.*, 60 FERC ¶ 62,197 (1992) (granting Putts Bridge Project exemption from FPA Part I licensing requirements).

Pursuant to 18 C.F.R. § 4.106(i), this letter provides the Commission with updated contact information for NAEA and for NAEA Energy Massachusetts, LLC,[3] as follows:

John McTear
NAEA Energy Massachusetts, LLC
c/o Industry Funds Management
Times Square Tower
7 Times Square 25th Floor
New York, NY 10036
Tel: (208)-215-6757
Fax: (212)-575-8738
john.mctear@naeallc.com

NAEA is serving a copy of this notice on the Commission's New York Regional Director.[4] Please contact the undersigned should you have any questions regarding this filing.

Respectfully submitted,

G. Philip Nowak
Bruce A. Grabow
Brian C. Drumm
Akin Gump Strauss Hauer & Feld LLP
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036-1564

Attorneys for NAEA

cc: Peter R. Valeri, Acting Regional Engineer, New York Office of Energy Projects

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[3] A Notice of Succession pursuant to the Commission's regulations at 18 C.F.R. § 35.16 is being filed with the Commission to reflect a corporate name change for CEEMI, which hereafter will be known as "NAEA Energy Massachusetts, LLC."

[4] *See* Exemption Orders.

AKIN GUMP
STRAUSS HAUER & FELD LLP
Attorneys at Law

BRUCE A. GRABOW
202.887.4255/fax: 202.887.4288
bgrabow@akingump.com

June 9, 2008

Jun 13, 2008

The Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, SE
Washington, D.C. 20426-0001

Re: **Dwight Project, Docket No. P-10675**
Red Bridge Project, Docket No. P-10676
Putts Project, Docket No. P-10677
Indian Orchard Project, Docket No. P-10678

NOTICE OF TRANSFER

Dear Secretary Bose:

On April 4, 2008, the Federal Energy Regulatory Commission ("Commission" or "FERC") authorized a transaction pursuant to which Consolidated Edison Development, Inc., *et al.* ("ConEd") disposed of, and North American Energy Alliance, LLC, *et al.* ("NAEA") acquired, certain jurisdictional facilities (the "Transaction").[1] On May 8, 2008, ownership of Consolidated Edison Energy Massachusetts, Inc. ("CEEMI"), a wholly-owned subsidiary of ConEd, was transferred to NAEA as part of the Transaction. CEEMI owns and operates, *inter alia*, certain hydroelectric generation facilities, including the Dwight Project, the Red Bridge Project, the Putts Project and the Indian Orchard Project (collectively, the "Projects"). The Commission previously issued orders exempting the Projects from the licensing requirements of Part I of the Federal Power Act ("FPA") (the "Exemption Orders").[2]

---

[1] *See Consolidated Edison Dev., Inc., et al.*, 123 FERC ¶ 61,022 (2008). The Transaction Order and the related FPA section 203 application provide additional details respecting ConEd, the Applicants, NAEA, and the Transaction. *See* Transaction Order; *Consolidated Edison Dev., Inc., et al.*, Joint Application Under Section 203 of the Federal Power Act for Authorization of Transactions and Request for Waivers and Expedited Consideration, filed Jan. 9, 2008, Docket No. EC08-36-000; *Consolidated Edison Dev., Inc., et al.*, Response to Deficiency Letter, Provision of Updated Information and Request for Shortened Comment Period, filed Mar. 10, 2008, Docket No. EC08-36-000.

[2] *See Western Mass. Elec. Co.*, 60 FERC ¶ 62,196 (1992) (granting Indian Orchard Project exemption from FPA Part I licensing requirements); *Western Mass. Elec. Co.*, Delegated Letter Order, issued Sept. 11, 1992, Project No. P-10675-001 (granting Dwight Project exemption from FPA Part I licensing requirements); *Western Mass. Elec. Co.*, 60 FERC ¶ 62,198 (1992) (granting Red Bridge Project exemption from FPA Part I licensing requirements); *Western Mass. Elec. Co.*, 60 FERC ¶ 62,197 (1992) (granting Putts Bridge Project exemption from FPA Part I licensing requirements).

Pursuant to 18 C.F.R. § 4.106(i), this letter provides the Commission with updated contact information for NAEA and for NAEA Energy Massachusetts, LLC,[3] as follows:

John McTear
NAEA Energy Massachusetts, LLC
c/o Industry Funds Management
Times Square Tower
7 Times Square 25th Floor
New York, NY 10036
Tel: (208)-215-6757
Fax: (212)-575-8738
john.mctear@naeallc.com

NAEA is serving a copy of this notice on the Commission's New York Regional Director.[4] Please contact the undersigned should you have any questions regarding this filing.

Respectfully submitted,

G. Philip Nowak
Bruce A. Grabow
Brian C. Drumm
Akin Gump Strauss Hauer & Feld LLP
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036-1564

Attorneys for NAEA

cc: Peter R. Valeri, Acting Regional Engineer, New York Office of Energy Projects

[3] A Notice of Succession pursuant to the Commission's regulations at 18 C.F.R. § 35.16 is being filed with the Commission to reflect a corporate name change for CEEMI, which hereafter will be known as "NAEA Energy Massachusetts, LLC."

[4] *See* Exemption Orders.

NAEA
NORTH AMERICAN ENERGY ALLIANCE, LLC

FILED
SECRETARY OF THE COMMISSION

2012 JAN -3 A 9:45

FEDERAL ENERGY REGULATORY COMMISSION

ORIGINAL

January 1, 2012

Federal Energy Regulatory Commission
888 First Street North East
Washington, DC 20426
Attention: Ms. Kimberly Bose
P-10675-MA Dwight Station;
P-2334-MA Gardners Falls/NATDAM No MA00853;
P-10678(A)-MA Indian Orchard/NATDAM No MA00722;
P-10677(A)-MA Putts Bridge;
P-10676(A)-MA Red Bridge/NATDAM No MA00723;
NAEA Energy Massachusetts, LLC;

Re: Change of Company Name

To Whom It May Concern:

Please be advised that, effective January 1, 2012, the names of the North American Energy Alliance family of companies have been changed as listed below. This notification of name change is effective for all of the NAEA entities.

Former Name	New Name
North American Energy Alliance Holdings, LLC	Essential Power Holdings, LLC
North American Energy Alliance, LLC	Essential Power, LLC
NAEA Rock Springs, LLC	EP Rock Springs, LLC
NAEA Ocean Peaking Power, LLC	EP Ocean Peaking Power, LLC
NAEA Energy Massachusetts, LLC	EP Energy Massachusetts, LLC
NAEA Newington Energy, LLC	EP Newington Energy, LLC
NAEA Lakewood, LLC	EP Lakewood, LLC
NAEA Generation Holding, LLC	EP Generation Holding, LLC
NAEA Lakewood Generation, LLC	EP Lakewood Generation, LLC
NAEA Operating Company, LLC	Essential Power Operating Company, LLC
North American Energy Alliance Finance Corp.	Essential Power Finance Corp.

These are only name changes and should be transparent to your company. There has been no change in ownership of these entities or of their corporate status. All tax identification numbers, both federal and state as well as any other identification numbers will not change. All of the rights and obligations of the listed entities are unaffected by this name change. Therefore, there is no reason for any formal assignment or assumption of the respective entities' rights and obligations. All documentation such as correspondence, contracts, invoices, checks, confirms, purchase orders, etc. will reflect the new name. However, during the interim transitional period while our systems are being updated you may receive documentation in either name.

If you have any questions on this notification please contact me at the phone number or e-mail address listed below.

Sincerely,

I. David Rosenstein, General Counsel
Phone: 732-623-8786
E-mail: david.rosenstein@naeallc.com

99 Wood Avenue South, Suite 200, Iselin, NJ 08830
Tel: 732.623.8700 – Fax: 732.623.8701 – www.naeallc.com

Document Content(s)

NAEA
NORTH AMERICAN ENERGY ALLIANCE, LLC

January 1, 2012

Federal Energy Regulatory Commission
Washington, DC 20426
Attention: Heather Campbell-Outdoor Recreation Planner- Div Hydropower Admin & Compliance
P-10675-MA Dwight Station;
P-2334-MA Gardners Falls/NATDAM No MA00853;
P-10678(A)-MA Indian Orchard/NATDAM No MA00722;
P-10677(A)-MA Putts Bridge;
P-10676(A)-MA Red Bridge/NATDAM No MA00723;
NAEA Energy Massachusetts, LLC;

Re: Change of Company Name

To Whom It May Concern:

Please be advised that, effective January 1, 2012, the names of the North American Energy Alliance family of companies have been changed as listed below. This notification of name change is effective for all of the NAEA entities.

Former Name	New Name
North American Energy Alliance Holdings, LLC	Essential Power Holdings, LLC
North American Energy Alliance, LLC	Essential Power, LLC
NAEA Rock Springs, LLC	EP Rock Springs, LLC
NAEA Ocean Peaking Power, LLC	EP Ocean Peaking Power, LLC
NAEA Energy Massachusetts, LLC	EP Energy Massachusetts, LLC
NAEA Newington Energy, LLC	EP Newington Energy, LLC
NAEA Lakewood, LLC	EP Lakewood, LLC
NAEA Generation Holding, LLC	EP Generation Holding, LLC
NAEA Lakewood Generation, LLC	EP Lakewood Generation, LLC
NAEA Operating Company, LLC	Essential Power Operating Company, LLC
North American Energy Alliance Finance Corp.	Essential Power Finance Corp.

These are only name changes and should be transparent to your company. There has been no change in ownership of these entities or of their corporate status. All tax identification numbers, both federal and state as well as any other identification numbers will not change. All of the rights and obligations of the listed entities are unaffected by this name change. Therefore, there is no reason for any formal assignment or assumption of the respective entities' rights and obligations. All documentation such as correspondence, contracts, invoices, checks, confirms, purchase orders, etc. will reflect the new name. However, during the interim transitional period while our systems are being updated you may receive documentation in either name.

If you have any questions on this notification please contact me at the phone number or e-mail address listed below.

Sincerely,

I. David Rosenstein, General Counsel
Phone: 732-623-8786
E-mail: david.rosenstein@naeallc.com

99 Wood Avenue South, Suite 200, Iselin, NJ 08830
Tel: 732.623.8700 – Fax: 732.623.8701 – www.naeallc.com

Document Content(s)

NAEA
NORTH AMERICAN ENERGY ALLIANCE, LLC

Filed: 9-01-2012

January 1, 2012

Federal Energy Regulatory Commission Office of Energy Projects
19 West 34th Street
Suite 400
New York, NY 10001
Attention: Chung Yao Hsu, Civil Engineer
P-10675-MA Dwight Station;
P-2334-MA Gardners Falls/NATDAM No MA00853;
P-10678(A)-MA Indian Orchard/NATDAM No MA00722;
P-10677(A)-MA Putts Bridge;
P-10676(A)-MA Red Bridge/NATDAM No MA00723;
NAEA Energy Massachusetts, LLC;

Re: Change of Company Name

To Whom It May Concern:

Please be advised that, effective January 1, 2012, the names of the North American Energy Alliance family of companies have been changed as listed below. This notification of name change is effective for all of the NAEA entities.

Former Name	New Name
North American Energy Alliance Holdings, LLC	Essential Power Holdings, LLC
North American Energy Alliance, LLC	Essential Power, LLC
NAEA Rock Springs, LLC	EP Rock Springs, LLC
NAEA Ocean Peaking Power, LLC	EP Ocean Peaking Power, LLC
NAEA Energy Massachusetts, LLC	EP Energy Massachusetts, LLC
NAEA Newington Energy, LLC	EP Newington Energy, LLC
NAEA Lakewood, LLC	EP Lakewood, LLC
NAEA Generation Holding, LLC	EP Generation Holding, LLC
NAEA Lakewood Generation, LLC	EP Lakewood Generation, LLC
NAEA Operating Company, LLC	Essential Power Operating Company, LLC
North American Energy Alliance Finance Corp.	Essential Power Finance Corp.

These are only name changes and should be transparent to your company. There has been no change in ownership of these entities or of their corporate status. All tax identification numbers, both federal and state as well as any other identification numbers will not change. All of the rights and obligations of the listed entities are unaffected by this name change. Therefore, there is no reason for any formal assignment or assumption of the respective entities' rights and obligations. All documentation such as correspondence, contracts, invoices, checks, confirms, purchase orders, etc. will reflect the new name. However, during the interim transitional period while our systems are being updated you may receive documentation in either name.

If you have any questions on this notification please contact me at the phone number or e-mail address listed below.

Sincerely,

I D Rosenstein

I. David Rosenstein, General Counsel
Phone: 732-623-8786
E-mail: david.rosenstein@naeallc.com

Document Content(s)

FEDERAL ENERGY REGULATORY COMMISSION
Washington, D.C. 20426

OFFICE OF ENERGY PROJECTS

Project No. 10675-015--MA
Dwight Station Project
North American Energy Alliance, LLC

Project No. 2334-050-MA
Gardners Falls Project
North American Energy Alliance, LLC

Project No. 10678-019--MA
Indian Orchard Project
North American Energy Massachusetts, LLC

Project No. 10677-016--MA
Putts Bridge project
North American Energy Massachusetts, LLC

Project No. 10676-019--MA
Red Bridge Project
North American Energy Massachusetts, LLC

February 15, 2012

Mr. John Bahrs
99 Wood Avenue South
Suite 200
Iselin, NJ 08830

Reference: Request for Additional Information

Dear Mr. Bahrs:

On January 6, 2012, I. David Rosenstein, General Counsel for North American Energy Alliance, LLC, on behalf of Mr. John Bahrs, licensee and exemptee for the above mentioned projects, filed a request to change the company names of the projects.

Based on staff's review of your filing, additional information is needed in order to process your request. In order to further process your filing, please provide documentation and show evidence that these are just name changes and not transfers. We request that you submit the additional information as soon as possible.

Pursuant to 18 C.F.R. §§ 385.2001(a)(1)(iii) and 385.2101(a), your response may be filed electronically via the Internet through the links provided at http://www.ferc.gov, or my mail. To file by mail, an original and eight copies of your response should be mailed to:

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street N.E., PJ-12
Washington, D.C. 20426

Thank you for your cooperation in this matter. If you have any questions, please contact Patricia W. Gillis at (202) 502-8735.

Sincerely,

Charles K. Cover, P.E.
Chief, Project Review Branch
Division of Hydropower Administration
and Compliance

cc: Mr. I. David Rosenstein
General Counsel
North American Energy Alliance, LLC
99 Wood Avenue South
Suite 200
Iselin, NJ 08830

Document Content(s)

ORIGINAL

February 20, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, PJ-12
Washington, DC 20426

Re: Project No. 10675-015-MA Dwight Station Project; Project No. 2334-050-MA Gardners Falls Project; Project No. 10678-019-MA Indian Orchard Project; Project No. 10677-016-MA Putts Bridge Project; Project No. 10676-019-MA Red Bridge Project

On January 6, 2012 I filed a Notification of Name Change for the above five licensed projects. The owner of all of these Projects is NAEA Energy Massachusetts, LLC. The new name of the owner is EP Energy Massachusetts, LLC. This was only a name change and did not involve a transfer of title.

By letter dated February 15, 2012 Charles Cover asked for proof that this involved only a name change on not a transfer of title. Not knowing exactly what is required to show proof of the name change I am enclosing nine copies of each of the following:

- Unanimous Written Consent of the Board of Managers of NAEA Energy Massachusetts, LLC, dated October 21, 2011, authorizing the name change to EP Energy Massachusetts, LLC;
- Certificate of Amendment filed with the State of Delaware (the state of incorporation), dated December 8, 2011, certifying the name change in the LLC Certificate of Formation; and
- Foreign LLC registration filed on January 10, 2012 with the Commonwealth of Massachusetts providing notice of the name change.

Please feel free to call me at (732) 623-8786 if there are any other questions with respect to this filing.

Sincerely,

I.David Rosenstein, General Counsel

NAEA ENERGY MASSACHUSETTS, LLC
UNANIMOUS WRITTEN CONSENT OF BOARD OF MANAGERS

The Board of Managers (the "Board") of NAEA Energy Massachusetts, LLC, a Delaware limited liability company (the "Company"), on this 21st day of October, 2011, unanimously consent in writing to the following resolutions without a meeting, and in counterparts:

WHEREAS, management of the Company has determined that it is in the best interests of the Company for the Company to change its name from NAEA Energy Massachusetts, LLC to EP Energy Massachusetts, LLC; and

WHEREAS, the Board agrees that the above described determination of management is in the best interests of the Company and approves the following resolutions.

CHANGE OF CORPORATE NAME

NOW THEREORE BE IT RESOLVED, that the Company Operating Agreement shall be amended so that the name of the Company is changed from NAEA Energy Massachusetts, LLC to EP Energy Massachusetts, LLC.

FURTHER RESOLVED, that the appropriate officers of the Company shall cause to be made all filings with government regulatory agencies and other entities as may be required to make effective the above described change of corporate name.

GENERAL AUTHORIZATION AND RATIFICATION

FURTHER RESOLVED, that the appropriate officers of the Company be, and they hereby are, authorized on behalf of the Company, to take or cause to be taken any and all such other and further actions and to execute, acknowledge, and deliver any and all such agreements and documents as they deem necessary and desirable in order to carry into effect the purpose and intent of the foregoing resolutions; and

FURTHER RESOLVED, That any and all actions previously taken by said officers in connection with the actions contemplated by the foregoing resolutions be, and they hereby are, ratified, confirmed and approved in all respects.

[SIGNATURE PAGE FOLLOWS]

IN WITNESS WHEREOF, the undersigned, constituting all of the members of the Board of Managers have caused this Consent to be executed on the date first written above.

Michael Thompson

Lars Bespolka

Thomas M. Rainwater

State of Delaware
Secretary of State
Division of Corporations
Delivered 10:00 AM 12/14/2011
FILED 10:00 AM 12/14/2011
SRV 111291253 - 3037155 FILE

STATE *of* DELAWARE

CERTIFICATE *of* AMENDMENT

FIRST: The name of the limited liability company is: NAEA Energy Massachusetts, LLC.

SECOND: The Certificate of Formation of the limited liability company is hereby amended as follows:

The name of the limited liability company shall be:

EP ENERGY MASSACHUSETTS, LLC

THIRD: The effective date of said amendment shall be January 1, 2012.

IN WITNESS WHEREOF, the undersigned has executed this Certificate of Amendment on the 14 day of December, 2011.

By: [signature]
I. David Rosenstein
Authorized Representative

{00342780;v3 }

The Commonwealth of Massachusetts
William Francis Galvin

Secretary of the Commonwealth, Corporations Division
One Ashburton Place, 17th floor
Boston, MA 02108-1512
Telephone: (617) 727-9640

EP ENERGY MASSACHUSETTS, LLC Summary Screen

Help with this form

Request a Certificate

The exact name of the Foreign Limited Liability Company (LLC): EP ENERGY MASSACHUSETTS, LLC

The name was changed from: NAEA ENERGY MASSACHUSETTS, LLC **on** 1/10/2012
The name was changed from: NAEA ENERGY MASSACHUSETTS, LLC **on** 4/21/2010
The name was changed from: CONSOLIDATED EDISON ENERGY MASSACHUSETTS, LLC **on** 5/9/2008

Converted from CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC. **on** 4/24/2008

Entity Type: Foreign Limited Liability Company (LLC)

Identification Number: 000976443

Date of Registration in Massachusetts: 04/23/2008

The is organized under the laws of: State: DE Country: USA on: 04/18/2008

The location of its principal office:
No. and Street: 99 WOOD AVE., SOUTH, SUITE 200
City or Town: ISELIN State: NJ Zip: 08830 Country: USA

The location of its Massachusetts office, if any:
No. and Street: 15 AGAWAM AVE.
City or Town: WEST SPRINGFIELD State: MA Zip: 01089 Country: USA

The name and address of the Resident Agent:
Name: CORPORATION SERVICE COMPANY
No. and Street: 84 STATE STREET
City or Town: BOSTON State: MA Zip: 02109 Country: USA

The name and business address of each manager:

Title	Individual Name First, Middle, Last, Suffix	Address (no PO Box) Address, City or Town, State, Zip Code
MANAGER	LARS BESPOLKA	99 WOOD AVE., SOUTH, SUITE 200 ISELIN, NJ 08830 USA
MANAGER	MICHAEL THOMPSON	99 WOOD AVE., SOUTH, SUITE 200 ISELIN, NJ 08830 USA
MANAGER	THOMAS M. RAINWATER	99 WOOD AVE., SOUTH, SUITE 200 ISELIN, NJ 08830 USA

The name and business address of the person(s) authorized to execute, acknowledge, deliver and record any recordable instrument purporting to affect an interest in real property

Document Content(s)

138 FERC ¶ 62,228
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

North American Energy Alliance Massachusetts, LLC
EP Energy Massachusetts, LLC

Project Nos. 10675-015, 2334-050, 10678-019, 10677-016, and 10676-019

ORDER AMENDING LICENSE AND EXEMPTIONS

(March 13, 2012)

1. North American Energy Alliance Massachusetts, LLC requests in a January 6, 2012 filing that its license and exemptions be amended to reflect its new name, EP Energy Massachusetts, LLC. EP Energy Massachusetts, LLC states that this is a name change only and that there has been no change in the legal entity. The projects affected by this amendment are:

Dwight Station Project Hydroelectric Project, FERC No. 10675, located on the Chicopee River in Hampden County, MA;

Gardners Falls Project, FERC No. 2334, located on the Deerfield River in Franklin County, MA;

Indian Orchard Project, FERC No. 10678, located on the Chicopee River in Hampden County, MA;

Putts Bridge Project, FERC No. 10677, located on the Chicopee River in Hampden County, MA; and

Red Bridge Project, FERC No. 10676, located on the Chicopee River in Hampden County, MA;

2. By letter dated February 15, 2012, the Commission requested the licensee and exemptee to provide documentation and show evidence that this request is for a name change.

3. On February 27, 2012, the licensee and exemptee filed documentation which included a Unanimous Written Consent of Board Managers of NAEA Energy Massachusetts, LLC dated October 21, 2011, authorizing the name change to EP Energy Massachusetts, LLC, the State of Delaware Certificate of Amendment dated December 8,

2011, certifying the name change, and the Foreign LLC registration filed on January 10, 2012 with the Commonwealth of Massachusetts proving notice of the name change.

The Director orders:

(A) The exemptions for the Dwight Station Project Hydroelectric Project No. 10675, Indian Orchard Project No. 10678, Putts Bridge Project No. 10677, Red Bridge Project No. 10676, and the license for the Gardners Falls Project No. 2334 are amended to change the exemptee's and licensee's name from North American Energy Alliance Massachusetts, LLC to EP Energy Massachusetts, LLC.

(B) This order constitutes final agency action. Any party may file a request for rehearing of this order within 30 days from the date of its issuance, as provided in section 313(a) of the FPA, 16 U.S.C. §825l (2006), and the Commission's regulations at 18 C.F.R. § 385.713 (2011). The filing of a request for rehearing does not operate as a stay of the effective date of this order, or of any other date specified in this order.

Charles K. Cover, P. E.
Chief, Project Review Branch
Division of Hydropower Administration
and Compliance

Document Content(s)

ELECTRONICALLY FILED

December 2, 2015

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Re: Notice of Change of Entity Name for Hydropower Licensees and Exemption Holders:

	Essential Power Massachusetts, LLC
P-10675	Dwight Station Project
P-2334	Gardners Falls Project
P-10678	Indian Orchard Project
P-10677	Putts Bridge Project
P-10676	Red Bridge Project

Dear Secretary Bose:

This letter shall serve as notice that the owner of the above listed hydroelectric generation projects changed its name from EP Energy Massachusetts, LLC to **Essential Power Massachusetts, LLC** effective February 26, 2013. There was no change in ownership or of entity type; only a name change.

On March 21, 2013 Essential Power Massachusetts, LLC filed its Notice of Succession to FERC Market-Based Rate Tariff in Docket No. ER13-1141-000, and thereby notified the Commission of the name change. On May 2, 2013, the Commission issued a Letter Order accepting the Notice of Succession.

At that time, Essential Power Massachusetts, LLC should have also notified the Commission of the name change with respect to the above-referenced hydroelectric projects. It is providing that notice now.

In support of this Notice of Change of Entity Name for Hydropower Licensees and Exemption Holders, please find a copy of the State of Delaware Certificate of Amendment (Attachment A) and a copy of the Amendment to the Commonwealth of Massachusetts Registration Certificate of EP Energy Massachusetts, LLC (Attachment B), which show that the change to the name Essential Power Massachusetts, LLC was properly registered in the state of the entity's incorporation and the state where the hydroelectric projects are located.

Essential Power Massachusetts, LLC hereby requests that the Commission change the entity name for each of the Hydropower Licensees and Exemption Holders.

If you require any additional information, please contact:

David Musselman
Associate General Counsel
Essential Power Services, LLC
150 College Road West, Suite 300
Princeton, NJ 08540
(609) 917-3790
david.musselman@essentialpowerllc.com

I appreciate your assistance in this matter.

Sincerely,

/s/ David Musselman

David Musselman

Attorney for Essential Power Massachusetts, LLC

Attachments

ATTACHMENT A

State of Delaware
Secretary of State
Division of Corporations
Delivered 10:00 AM 03/05/2013
FILED 10:00 AM 03/05/2013
SRV 130275999 - 3037155 FILE

STATE *of* DELAWARE

CERTIFICATE *of* AMENDMENT

FIRST: The name of the limited liability company is: EP Energy Massachusetts, LLC

SECOND: The Certificate of Formation of the limited liability company is hereby amended as follows:

The name of the limited liability company shall be:

ESSENTIAL POWER MASSACHUSETTS, LLC

IN WITNESS WHEREOF, the undersigned has executed this Certificate of Amendment on the 21st day of February, 2013.

By: [signature]
I. David Rosenstein
Authorized Representative

ATTACHMENT B

MA SOC Filing Number: 201329613050 Date: 3/18/2013 10:58:00 AM

THE COMMONWEALTH OF MASSACHUSETTS

I hereby certify that, upon examination of this document, duly submitted to me, it appears that the provisions of the General Laws relative to corporations have been complied with, and I hereby approve said articles; and the filing fee having been paid, said articles are deemed to have been filed with me on:

March 18, 2013 10:58 AM

WILLIAM FRANCIS GALVIN

Secretary of the Commonwealth

AMENDMENT TO REGISTRATION CERTIFICATE

OF

EP ENERGY MASSACHUSETTS, LLC

The undersigned authorized individual, for the purpose of amending the Certificate of Organization of EP Energy Massachusetts, LLC, a Massachusetts limited liability company (the "Company"), under the provisions and subject to Chapter 156C Section 13 (the "Act") of the Massachusetts General Laws hereby certifies as follows:

1. **Federal Employer Identification Number.** The Federal Employer Identification Number of the Company is 26-2484366.

2. **Name of the Limited Liability Company.** The name of the Company is EP Energy Massachusetts, LLC.

3. **Jurisdiction.** The Company was duly formed under the laws of the State of Delaware on April 18, 2008.

4. **Date of Registration.** The date of the filing of the Certificate of Organization in Massachusetts is April 23, 2008.

5. **Principal Office of the Company.** The address of the principal office of the Company is 99 Wood Avenue South, Suite 200, Iselin, NJ 08830.

6. **Location of Massachusetts office.** The address of the Company within the Commonwealth of Massachusetts is 15 Agawam Avenue, West Springfield, MA 01089.

7. **Registered Agent.** The name and address of the Registered Agent of the Company is Corporation Service Company, 84 State Street, Boston, MA 02109.

8. **Managers.** The names and address of the managers of the Company are as follows:

Lars Bespolka	99 Wood Avenue South, Suite 200 Iselin, NJ 08830
Alec Montgomery	99 Wood Avenue South, Suite 200 Iselin, NJ 08830
Thomas M Rainwater	99 Wood Avenue South, Suite 200 Iselin, NJ 08830

9. **Execution of Documents.** The name and address of the individual, in addition to the Managers, who is authorized to execute on behalf of the Company any documents to be filed with the Secretary of the Commonwealth of Massachusetts is as follows:

I. David Rosenstein	99 Wood Avenue South, Suite 200 Iselin, NJ 08830

10. Amendment. This Certificate of Amendment shall amend the Certificate of Organization of the Company as follows:

a. The name of the Company shall be changed to:
ESSENTIAL POWER MASSACHUSETTS, LLC

b. The names and addresses of the managers of the company are restated as follows:

Lars Bespolka	99 Wood Avenue South, Suite 200 Iselin, NJ 08830
Alec Montgomery	99 Wood Avenue South, Suite 200 Iselin, NJ 08830
Thomas M Rainwater	99 Wood Avenue South, Suite 200 Iselin, NJ 08830

c. The names and addresses of each individual authorized to execute any documents to be filed with the Secretary of the Commonwealth of Massachusetts are restated as follows:

Lars Bespolka	99 Wood Avenue South, Suite 200 Iselin, NJ 08830
Alec Montgomery	99 Wood Avenue South, Suite 200 Iselin, NJ 08830
Thomas M Rainwater	99 Wood Avenue South, Suite 200 Iselin, NJ 08830
I. David Rosenstein	99 Wood Avenue South, Suite 200 Iselin, NJ 08830

11. Certificate. Attached hereto is a Certificate from the State of Delaware evidencing the filing of the above name change in the Company's state of formation on March 5, 2013.

IN WITNESS WHEREOF, the undersigned has executed this Amendment to Registration Certificate as of the 29 day of March, 2013.

[signature]

I. David Rosenstein
Vice President and General Counsel

Delaware

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY "ESSENTIAL POWER MASSACHUSETTS, LLC" IS DULY FORMED UNDER THE LAWS OF THE STATE OF DELAWARE AND IS IN GOOD STANDING AND HAS A LEGAL EXISTENCE SO FAR AS THE RECORDS OF THIS OFFICE SHOW, AS OF THE FOURTEENTH DAY OF MARCH, A.D. 2013.

Document Content(s)

154 FERC ¶ 62,142
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

EP Energy Massachusetts, LLC
Essential Power Massachusetts, LLC

Project Nos. 10675-018, 2334-054, 10678-023, 10677-019, and 10676-023

ORDER AMENDING EXEMPTIONS AND LICENSE

(March 1, 2016)

1. On December 2, 2015, EP Energy Massachusetts, LLC, (EP Energy, licensee/exemptee) filed a notice advising the Commission that EP Energy, licensee/exemptee for the five captioned projects,[1] had changed its name to Essential Power Massachusetts, LLC effective February 26, 2013. EP Energy states that this is a change of name only and that there has been no change in the legal entity.

2. The name change does not affect the exemptee's/licensee's qualifications to be an exemptee/licensee under the Federal Power Act nor any other conditions of the exemptions or license. The request to approve a change in a corporate name should be approved.

The Director orders:

(A) The exemptee/licensee for the five projects identified herein are amended to change the exemptee's/licensee's name from EP Energy Massachusetts, LLC to Essential Power Massachusetts, LLC.

[1] The project numbers, names of projects, and exemptions/license order citations are: Project No. 2334, Gardners Falls, *79 FERC ¶ 61,007(1997);*Project No. 10675, Dwight, *60 FERC ¶ 62,199 (1992);* Project No. 10676, Red Bridge, *60 FERC ¶ 62,198 (1992);* Project No. 10677, Putts, *60 FERC ¶ 62,197 (1992);* and Project No. 10678, Indian Orchard, *60 FERC ¶ 62,196 (1992).*

(B) This order constitutes final agency action. Any party may file a request for rehearing of this order within 30 days from the date of its issuance, as provided in section (§) 313(a) of the Federal Power Act, 16 U.S.C. § 825*l* (2012), and the Commission's regulations at 18 C.F.R. § 385.713 (2015). The filing of a request for rehearing does not operate as a stay of the effective date of this order, or of any other date specified in this order. The licensee's failure to file a request for rehearing shall constitute acceptance of this order.

Heather Campbell
Deputy Director
Division of Hydropower Administration
and Compliance

Document Content(s)

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Essential Power Massachusetts, LLC Nautilus Hydro, LLC	Project Nos.	10675-019 10676-024 10677-021 10678-024

NOTICE OF TRANSFER OF EXEMPTIONS

(June 27, 2017)

1. By letter filed May 15, 2017, Essential Power Massachusetts, LLC informed the Commission that the exemptions from licensing for the Dwight Project No. 10675, originally issued September 11, 1992,[1] the Red Bridge Project No. 10676, originally issued September 11, 1992,[2] the Putts Project No. 10677, originally issued September 11, 1992,[3] and the Indian Orchard Project No. 10678, originally issued September 11, 1992,[4] have been transferred to Nautilus Hydro, LLC. The projects are located on the Chicopee River in Hampden County, Massachusetts. The transfer of an exemption does not require Commission approval.

[1] Order Granting Exemption From Licensing (5 MW or Less). *Western Massachusetts Electric Company*, 60 FERC ¶ 62,199 (1992).

[2] Order Granting Exemption From Licensing (5 MW or Less). *Western Massachusetts Electric Company*, 60 FERC ¶ 62,198 (1992).

[3] Order Granting Exemption From Licensing (5 MW or Less). *Western Massachusetts Electric Company*, 60 FERC ¶ 62,197 (1992).

[4] Order Granting Exemption From Licensing (5 MW or Less). *Western Massachusetts Electric Company*, 60 FERC ¶ 62,196 (1992).

2. Nautilus Hydro, LLC is now the exemptee of the Dwight Project No. 10675, the Red Bridge Project No. 10676, the Putts Project No. 10677, and the Indian Orchard Project No. 10678. All correspondence should be forwarded to: Mr. Jacob A. Pollack, Vice President and Secretary, Nautilus Hydro, LLC, 9405 Arrowpoint Blvd., Charlotte, NC 28273.

Kimberly D. Bose
Secretary.

164 FERC ¶ 62,032

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Nautilus Hydro, LLC
Central Rivers Power MA, LLC

Project Nos. 2334-057, 10675-020, 10676-025, 10677-022, and 10678-025

ORDER AMENDING LICENSES AND EXEMPTIONS TO CHANGE LICENSEE AND EXEMPTEE NAMES

(Issued July 18, 2018)

1. On June 20, 2018, Nautilus Hydro, LLC, filed a notice advising the Commission that it had changed its name from Nautilus Hydro, LLC to Central Rivers Power MA, LLC for the projects listed in the table below.

Project Numbers	**Project Names**	**Locations**
P-2334, license	Gardners Fall	Deerfield River, Franklin County, MA
P-10675, exemption	Dwight Station	Chicopee River, Hamden County, MA
P-10676, exemption	Red Bridge	Chicopee River, Hamden County, MA
P-10677, exemption	Putts Bridge	Chicopee River, Hamden County, MA
P-10678, exemption	Indian Orchard	Chicopee River, Hamden County, MA

2. Nautilus Hydro, LLC states that this is a change of name only and that there has been no change in the legal entities holding the license and exemptions.

3. The licensee and exemptee should ensure that all of the references to "Nautilus Hydro, LLC" are changed, including but not limited to, the projects' Part 8 signs, any safety signs with the licensee's or exemptee's name on them, and any other directional signs. The projects should reflect the new licensee and exemptee name "Central Rivers Power MA, LLC." This change is administrative and does not change any other conditions or requirements of the projects. The licensee's and exemptee's request to change its name is approved.

The Director orders:

(A) The license and exemptions mentioned in the table are amended to change the licensee's and exemptee's name from Nautilus Hydro, LLC to Central Rivers Power MA, LLC.

(B) This order constitutes final agency action. Any party may file a request for rehearing of this order within 30 days from the date of its issuance, as provided in section (§) 313(a) of the Federal Power Act, 16 U.S.C. § 825*l* (2012), and the Commission's regulations at 18 C.F.R. § 385.713 (2017). The filing of a request for rehearing does not operate as a stay of the effective date of this order, or of any other date specified in this order. The licensee's failure to file a request for rehearing shall constitute acceptance of this order.

CarLisa Linton
Acting Director
Division of Hydropower Administration
and Compliance

Document Content(s)

ATTACHMENT
E-2 Form

FEDERAL ENERGY REGULATORY COMMISSION

§ 4.106 Standard terms and conditions of exemption from licensing

Any exemption from licensing granted under this subpart for a small hydroelectric power project is subject to the following standard terms and conditions:

(a) Article 1. The Commission reserves the right to conduct investigations under sections 4(g), 306, 307, and 311 of the Federal Power Act with respect to any acts, complaints, facts, conditions, practices, or other matters related to the construction, operation, or maintenance of the exempt project. If any term or condition of the exemption is violated, the Commission may revoke the exemption, issue a suitable order under section 4(g) of the Federal Power Act, or take appropriate action for enforcement, forfeiture, or penalties under Part III of the Federal Power Act.

(b) Article 2. The construction, operation, and maintenance of the exempt project must comply with any terms and conditions that the United States Fish and Wildlife Service and any state fish and wildlife agencies have determined are appropriate to prevent loss of, or damage to, fish or wildlife resources or to otherwise carry out the purposes of the Fish and Wildlife Coordination Act, as specified in Exhibit E of the application for exemption from licensing or in the comments submitted in response to the notice of the exemption application.

(c) Article 3. The Commission may revoke this exemption if actual construction of any proposed generating facilities has not begun within two years or has not been completed within four years from the date on which this exemption was granted. If an exemption is revoked under this article, the Commission will not accept from the prior exemption holder a subsequent application for exemption from licensing or a notice of exemption from licensing for the same project within two years of the revocation.

(d) Article 4. This exemption is subject to the navigation servitude of the United States if the project is located on navigable waters of the United States.

(e) Article 5. This exemption does not confer any right to use or occupy any Federal lands that may be necessary for the development or operation of the project. Any right to use or occupy any Federal lands for those purposes must be obtained from the administering Federal agencies. The Commission may accept a license application by any qualified license applicant and revoke this exemption, if any necessary right to use or occupy Federal lands for those purposes has not been obtained within one year from the date on which this exemption was granted.

(f) **Article 6**. In order to best develop, conserve, and utilize in the public interest the water resources of the region, the Commission may require that the exempt facilities be modified in structure or operation or may revoke this exemption.

(g) **Article 7**. The Commission may revoke this exemption if, in the application process, material discrepancies, inaccuracies, or falsehoods were made by or on behalf of the applicant.

(h) **Article 8**. Any exempted small hydroelectric power project that utilizes a dam that is more than 33 feet in height above streambed, as defined in 18 CFR 12.31(c) of this chapter, impounds more than 2,000 acre-feet of water, or has a significant or high hazard potential, as defined in 33 CFR Part 222, is subject to the following provisions of 18 CFR Part 12, as it may be amended:

(1) Section 12.4(b)(1)(i) and (ii), (b)(2)(i) and (iii), (b)(iv), and (b)(v);

(2) Section 12.4(c);

(3) Section 12.5;

(4) Subpart C; and

(5) Subpart D.

For the purposes of applying these provisions of 18 CFR Part 12, the exempted project is deemed to be a licensed project development and the owner of the exempted project is deemed to be a licensee.

(i) **Article 9**. Before transferring any property interests in the exempt project, the exemption holder must inform the transferee of the terms and conditions of the exemption. Within 30 days of transferring the property interests, the exemption holder must inform the Commission of the identity and address of the transferee.

89 FERC ¶ 62,256

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Consolidated Edison Energy, Inc.

Project Nos. 10675-010
10676-011, 10677-011
10678-014

ORDER AMENDING EXEMPTIONS

(Issued December 29, 1999)

Consolidated Edison Energy, Inc., (CEEI) exemptee for the Chicopee River projects, FERC Nos. 10675 (Dwight), 10676 (Red Bridge), 10677 (Putts Bridge), and 10678 (Indian Orchard), filed a development plan to amend the installed capacity at each project on July 30, 1999 and supplemented the filing on December 6, 1999. The projects are located on the Chicopee River in Hampden and Hampshire Counties, Massachusetts.

Background

On September 11, 1992,[1] the Commission granted Western Massachusetts Electric Company (WMEC) exemptions from licensing for the four Chicopee River projects. The projects qualified for an exemption from licensing under Part I of the Federal Power Act [2] because WMEC proposed additional capacity by installing a minimum flow turbine unit at each project. Each project was authorized to contain the following existing and new generating units:

FERC PROJECT NO.	NUMBER OF EXISTING UNITS	TOTAL EXISTING CAPACITY (KW)	NEW MIN. FLOW UNIT CAPACITY (KW)	AUTHORIZED CAPACITY (KW)
10675	3	1,440	210	1,650
10676	2	3,600	695	4,295
10677	2	3,200	370	3,570

1/ See, 60 FERC ¶62,195, 62,196, 62,197, 62,198, Order Granting Exemption From Licensing (5 MW Or Less).

2/ Under § 4.30(b)(29) of the Commission's regulations, a "small hydroelectric power project" is defined as any project in which capacity will be installed or increased after the date of notice or exemption or application.

FERC PROJECT NO.	NUMBER OF EXISTING UNITS	TOTAL EXISTING CAPACITY (KW)	NEW MIN. FLOW UNIT CAPACITY (KW)	AUTHORIZED CAPACITY (KW)
10678	2	3,700	430	4,130
Total	9	11,940	1,705	13,645

The exemptions for the four Chicopee River projects authorized a combined installed capacity of 13,645 kW, which included 1,705 kW of capacity for new minimum flow units. The exemptions indicate the minimum flow units will be installed at such time the units become economically feasible.

WMEC requested two extensions of time to extend the deadline to commence and complete construction of the projects. In an August 30, 1996 order, the Commission extended the deadlines to begin and finish construction until September 10, 1998, and September 10, 2000, respectively. Ordering paragraph (B) of the order stated that in the event WMEC cannot comply with the deadline requirements, then it shall by September 10, 1998, either file license applications to convert its exemption into licenses, or cease operation and file to surrender its exemptions pursuant to the Commission's rules and regulations.

In a February 12, 1998 letter, WMEC informed the Commission the minimum flow units were not economically feasible. WMEC requested the Commission eliminate the requirement to install minimum flow units at all four projects and stated it would complete performance tests of the existing units and, if feasible, upgrade one turbine runner at each project. In a letter dated April 13, 1998, the Commission accepted WMEC's proposal to eliminate the minimum flow units and upgrade the runners.

On July 23, 1999, CEEI purchased the four projects from WMEC. CEEI reviewed all the options for increasing the capacity and again concluded the minimum flow units and most of the runner upgrades are uneconomical. The exemptee filed a revised development plan with the Commission on July 30, 1999. In a letter dated October 27, 1999, the Commission requested CEEI to provide additional information regarding the plan. The exemptee submitted its response in a supplemental filing dated December 6, 1999.

Development Plan

In the July 30, 1999 filing, CEEI submitted a proposed plan for capacity increases at each project, as follows:

Dwight Project (FERC No. 10675)

The existing powerhouse contains three active units with a total installed capacity of 1,440 kW. The units were rehabilitated between 1984 and 1990. The rehabilitation work consisted of rewinding one of the generators to a higher capacity rating.

CEEI proposes to provide a new generator nameplate and replace the existing metering current transformers to increase the capacity of the project. The exemptee also proposes to install new automated canal headgates to restore the hydraulic capacity of the project. CEEI explains the rehabilitation work would result in increased energy production, less pond fluctuation at the dam, and more controlled operation of the canal.

Red Bridge Project (FERC No. 10676)

The existing powerhouse contains two active units with a total installed capacity of 3,600 kW. The powerhouse also has two inactive units which were retired in 1938. The active units were rewound between 1981 and 1987.

CEEI proposes to replace the existing current limiting reactor, and install cooling fans for the station transformers to increase the capacity of the project. In addition, CEEI proposes to install new generator nameplates reflecting the rewinding of the units. In the Plan, CEEI explains the proposed work will not affect impoundment water levels or required minimum flow. CEEI intends to begin operation of the project for its exemption condition of a one-foot drawdown during fish spawning season, and a two-foot drawdown for the remainder of the year.

Putts Bridge Project (FERC No. 10677)

The existing powerhouse contains two active units, two retired units, and an empty bay for a fifth unit which was never installed. The two active units have a total capacity of 3,200 kW. In 1987, WMEC rewound one of the generators, performed testing on the unit, and found the unit is capable of generating at a higher capacity.

CEEI proposes to replace the existing cable, and install cooling fans for the station transformer to increase capacity. In addition, a new generator nameplate would be installed to reflect the rewinding of the unit. The anticipated new station rating would result in an increase in rated capacity. CEEI states the proposed work is not anticipated to affect impoundment water levels or required minimum flows.

Indian Orchard (FERC No. 10678)

The existing powerhouse contains two active and two inactive units of differing sizes. The two active units have a total capacity of 3,700 kW. The existing generators are significantly oversized for these turbines. A review of the turbines indicates that the existing runners are in poor condition, and should be replaced.

CEEI proposes to replace the runner in unit three to maximize the unit's capacity, which would result in an increased rated capacity. CEEI does not propose any changes to unit four, the pond level fluctuations, or the required minimum flow.

In its December 6, 1999 supplemental filing, CEEI explains that the proposed capacity increase percentage presented in the Plan are based on adjusted nameplate ratings. Based on the upgrades, the proposed unit capacities for the four projects are indicated in the table below.

FERC PROJECT No.	UNIT No.	GENERATOR (KW)	TURBINE RATING (HP)	TOTAL PROPOSED CAPACITY RATING (KW)
10675	2, 3, & 4	3@ 633	3@ 650	1,899
10676	3 & 4	2@ 2,315	2@ 3,000	4,630
10677	2 & 3	2@ 2,050	2@ 2,600	4,100
10678	3	1,500	2,080	1,500
10678	4	2,200	3,000	2,200
TOTAL	9	14,329	18,230	14,329

Review

A. Consultation

On June 22, 1999, CEEI met with federal, state, and local agencies to review and obtain comments on the development plan. The plan includes summaries of the meeting. All the agencies concurred with CEEI's proposed measures at all four of its Chicopee River projects. Further, the Commission issued a public notice of the proposed Plan on October 7, 1999. No protests, interventions, or comments on CEEI's proposed measures were received.

B. Environmental Review

Staff review of the environmental impacts of the proposed measures on each of the four projects finds that an Environmental Assessment (EA) is not required. There are sufficient environmental safeguards included in the existing exemption orders, as fully described below.

Dwight Project.

The Dwight Project includes a dam, a canal headgate house (with six gates), a power canal, an intake structure, three buried steel penstocks, and a single powerhouse. The dam consists of a masonry spillway about 306 feet long by 15 feet high with masonry abutments and 2.3 feet high flashboards.

The exemption authorizes a continuous minimum flow release of 258 cfs, or inflow into the bypass reach. The exemption also limits the pond draw down to one foot below the dam crest. In April 1997, the Massachusetts Division of Fish and Wildlife Service (MDFWS) agreed, as an interim measure, that a range between 140 cfs and 305 cfs could be used by maintaining constant spillage through flashboards slots and canal drain gates. In a November 16, 1998 letter, the U.S. Fish and Wildlife Service (FWS) indicated the present release method is inadequate for a permanent measure due to large fluctuations in actual release amounts.

To address FWS's concern, CEEI proposes to install new automated headgates at the entrance to the project's canal, which would restore the canal's hydraulic capacity, increase project generation, and better regulate the pond level. CEEI indicated in the December 6, 1999 filing, that the new headgates are acceptable to both the FWS and MDFWS. CEEI also proposes to maintain the existing mechanism for releasing minimum flows to the bypass reach, which consists of a series of notches in the flashboards. While the boards are installed, CEEI will limit the pond draw down to three inches below the top of the boards. During periods when the flashboard system is damaged or lost, CEEI will maintain the pond level a minimum five inches above the crest to maintain the required minimum flow during generation.

Articles 12 and 13 of the exemption will ensure the proposed action does not produce adverse impacts to the site's historic resources. The long-term benefits to the environment from implementing the proposal would be offset by some minor adverse impacts to area soils, water quality, and fisheries. During installation, the 3,000-foot-long canal would be dewatered temporarily, which would result in some impacts on the fish population. Impacts to water quality, however, would be minimized by measures to be included in CEEI's erosion control plan, which is required by article 14 of the exemption.

Red Bridge Project.

The Red Bridge Project includes a dam, a canal headgate house (with 10 intake gates), a power canal, two operating penstocks, and a powerhouse. CEEI proposes to increase the generating capacity at the Red Bridge Project by upgrading the existing transformer through the installation of new cooling fans. The proposed measure would not have any land-disturbing impacts.

The exemption requires a continuous minimum flow release of 237 cfs, or inflow, at the base of the spillway. The exemption also limits pond drawdowns to one foot below the crest from April to June and two feet for the remainder of the year. During the June 22, 1999 meeting, the resource agencies indicated the drawdowns would not likely have an adverse impact on fish habitat, but could adversely impact the existing boat launch. Also, FWS indicated the present flow release mechanism is inadequate for a permanent measure due to large fluctuations in actual release amounts.

The exemptee intends to implement limitations for the pond level and proposes to review whether a one or two foot drawdown would affect the existing boat launch ramp. CEEI also proposes to install an automated slide gate at the spillway. The new slide gate would be capable of releasing the required minimum flow from a single point on the spillway during full and low pond conditions. The CEEI indicated in the December 6, 1999 letter that the use of a new slide gate at the spillway is also acceptable to both the FWS and the MADFW.

Articles 12 and 13 of the exemption will preclude adverse impacts to historic resources. Article 12 requires CEEI to: (1) consult with the State Historic Preservation Officer (SHPO) before undertaking any construction activity that would result in any modification of the project's existing historic facilities; and (2) file, for Commission approval, its final design drawings, including SHPO's comments on these drawings. Article 13 requires that CEEI consult with the SHPO and, if necessary, develop and implement a cultural resource management plan before undertaking any project-related construction activity that is not specifically authorized by the 1992 exemption order. Since the proposed automatic slide gate was not authorized by the subject order, CEEI must fulfill the measures delineated by Articles 12 and 13 before proceeding with its proposed installation.

Also, Article 14 of the exemption requires the exemptee to file, for Commission approval, an erosion control plan before the start of any land-disturbing, land-clearing or spoil-producing activities at the project. Development and implementation of the erosion control plan will minimize any adverse impacts of slide gate installation on water quality and fishery resources.

Putts Bridge Station

The Putts Bridge Project includes a dam, headworks structure, twin barreled concrete penstocks, forebay, intake structure, powerhouse and mechanical equipment. The exemption requires a minimum flow of 25 cfs into the bypass reach. The exemption also limits pond draw downs to one foot below the top of the flashboards from April to June and two feet for the remainder of the year. During the June 22, 1999 meeting, FWS requested evidence that operation of the Putts Bridge Project does not impact the minimum flow release at the downstream Indian Orchard Project.

In response to FWS concerns, CEEI filed on December 6, 1999, calculation tables on pond fluctuations permitted by the exemptions. Based on the results, it appears that the pond level control at the Indian Orchard Project should be set at 6 inches during the spring period. This measure would provide sufficient storage to permit the continuous discharge of the minimum flow at the Indian Orchard Project. Therefore, CEEI indicated in the December 6, 1999 letter, that it plans to operate the upgraded units within the head pond restrictions such that the total outflow from the Putts Bridge Project (i.e., the turbine discharge plus the 25 cfs minimum flow) is adequate to maintain the 247 cfs minimum flow requirement at the Indian Orchard Project.

CEEI proposes to replace an existing underground cable and install cooling fans for the project's transformer. Articles 12 and 13 of the exemption will ensure the protection of the site's historic resources. Also, article 14 of the exemption requires CEEI to develop a plan to control erosion before implementing any land-disturbing activities resulting from these activities. Staff concludes that the proposed measures would not produce adverse impacts to environmental resources.

Indian Orchard Project

The Indian Orchard Project includes a dam, headworks, power canal, penstocks, powerhouse and mechanical equipment. The CEEI proposes to increase the generating capacity of the Indian Orchard Project by replacing the runners on one of the project's two turbines. This measure would not affect the project's existing 247 cfs minimum flow, nor the operation of the project's head pond. Articles 12, 13, and 14 included in the exemption for the Indian Orchard Project will ensure any resultant land-disturbing activities related to this measure will not produce significant impacts to environmental or historical resources.

CEEI also proposes to investigate the installation of a bar rack or trash boom to prevent large debris from plugging the project's minimum flow drain gates and inspect the project's three penstocks which are in poor condition. These measures are considered maintenance activities.

C. Exhibits and Projects Revisions

During the review of the development plan, staff found the Commission has never approved as-built exhibits B (a general location map showing physical features, project boundary, and land ownership) and G (drawings showing the structures and equipment necessary to show the proposed features). The latest exhibits we have are those that were filed on December 6, 1989, as part of the application for exemption. This order requires the exemptee to file as-built exhibit B and G drawings for all four projects for the Commission's approval.

Summary of Findings

Staff finds the impacts from the proposed development plan are less than the anticipated impacts resulting from installation of the minimum flow units, since less ground disturbance is required. Staff concludes approving CEEI' s proposed plan and amending the exemptions would not constitute a major federal action significantly affecting the quality of the human environment.

The Director orders:

(A) The exemption for the Chicopee River projects, FERC Nos. 10675, 10676, 10677, and 10678, is amended as provided by this order, effective the first day of the month in which this order is issued.

(B) The development plan for the Chicopee River projects filed on July 30, 1999, and supplemented on December 6, 1999, is approved by this order.

(C) The project description for each of the four exemptions is revised, in part, to read:

Dwight Project (FERC No. 10675)

Description of Project: ". . . ; (5) a powerhouse containing three generating units, with a rated capacity of 633 kW each, for a total installed capacity of 1,899.0 (KW) . . . "

Red Bridge Project (FERC No. 10676)

Description of Project: " . . . ; (5) a powerhouse containing two generating units, with a rated capacity of 2,315 kW each, for a total installed capacity of 4,630 (KW) . . . ".

Putts Bridge Project (FERC No. 10677)

Description of Project: ". . . ; (4) a powerhouse containing two generating units, with a rated capacity of 2,050 kW each, for a total installed capacity of 4,100 (KW).. . . "

Indian Orchard Project (FERC No. 10678)

Description of Project ". . . ; (5) a powerhouse containing two generating units of 1,500 KW, and 2,200 kW, for a total installed capacity of 3,700 (KW) . . . "

(D) Within 60 days of issuance of this order, the exemptee shall install new generator nameplates on the units at all four projects to indicate their new capacities.

Within 30 days of installation of the nameplates, the exemptee shall provide photographs of nameplates to the Commission with a copy to the Commission's New York Regional Office, for verification.

(E) Within 60 days of the date of issuance of this order, the exemptee shall file for approval an original and eight copies of a complete set of as-built Exhibits B and G drawings showing the project boundary and physical structures of each of the four Chicopee River projects. In addition, within 90 days of installing any new features authorized by this order, the exemptee should file, for the Commission's approval, revised drawings of the appropriate exhibits.

(F) The exemptee shall perform all project modifications in accordance with the terms and conditions set by the resource agencies and the requirements indicated in articles 12, 13 and 14 of each exemption. The exemptee shall report to the Commission any future proposed changes to the project prior to implementing them.

(G) This order constitutes final agency action. Requests for a rehearing by the Commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 C.F.R. §385.713.

Peter J. McDonn
for Hossein Ildari
Chief
Engineering Compliance Branch

97 FERC ¶ 62, 137
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Consolidated Edison Energy, Inc.

Project Nos. 10675-012
10676-013, 10677-013
10678-016

ORDER AMENDING EXEMPTIONS

(Issued November 08, 2001)

On September 13, 2000, and supplemented on June 1, 2001, Consolidated Edison Energy, Inc., (CEEI) exemptee for the Chicopee River projects, FERC Nos. 10675 (Dwight), 10676 (Red Bridge), 10677 (Putts Bridge), and 10678 (Indian Orchard), filed documentation regarding the generating units installed at their projects. CEEI submitted the filing in accordance with ordering paragraph (D) of the Order Amending Exemptions issued on December 29, 1999. [1] The projects are located on the Chicopee River in Hampden and Hampshire Counties, Massachusetts.

BACKGROUND

On December 29, 1999, the Commission approved a Development Plan to amend the installed capacity at each of the four Chicopee River Projects. In the Plan, CEEI proposed miscellaneous upgrades or modifications to increase the installed capacity at each of the projects, as shown in Table 1.

Table 1

FERC PROJECT No.	UNIT No.	GENERATOR (KW)	TURBINE RATING (HP)	TOTAL PROPOSED CAPACITY RATING (KW)
10675	2, 3, & 4	3@ 633	3@ 650	1,899
10676	3 & 4	2@ 2,315	2@ 3,000	4,630
10677	2 & 3	2@ 2,050	2@ 2,600	4,100
10678	3	1,500	2,080	1,500

1 See, 89 FERC ¶ 62,256.

Table 1

FERC PROJECT No.	UNIT No.	GENERATOR (KW)	TURBINE RATING (HP)	TOTAL PROPOSED CAPACITY RATING (KW)
10678	4	2,200	3,000	2,200
TOTAL	9	14,329	18,230	14,329

Ordering paragraph (D) of the order required CEEI to install new generator nameplates on the units at all four projects to indicate their new capacities. The order also required CEEI to file with the Commission photographs of new nameplates for verification.

REVIEW

In the September 13, 2000, filing CEEI provided information regarding the as-built generator capacity of the units installed at Dwight, Red Bridge and Putts Bridge projects. In the filing, CEEI indicated that new transformers fans were installed at the Putts Bridge and Red Bridge projects, and included photo documentation of new generator nameplates for the three projects. In the supplemental filing of June 29, 2001, CEEI indicated that a new runner assembly and a new turbine nameplate was installed for the Indian Orchard Unit # 3, and included photo documentation of the unit. The new turbine and generator ratings for the four projects are indicated in table 2.

Table 2

PROJECT NAME & FERC No.	UNIT #	Turbine		Generator		Limiting Unit Capacity	Installed Capacity (kW) [1]
		HP	kW	KVA Rating and Power Factor	kW		
Dwight (10675)	2	650	488	672.5 @ 0.8	538	488	1,464
	3	650	488	714.3 @ 0.8	571	488	
	4	650	488	796.8 @ 0.8	637	488	
Red Bridge (10676)	3	3,000	2,250	2,815 @ 0.8	2,252	2,250	4,500
	4	3,000	2,250	2,963 @ 0.8	2,370	2,250	
Putts Bridge (10677)	2	2,600	1,950	3,032 @ 0.8	2,426	1,950	3,900
	3	2,600	1,950	2,851 @ 0.8	2,281	1,950	

Table 2								
PROJECT NAME & FERC No.	UNIT #	Turbine		Generator		Limiting Unit Capacity	Installed Capacity (kW) [1]
		HP	kW	KVA Rating and Power Factor	kW		
Indian Orchard (10678)	3	2,100	1,575	1,875 @ 0.8	1,500	1,500	3,700
	4	3,000	2,250	2,750 @ 0.8	2,200	2,200	

The installed capacity is based on the lesser of ratings of the turbine or generator units. The turbine's rating in HP is multiplied by 3/4 to convert to kW. The KVA rating is multiplied by Power Factor to convert to kW.

In our review of the installed capacity for each project, we found that the turbine is the limiting factor for power production for the Dwight, Red Bridge, and Putts Bridge projects, and the generator is the limiting factor for the Indian Orchard Project. According to the Commission's Final Rule on Charges and Fees for Hydroelectric Projects, the projects exempted before March 21, 1995 are not subject to annual charges.[2] The four projects were originally exempted on September 11, 1992.[3] Therefore, this order is solely to revise the project description on each of the four exemptions to reflect their as-built capacities. This order does not revise the installed capacity of the exemptions for annual charges purposes. The total installed capacity of each exemption will be revised as shown in the above table.

The Director orders:

(A) The exemption for the Chicopee River projects, FERC Nos. 10675, 10676, 10677, and 10678, is amended as provided by this order, effective the first day of the month in which this order is issued.

(B) The project description for each of the four exemptions is revised, in part, to read:

---

2 FERC Order 576, issued March 15, 1995, with an effective date of April 21, 1995, 60 FR 15040.

3 See, 60 FERC ¶ 62,195, 62,196, 72,197, 62,198, Order Granting Exemption From Licensing (5MW or Less).

Dwight Project (FERC No. 10675)

Description of Project: ". . . ; (5) a powerhouse containing three generating units, with a total installed capacity of 1,464 kW . . . "

Red Bridge Project (FERC No. 10676)

Description of Project: " . . . ; (5) a powerhouse containing two generating units, with a total installed capacity of 4,500 kW . . . ".

Putts Bridge Project (FERC No. 10677)

Description of Project: ". . . ; (4) a powerhouse containing two generating units, with a total installed capacity of 3,900 KW.. . . "

Indian Orchard Project (FERC No. 10678)

Description of Project ". . . ; (5) a powerhouse containing two generating units with a total installed capacity of 3,700 KW . . . "

(C) This order constitutes final agency action. Requests for a rehearing by the Commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 C.F.R. §385.713.

Mohamad Fayyad
Engineering Team Lead
Engineering and Jurisdiction Branch
Division of Hydropower Administration
and Compliance

October 22, 2013

VIA EFILING

Mr. Gerald L. Cross, P.E.
Regional Engineer
Federal Energy Regulatory Commission
New York Regional Office
19 West 34th Street, Suite 400
New York, NY 10001

FERC Project No. 10675-MA
Report of Safety Incident

Dear Mr. Cross:

Essential Power Massachusetts, LLC owns and operates the Dwight Hydroelectric Project (FERC Project No. 10675-MA) located on the Chicopee River in Western Massachusetts. This letter is to report a safety incident at the Dwight Project in which a penstock ruptured causing flooding in the powerhouse, and adjacent parking lots and buildings. During the incident the station was offline. Two people were inside the building at the time of the rupture, there were no injuries. Attached for your records is an incident report with picture documentation of the rupture.

The penstock is 7' diameter measuring approximately 170' in length and is believed to be 93 years old. The failure appears to be due to wear and tear from age. In the interim, repairs will be made to the damaged section and testing by a third party of the integrity of all three penstocks at the site will be performed prior to return to service.

If you have any questions or require additional information regarding this filing, please contact me at 413.730.4721 (email: kim.marsili@essentialpowerllc.com).

Sincerely,

Essential Power Massachusetts, LLC

cc: John Bahrs (NAEA)

Public Safety Incident Report

1. Project Number-State 10675 - MA

2. Name of Project Dwight

Name of Development Dwight

3. Licensee or Exemptee Essential Power, LLC

4. River or Stream Chicopee River

5. Date of Incident 10/10/13 Time of Incident Approx. 12:55

6. Licensee Report Dates: Verbal 10/10/13 Written 10/22/13

7. Description of Incident: The Unit #2 penstock ruptured causing flooding in the powerhouse which spilled into adjacent parking lots and buildings.

8. Location of Incident (check one): Reservoir or Upstream_; Tailrace___; Intake___; Downstream___; Canal___; Conduit___; Penstock_X_; Powerhouse___; Substation___; Spillway or Dam___ ; Project Land___; Other (describe)_______;

9. Number of people involved in incident ___; Injured ___; Fatalities___; No injury or fatality _X;

10. Type of Activity (check one): Boating___; Swimming __; Auto/Vehicle __.; Fall __; Inspection/Maintenance __; Bank Fishing ___; Boat Fishing__; Suicide___; Natural Causes __; Homicide ___;Construction __; Unknown; Other _X_;

11. Result from Incident: Drowning___; Electrocution:

This Form Prepared by:

Nick Hollister – Manager, Hydro Operations Essential Power, LLC - on 10/22/13

Phone No. 413-730-4789

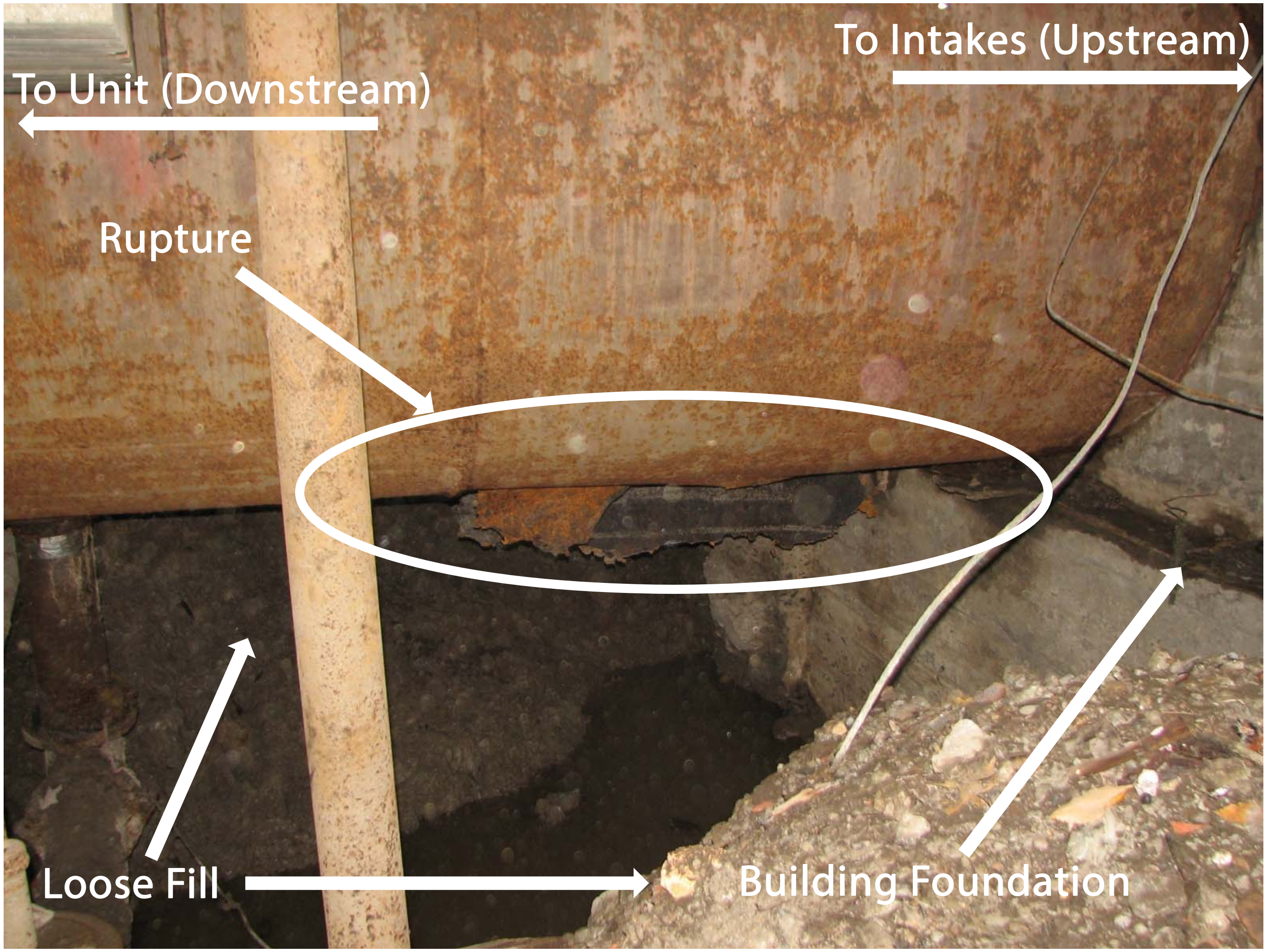
15 Agawam Ave West Springfield Massachusetts 01089

Phone: (413)730-4721 • Fax: (413) 730-4769

Dwight Station Penstock Failure 10/10/13
Preliminary Detail

The rupture is in the Unit 2 penstock, a riveted steel penstock initially constructed in 1920 and lined with a spray on rubber coating in 2004.

The failure occurred at the 6 o'clock position in the part of the penstock located in the crawl space beneath the main operating floor of the plant.

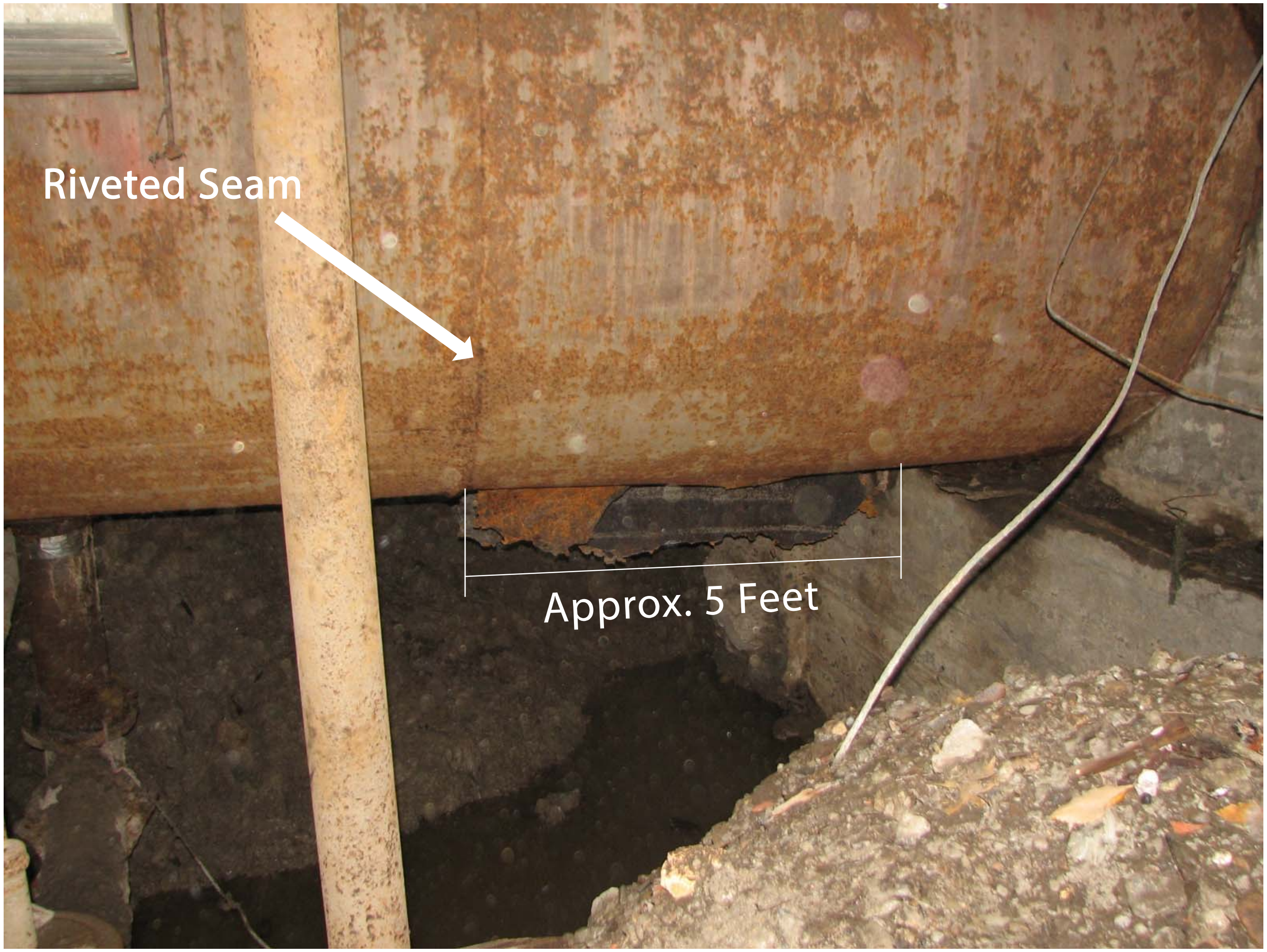


ESSENTIAL POWER.

Dwight Station Penstock Failure 10/10/13
Preliminary Detail

The rupture is approximately 5 feet long extending from the circumferential riveted seam to the foundation wall.

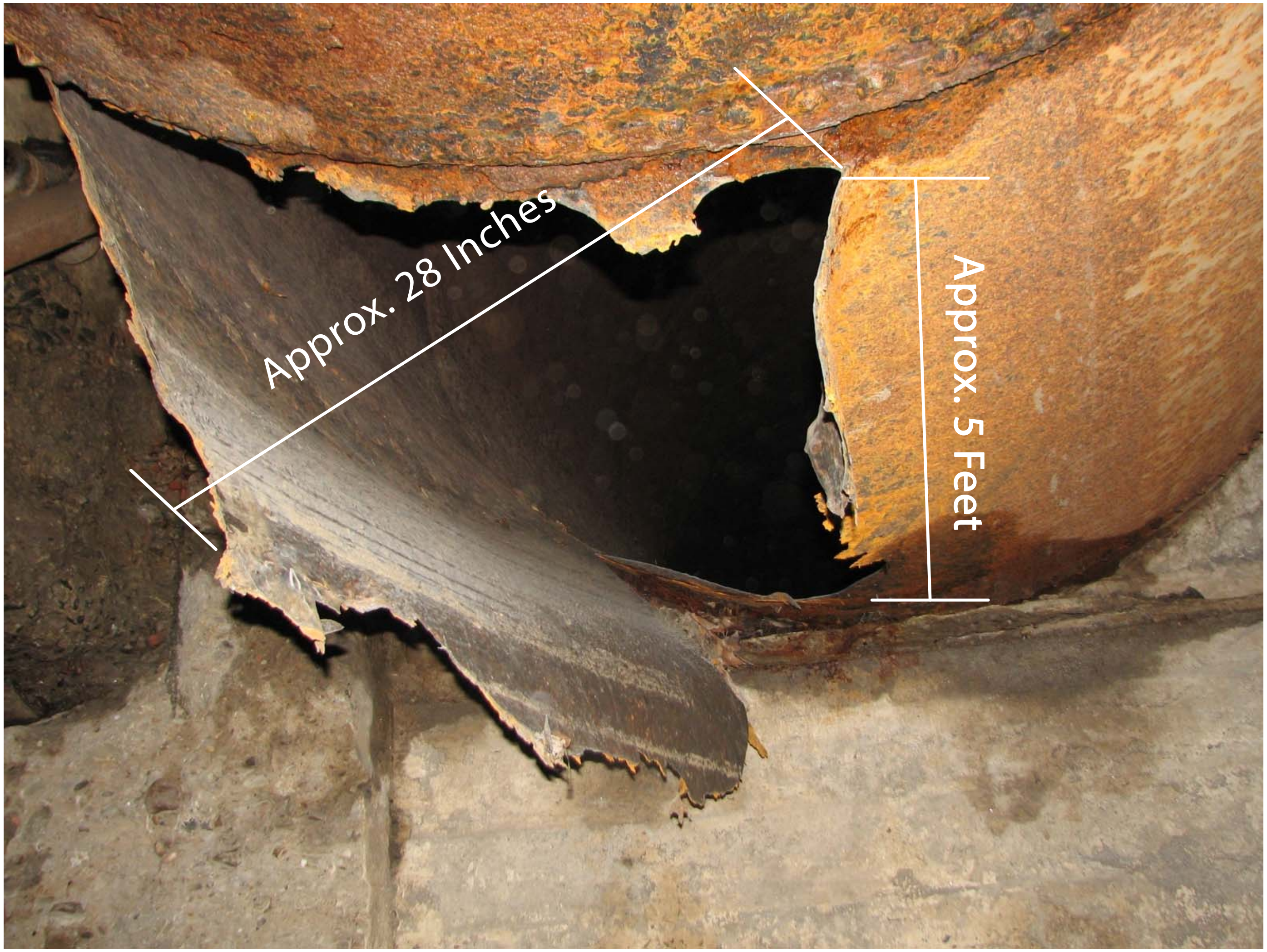
There is no longitudinal seam in the location of the failure.



Dwight Station Penstock Failure 10/10/13
Preliminary Detail

This photo was taken looking towards the intakes (upstream)

In addition to the longitudinal tear, there is a circumferential tear just before the riveted joint and another at the foundation wall.



Dwight Station Penstock Failure 10/10/13
Preliminary Detail

Additional photo for reference.

Looking upstream.

Dwight Station Penstock Failure 10/10/13
Preliminary Detail

Additional photo for reference.

Looking upstream.

Dwight Station Penstock Failure 10/10/13
Preliminary Detail

Additional photo for reference.

Same as first photo, without comments.

Dwight Station Penstock Failure 10/10/13
Preliminary Detail

Additional photo for reference.

Same as second photo, without comments.

Dwight Station Penstock Failure 10/10/13
Preliminary Detail

Additional photo for reference.

Looking upstream.

Document Content(s)

January 17, 2014

VIA E-FILING

Mr. Gerald L. Cross, P.E.
Regional Engineer
Federal Regulatory Commission
New York Regional Office
19 West 34th Street, Suite 400
New York, NY 10001

Dwight Hydroelectric Project – FERC No. 10675-MA
NATDAM ID No. MA00721
Dwight Project – Penstock Repair

Dear Mr. Cross:

Essential Power Massachusetts, LLC (EP) submits this report in response to your letter of January 13, 2014 requesting that we address the following comments prior to opening the headgates and refilling the penstocks.

1 – ASSESSMENT OF ALL 3 PENSTOCKS

An inspection and evaluation of the entirety of all three penstocks was conducted by Kleinschmidt Associates (Kleinschmidt) in November and December 2013. Attached is the *Dwight Penstock Evaluation* report issued by Kleinschmidt on January 13, 2014. In their report Kleinschmidt recommends that the exposed sections of Penstocks No. 3 and No. 4 be reinforced similar to the repair of Penstock No. 2 before being placed back in service. The buried lengths of all three penstocks are not susceptible to the same type of failure as the exposed section of penstock No. 2 and, as such, Kleinschmidt has recommended a leakage monitoring plan for the buried portions.

2 – REFILL PLAN

The penstocks are currently dewatered and isolated from the filled canal by unit headgates. Upon receipt of FERC approval to re-water Penstock No. 2, EP plans to:

1. Open the penstock fill gate on Unit No. 2. This purpose of this gate is to have a controlled filling of the penstock to equalize pressure on either side of the gate.
2. While waiting for penstock to fill, visual checks will be made of courtyard and powerhouse for signs of leakage.
3. With the penstock filled, the No. 2 unit headgate will be opened.

If you have any questions or require additional information regarding this filing, please contact me at 413.730.4271 (email: kim.marsili@essentialpowerllc.com). This letter was prepared in accordance with the requirements of 18 CFR 12.10(a).

Sincerely,

Kim Marsili
Station Manager

Attachments: Dwight Penstock Evaluation Report

DWIGHT PENSTOCK EVALUATION PENSTOCKS NO. 2, NO. 3 AND NO. 4

DWIGHT HYDROELECTRIC PROJECT

FERC NO. 10675-MA

Prepared for:

Essential Power Massachusetts, LLC
West Springfield, Massachusetts

Prepared by:

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtUSA.com

January 13, 2014

DWIGHT PENSTOCK EVALUATION
PENSTOCKS NO. 2, NO. 3 AND NO. 4

DWIGHT HYDROELECTRIC PROJECT

FERC NO. 10675-MA

Prepared for:

Essential Power Massachusetts, LLC
West Springfield, Massachusetts

Prepared by:

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtUSA.com

January 13, 2014

DWIGHT PENSTOCK EVALUATION
PENSTOCKS NO. 2, NO. 3 AND NO. 4

DWIGHT HYDROELECTRIC PROJECT

FERC NO. 10675-MA

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DWIGHT PENSTOCK EVALUATION
PENSTOCKS NO. 2, NO. 3 AND NO. 4

DWIGHT HYDROELECTRIC PROJECT

FERC NO. 10675-MA

1.0 DESCRIPTION AND BACKGROUND

The Dwight Hydroelectric Project is located on the Chicopee River in Hampden County, approximately 4 miles north of Springfield, Massachusetts and was constructed in 1910. The Project is owned and operated by Essential Power, LLC (EP). The normal headwater elevation is 78.84 feet (NGVD) and the generating head is approximately 18 feet. The conversion from NVGD (National Geodetic Vertical Datum) to the Operating datum is Operating datum minus 23.49 feet. Elevations provided in the report are NGVD datum; however elevations in Appendices B and C thru E, are in Operating datum.

This station is operated as a run of river project, with water from the impoundment directed through a headgate house to the power canal. From the power canal, water passes through the intake structure and penstocks to the powerhouse turbines, which discharges directly into the Chicopee River.

1.1 DESCRIPTION

Dwight Station consists of an intake structure connected to a power canal, three buried steel penstocks, three turbine generator units (Numbered 2, 3, and 4), and a tailrace structure. The penstocks are located beneath the Cabotville Mill, an active mill building, and are buried between the mill and the project powerhouse. There is a 12 foot 4 inch exposed portion of each penstock located in the crawl space below the floor slab of the powerhouse just upstream of the scroll case.

Each penstock is 7 foot in diameter and has a length of approximately 172 feet from the downstream face of the head gate to the upstream face of the most upstream turbine stay vane. The original shell, fabricated in 1920, had a thickness of 3/8 inch. The steel penstocks have both longitudinal and circumferential lapped, riveted seams. Each seam consists of a single row of rivets with head diameters of 1¼ inch and a pitch of 2½ inch. The steel shell is supported by concrete saddles with a center to center spacing of approximately 18'. The contact angle between the shell and the saddle is between 140 and 150 degrees.

The maximum turbine capacities are:

- Unit No. 2 – 0.58 MW 254 cfs at 100% gate
- Unit No. 3 – 0.58 MW 254 cfs at 100% gate
- Unit No. 4 – 0.58 MW 254 cfs at 100% gate

1.2 2013 RUPTURE OF PENSTOCK NO. 2

On October 10, 2013 at 12:55 pm, Penstock No. 2 ruptured causing flooding in the powerhouse, and adjacent parking lots and buildings. During the incident, the station was offline due to work being completed within the powerhouse. There were no injuries. EP gave verbal notice to FERC about the failure on October 10 and written notice of the event on October 22, 2013.

The rupture of Penstock No. 2 occurred along the invert of the steel shell at the exposed section of the penstock under the powerhouse floor slab (Appendix A, Photos 1-4). The rupture is approximately 5 feet long, extending from the upstream concrete wall to the nearest circumferential riveted seam downstream. Water exiting through the rupture filled the crawlspace and entered the powerhouse through the crawlspace entrance in the southwest corner of the powerhouse. Water from the rupture caused damage to the powerhouse, as well as to adjacent buildings and parking lots.

The rupture of Penstock No. 2 may have been caused by corrosion along the invert of the exposed penstock as well as accelerated corrosion due to moisture entrapment at the steel to concrete interface where the penstock is supported by the powerhouse foundation wall.

1.3 PREVIOUS MAINTENANCE & INSPECTIONS

1.3.1 1993 CANAL REFILL

On August 2, 1993, the Dwight canal was refilled after being empty for three weeks for its annual inspection and maintenance. Approximately 2½ hours after the penstocks were refilled, the ground above Penstock No. 2 began settling and water appeared in local sink holes. An investigation of Penstock No. 2 revealed a small perforation in the interior. Material testing during the investigation concluded that the steel had a yield strength of 51,000 psi and a tensile strength of 61,000 psi. A 1994 inspection indicated an average thickness of 0.20 inches for Penstock No. 2.

To stop the leakage, a patch consisting of latex modified concrete was installed to the bottom of the penstock from the 3-o'clock position to 9-o'clock. The patch extended from the turbine approximately 61 to 81 feet upstream. New manholes were installed in Penstock No. 2 and No. 3. A manhole for Penstock No. 4 was fabricated but not installed due to thinning base material at proposed location. Weld repairs were completed along lap seams with deteriorated rivet heads, as well as for holes larger than 1/8 inch. Penstock No. 2 resumed operation in 1995.

1.3.2 1999 DEWATERING

On July 15, 1999, the canal and penstocks were dewatered to allow the local municipality to repair a water main leak. During the rewatering, water appeared in the courtyard and the Units were shut down. The next day, a 9 foot by 12 foot oblong depression ranging from 6 to 12 inches was observed in the courtyard where the water had appeared the day before. In this area, there were three distinct sinkholes where piping of the soil had occurred in a west to east direction.

The dewatered penstock for Unit 2 was inspected by Kleinschmidt on Monday, July 19, 1999 (See Appendix D). Shell thickness measurements were taken at approximately 10 foot intervals at various positions in the pipe. The tests resulted in a minimum thickness of 0.112 inches, a maximum thickness of 0.271 inches, and an average thickness of 0.190 inches. The average thickness is similar to the 1994 inspection results. Many of the rivets in the penstock appeared to have lost approximately 50% of their heads.

In 2000, Penstock No. 2 underwent patch repairs and the interior was lined with an elastomeric polyurethane by Tenemec, “Elasto-Shield” Series 262. The technical specifications for this coating indicated an average coating thickness of 80 mils DFT.

1.3.3 2006 Repair and Lining of Unit 3 & 4

In 2006, Penstock No. 3 and No. 4 were repaired and lined by Aulson Industrial Services (ALS). The repairs began in March, and were completed in May. Work completed to both penstocks is as follows:

a. Closely Grouped Holes – A coat of Devoe Bar-Rust 235 applied, followed by a layer of fiberglass mat which was then wetted out with another coat of Bar-Rust 235.

b. Isolated Holes – Devoe Bar-Rust 233H mixed with cabosil (silica flour) to create an epoxy paste for patching. Holes with exposed voids deeper than ½" first filled with cement grout (Degussa Emaco T430 repair mortar) and then, after the grout has fully cured, the epoxy was applied to seal the hole.

c. Voids beneath Penstocks – Filled with Degussa Emaco T430.

d. Where rivet heads were deteriorated the lap seam was welded.

e. Holes larger than 1/8 inch weld repaired or used the repair motar.

f. Liner – Futura-Bond 316 epoxy primer 3-4 mils DFT and Futura-Thane 5042 Polyurea Elastomer 80-100 mils DFT.

g. Manhole installed in Penstock No. 4.

1.4 Purpose of 2013 Inspections

The purpose of Kleinschmidt’s inspection and evaluation of Penstocks No. 2, No. 3 and No. 4 is to determine the penstocks’ allowable capacity ratio, identify any areas of concern, estimate the useful remaining service life if possible, and provide recommendations for future maintenance and inspection activities.

2.0 INSPECTION

The inspection of Penstocks No. 2, No. 3 and No. 4 were conducted over a 1 month period and consisted of three separate site visits.

November 12th

The first inspection was conducted on November 12, 2013 by Ms. Jillian Davis, Mr. Harold Thompson, and Mr. Nicholas Ciomei of Kleinschmidt with assistance from Mr. Nicholas Hollister and EP operating personnel.

After arriving on site, Kleinschmidt personnel were informed that air testing had been completed for each of the penstocks. A ladder was used to access the penstocks through manholes located adjacent to the turbines for each Unit (Appendix A, Photo 5).

The inspection of Penstock No. 2 consisted of a visual inspection of the exterior of the penstock where it is exposed beneath the powerhouse and the interior at the ruptured section. At the time of the inspection EP's contractor was sand blasting the interior of the penstock in preparation for the installation of a new 3/8 inch thick sleeve to span the exposed section of the pipe (sleeve to be installed in interior of the pipe) so the penstock upstream of the rupture was not accessible. Mr. Hollister described EP's proposed method for repair of the pipe with Kleinschmidt and requested that Kleinschmidt return to inspect the repair section and remaining penstock at a later date.

The inspection of Penstocks No. 3 and No. 4 consisted of a thorough close-up visual inspection of the interiors and exteriors, and thickness readings for the 12 foot 4 inch exterior exposed portion of Penstocks No. 3 and No. 4 in the crawlspace located under the powerhouse floor slab. The interior inspection included a walkthrough of both penstocks, an inspection of the Polyurea Elastomer protective coating, and sounding with a geologist hammer to determine locations of possible voids in the soil around the penstock shells.

Thickness readings were attempted from the interior of Penstocks No. 3 and No. 4 at multiple locations using an ultrasonic thickness gage. Kleinschmidt anticipated interior coating thicknesses between 80 and 100 mils DFT (less than 0.1 inch thick). However, measured readings of coating thickness were between 0.2 and 0.45 inches. The ultrasonic thickness gage was not able to handle such a thick coating in standard operating mode, and therefore no interior thickness readings of the penstocks were made at the time.

Thickness readings of the exposed section of each penstock were recorded from the exterior at various locations (Tables 2 & 3). Shell thickness measurements were taken in the "thru coat" mode using an Olympus 38 DL Plus Ultrasonic Thickness Gage and D7906 Thru Coat Dual Element Transducer. In "thru coat" mode the paint thickness is measured separately from the steel thickness. The gage was calibrated before the field measurements to within an accuracy of 0.001 inch. The acoustical wave form was saved for each reading so that it could be considered during data review.

<u>November 25th</u>

Penstocks No. 3 and No. 4 were reinspected on November 25, 2013 by Ms. Davis and Mr. Ciomei. The ultrasonic thickness gage was adjusted to penetrate the thicker coating and obtain thickness readings of the penstock steel. The gage was again calibrated before the field measurements to within an accuracy of 0.001 inch. The acoustical wave form was saved for each reading so that it could be considered during data review.

<u>December 12th</u>

Repairs to Penstock No. 2 were completed on December 11, 2013. Kleinschmidt returned to the site on December 12 following the completion of the repair work to inspect the new penstock sleeve and the existing buried pipe upstream.

The inspection consisted of a thorough close-up visual inspection of the coated interior, sounding with a geologist hammer to determined locations of possible voids in the soil around the penstock shell, and thickness readings of the penstock.

Thickness readings were taken from the interior of Penstock No. 2 at multiple locations using an ultrasonic thickness gage. The ultrasonic thickness gage was adjusted to penetrate the thicker coating and obtain thickness readings of the penstock steel. The gage was calibrated before the field measurements to within an accuracy of 0.001 inch. The acoustical wave form was saved for each reading so that it could be considered during data review.

2.1 INSPECTION OF PENSTOCK NO. 2

Inspection of Penstock Repair Sleeve

Repairs included the installation of a 7 foot (nominal) diameter, 3/8 inch thick (field measurements with the UT Gage indicated that the actual material thickness was 0.355 inches), A36 carbon steel sleeve with 1/4 inch fillet welds inside the existing penstock (See Appendix B, Figure 4). The sleeve was measured to be 18.5 feet long and centered in the exposed section located under the powerhouse floor slab. The sleeve has three or four longitudinal joints between each of the three circumferential joints. Photos 6 thru 11 in Appendix A show the repaired section of penstock.

Penstock Interior Surface

All references to penstock left, right and clock positions are oriented looking downstream. The reference baseline for the inspection of Penstock No. 2, station 0+00, was located at the manhole access point. The 262 Tnemec interior coating was found to be in good to fair condition (Photos 12 and 13). Using a geologist hammer, only small, local voids throughout the pipe were found. Each void occurred at approximately the 4 - 7 o'clock positions. These voids are to be anticipated when the penstock is dewatered since it may “rise” above the soil slightly due to the lighter weight. The penstock did not exhibit any shell deformation or buckling.

Shell thickness readings were taken at various locations inside the penstock (Photos 14 and 15).

The 262 Tnemec coating was determined to be thinner than the Polyurea Elastomer coating lining Penstocks No. 3 and 4. The ultrasonic gage was adjusted to penetrate the coating, and readings for the lined portion of the penstock interior were more easily obtained than the readings taken for Penstocks No. 3 and 4. Readings along the invert were not able to be obtained due to water in the penstock, but readings were taken to either side of the water line (Photo 16). The acoustical wave form for each reading was analyzed to determine actual thickness values for the penstock steel. The tests resulted in an average thickness of 0.194 inches and a 97% confidence level thickness of 0.087 inches.

Penstock Exterior Surface

Due to the installation of the new sleeve and the lack of soil beneath the No. 2 Penstock (washed away in the flood), no thickness measurements were taken on the existing exterior shell.

2.2 INSPECTION OF PENSTOCK NO. 3

Penstock Interior Surface

The reference baseline for the inspection of Penstock No. 3, station 0+00, was located at the manhole access point. The Polyurea Elastomer coating was determined to be thicker than anticipated, but was found to be in good to fair condition. Delaminated coating was observed from station 0+24 to 0+60 (Appendix A, Photos 17-27). A visual inspection of the delaminated areas showed either a second coat of Polyurea Elastomer or the latex modified concrete patch. At station 0+80, multiple screw threads were observed at the 1 o'clock position. Most screws were coated with the Polyurea Elastomer, but some had exposed threads. Using a geologist hammer, voids were found from station 0+26 to 0+29, 1+00 to 1+04, 1+17 to 1+27, and 1+34 to 1+40. A local void was also discovered at station 0+45. Each void occurred at approximately the 4 - 7 o'clock positions. These voids are to be anticipated when the penstock is dewatered since it may “rise” above the soil slightly due to the lighter weight. The penstock did not exhibit any shell deformation or buckling.

Shell thickness readings were taken at various locations inside the penstock (Photos 28 and 29). Although the ultrasonic gage was adjusted to penetrate the thick coating, accurate readings were difficult to obtain. The ability to achieve clean, reflective waves on the ultrasonic gage indicates that the steel surface beneath the liner is likely extremely rough and pitted. It is possible that further deterioration of the steel since the 1994 inspection has occurred on the exterior buried surface of the penstock. Readings along the invert were not able to be obtained due to mud and water in the penstock, but readings were taken to either side of the water line. The acoustical wave form for each reading was analyzed to determine actual thickness values for the penstock steel. The tests resulted in an average thickness of 0.111 inches and a 97% confidence level thickness of -0.071 inches.

<u>Penstock Exterior Surface</u>

The exterior of Penstock No. 3 beneath the powerhouse was inspected and is considered to be in fair to poor condition (Photos 30 and 31). The penstock did not exhibit any shell deformation or buckling. The entire exterior of the penstock was coated with a grey paint and appears to be more recently coated than Penstocks No. 2 and 4. Corrosion and pitting to a depth of approximately 1/16 inch has occurred on the exterior of the penstock. The pitting was the greatest, up to 1/8 inch, along the invert of the penstock.

Shell thickness measurements were taken at multiple locations along the exposed portion of the penstock in the crawlspace under the powerhouse floor slab to get a thorough range of thickness readings (See Appendix B, Figure 5). Due to the pitting on the invert, thickness readings were no able to be taken at that location. The tests resulted in an average thickness of 0.243 inches and a 97% confidence level thickness of 0.182 inches.

2.3 INSPECTION OF PENSTOCK NO. 4

<u>Penstock Interior Surface</u>

The reference baseline for the inspection of Penstock No. 4, station 0+00, was located at the manhole access point. The Polyurea Elastomer coating was determined to be thicker than anticipated, but was found to be in good condition (Appendix A, Photos 32-35). Using a geologist hammer, voids were found from station 0+53 to 0+56, 0+64 to 0+74, 0+85 to 0+88, 0+91 to 1+07, and 1+30 to 1+37. A local void was also discovered at station 1+45. Each void occurred at approximately the 4 - 7 o'clock positions. These voids are to be anticipated when the penstock is dewatered since it may “rise” above the soil slightly due to the lighter weight. However, the void between stations 0+91 and 1+07 allowed for vibrations due to walking being felt when crossing the void. The vibrations indicate that this may be the location of a larger void due to piping thru the local soil. The penstock did not exhibit any shell deformation or buckling.

Shell thickness readings were taken at various locations inside the penstock. Although the ultrasonic gage was adjusted to penetrate the thick coating, like Penstock No. 3, accurate readings were difficult to obtain. Also similar to penstock No. 3, readings along the invert were not able to be obtained due to mud and water in the penstock, but readings were taken to either side of the water line. The acoustical wave form for each reading was analyzed to determine actual thickness values for the penstock steel. The tests resulted in an average thickness of 0.096 inches and a 97% confidence level thickness of -0.004 inches.

Penstock Exterior Surface

The exterior of Penstock No. 4 was inspected and is considered to be in poor condition (Photos 36-39). The penstock did not exhibit any shell deformation or buckling. The left side exterior of the penstock was coated with a black paint from the downstream interface of the penstock with the powerhouse concrete in the upstream direction for 4 feet 10 inches. Corrosion and pitting to a depth of approximately 1/16 inch has occurred on the penstock exterior. The pitting was the greatest, up to 1/8 inch, along the invert of the penstock.

Shell thickness measurements were taken at multiple locations along the exposed portion of the penstock in the crawlspace under the powerhouse floor slab to get a thorough range of thickness readings. The upstream section of plate between rivet joints was thinner than the downstream plate section (See Appendix B, Figure 6). Due to the pitting on the invert, thickness readings were no able to be taken at that location. The tests resulted in an average thickness of 0.148 inches and a 97% confidence level thickness of 0.078 inches. The downstream plate section was similar to Penstock No. 3's readings. The tests resulted in an average thickness of 0.185 inches and a 97% confidence level thickness of 0.085 inches.

3.0 EVALUATION

Based on Kleinschmidt's experience and judgment the three potential ways that Dwight Penstocks No. 2, No. 3 and No. 4 could fail are bursting due to excessive internal pressure or loss of shell thickness, general buckling due to external pressure, or local buckling due to loss of soil support.

3.1 INTERNAL PRESSURE AND HOOP STRESSES

Loading Conditions and Allowable Stresses

The loading conditions and allowable stresses were determined from the criteria presented in the American Society of Civil Engineers (ASCE) Manuals and Reports on Engineering Practice No. 79 Steel Penstocks, 2nd Edition. The allowable primary stress intensity of the penstock steel is the lesser of the material yield stress (F_y) divided by 1.5 or of the ultimate tensile stress (F_u) divided by 2.4. The 1993 testing indicates that the actual penstock steel material showed Fy = 51.0 ksi and Fu = 61.0 ksi, resulting in an allowable stress of 25.4 ksi.

The primary internal pressures, Pr/t, are in the circumferential "hoop" direction. Appendices C and E contain the calculations of the allowable stress, the internal pressure which creates the "hoop" stresses and the additional hoop stresses due to external loads and water hammer for the original steel in the penstocks. Appendix D analyzes the repair section of steel for Penstock No. 2.

Transient Water Hammer Pressure

The primary internal pressures are in the circumferential "hoop" direction. The internal pressures are a result of the hydrostatic pressure and hydrodynamic water pressure. These were incorporated into a water hammer analysis to determine the maximum hydrodynamic water pressure. A water hammer pressure head rise of 16.2 feet was based on an assumed emergency 3-second turbine trip time for each of the penstocks (Appendix E).

Internal Load Conditions

Tables 1, 2, and 3 summarize the penstock thickness readings, resulting static hoop stresses, and stress ratios. The stress ratios are the calculated material/steel stresses divided by the allowable material/steel stress. A stress ratio less than 1.0 means that the calculated stresses are below the allowable stresses and therefore meet industry standard Factors of Safety. The stress ratios were also checked for the overall average penstock thickness, and the overall average penstock thickness minus two standard deviations which provides a 97.5% probability of the minimum shell thickness which conservatively accounts for penstock thickness readings that were less than the overall average thickness. The 97.5% confidence level is a statistical evaluation useful for understanding the general condition of the penstock. However, stress ratios and penstock capacity calculations were based on the average thickness at each station.

The average Penstock No. 2 thickness reading was 0.194 inches with a standard deviation of 0.054 inches resulting in a 97.5% probable minimum thickness of 0.087 inches. No locations produced hoop stress ratios greater than 1.0 for Penstock No. 2 (Table 1), therefore not exceeding industry standard Factors of Safety. The average stress ratio was 0.263 with a maximum stress ratio of 0.390 at the shell’s riveted joints.

The average Penstock No. 3 thickness reading was 0.166 inches with a standard deviation of 0.099 inches resulting in a 97.5% probable minimum thickness of -0.071 inches. Three locations produced hoop stress ratios greater than 1.0 for Penstock No. 3 (Table 2), exceeding industry standard Factors of Safety. The average stress ratio was 0.358 with a maximum stress ratio of 1.515 at the shell’s riveted joints.

The average Penstock No. 4 thickness reading was 0.134 inches with a standard deviation of 0.066 inches resulting in a 97.5% probability of 0.003 inches. Two locations produced hoop stress ratios greater than 1.0 for Penstock No. 4 (Table 3), exceeding industry standard Factors of Safety. The average stress ratio was 0.362 with a maximum stress ratio of 1.337 at the shell’s riveted joints.

3.2 External Load Conditions

Penstocks No. 2, No. 3 and No. 4 were examined under external load conditions based on inspection results. To be conservative, two scenarios were analyzed using the worst case variables from either penstock.

The first scenario determined the maximum allowable length of a void section including dead loads and live loads on the penstocks. Live and dead loads for heavy manufacturing, and weight of soil, penstock steel, and water in the penstock, as well as stress due to water hammer were used in the calculations. The results of the first scenario revealed that for a 17.5 ft void section in Penstock No. 2 would produce maximum stresses of 24.35 ksi under both live and dead loads (Appendix C). For Penstocks No. 3 and No. 4, a 9 ft void section would produce maximum stresses of 25.25 ksi under both live and dead loads (Appendix E). These results are slightly below the allowable stress in the penstock steel, 25.4 ksi.

The second scenario analyzed Penstocks No. 2, No. 3, and No. 4 along the 12.33 foot exposed sections. Due to the section being exposed, the live loads from the heavy manufacturing and dead loads from soil weight were left out of the calculations. The results of the second scenario revealed the maximum stresses in the No. 3 and No. 4 penstocks to be 11.28 ksi under the remaining dead loads (Appendix E). The No. 2 penstock’s 3/8 inch repair sleeve had a maximum stress of 2.68 ksi (Appendix D). These results are well below the allowable stress in the penstock steel, 25.4 ksi.

3.3 LOCAL BUCKLING AND STRESSES

Local buckling occurs when a small area of the shell is stressed above its material yield stress and becomes permanently deformed. Since no local indentations or deformations were observed in the penstock shell, local buckling is not considered a potential failure mode except at saddle locations. Saddle locations are based on prior inspection reports, and were not able to be inspected. The saddles’ existence was therefore unable to be confirmed and we were unable to determine how much of the penstock’s weight they support. There is likely both fill and grout beneath the penstocks that assist in supporting the penstock’s weight, reducing localized stresses.

The saddle supports cause localized shear and circumferential bending stresses on the penstock steel shell. These stresses are checked in Appendix C & D. The maximum shear stress in the Penstock No. 2 shell, 17,141 psi, meets allowable stress criteria, however, the circumferential shell stress of 481.12 ksi is greater than the allowable local stress of $3*S_A$, or 76.25 ksi. The maximum shear stress in the Penstock No. 3 and No. 4 shells, 34,657 psi, does not meet allowable stress criteria. The circumferential shell stress of 1,940.53 ksi is greater than the allowable local stress of $3*S_A$, or 76.25 ksi. However, these calculations assumed extreme conditions, i.e. no soil or grout support along the length of the penstock.

4.0 SUMMARY AND RECOMMENDATIONS

4.1 OVERALL CONDITION

Our evaluation is that the Dwight Station steel penstocks for Units No. 2, No. 3 and No. 4 are currently in poor condition which is to be reasonably expected considering their 93 year age.

Although the thickness reading results indicate that the shell is still structurally competent the readings do not show where pin holes may be forming in the steel and rupture similar to Penstock No. 2 is possible. The polyeurea lining in the penstocks does not have any structural capacity, this is why during the 2006 repairs pinholes greater than 1/8 inch in diameter were patched or weld repaired prior to the application of the liner. As pin holes develop in the steel there will be no indication until the liner is unable to span the developing pin hole and leakage develops. If the pin hole(s) occur along the buried portion EP may begin to notice sink holes developing in the courtyard. If the pin hole occurs in the exposed portion beneath the powerhouse, the shell may rupture before any leakage is noted.

The expected service life for a riveted steel penstock is typically at least 80 years, which these penstocks have exceeded. This, combined with material loss of the penstock shells due to what appears to be a corrosive exterior environment, leaves Kleinschmidt hesitant to estimate the remaining expected service life of the penstocks in their current condition. However, the following short term and long term maintenance items can considerably extend the service life.

4.2 RECOMMENDED MAINTENANCE & OBSERVATIONS – SHORT TERM

1. In order to prevent another rupture similar to Penstock No. 2 we recommend lining the interior of Penstock No. 3 and No. 4 with an 18 foot long by 3/8” thick steel liner similar to the repair of Penstock No.2. The liner would be installed to span the 12.33 foot exposed portion and would extend approximately 3 feet to either side of the powerhouse foundation supports. Welding of the liner to the original steel would occur at each end to make a watertight seal.

2. We recommend installing wells in the courtyard between the Cabotville Mill and Dwight Powerstation. The wells should be a perforated pvc pipe with cap. The ground water level in the wells can be monitored and a rise in the water levels not associated with a precipitation event would indicate possible leakage from the buried penstocks.

3. We recommend performing penstock inspection of the penstocks, complete with penstock thickness measurements, every 5 years to monitor the rate of deterioration of the steel. Between 1994 and 2013, approximately 20 years, the average steel thickness readings in Penstock No. 3 and No. 4 decreased approximately 0.04 inches or 21%.

4.3 RECOMMENDED MAINTENANCE – LONG TERM

Due to the apparent corrosiveness of the soil environment the penstocks appear to be corroding from the outside in and there is no long term mitigation for that. As a result, we recommend that EP consider either slip lining the existing penstocks or replacing them.

1. As part of our evaluation Kleinschmidt also preformed a frictional headloss comparison of the penstocks, comparing existing conditions to the installation of either a 3/8 inch thick steel liner or a 1 inch thick fiberglass liner. The table below compares the frictional headloss for each condition. The steel liner, if full penetration welds are used between the liner sections, actually decreases friction headloss, increasing overall power of the unit(s). The effect to the power of the units was determined using the Affinity Law where $P_{ratio} = (H_1/H_2)^{1.5}$ (the Power ratio/change is equal to the current net head divided by the proposed net head and multiplied to the 1.5th power).

FRICTIONAL HEADLOSS AND IMPACT ON GENERATION			
Penstock Condition	**Frictional Headloss (ft)**	**Net Head (ft)**	**P_{ratio}**
Existing Conditions – 7' I.D.	0.66	17.34	---
Steel Liner – 6.77' I.D.	0.58	17.42	1.01
Fiberglass Liner – 6.66' I.D.	0.73	17.27	0.99

2. A second long term option would be to replace the full length of the penstocks. With the location of the penstock beneath the Cabotville mill, this may be difficult.

4.4 PENSTOCK SAFETY RISK

To mitigate potential penstock safety risks, EP may want to consider evaluating the operation of the existing headgates. Currently, the Penstock No. 2 headgate can only be closed by a crane and there is no headgate operator. When the No. 2 Penstock ruptured the entire flow of the canal passed through the penstock before the flooding ceased. The Penstock No. 3 and No. 4 headgates share an operator so that they can only be lowered one at a time by EP personnel and closing one headgate takes approximately one hour. In the possible event of another penstock failure, the existing gates cannot be closed quickly and damage from the flowing water will again impact the other penstocks, powerhouse, and surrounding area.

5.0 REFERENCES

ASCE Manuals and Reports on Engineering Practice No. 79 2nd Edition, Steel Penstocks, 2012.

Dwight Station Unit 2 Penstock Condition Assessment, Kleinschmidt Associates, July, 1999.

2003 Penstock Condition Assessment, Dwight Hydroelectric Project, Kleinschmidt Associates, October, 2003.

TABLES

TABLE 1
Penstock #2 Thickness Measurements

Gross Head (ft) =	18
Water Hammer (ft) =	16.4
Max Pressure (psi) =	15.8
Penstock Internal Diameter (ft) =	7
Longitudinal Joint Efficiency =	0.55
Allowable Hoop Stress (ksi) =	25.42

Thickness Readings

Point Name [1]	Clock Position [2]	Reading No. [3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi) [5]	Stress Ratio [6]	Stress (psi) [5]	Stress Ratio [6]
0+07	6	004	0.102	0.123	9836	0.387	5410	0.213
		005	0.099					
		006	0.167					
0+07	3	007	0.245	0.166	7268	0.286	3998	0.157
		008	0.150					
		009	0.103					
0+07	12	010	0.185	0.176	6868	0.270	3778	0.149
		011	0.100					
		012	0.242					
0+07	9	013	0.085	0.142	8517	0.335	4684	0.184
		014	0.190					
		015	0.150					
0+27	5	016	0.262	0.273	4425	0.174	2434	0.096
		017	0.275					
		018	0.281					
0+27	3	019	0.180	0.163	7417	0.292	4080	0.161
		020	0.179					
		021	0.129					
0+27	12	022	0.248	0.220	5476	0.215	3012	0.118
		023	0.223					
		024	0.190					
0+27	9	025	0.239	0.160	7525	0.296	4139	0.163
		026	0.100					
		027	0.142					
0+42	7	028	0.169	0.177	6804	0.268	3742	0.147
		029	0.181					
		030	0.182					
0+42	9	031	0.298	0.301	4008	0.158	2205	0.087
		032	0.300					
		033	0.305					
0+42	3	034	0.210	0.262	4599	0.181	2530	0.100

Table 1 continued....

Point Name [1]	Clock Position [2]	Reading No. [3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi) [5]	Stress Ratio [6]	Stress (psi) [5]	Stress Ratio [6]
		035	0.280					
		036	0.297					
0+42	12	037	0.159	0.159	7588	0.299	4174	0.164
0+58	3	040	0.179	0.213	5665	0.223	3115	0.123
		041	0.225					
		042	0.235					
0+58	5	043	0.146	0.252	4794	0.189	2637	0.104
		044	0.304					
		045	0.305					
0+58	9	046	0.120	0.147	8226	0.324	4525	0.178
		047	0.170					
		048	0.150					
0+58	12	049	0.172	0.141	8577	0.337	4718	0.186
		050	0.150					
		051	0.100					
0+73	9	052	0.250	0.263	4582	0.180	2520	0.099
		053	0.290					
		054	0.250					
0+73	7	055	0.185	0.179	6728	0.265	3700	0.146
		056	0.180					
		057	0.173					
0+73	3	058	0.172	0.155	7767	0.306	4272	0.168
		059	0.144					
		060	0.150					
0+73	12	061	0.310	0.296	4072	0.160	2239	0.088
		062	0.299					
		063	0.280					
0+99	9	064	0.141	0.160	7525	0.296	4139	0.163
		065	0.200					
		066	0.140					
0+99	5	067	0.200	0.206	5848	0.230	3216	0.127
		068	0.224					
		069	0.195					
0+99	3	070	0.250	0.253	4763	0.187	2619	0.103
		071	0.260					
		072	0.250					
0+99	12	074	0.201	0.212	5691	0.224	3130	0.123
		075	0.223					
1+24	9	076	0.159	0.160	7525	0.296	4139	0.163
		077	0.157					
		078	0.165					
1+24	7	079	0.145	0.131	9210	0.362	5066	0.199
		080	0.118					

Table 1 continued....

Station [7]	Clock Position[2]	Reading No.[3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi)[5]	Stress Ratio[6]	Stress (psi)[5]	Stress Ratio[6]
1+24	3	081 082 083	0.130 0.184 0.166	0.166	7283	0.287	4006	0.158
1+24	12	084 085 086	0.147 0.287 0.296	0.292	4137	0.163	2275	0.090
1+46	3	087 088 089	0.292 0.155 0.150	0.153	7912	0.311	4351	0.171
1+46	6	091 092	0.132 0.210	0.191	6306	0.248	3468	0.136
1+46	9	094 095 096	0.232 0.105 0.140	0.122	9917	0.390	5454	0.215
1+46	12	097 098 099 100	0.120 0.200 0.110 0.200	0.170	7097	0.279	3904	0.154

Summary of Table 1:

Penstock #2						
Original Pipe Thickness (in)		Average Field Thickness (in)	Average Material Loss (in, %)		Standard Deviation	97% Confidence[7]
3/8	0.375	0.194	0.181	48.2%	0.054	0.087

Stress at Joints			Stress at Base Material		
Average (psi)	Std. Dev.	97% Confidence	Average (psi)	Std. Dev.	97% Confidence
6686	1695	10077	3677	932	5542

Notes:

1 - Station 0+01 is at the centerline of the manhole entrance in the powerhouse.
2 - Radial location of pipe reading when looking downstream
3 - UT Gage Readings No.
4 - Readings from 12/12 inspection
5 - Hoop Stress at Joint = Pr/Et
6 - Stress Ratio = Actual Stress / Allowable Stress = σ_{allow}
7 - Overall penstock thickness minus two standard deviations

P = Pressure = γ_w*Head; γ_w = 62.4 pcf
r = Pipe Diameter/2 = 42 in
E = Joint Efficiency
t = Avg. Thickness at Point

TABLE 2
Penstock #3 Thickness Measurements

Gross Head (ft) =	18
Water Hammer (ft) =	16.4
Max Pressure (psi) =	15.8
Penstock Internal Diameter (ft) =	7
Longitudinal Joint Efficiency =	0.55
Allowable Hoop Stress (ksi) =	25.42

Exterior Thickness Readings

Point Name [1]	Clock Position[2]	Reading No.[3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi)[5]	Stress Ratio[6]	Stress (psi)[5]	Stress Ratio[6]
S	9	055	0.219	0.225	5370	0.211	2954	0.116
		056	0.225					
		057	0.230					
T	9	058	0.247	0.247	4891	0.192	2690	0.106
		059	0.240					
		060	0.253					
U	7	061	0.265	0.260	4641	0.183	2552	0.100
		062	0.260					
		063	0.255					
V	10	064	0.229	0.227	5307	0.209	2919	0.115
		065	0.225					
		066	0.228					
W	7	067	0.260	0.272	4430	0.174	2437	0.096
		068	0.278					
		069	0.279					
X	10	070	0.247	0.251	4813	0.189	2647	0.104
		071	0.264					
		072	0.241					
Y	9	073	0.233	0.231	5216	0.205	2869	0.113
		074	0.231					
		075	0.230					
Z	7	076	0.277	0.277	4361	0.172	2399	0.094
		077	0.280					
		078	0.273					
AA	10	079	0.236	0.237	5084	0.200	2796	0.110
		080	0.236					
		081	0.240					
BB	9	082	0.227	0.229	5269	0.207	2898	0.114
		083	0.228					
		084	0.232					
CC	2	085	0.182	0.182	6629	0.261	3646	0.143

Table 2 continued....

Point Name [1]	Clock Position[2]	Reading No.[3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi)[5]	Stress Ratio[6]	Stress (psi)[5]	Stress Ratio[6]
		086	0.191					
		087	0.184					
DD	5	088	0.250	0.257	4695	0.185	2582	0.102
		089	0.260					
		090	0.261					
EE	4	091	0.232	0.231	5216	0.205	2869	0.113
		092	0.238					
		093	0.224					
FF	5	094	0.304	0.300	4017	0.158	2210	0.087
		095	0.331					
		096	0.266					
GG	3	097	0.250	0.243	4958	0.195	2727	0.107
		098	0.242					
		099	0.238					
HH	5	100	0.300	0.292	4132	0.163	2273	0.089
		101	0.290					
		102	0.286					
II	3	103	0.207	0.214	5638	0.222	3101	0.122
		104	0.219					
		105	0.216					
JJ	3	106	0.195	0.197	6125	0.241	3369	0.133
		107	0.199					
		108	0.197					
Table 2 continued….								

Interior Thickness Readings

Station [7]	Clock Position [2]	Reading No. [3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi) [5]	Stress Ratio [6]	Stress (psi) [5]	Stress Ratio [6]
0+07.5	3	001	0.209	0.188	6418	0.253	3530	0.139
		002	0.205					
		003	0.150					
	12	004	0.105	0.148	8152	0.321	4484	0.176
		005	0.194					
		006	0.145					
	9	007	0.100	0.368	3276	0.129	1802	0.071
		008	0.900					
		009	0.105					
	6	010	0.102	0.101	11946	0.470	6570	0.259
		011	0.101					
		012	0.100					
0+12	6	013	0.040	0.050	24131	0.949	13272	0.522
		015	0.060					
	9	016	0.064	0.075	16195	0.637	8907	0.350
		017	0.085					
	3	019	0.040	0.079	15273	0.601	8400	0.330
		021	0.118					
	12	022	0.095	0.104	11546	0.454	6350	0.250
		023	0.114					
0+19	3	025	0.081	0.102	11790	0.464	6485	0.255
		026	0.100					
		027	0.126					
	7	028	0.108	0.100	12065	0.475	6636	0.261
		030	0.092					
	9	032	0.900	0.500	2413	0.095	1327	0.052
		033	0.100					
	12	034	0.027	0.031	38507	**1.515**	21179	0.833
		035	0.037					
		036	0.030					
0+35	3	037	0.113	0.081	14804	0.582	8142	0.320
		039	0.050					
	12	040	0.108	0.089	13557	0.533	7456	0.293
		041	0.130					
		042	0.029					
	9	044	0.038	0.038	31751	**1.249**	17463	0.687
	7	048	0.131	0.131	9210	0.362	5066	0.199
0+56	9	049	0.052	0.070	17319	0.681	9525	0.375
		050	0.080					
		051	0.077					
	5	052	0.105	0.066	18189	0.716	10004	0.394

Table 2 continued....

Station [7]	Clock Position [2]	Reading No. [3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi) [5]	Stress Ratio [6]	Stress (psi) [5]	Stress Ratio [6]
		053	0.047					
		054	0.047					
	3	055	0.110	0.082	14654	0.577	8060	0.317
		056	0.111					
		057	0.026					
	12	058	0.116	0.089	13506	0.531	7428	0.292
		059	0.099					
		060	0.053					
0+74	9	062	0.124	0.116	10401	0.409	5721	0.225
		063	0.108					
	3	064	0.036	0.039	30937	**1.217**	17015	0.669
		065	0.042					
	12	067	0.030	0.071	16914	0.665	9303	0.366
		068	0.067					
		069	0.117					
	7	070	0.048	0.076	15876	0.625	8732	0.344
		072	0.104					
0+95	9	074	0.066	0.083	14537	0.572	7995	0.315
		075	0.100					
	3	080	0.090	0.090	13406	0.527	7373	0.290
	12	082	0.120	0.110	10969	0.432	6033	0.237
		083	0.100					
1+16	3	087	0.105	0.105	11491	0.452	6320	0.249
	7	089	0.100	0.102	11829	0.465	6506	0.256
		090	0.104					
	9	091	0.087	0.092	13067	0.514	7187	0.283
		092	0.100					
		093	0.090					
	12	094	0.053	0.052	23428	0.922	12885	0.507
		095	0.050					
1+47	6	098	0.191	0.173	6974	0.274	3836	0.151
		099	0.155					
	9	102	0.100	0.100	12065	0.475	6636	0.261
	3	103	0.045	0.037	32609	**1.283**	17935	0.706
		104	0.040					
		105	0.026					

Summary of Table 2:

Exposed Portion						
Original Pipe Thickness (in)		Average Field Thickness (in)	Average Material Loss (in, %)		Standard Deviation	97% Confidence[8]
3/8	0.375	0.243	0.132	35.2%	0.031	0.182

Stress at Joints			Stress at Base Material		
Average (psi)	Std. Dev.	97% Confidence	Average (psi)	Std. Dev.	97% Confidence
5044	661	6365	2774	363	3501

Buried Portion						
Original Pipe Thickness (in)		Average Field Thickness (in)	Average Material Loss (in, %)		Standard Deviation	97% Confidence[8]
3/8	0.375	0.111	0.264	70.4%	0.091	-0.071

Stress at Joints			Stress at Base Material		
Average (psi)	Std. Dev.	97% Confidence	Average (psi)	Std. Dev.	97% Confidence
15271	8173	31618	8399	4495	17390

Total						
Original Pipe Thickness (in)		Average Field Thickness (in)	Average Material Loss (in, %)		Standard Deviation	97% Confidence[8]
3/8	0.375	0.166	0.209	55.9%	0.099	-0.032

Stress at Joints			Stress at Base Material		
Average (psi)	Std. Dev.	97% Confidence	Average (psi)	Std. Dev.	97% Confidence
11731	8216	28163	6452	4519	15490

Notes:

1 - Exposed Portion Point Name per Sketch 1 through 4. No Point Names for Buried Portion.
2 - Radial location of pipe reading when looking downstream — P = Pressure = γ_w*Head; γ_w = 62.4 pcf
3 - UT Gage Readings No. — r = Pipe Diameter/2 = 42 in
4 - Readings from 11/12 and 11/25 Inspections — E = Joint Efficiency
5 - Hoop Stress at Joint = Pr/Et — t = Avg. Thickness at Point
6 - Stress Ratio = Actual Stress / Allowable Stress = σ_{allow}
7 - Station 0 + 01 is at the centerline of the manhole entrance in the powerhouse.
8 - Overall penstock thickness minus two standard deviations

TABLE 3
Penstock #4 Thickness Measurements

Gross Head (ft) =	18
Water Hammer (ft) =	16.4
Max Pressure (psi) =	15.8
Penstock Internal Diameter (ft) =	7
Longitudinal Joint Efficiency =	0.55
Allowable Hoop Stress (ksi) =	25.42

Exterior Thickness Readings

Point Name [1]	Clock Position[2]	Reading No.[3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi)[5]	Stress Ratio[6]	Stress (psi)[5]	Stress Ratio[6]
A	9	001	0.249	0.278	4335	0.171	2384	0.094
		002	0.302					
		003	0.284					
B	9	004	0.242	0.238	5070	0.199	2788	0.110
		005	0.225					
		006	0.247					
C	7	007	0.236	0.234	5164	0.203	2840	0.112
		008	0.230					
		009	0.235					
D	9	010	0.145	0.142	8497	0.334	4673	0.184
		011	0.134					
		012	0.147					
E	10	013	0.115	0.118	10254	0.403	5640	0.222
		014	0.118					
		015	0.120					
F	9	016	0.216	0.217	5552	0.218	3053	0.120
		017	0.221					
		018	0.215					
G	7	019	0.219	0.228	5292	0.208	2911	0.115
		020	0.236					
		021	0.229					
H	9	022	0.112	0.116	10431	0.410	5737	0.226
		023	0.122					
		024	0.113					
I	10	025	0.168	0.167	7210	0.284	3966	0.156
		026	0.165					
		027	0.169					
J	7	028	0.182	0.199	6053	0.238	3329	0.131
		029	0.236					
		030	0.180					
K	1	031	0.134	0.124	9730	0.383	5352	0.211

Table 3 continued....

Point Name [1]	Clock Position[2]	Reading No.[3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi)[5]	Stress Ratio[6]	Stress (psi)[5]	Stress Ratio[6]
L	3	032 033 034 035	0.087 0.151 0.098 0.112	0.105	11528	0.454	6340	0.249
M	3	036 037 038	0.104 0.190 0.164	0.179	6740	0.265	3707	0.146
N	3	039 040 041	0.183 0.236 0.238	0.238	5062	0.199	2784	0.110
O	3	042 043 044	0.241 0.185 0.189	0.184	6545	0.258	3600	0.142
P	4	045 046 047	0.179 0.165 0.182	0.177	6830	0.269	3756	0.148
Q	3	048 049 050	0.183 0.205 0.174	0.191	6306	0.248	3468	0.136
R	3	051 052 053 054	0.195 0.205 0.199 0.211	0.205	5886	0.232	3237	0.127
Table 3 continued….								

Interior Thickness Readings								
Station [7]	Clock Position[2]	Reading No.[3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi)[5]	Stress Ratio[6]	Stress (psi)[5]	Stress Ratio[6]
0+04	3	106	0.152	0.122	9863	0.388	5425	0.213
		107	0.095					
		108	0.120					
	9	109	0.080	0.081	14896	0.586	8193	0.322
		110	0.100					
		111	0.063					
	12	112	0.100	0.080	15082	0.593	8295	0.326
		113	0.090					
		114	0.050					
0+15	9	115	0.060	0.117	10342	0.407	5688	0.224
		116	0.190					
		117	0.100					
	5	118	0.050	0.068	17657	0.695	9711	0.382
		121	0.065					
		122	0.090					
	3	123	0.114	0.112	10773	0.424	5925	0.233
		124	0.092					
		125	0.130					
0+22	9	126	0.080	0.080	15082	0.593	8295	0.326
		128	0.080					
	7	129	0.070	0.072	16836	0.662	9260	0.364
		130	0.047					
		131	0.098					
	3	132	0.080	0.067	18098	0.712	9954	0.392
		133	0.070					
		134	0.050					
0+75	7	135	0.033	0.035	33987	**1.337**	18693	0.735
		137	0.038					
	9	138	0.042	0.041	29428	**1.158**	16185	0.637
		140	0.040					
	3	141	0.049	0.059	20278	0.798	11153	0.439
		142	0.070					
0+76.5	12	145	0.060	0.109	11069	0.436	6088	0.240
		146	0.158					
0+89	9	148	0.308	0.308	3917	0.154	2155	0.085
	6	150	0.085	0.085	14195	0.558	7807	0.307
	3	153	0.090	0.084	14364	0.565	7900	0.311
		154	0.078					
		155	0.084					
	12	156	0.092	0.100	12106	0.476	6658	0.262
		157	0.127					
		158	0.080					
1+03	9	159	0.132	0.114	10584	0.416	5821	0.229

Table 3 continued....

Station [7]	Clock Position[2]	Reading No.[3,4]	Thickness Reading (in)	Avg. Thickness (in)	Stress at Joints		Base Material	
					Stress (psi)[5]	Stress Ratio[6]	Stress (psi)[5]	Stress Ratio[6]
		160	0.097					
		161	0.113					
	7	162	0.080	0.113	10677	0.420	5873	0.231
		163	0.085					
		164	0.174					
	3	165	0.065	0.065	18562	0.730	10209	0.402
	12	169	0.204	0.161	7494	0.295	4122	0.162
		170	0.164					
		171	0.115					
1+19	9	172	0.055	0.055	21937	0.863	12065	0.475
	4	176	0.100	0.091	13332	0.525	7333	0.288
		177	0.081					
	3	178	0.085	0.086	14030	0.552	7716	0.304
		179	0.100					
		180	0.073					
	12	182	0.089	0.091	13259	0.522	7292	0.287
		183	0.093					
1+50	9	184	0.089	0.077	15669	0.617	8618	0.339
		185	0.069					
		186	0.073					
	6	187	0.133	0.120	10083	0.397	5545	0.218
		188	0.113					
		189	0.113					
	3	190	0.050	0.062	19460	0.766	10703	0.421
		193	0.074					
	12	194	0.082	0.140	8598	0.338	4729	0.186
		195	0.152					
		196	0.187					

Summary of Table 3:

Exposed Portion						
Original Pipe Thickness (in)		Average Field Thickness (in)	Average Material Loss (in, %)		Standard Deviation	97% Confidence[8]
3/8	0.375	0.185	0.190	50.7%	0.050	0.085

Stress at Joints			Stress at Base Material		
Average (psi)	Std. Dev.	97% Confidence	Average (psi)	Std. Dev.	97% Confidence
7027	2149	11324	3865	1182	6228

Thin Plate of Exposed Portion						
Original Pipe Thickness (in)		Average Field Thickness (in)	Average Material Loss (in, %)		Standard Deviation	97% Confidence[8]
3/8	0.375	0.148	0.227	60.5%	0.035	0.078

Stress at Joints			Stress at Base Material		
Average (psi)	Std. Dev.	97% Confidence	Average (psi)	Std. Dev.	97% Confidence
8554	2001	12556	4705	1100	6906

Buried Portion						
Original Pipe Thickness (in)		Average Field Thickness (in)	Average Material Loss (in, %)		Standard Deviation	97% Confidence[8]
3/8	0.375	0.096	0.279	74.5%	0.050	-0.004

Stress at Joints			Stress at Base Material		
Average (psi)	Std. Dev.	97% Confidence	Average (psi)	Std. Dev.	97% Confidence
14885	6203	27291	8187	3412	15010

Total						
Original Pipe Thickness (in)		Average Field Thickness (in)	Average Material Loss (in, %)		Standard Deviation	97% Confidence[8]
3/8	0.375	0.134	0.241	64.1%	0.066	0.003

Stress at Joints			Stress at Base Material		
Average (psi)	Std. Dev.	97% Confidence	Average (psi)	Std. Dev.	97% Confidence
11875	6328	24530	6531	3480	13492

Notes:

1 - Exposed Portion Point Name per Sketch 1 through 4. No Point Names for Buried Portion.
2 - Radial location of pipe reading when looking downstream
3 - UT Gage Readings No.
4 - Readings from 11/12 and 11/25 Inspections
5 - Hoop Stress at Joint = Pr/Et
6 - Stress Ratio = Actual Stress / Allowable Stress = σ_{allow}
7 - Station 0 + 01 is at the centerline of the manhole entrance in the powerhouse.
8 - Overall penstock thickness minus two standard deviations

P = Pressure = γ_w*Head; γ_w = 62.4 pcf
r = Pipe Diameter/2 = 42 in
E = Joint Efficiency
t = Avg. Thickness at Point

APPENDIX A

PHOTOGRAPHS 1 THROUGH 39

PHOTO 1 – INTERIOR OF PENSTOCK NO. 2 FAILURE LOOKING UPSTREAM

PHOTO 2 – CLOSER VIEW OF PENSTOCK NO. 2 FAILURE

PHOTO 3 – EXTERIOR OF PENSTOCK NO. 2 FAILURE

PHOTO 4 – DISPLACED SOIL BELOW PENSTOCK NO. 2 FAILURE

PHOTO 5 – MANHOLE ENTRANCE TO PENSTOCK IN POWERHOUSE

PHOTO 6 – PENSTOCK NO. 2 INTERIOR STEEL SLEEVE REPAIRED SECTION

PHOTO 7 – PENSTOCK NO. 2 LONGITUDINAL AND
CIRCUMFERENTIAL JOINTS OF REPAIRED SECTION (1)

PHOTO 8 – PENSTOCK NO. 2 LONGITUDINAL AND
CIRCUMFERENTIAL JOINTS OF REPAIRED SECTION (2)

PHOTO 9 – PENSTOCK NO. 2 CLOSE UP OF 1/4 INCH FILLET WELDS

PHOTO 10 – PENSTOCK NO. 2 CLOSE UP OF 1/4 INCH FILLET WELD & SAND BLASTED COATING

PHOTO 11 – PENSTOCK NO. 2 NEW FLOOR DRAIN AT NEW SECTION

PHOTO 12– PENSTOCK NO. 2 INTERIOR COATING & RIVETED LAP SEAMS

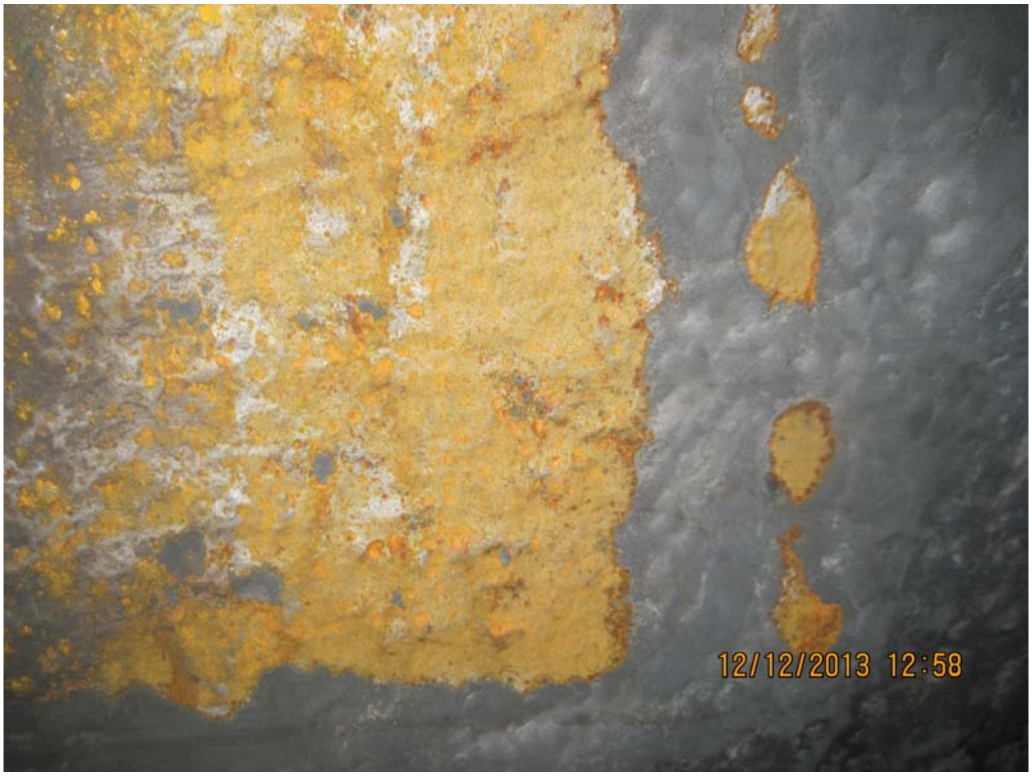


PHOTO 13 – EDGE OF PENSTOCK NO. 2 COATING NEAR REPAIR SLEEVE

PHOTO 14 – PENSTOCK NO. 2 IRREGULAR SURFACE OF INTERIOR COATING

PHOTO 15 – PENSTOCK NO. 2 SCRAPED SURFACE OF
INTERIOR COATING TO OBTAIN THICKNESS READINGS

PHOTO 16 – PENSTOCK NO. 2 INTERIOR COATED SECTION & WATER LINE

PHOTO 17 – OVERCOATED PENSTOCK NO. 3 INTERIOR

PHOTO 18 – DELAMINATION OF PENSTOCK NO. 3 COATING

PHOTO 19 – DELAMINATION OF PENSTOCK NO. 3 INTERIOR (1)

PHOTO 20 – DELAMINATION OF PENSTOCK NO. 3 INTERIOR (2)

PHOTO 21 – DELAMINATION OF PENSTOCK NO. 3 INTERIOR (3)

PHOTO 22 – CLOSE UP VIEW OF PENSTOCK NO. 3 DELAMINATION

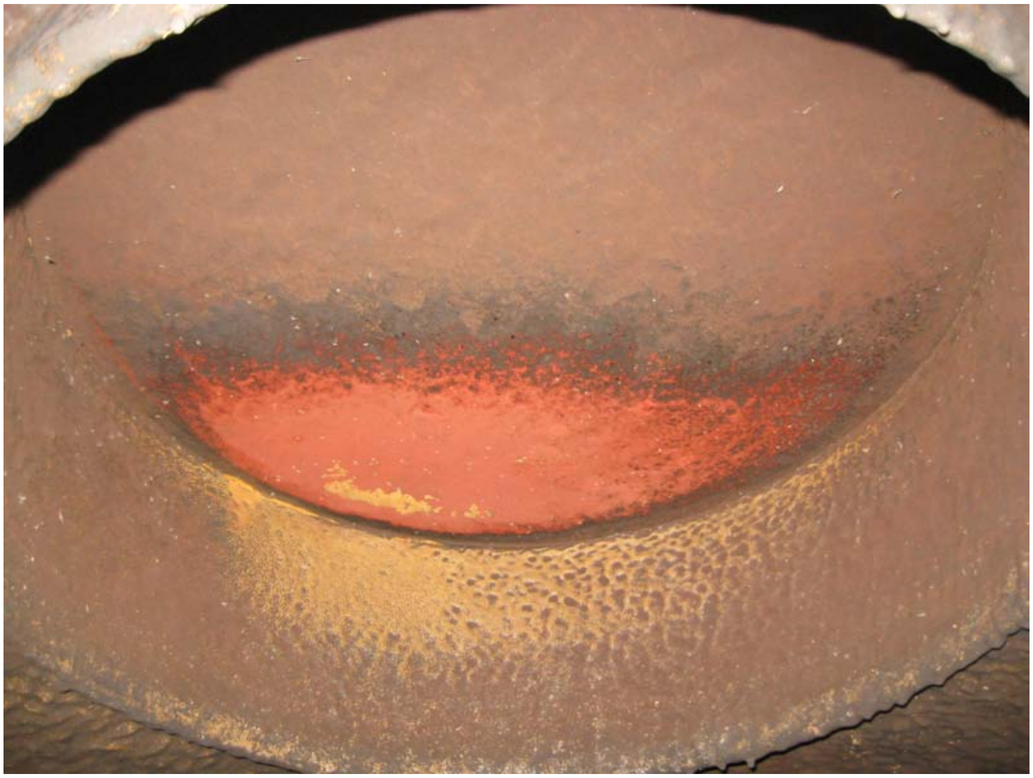


PHOTO 23 – PENSTOCK NO. 3 MANHOLE AT STATION 0+69'

PHOTO 24 – PENSTOCK NO. 3 COATED RIVET JOINTS (1)

PHOTO 25 – PENSTOCK NO. 3 COATED RIVET JOINTS (2)

PHOTO 26 – PENSTOCK NO. 3 CLOSE UP OF COATED RIVER JOINTS

PHOTO 27 – LOOKING UPSTREAM FROM PENSTOCK NO. 3 INLET


PHOTO 28 – CLEANED INTERIOR SURFACE OF PENSTOCK FOR THICKNESS MEASUREMENTS (1)

PHOTO 29 – CLEANED INTERIOR SURFACE OF PENSTOCK FOR THICKNESS MEASUREMENTS (2)

PHOTO 30 – PENSTOCK NO. 3 EXPOSED & PAINTED UPSTREAM LEFT FACE

PHOTO 31 – PENSTOCK NO. 3 EXPOSED & PAINTED DOWNSTREAM LEFT FACE

PHOTO 32 – PENSTOCK NO. 4 DELAMINATED COATING

PHOTO 33 – PATCH LOCATION IN PENSTOCK NO. 4

PHOTO 34 – PENSTOCK NO. 4 PATCH PLATE (APPROX. 2' X 4') AT STATION 0+86

PHOTO 35 – BACTERIA ATTACHED TO INTERIOR PENSTOCK COATING (MULTIPLE LOCATIONS)

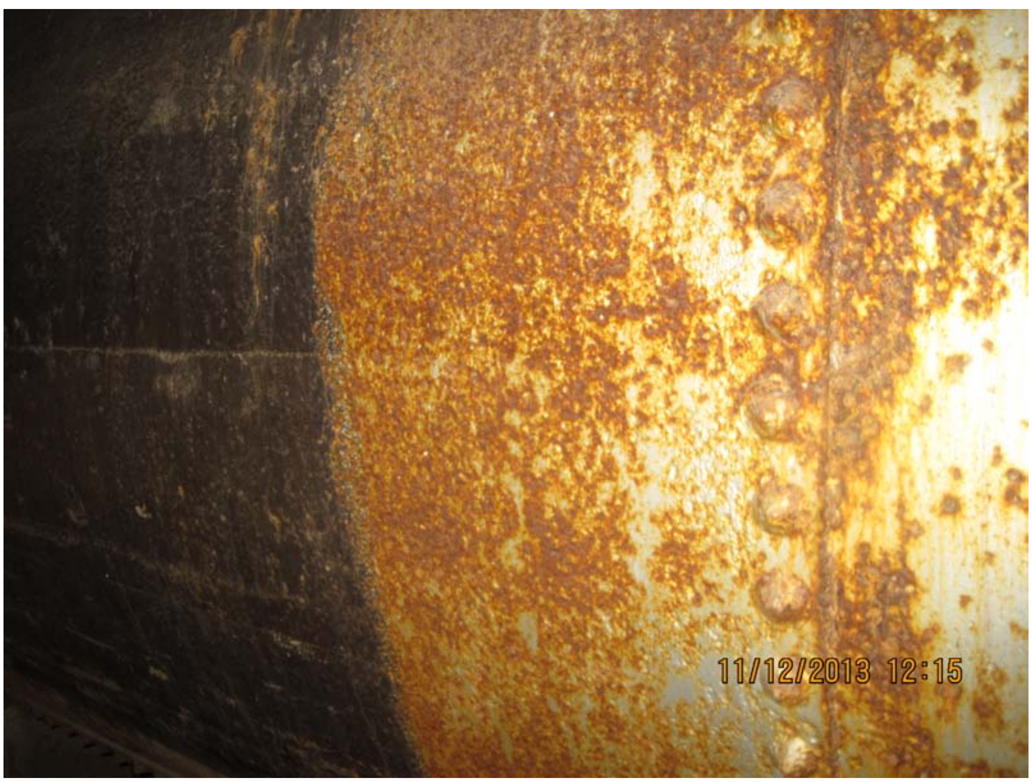


PHOTO 36 – PENSTOCK NO. 4 EXPOSED LEFT FACE

PHOTO 37 – PENSTOCK NO. 4 PAINTED SECTION OF EXPOSED LEFT FACE

PHOTO 38 – PENSTOCK NO. 4 DOWNSTREAM SECTION OF EXPOSED LEFT FACE

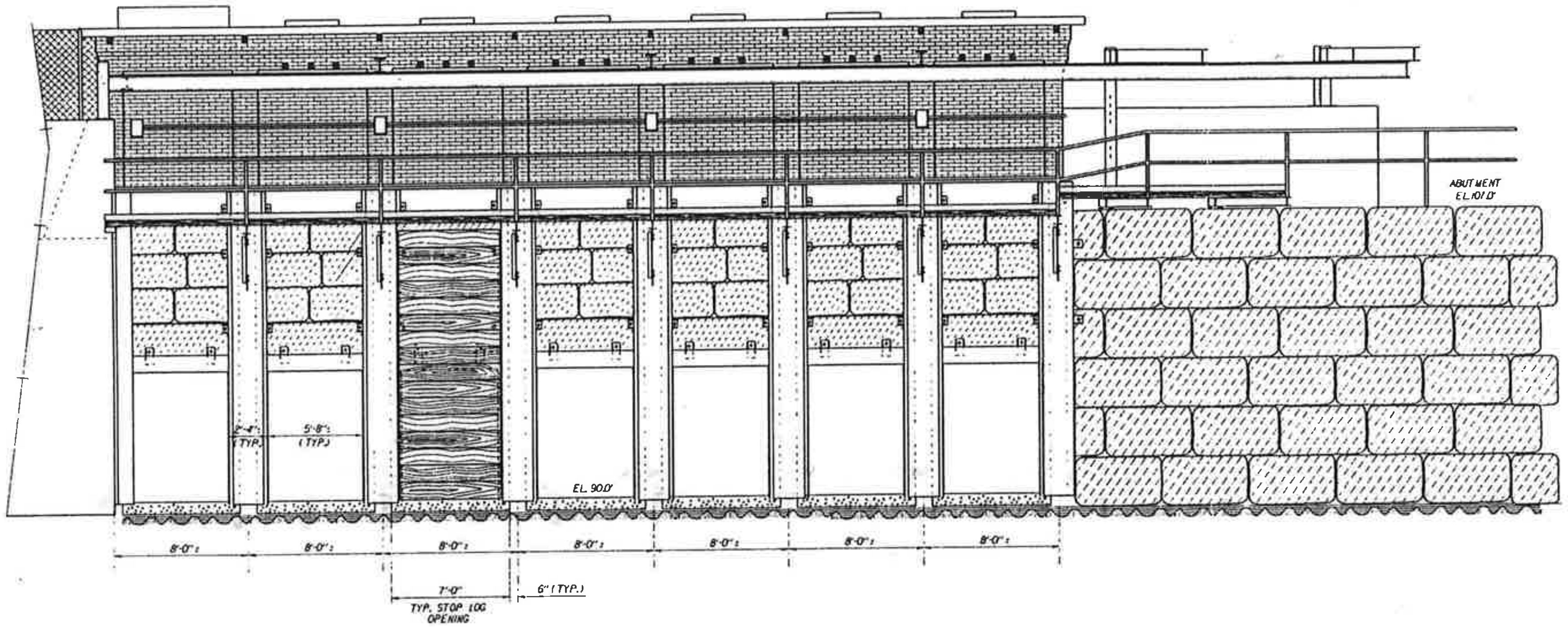
PHOTO 39 – PENSTOCK NO. 4 EXPOSED RIGHT FACE

APPENDIX B

FIGURES

APPENDIX B-1

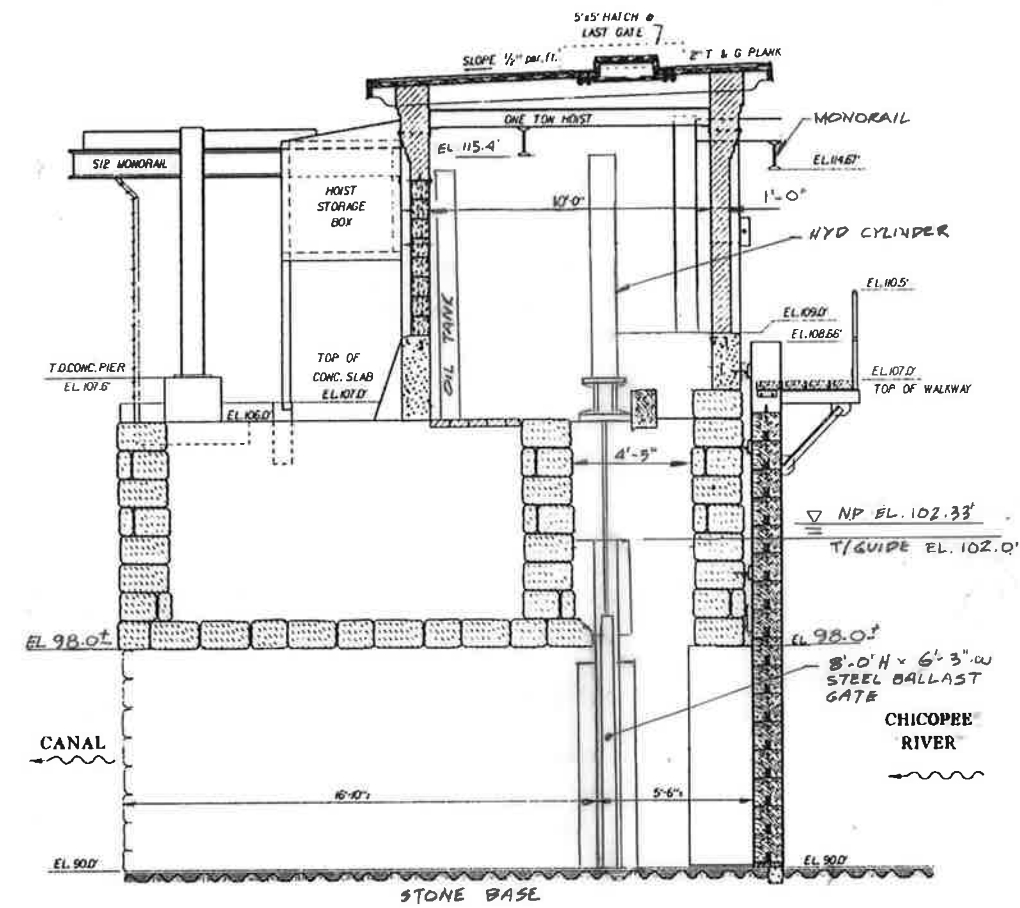
FIGURE 1 – EXHIBIT G – SHEET 3 OF 8 – ELEVATIONS AND SECTIONS OF GATEHOUSE



EAST ELEVATION OF GATEHOUSE

10 0 10

1/4 INCH = ONE FOOT

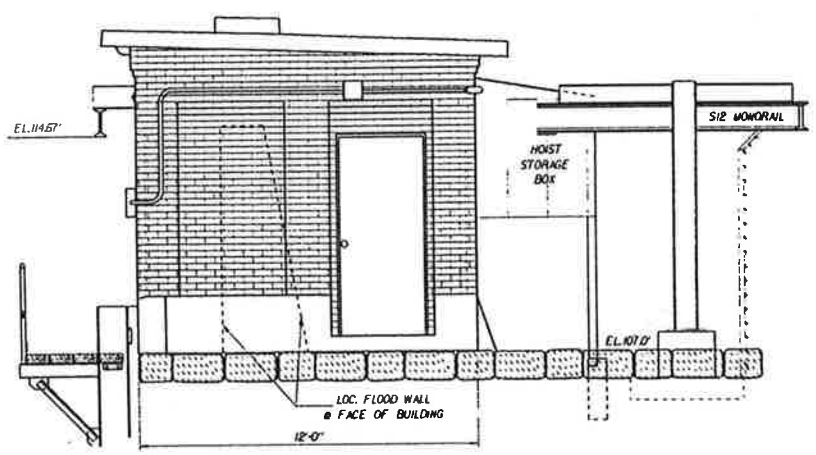


SECTION G - G

SEE EXHIBIT G SHEET 2 OF 9

5 0 5

3/8 INCH = ONE FOOT



SOUTH ELEVATION

5 0 5

3/8 INCH = ONE FOOT

NOTE:
ELEVATIONS ARE ON OPERATING DATUM
SUBTRACT 23.49 FOR NGVD.

EXHIBIT G - SHEET 3 OF 8

ELEVATIONS AND SECTIONS OF GATEHOUSE

FERC PROJECT NO. **10675**

DWIGHT STATION PROJECT

CONSOLIDATED EDISON ENERGY, INC.

SCALE: AS SHOWN

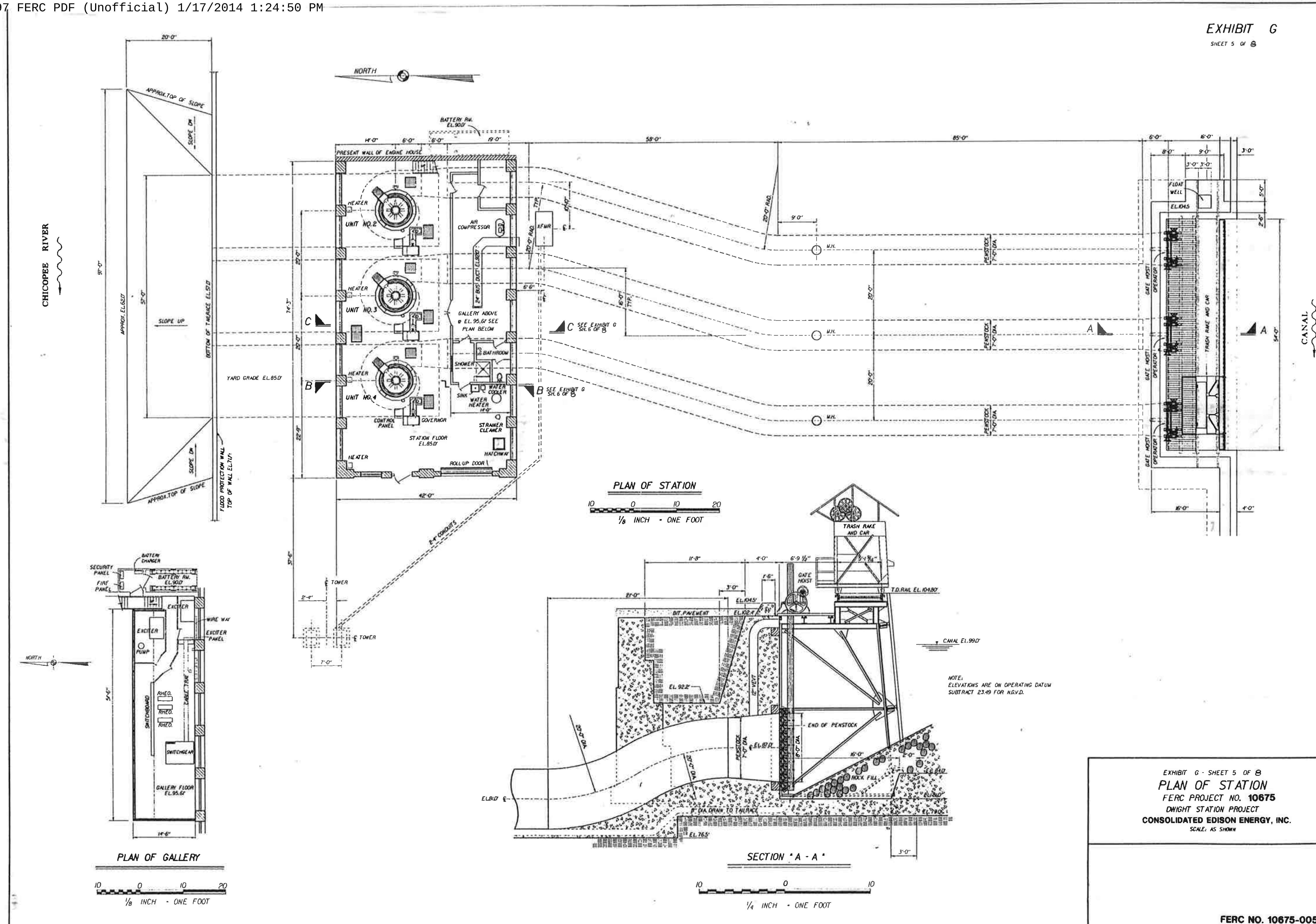
EXHIBIT G SHEET 3 OF 8

FERC NO. 10675-003

APPENDIX B-2

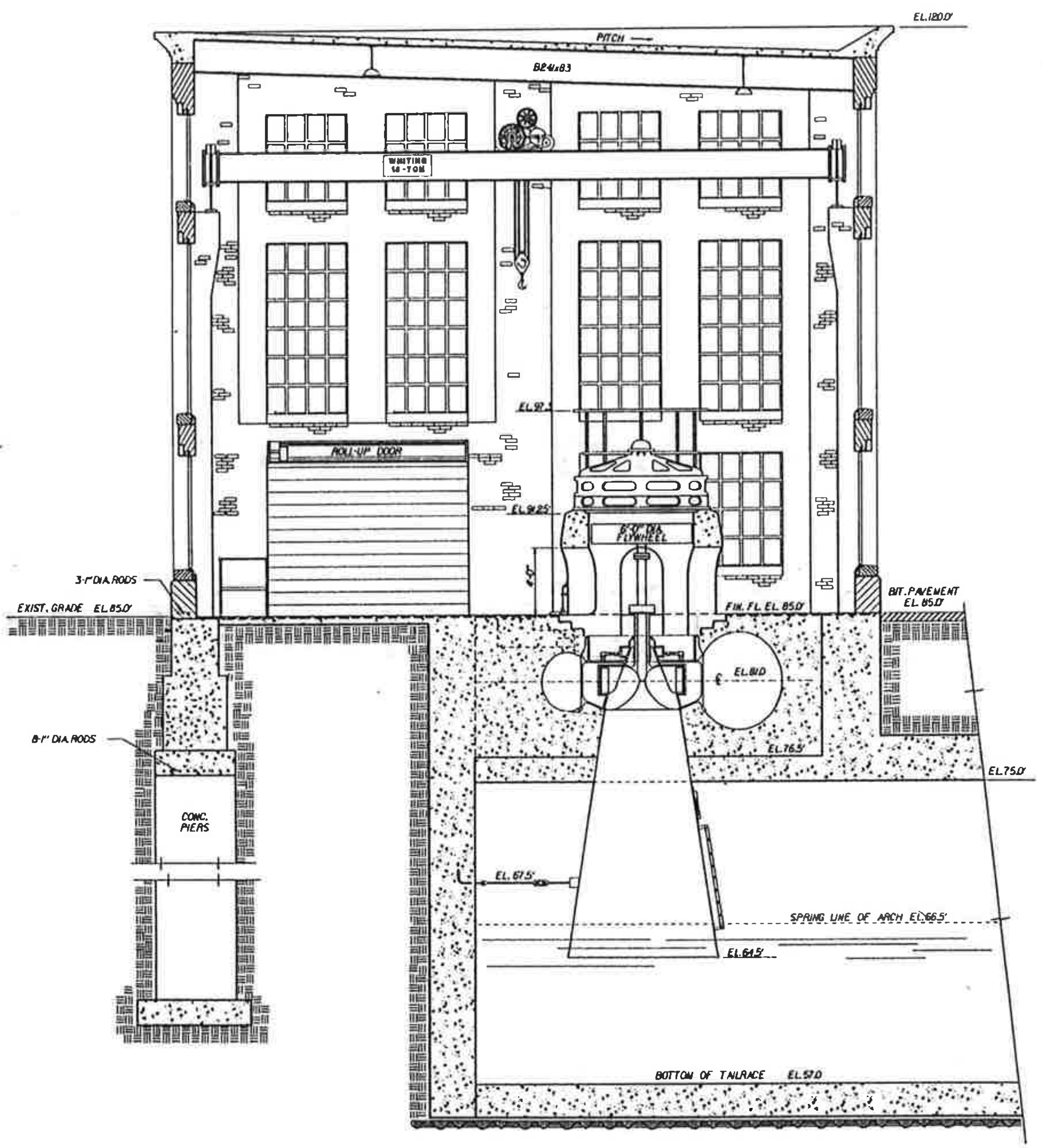
FIGURE 2 – EXHIBIT G – SHEET 5 OF 8 – PLAN OF STATION

20140117-5197 FERC PDF (Unofficial) 1/17/2014 1:24:50 PM



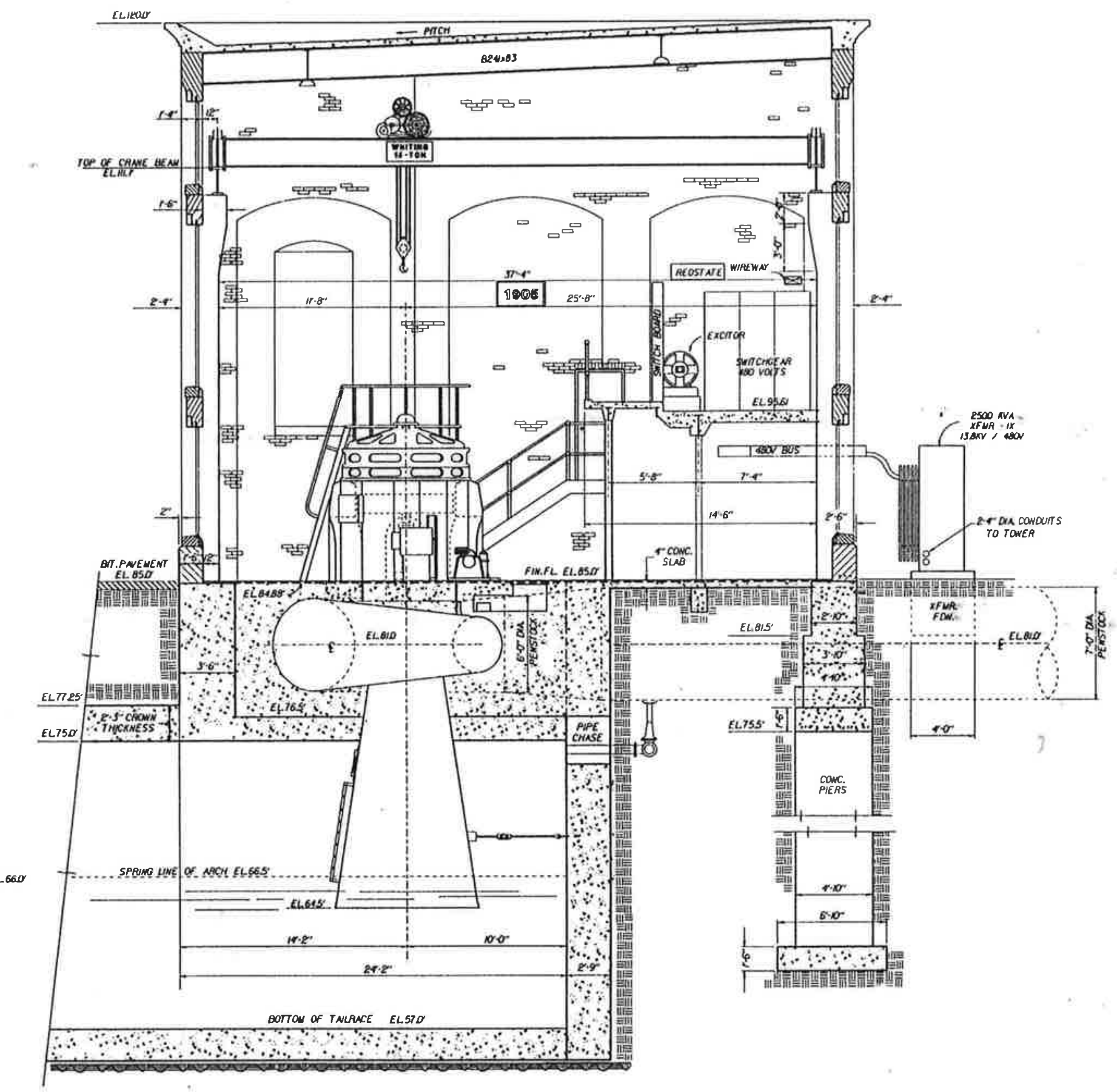
APPENDIX B-3

FIGURE 3 – EXHIBIT G – SHEET 6 OF 8 – CROSS-SECTION THRU UNITS NO. 3 & NO. 4



SECTION B - B

SEE EXHIBIT G SHEET 5 OF 8



SECTION C - C

SEE EXHIBIT G SHEET 5 OF 8

10 0 10

1/4 INCH - ONE FOOT

NOTE:
ELEVATIONS ARE ON OPERATING DATUM
SUBTRACT 23.49 FOR N.G.V.D.

EXHIBIT G - SHEET 6 OF 8

CROSS-SECTION THRU
UNITS No.3 & No.4

FERC PROJECT NO. 10675
DWIGHT STATION PROJECT
CONSOLIDATED EDISON ENERGY, INC.
SCALE: 1/4" - 1'-0"

FERC NO. 10675-006

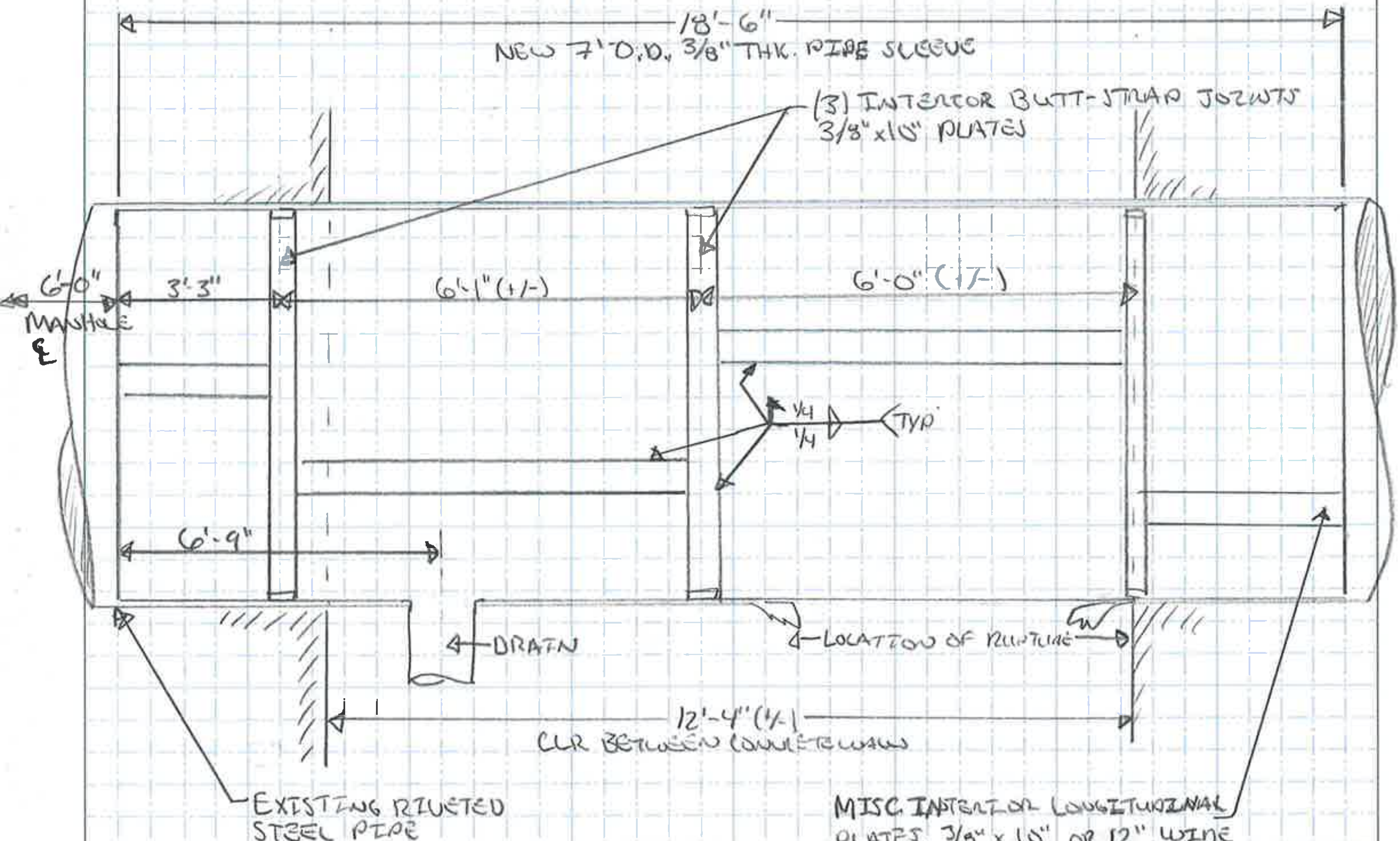
EXHIBIT G SHEET 6 OF 8

APPENDIX B-4

FIGURE 4 – SKETCH OF PENSTOCK NO. 2 REPAIR

Kleinschmidt
P.O. Box 650
141 Main Street
Pittsfield, Maine 04967
Telephone: 207.487.3328
www.KleinschmidtUSA.com

Page:	B-4		
Project No.:	803029		
Project:	DWIGHT PENSTOCK	By: JLD	Date: 12-12-13
Subject:	PENSTOCK #2 REPAIR	Checked:	Date:



PENSTOCK NO. 2 REPAIR DETAIL
- AS OBSERVED DURING 12/12/13 SITE INSPECTION

(N.T.S.)

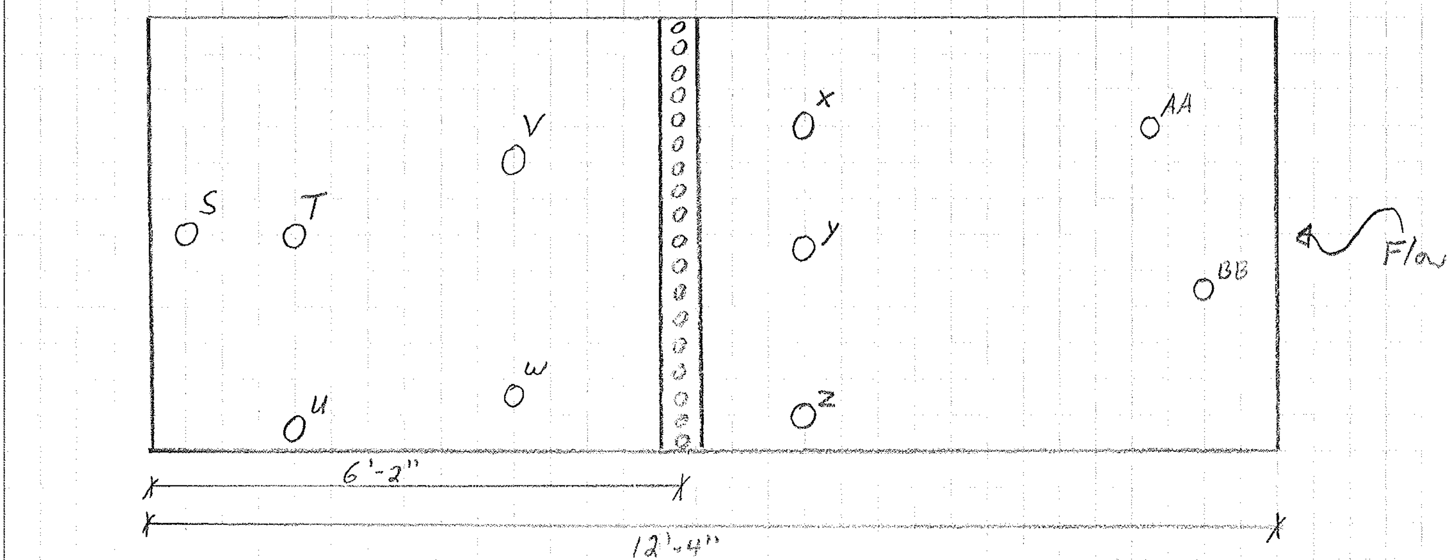
APPENDIX B-5

FIGURE 5 – SKETCH OF EXPOSED SECTION OF PENSTOCK NO. 3

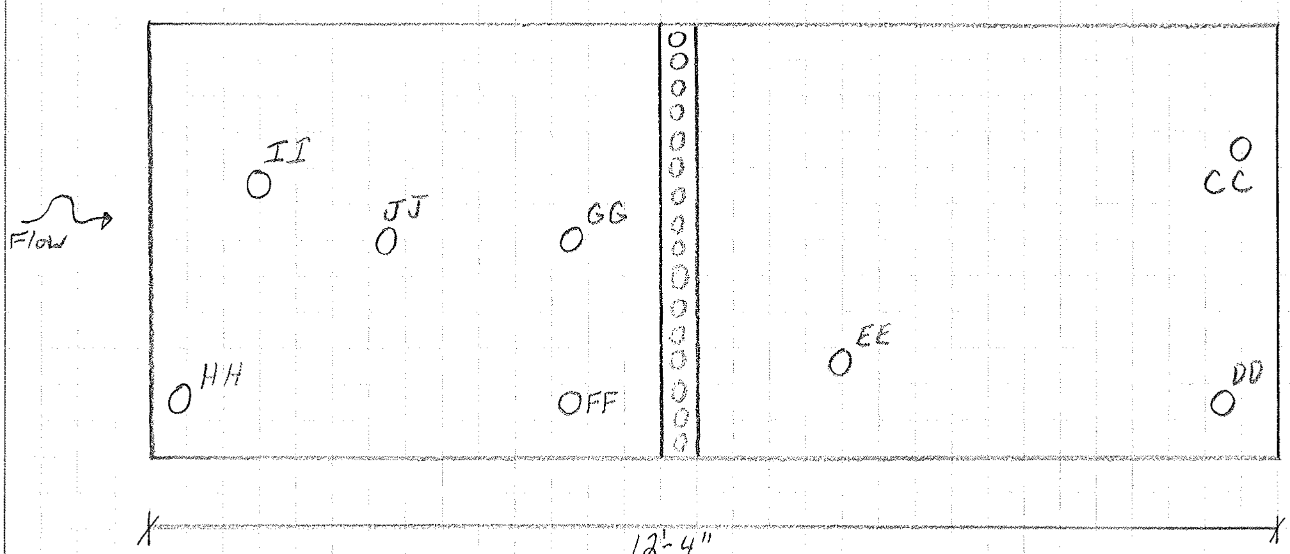
Kleinschmidt
P.O. Box 278
400 Historic Drive
Strasburg, Pennsylvania 17579
Telephone: 717.687.7211
www.KleinschmidtUSA.com

Page: 1 of 2	
Project No.: 0803-029	
Project: Dwight Penstock Inspection	By: NMC Date: 11/13/13
Subject: Crawl Space Penstock Sections	Checked: Date:

Left Side of Penstock #3 (Looking Downstream)



Right Side of Penstock #3 (Looking Downstream)



APPENDIX B-6

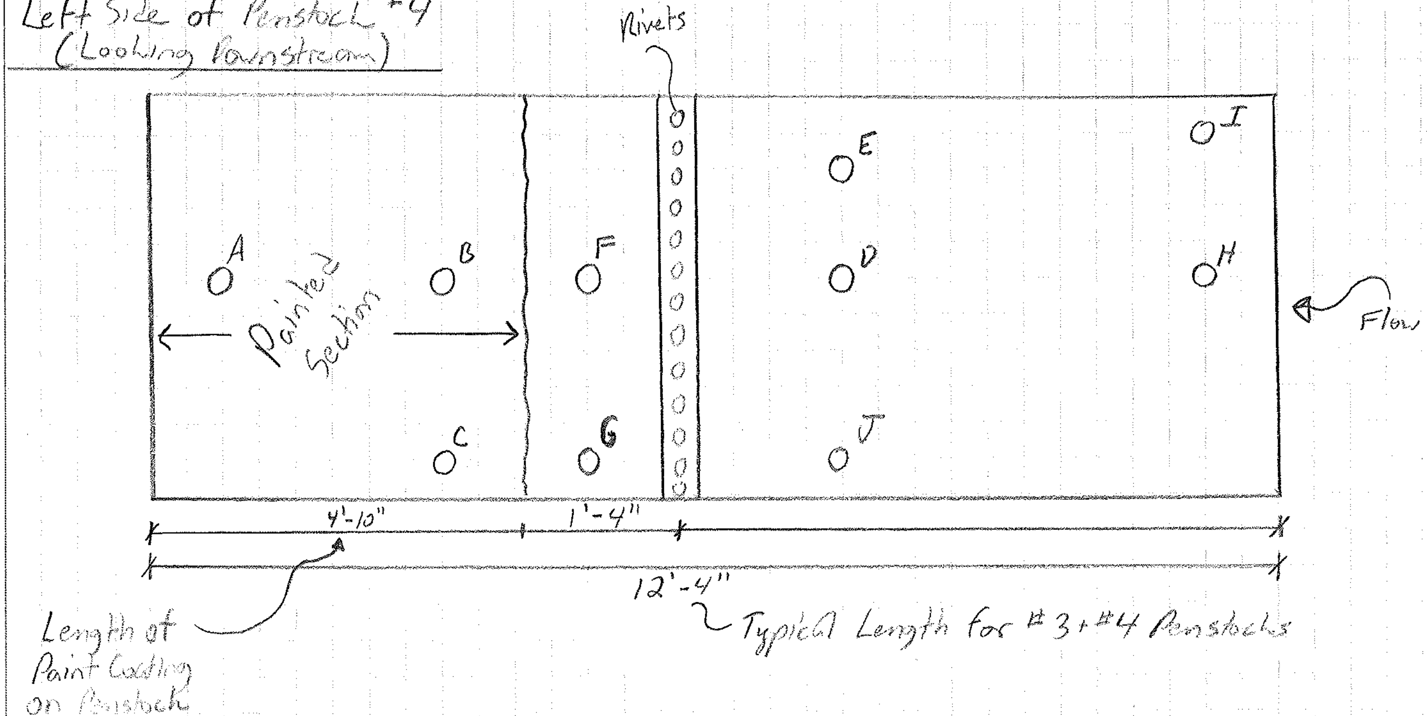
FIGURE 6 – SKETCH OF EXPOSED SECTION OF PENSTOCK NO. 4

Kleinschmidt

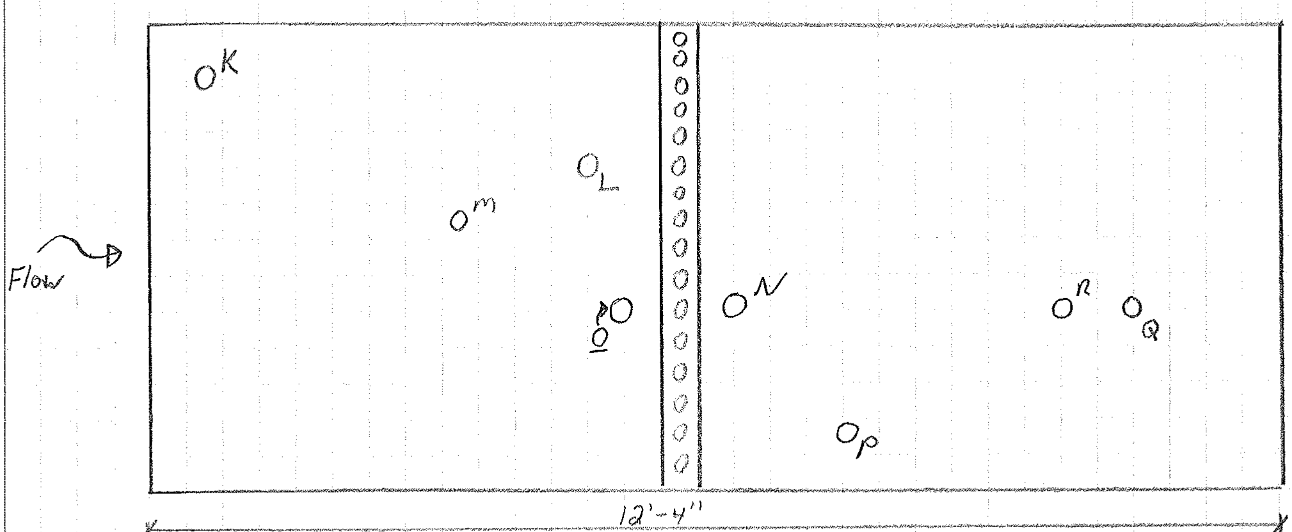
P.O. Box 278
400 Historic Drive
Strasburg, Pennsylvania 17579
Telephone: 717.687.7211
www.KleinschmidtUSA.com

Project No.:	0803-029
Project:	Dwight Penstock Inspection
By:	NMC
Date:	11/13/13
Subject:	Crawl Space Penstock Sections
Checked:	
Date:	

Left Side of Penstock #4
(Looking Downstream)



Right Side of Penstock #4
(Looking Downstream)



APPENDIX C

DWIGHT PENSTOCK NO. 2 INSPECTION CALCULATIONS

Kleinschmidt

P.O. Box 650
141 Main St.
Pittsfield, Maine 04967
Telephone: 207.487.3328
www.KleinschmidtUSA.com

Designed By: NMC
Date: 12/16/13
Checked By: JLD
Date: 12/17/13
Job Number: 0803-029

Project: Dwight Penstock Inspection

Task: Penstock No. 2 Calculations - Original Steel

Objective:

Determine the capacity of and the loads on the steel penstock. Inspected on 12/12/2013.

References:

1. Site Visit Notes (Attached)
2. Penstock Thickness Readings from UT Gage (see Table 1)
3. ASCE No. 79, 2nd Edition, 2012
4. Existing Drawings:
   - Exhibit G - Sheet 3 - "Elevations and Sections of Gatehouse"
   - Exhibit G - Sheet 5 - "Plan of Station"
   - Exhibit G - Sheet 6 - "Cross-Section Thru Units No. 3 & No. 4"
5. AISC Iron & Steel Beams 1873 to 1952
6. 1999 Dwight Station Unit 2 Penstock Condition Assessment
7. 2013 Report Table 1
8. AWWA M11. 4th Edition
9. AISI Buried Steel Penstocks Steel Plate Engineering Data Vol. 4 1st ED 1992

Inputs - Data From 1994 Condition Assessment Report & Existing Drawings:

1925 Vintage Steel - Properties per R.5 and R.6

$F_y := 51\text{ksi}$ — *Steel Plate Yield Stress (R.6, Section 1.2)*

$F_u := 61\text{ksi}$ — *Steel Plate Tensile Stress (R.6, Section 1.2)*

$S_A := \min\left(\frac{F_y}{1.5}, \frac{F_u}{2.4}\right) = 25\cdot\text{ksi}$ — *Allowable Stress in Penstock Steel (R.3, 3.5.3) based on current standards and historic steel properties*

$HW := 99\text{ft}$ — *Normal Pond - Head Pond Elevation (R.4, Exhibit G - Sheet 5)*

$TW := 66\text{ft}$ — *Normal Pond - Tailwater Elevation (R.4, Exhibit G - Sheet 6)*

$Pipe := 81\text{ft}$ — *Penstock C.L. Elevation (R.4, Exhibit G - Sheet 5)*

All elevations are in Operating datum, USGS (i.e. NGVD) = Operating - 23.49'

Joint Efficiency Per R.3 - pg. 281 and R.7 Tables 1 & 2:

General Inputs:

$T_s := F_u = 61.00 \cdot ksi$	*Tensile Strength*
$c := 95 \cdot ksi$	*Crushing Strength Of Mild Steel*
$d := 0.875in$	*Rivet Diameter (R.6, Section 1.1)*
$d_h := 0.875in$	*Rivet Hole Diameter (= rivet shaft diameter)*
$s := 44ksi$	*Strength Of Field Rivet In Single Shear*
$S := s \cdot 2 = 88.00 \cdot ksi$	*Strength Of Field Rivet In Double Shear*
$a := \pi \cdot \frac{d_h^{\,2}}{4} = 0.60 \cdot in^2$	*Cross-sectional Area of Rivets*
$t_{avg} := 0.194in$	*Penstock #2 Average Interior Plate Thickness Plate Thickness (R.7, Table 1)*
$t_{exp} := 0.087in$	*Penstock #2 97% Confidence Plate Thickness Plate Thickness (R.7, Table 1)*
$P := 2.5in$	*Pitch or Spacing of Rivets (R.6, Section 1.1)*

Penstock #2 Joint Efficiency:

$s = 44000.00\,psi$	*Strenth of Field Rivet in Single Shear*
$S = 88000.00\,psi$	*Strength of Field Rivet in Double Shear*
$c = 95000.00\,psi$	*Crushing Strength of Mild Steel*
$n := 1$	*Number of rivets in single shear per unit length of joint*
$A := P \cdot \min(t_{avg}, t_{exp}) \cdot T_s = 13267.50\,lbf$	*Strength of Solid Plate*
$B := (P - d) \cdot \min(t_{avg}, t_{exp}) \cdot T_s = 8623.88\,lbf$	*Strength of Plate Btwn. Holes*
$C := n \cdot s \cdot a = 26458.10\,lbf$	*Shear strength of Rivets in single shear*
$D := n \cdot d \cdot \min(t_{avg}, t_{exp}) \cdot c = 7231.87\,lbf$	*Crushing strength of plate in front of rivets*
$e := \frac{\min(B, C, D)}{A} = 0.55$	*Joint Efficiency of Riveted Joints*

Penstock Hoop Stress:

$\sigma_{Hoop} = \frac{P \cdot r}{E \cdot t}$ $P = Pressure = \gamma_w \cdot Head$

$r := 42in$ *Radius of Penstock*

$E := e = 0.55$ *Joint Efficiency*

See attached Tables 1 thru 2 for hoop stresses (Normal Pond and Water Hammer)

$D_p := 2 \cdot r = 84.00 \cdot in$ *Penstock Diameter Used for Following Calculations*

Load Case	*97.5% Hoop Stress (@ Joints)*	
N.P.	$\sigma_{NP} := \frac{62.4pcf \cdot (HW - Pipe) \cdot r}{e \cdot \min(t_{avg}, t_{exp})} = 6.91 \cdot ksi$	
Water Hammer	$\sigma_{WH} := 10.077ksi$	*(Table 1 Summary - Note see Appendix E for water hammer calcs)*

Penstock External Loads:

Penstock is buried until it reaches the powerhouse. There is a 12'-4" section unburied in a crawl space below the powerhouse floor.

Buried Section:

$L_p := 17.5ft$ — ***Max allowable** length of void section per following check*

Dead Load:

$\gamma_w := 62.4pcf$

$A_P := \pi \cdot D_p \cdot \max(t_{avg}, t_{exp}) = 51.20 \cdot in^2$ — *Cross Section Area of Penstock Steel*

$W_P := 490pcf \cdot A_P = 174.21 \cdot plf$ — *Weight of Penstock Steel*

$A_{wp} := \frac{\pi (D_p)^2}{4} = 38.48 \cdot ft^2$ — *Area of Water in Full Penstock*

$W_{wP} := \gamma_w \cdot A_{wp} = 2401.43 \cdot plf$ — *Weight of Water in Penstocks*

$H_s := (102ft - Pipe) - r = 17.50\ ft$ — *Height of fill above conduit, (R.4, Exhibit G - Sheet 5)*

$\gamma_b := 120pcf$ — *Unit Weight of fill, assumed*

$W_{FP} := \gamma_b \cdot H_s \cdot D_p = 14700.00 \cdot plf$ — *Fill Load on Penstock, (R.8, eqn. 6-4)*

Live Load:

$P := 250psf$ — *Superimposed Load, (R.9, Table 4-1, assumed Heavy Manufacturing unformly distributed)*

$W_{LP} := P \cdot D_p = 1750.00 \cdot plf$ — *Live Load on Penstock*

Check of Penstock for External Loads:

$$w_{uP.b} := \begin{pmatrix} W_P + W_{wP} + W_{FP} \\ W_P + W_{wP} + W_{FP} + W_{LP} \end{pmatrix} = \begin{pmatrix} 17275.64 \\ 19025.64 \end{pmatrix} \cdot plf$$
Uniform Loads to Penstocks (Dead Only and D+L)

$$M_{uP.b} := \frac{w_{uP.b} \cdot L_p^2}{12} = \begin{pmatrix} 440.89 \\ 485.55 \end{pmatrix} \cdot k \cdot ft$$
Design Moments

$$S_{LP.b} := \frac{M_{uP.b}}{\pi \cdot \left(\frac{D_p}{2}\right)^2 \cdot \min(t_{avg}, t_{exp}) \cdot E} = \begin{pmatrix} 20.13 \\ 22.17 \end{pmatrix} \cdot ksi$$
Longitudinal stress in Penstocks

$Check := if(\max(S_{LP.b}) \le S_A, \text{"Okay"}, \text{"Over Stressed"}) = \text{"Okay"}$

Check Hoop Stresses and Bending:

$$\sigma_{combo\_max.b} := \sqrt{(S_{LP.b})^2 + \sigma_{WH}^2} = \begin{pmatrix} 22.51 \\ 24.35 \end{pmatrix} \cdot ksi \qquad Check := if(\max(\sigma_{combo\_max.b}) \le S_A, \text{"Okay"}, \text{"Over Stressed"}) = \text{"Okay"}$$

Check Shell Stresses at Saddles:

(per. Ref. 3, page 47 (sect. 4.4))

Saddle Info:

Assume a concrete saddle - no drawing information available on the saddles, saddle info. per 1994 and 1999 reports

$r_c := D_p \cdot 0.5 = 3.50\,\text{ft}$ — *Radius of saddle curve around pipe*

$\theta := 140\text{deg}$ — *Angle span that the penstock is in continuous contact with the saddle, per 4.4.4.1 this value should be between 120deg and 180deg, per old reports it is between 140deg and 150 deg.*

$w_c := \dfrac{\theta \cdot 2 \cdot \pi \cdot r_c}{360\text{deg}} = 8.55\,\text{ft}$ — *Length of curve*

$b := 2\text{ft} + 6\text{in} = 2.50\,\text{ft}$ — *Saddle support width (assumed)*

$t := t_{avg} = 0.19 \cdot \text{in}$

There is no stiffener ring around the penstock at or near the saddle locations (estimated)

$\beta := \pi - \dfrac{\theta}{2} = 110.00 \cdot \text{deg}$ $\quad \alpha := \beta - \dfrac{\beta}{20} = 104.50 \cdot \text{deg}$ — *Saddle Angular location of shear stresses Properties (Fig. 4-8)*

Shear Stresses:

$L_s := 18\text{ft}$ — *Length of pipe between saddles*

$T := \left(W_P + W_{wP} + W_{FP}\right) \cdot \dfrac{L_s}{2} = 155480.76\,\text{lbf}$ — *Max shear stress at saddle*

$R_m := \dfrac{D_p}{2} + \dfrac{t}{2} = 42.10 \cdot \text{in}$ — *Mean radius of penstock shell*

$K_1 := \dfrac{\sin(\alpha)}{\pi - \alpha + \sin(\alpha) \cdot \cos(\alpha)} = 0.90034$ — *Coefficient (Fig. 4-9)*

$\tau_2 := \dfrac{K_1 \cdot T}{R_m \cdot t} = 17140.68\,\text{psi}$ — *Maximum shear stress in shell when there is no stiffener ring (eqn. 4-18)*

$\text{Check} := \text{if}\left(\tau_2 \le 0.8 \cdot S_A, \text{"Okay"}, \text{"Not Okay"}\right) = \text{"Okay"}$ $\quad 0.8 \cdot S_A = 20333.33\,\text{psi}$

Circumferential Stresses:

$Q := 2 \cdot T = 310.96 \cdot \text{k}$ — *Max reaction per saddle*

$$K_3 := \frac{\left[\dfrac{3\cdot\cos(\beta)}{4}\cdot\left(\dfrac{\sin(\beta)}{\beta}\right)^2 - \dfrac{5\cdot\sin(\beta)\cdot\cos(\beta)^2}{4\cdot\beta} + \dfrac{\cos(\beta)^3}{2} - \dfrac{\sin(\beta)}{4\cdot\beta} \cdots + \dfrac{\cos(\beta)}{4} - \beta\cdot\sin(\beta)\cdot\left[\left(\dfrac{\sin(\beta)}{\beta}\right)^2 - \dfrac{1}{2} - \dfrac{\sin(2\cdot\beta)}{4\cdot\beta}\right]\right]}{2\cdot\pi\cdot\left[\left(\dfrac{\sin(\beta)}{\beta}\right)^2 - \dfrac{1}{2} - \dfrac{\sin(2\cdot\beta)}{4\cdot\beta}\right]} = 0.03788$$

Maximum reaction at saddle support from all loads

$M_\beta := K_3 \cdot Q \cdot R_m = 41.32 \cdot \text{k} \cdot \text{ft}$ — *Maximum circumferential bending moment of the shell at the saddle (eqn. 4-19)*

$x := 0.78 \cdot \sqrt{R_m \cdot t} = 2.23 \cdot \text{in}$ — *Maximum width of the penstock shell that contributes to the strength of the shell at the saddle (eqn. 4-21)*

$K_2 := \frac{1 + \cos(\alpha)}{\pi - \alpha + \sin(\alpha)\cdot\cos(\alpha)} = 0.69711$ *Coefficient (Fig. 4-9)*

$k_o := 1.0$ *Factor to account for the support condition (1.0=resting on support, 0.1=welded to support, per page 242)*

$\sigma_6 := \frac{-K_2\cdot Q\cdot k_o}{t\cdot(b + 2\cdot x)} = -32427.79\,psi$ *Maximum circumferential compressive stress in the shell at the base of the saddle support (eqn. 4-22)*

$K_{A2} := \min\left(4\cdot R_m, L_s\right) = 14.03\,ft$

$\sigma_7 := \frac{-Q}{4\cdot t\cdot(b + 2\cdot x)} - \frac{3\cdot K_3\cdot Q}{2\cdot t^2}\cdot\frac{4\cdot R_m}{K_{A2}} = -481123.42\,psi$ *Max compressive stress in shell at horn of saddle*

$\sigma_{max} := \max\left(\left|\sigma_6\right|, \left|\sigma_7\right|\right) = 481123.42\,psi$ *Max absolute circumferential stress in shell*

$Check := if\left(\sigma_{max} \le 3S_A, \text{"Okay"}, \text{"Not Okay"}\right) = \text{"Not Okay"}$ $3S_A = 76250.00\,psi$ *per ref. 3 for stress concentrations*

APPENDIX D

DWIGHT PENSTOCK NO. 2 REPAIR CALCULATIONS

Kleinschmidt

Project: Dwight Penstock Inspection

P.O. Box 650
141 Main St.
Pittsfield, Maine 04967
Telephone: 207.487.3328
www.KleinschmidtUSA.com

Designed By: NMC
Date: 12/16/13
Checked By: JLD
Date: 12/17/13
Job Number: 0803-029

Task: Penstock No. 2 - Repair Liner Calculations

Objective:

In October Penstock No. 2 Ruptured where is is exposed in the Powerhouse crawl space (penstock spance between foundation walls at this point). EP repaird the rupture by installing a 3/8" thick sleeve that was 18.5 feet long and spanned the interior of the penstock over the exposed section. Check this new replacement section, neglecting any residual capacity from the existing pipe. Field measurments indicate that the new plate thickness was 0.355in.

References:

1. ASCE No. 79, 2nd Edition, 2012
2. Existing Drawings:
   - Exhibit G - Sheet 3 - "Elevations and Sections of Gatehouse"
   - Exhibit G - Sheet 5 - "Plan of Station"
   - Exhibit G - Sheet 6 - "Cross-Section Thru Units No. 3 & No. 4"
3. AWWA M11. 4th Edition

Inputs - Data From 1994 Condition Assessment Report & Existing Drawings:

A36 Steel Plate Liner

$F_y := 36\text{ksi}$ — *Steel Plate Yield Stress*

$F_u := 58\text{ksi}$ — *Steel Plate Tensile Stress*

$S_A := \min\left(\frac{F_y}{1.5}, \frac{F_u}{2.4}\right) = 24 \cdot \text{ksi}$ — *Allowable Stress in Penstock Steel (R.1, 3.5.3) based on current standards and historic steel properties*

$HW := 99\text{ft}$ — *Normal Pond - Head Pond Elevation (R.2, Exhibit G - Sheet 5)*

$TW := 66\text{ft}$ — *Normal Pond - Tailwater Elevation (R.2, Exhibit G - Sheet 6)*

$Pipe := 81\text{ft}$ — *Penstock C.L. Elevation (R.2, Exhibit G - Sheet 5)*

All elevations are in Operating datum, USGS (i.e. NGVD) = Operating - 23.49'

$e := 0.65$ — *Welded Joint Efficiency, Sibgle Welded butt-joints (R.1, Table 3-3)*

$t := 0.355\text{in}$ — *Plate Thickness (Field Confirmed based on 3/8" nominal plate size)*

$D_p := 82.5\text{in}$ — *Field Measured Interior Diameter*

$H_{NP} := HW - Pipe = 18.00\ \text{ft}$ — *Normal Pond Pressure Head on Pipe*

$H_{WH} := H_{NP} + 16.4\text{ft} = 34.40\ \text{ft}$ — *Water Hammer Pressure (per Penstock 3 & 4 Analysis)*

$\gamma_w := 62.4\text{pcf}$

Penstock Hoop Stress:

$\sigma_{Hoop} = \frac{P \cdot r}{e \cdot t}$ $P = Pressure = \gamma_w \cdot Head$

$r := \frac{D_p}{2} = 41.25 \cdot in$ *Radius of Penstock*

N.P. $\sigma_{NP} := \frac{\gamma_w \cdot H_{NP} \cdot r}{e \cdot t} = 1.39 \cdot ksi$

Water Hammer $\sigma_{WH} := \frac{\gamma_w \cdot H_{WH} \cdot r}{e \cdot t} = 2.66 \cdot ksi$

Penstock Bending Stress:

$L_p := 12.33ft$ *Length of section that is exposed in the powerhouse crawl space*

$A_P := \pi \cdot D_p \cdot t = 92.01 \cdot in^2$ *Cross Section Area of Penstock Steel*

$W_P := 490pcf \cdot A_P = 313.09 \cdot plf$ *Weight of Penstock Steel*

$A_{wp} := \frac{\pi (D_p)^2}{4} = 37.12 \cdot ft^2$ *Area of Water in Full Penstock*

$W_{wP} := \gamma_w \cdot A_{wp} = 2316.43 \cdot plf$ *Weight of Water in Penstock*

No live load on penstock.

$w_{uP} := W_P + W_{wP} = 2629.52 \cdot plf$ *Uniform Load to Penstock (Dead Only)*

$M_{uP} := \frac{w_{uP} \cdot L_p^2}{12} = 33.31 \cdot k \cdot ft$ *Design Moment (fixed-fixed at walls)*

$S_{LP} := \frac{M_{uP}}{\pi \cdot \left(\frac{D_p}{2}\right)^2 \cdot t \cdot e} = 0.32 \cdot ksi$ *Longitudinal stress in Penstock*

$Check := if\left(max(S_{LP}) \le S_A, "Okay", "Over Stressed"\right) = "Okay"$

Check Hoop Stresses and Bending:

$\sigma_{combo\_max} := \sqrt{(S_{LP})^2 + \sigma_{WH}^2} = 2.68 \cdot ksi$ $Check := if\left(max(\sigma_{combo\_max}) \le S_A, "Okay", "Over Stressed"\right) = "Okay"$

APPENDIX E

DWIGHT PENSTOCK NO. 3 & NO. 4 INSPECTION CALCULATIONS

Kleinschmidt

Project: Dwight Penstock Inspection

Task: Penstock Calculations

P.O. Box 650
141 Main St.
Pittsfield, Maine 04967
Telephone: 207.487.3328
www.KleinschmidtUSA.com

Designed By:	NMC
Date:	11/14/13
Checked By:	JLD
Date:	12/16/13
Job Number:	0803-029

Objective:

Determine the capacity of and the loads on the steel penstock. Inspected on 11/12/2013.

References:

1. Site Visit Notes (Attached)
2. Penstock Thickness Readings from UT Gage (see Tables 2 & 3)
3. ASCE No. 79, 2nd Edition, 2012
4. Existing Drawings:
   - Exhibit G - Sheet 3 - "Elevations and Sections of Gatehouse"
   - Exhibit G - Sheet 5 - "Plan of Station"
   - Exhibit G - Sheet 6 - "Cross-Section Thru Units No. 3 & No. 4"
5. AISC Iron & Steel Beams 1873 to 1952
6. 1999 Dwight Station Unit 2 Penstock Condition Assessment
7. 2013 Report Tables 2 thru 3
8. AWWA M11. 4th Edition
9. AISI Buried Steel Penstocks Steel Plate Engineering Data Vol. 4 1st ED 1992

Inputs - Data From 1994 Condition Assessment Report & Existing Drawings:

1925 Vintage Steel - Properties per R.5 and R.6

$F_y := 51\text{ksi}$ — *Steel Plate Yield Stress (R.6, Section 1.2)*

$F_u := 61\text{ksi}$ — *Steel Plate Tensile Stress (R.6, Section 1.2)*

$S_A := \min\left(\frac{F_y}{1.5}, \frac{F_u}{2.4}\right) = 25 \cdot \text{ksi}$ — *Allowable Stress in Penstock Steel (R.3, 3.5.3) based on current standards and historic steel properties*

$HW := 99\text{ft}$ — *Normal Pond - Head Pond Elevation (R.4, Exhibit G - Sheet 5)*

$TW := 66\text{ft}$ — *Normal Pond - Tailwater Elevation (R.4, Exhibit G - Sheet 6)*

$Pipe := 81\text{ft}$ — *Penstock C.L. Elevation (R.4, Exhibit G - Sheet 5)*

All elevations are in Operating datum, USGS (i.e. NGVD) = Operating - 23.49'

Kleinschmidt Associates
Pittsfield, Maine

Joint Efficiency Per R.3 - pg. 281 and R.7 Tables 1 & 2:

General Inputs:

$T_s := F_u = 61.00 \cdot ksi$	*Tensile Strength*
$c := 95 \cdot ksi$	*Crushing Strength Of Mild Steel*
$d := 0.875in$	*Rivet Diameter (R.6, Section 1.1)*
$d_h := 0.875in$	*Rivet Hole Diameter (= rivet shaft diameter)*
$s := 44ksi$	*Strength Of Field Rivet In Single Shear*
$S := s \cdot 2 = 88.00 \cdot ksi$	*Strength Of Field Rivet In Double Shear*
$a := \pi \cdot \frac{d_h^{\,2}}{4} = 0.60 \cdot in^2$	*Cross-sectional Area of Rivets*
$t_{3avg} := 0.111in$	*Penstock #3 Average Interior Plate Thickness Plate Thickness (R.7, Table 2)*
$t_{4avg} := 0.096in$	*Penstock #4 Average Interior Plate Thickness Plate Thickness (R.7, Table 3)*
$t_{3exp} := 0.182in$	*Penstock #3 97% Confidence Plate Thickness Plate Thickness (R.7, Table 2)*
$t_{4exp} := 0.085in$	*Penstock #4 97% Confidence Plate Thickness Plate Thickness (R.7, Table 3)*
$P := 2.5in$	*Pitch or Spacing of Rivets (R.6, Section 1.1)*

Penstock #3 & #4 Joint Efficiency:

$s = 44000.00\,psi$	*Strenth of Field Rivet in Single Shear*
$S = 88000.00\,psi$	*Strength of Field Rivet in Double Shear*
$c = 95000.00\,psi$	*Crushing Strength of Mild Steel*
$n := 1$	*Number of rivets in single shear per unit length of joint*
$A := P \cdot \min(t_{3avg}, t_{4avg}, t_{3exp}, t_{4exp}) \cdot T_s = 12962.50\,lbf$	*Strength of Solid Plate*
$B := (P - d) \cdot \min(t_{3avg}, t_{4avg}, t_{3exp}, t_{4exp}) \cdot T_s = 8425.63\,lbf$	*Strength of Plate Btwn. Holes*
$C := n \cdot s \cdot a = 26458.10\,lbf$	*Shear strength of Rivets in single shear*
$D := n \cdot d \cdot \min(t_{3avg}, t_{4avg}, t_{3exp}, t_{4exp}) \cdot c = 7065.63\,lbf$	*Crushing strength of plate in front of rivets*
$e := \frac{\min(B, C, D)}{A} = 0.55$	*Joint Efficiency of Riveted Joints*

Penstock Hoop Stress:

$$\sigma_{Hoop} = \frac{P \cdot r}{E \cdot t} \qquad P = Pressure = \gamma_w \cdot Head$$

$r := 42in$	*Radius of Penstock*
$E := e = 0.55$	*Joint Efficiency*

See attached Tables 2 & 3 for hoop stresses (Normal Pond and Water Hammer)

$D_p := 2 \cdot r = 84.00 \cdot in$ *Penstock Diameter Used for Following Calculations*

Load Case	*97.5% Hoop Stress (@ Joints)*	
N.P.	$\sigma_{NP} := \frac{62.4pcf \cdot (HW - Pipe) \cdot r}{e \cdot \min(t_{3avg}, t_{4avg}, t_{3exp}, t_{4exp})} = 7.07 \cdot ksi$	
Total Hoop Stress	$\sigma_{WH} := 24.53ksi$	*(Table 3 Summary)*

Penstock External Loads:

Penstock is buried until it reaches the powerhouse. There is a 12'-4" section unburied in a crawl space below the powerhouse floor. The 11/12/2013 inspection revealed voids at multiple locations below the penstock.

Buried Section:

$L_p := 9ft$ — ***Max allowable*** *length of void section per following check*

Dead Load:

$\gamma_w := 62.4pcf$

$A_P := \pi \cdot D_p \cdot max(t_{3avg}, t_{4avg}, t_{3exp}, t_{4exp}) = 48.03 \cdot in^2$ — *Cross Section Area of Penstock Steel*

$W_P := 490pcf \cdot A_P = 163.43 \cdot plf$ — *Weight of Penstock Steel*

$A_{wp} := \frac{\pi (D_p)^2}{4} = 38.48 \cdot ft^2$ — *Area of Water in Full Penstock*

$W_{wP} := \gamma_w \cdot A_{wp} = 2401.43 \cdot plf$ — *Weight of Water in Penstocks*

$H_s := (102ft - Pipe) - r = 17.50\ ft$ — *Height of fill above conduit, (R.4, Exhibit G - Sheet 5)*

$\gamma_b := 120pcf$ — *Unit Weight of fill, assumed*

$W_{FP} := \gamma_b \cdot H_s \cdot D_p = 14700.00 \cdot plf$ — *Fill Load on Penstock, (R.8, eqn. 6-4)*

Live Load:

$P := 250psf$ — *Superimposed Load, (R.9, Table 4-1, assumed Heavy Manufacturing unformly distributed)*

$W_{LP} := P \cdot D_p = 1750.00 \cdot plf$ — *Live Load on Penstock*

Check of Penstock for External Loads:

$$w_{uP.b} := \begin{pmatrix} W_P + W_{wP} + W_{FP} \\ W_P + W_{wP} + W_{FP} + W_{LP} \end{pmatrix} = \begin{pmatrix} 17264.86 \\ 19014.86 \end{pmatrix} \cdot plf$$
Uniform Loads to Penstocks (Dead Only and D+L)

$$M_{uP.b} := \frac{w_{uP.b} \cdot L_p^2}{12} = \begin{pmatrix} 116.54 \\ 128.35 \end{pmatrix} \cdot k \cdot ft$$
Design Moments

$$S_{LP.b} := \frac{M_{uP.b}}{\pi \cdot \left(\frac{D_p}{2}\right)^2 \cdot min(t_{3avg}, t_{4avg}, t_{3exp}, t_{4exp}) \cdot E} = \begin{pmatrix} 5.45 \\ 6.00 \end{pmatrix} \cdot ksi$$
Longitudinal stress in Penstocks

$Check := if(max(S_{LP.b}) \le S_A, \text{"Okay"}, \text{"Over Stressed"}) = \text{"Okay"}$

Check Hoop Stresses and Bending:

$$\sigma_{combo\_max.b} := \sqrt{(S_{LP.b})^2 + \sigma_{WH}^2} = \begin{pmatrix} 25.13 \\ 25.25 \end{pmatrix} \cdot ksi$$
$Check := if(max(\sigma_{combo\_max.b}) \le S_A, \text{"Okay"}, \text{"Over Stressed"}) = \text{"Okay"}$

Exposed Section:

$L_p := 12.33ft$ — *Length of Open Section*

$w_{uP.o} := W_{wP} = 2401.43 \cdot plf$ — *Uniform Loads to Penstocks (Dead Only)*

$M_{uP.o} := \frac{w_{uP.o} \cdot L_p^{2}}{12} = 30.42 \cdot k \cdot ft$ — *Design Moments*

$S_{LP.o} := \frac{M_{uP.o}}{\pi \cdot \left(\frac{D_p}{2}\right)^2 \cdot \min(t_{3avg}, t_{4avg}, t_{3exp}, t_{4exp}) \cdot E} = 1.42 \cdot ksi$ — *Longitudinal stress in Penstocks*

Check := if$(S_{LP.o} \le S_A$, "Okay" , "Over Stressed"$)$ = "Okay"

Check Hoop Stresses and Bending:

$\sigma_{D.o} := \sqrt{(S_{LP.o})^2 + \sigma_{WH}^{2}} = 24.57 \cdot ksi$ Check := if$(\sigma_{D.o} \le S_A$, "Okay" , "Over Stressed"$)$ = "Okay"

Water Hammer: *(per ref. 7)*

$H := 19ft$ — *Rated Head of Units*

$L := 172ft$ — *Penstock Length (Gate to Turbine)*

$D_p = 84.00 \cdot in$ — *Penstock Diameter*

$t_{min} := \min(t_{3avg}, t_{4avg}, t_{3exp}, t_{4exp}) = 0.0850 \cdot in$ — *Average Penstock Thickness*

$t_c := 3sec$ — *Average Emergency Closure Time (assumed)*

$Q := 254cfs$ — *Flow*

$A_P := \pi \cdot D_p \cdot t_{min} = 22.43 \cdot in^2$ — *Cross Section Area of Penstock Steel*

$A_w := \pi \frac{(D_p)^2}{4} = 38.48 \cdot ft^2$ — *Interior Area*

$V := \frac{Q}{A_w} = 6.60 \frac{ft}{s}$ — *Water Velocity*

$a := \frac{4660}{\sqrt{1 + \frac{D_p}{100 \cdot t_{min}}}} \frac{ft}{sec} = 1412.62 \frac{ft}{s}$ — *Pressure Wave Velocity*

$N := \frac{a \cdot t_c}{2 \cdot L} = 12.32$ — *Time Constant*

$k := \frac{(a \cdot V)}{(2 \cdot g \cdot H)} = 7.63$ — *Pipeline Constant*

$P := 0.056$ — *Pressure Rise Constant, per Parmakian Chart Ref. 7, Pg 8 (see below)*

$hammer := \frac{P \cdot a \cdot V}{g} = 16.23 \cdot ft$ — *Water Hammer Pressure Rise*

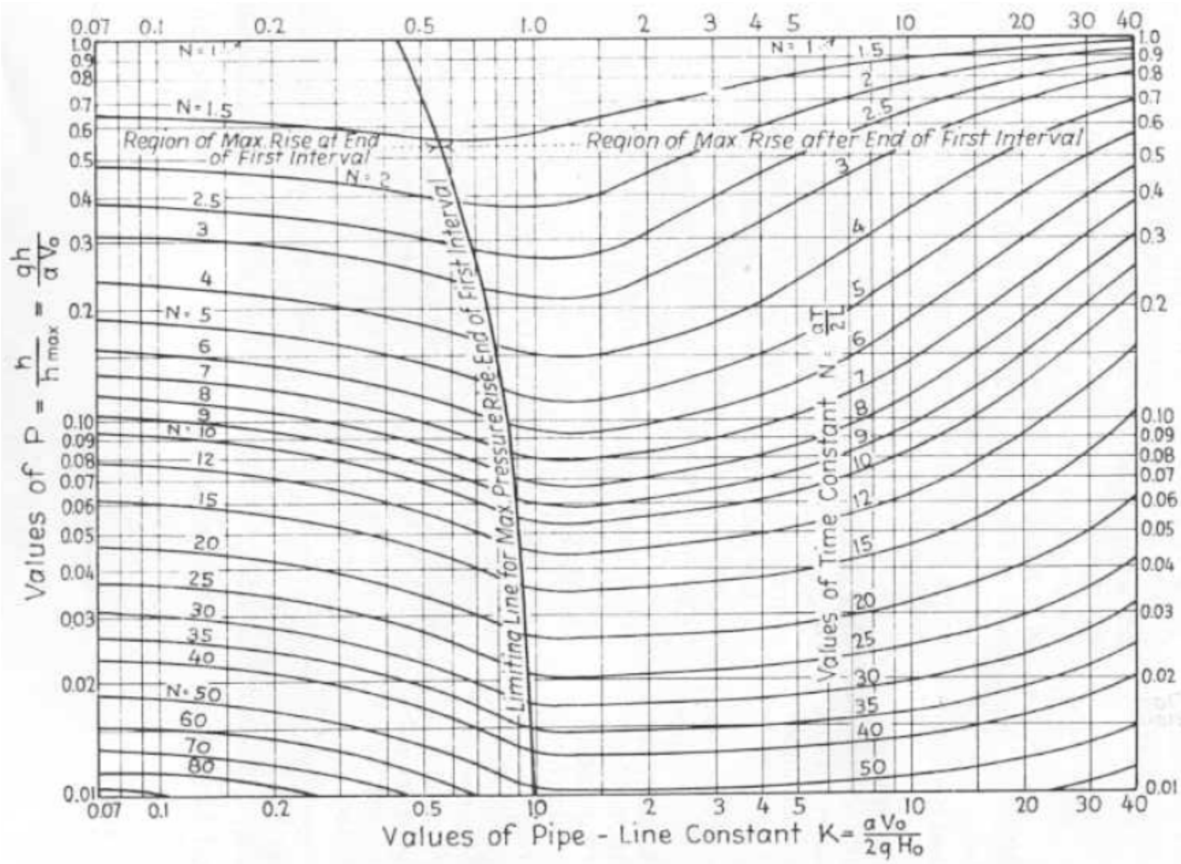


CHART SHOWING MAXIMUM PRESSURE RISE WITH UNIFORM GATE MOTION AND COMPLETE CLOSURE : BASED ON ELASTIC-WATER-COLUMN THEORY

NOTE: Ratio of Pressure Rise "h" to Initial Steady Head "H_o" determined from relation $2KP = h/H_o$

Check Shell Stresses at Saddles:

(per. Ref. 3, page 47 (sect. 4.4))

Saddle Info:

Assume a concrete saddle - no drawing information available on the saddles, saddle info. per 1994 and 1999 reports

$r_c := D_p \cdot 0.5 = 3.50\,\text{ft}$ — *Radius of saddle curve around pipe*

$\theta := 140\text{deg}$ — *Angle span that the penstock is in continuous contact with the saddle, per 4.4.4.1 this value should be between 120deg and 180deg, per old reports it is between 140deg and 150 deg.*

$w_c := \dfrac{\theta \cdot 2 \cdot \pi \cdot r_c}{360\text{deg}} = 8.55\,\text{ft}$ — *Length of curve*

$b := 2\text{ft} + 6\text{in} = 2.50\,\text{ft}$ — *Saddle support width (assumed)*

$t := \min(t_{3avg}, t_{4avg}) = 0.10 \cdot \text{in}$

There is no stiffener ring around the penstock at or near the saddle locations (estimated)

$\beta := \pi - \dfrac{\theta}{2} = 110.00 \cdot \text{deg}$ $\quad \alpha := \beta - \dfrac{\beta}{20} = 104.50 \cdot \text{deg}$ — *Saddle Angular location of shear stresses Properties (Fig. 4-8)*

Shear Stresses:

$L_s := 18\text{ft}$ — *Length of pipe between saddles*

$T := (W_P + W_{wP} + W_{FP}) \cdot \dfrac{L_s}{2} = 155383.78\,\text{lbf}$ — *Max shear stress at saddle*

$R_m := \dfrac{D_p}{2} + \dfrac{t}{2} = 42.05 \cdot \text{in}$ — *Mean radius of penstock shell*

$K_1 := \dfrac{\sin(\alpha)}{\pi - \alpha + \sin(\alpha) \cdot \cos(\alpha)} = 0.90034$ — *Coefficient (Fig. 4-9)*

$\tau_2 := \dfrac{K_1 \cdot T}{R_m \cdot t} = 34657.20\,\text{psi}$ — *Maximum shear stress in shell when there is no stiffener ring (eqn. 4-18)*

$\text{Check} := \text{if}(\tau_2 \le 0.8 \cdot S_A, \text{"Okay"}, \text{"Not Okay"}) = \text{"Not Okay"}$ $\quad 0.8 \cdot S_A = 20333.33\,\text{psi}$

Circumferential Stresses:

$Q := 2 \cdot T = 40752.36\,\text{lbf} \cdot \text{k}$ — *Max reaction per saddle*

$$K_3 := \frac{\left[\dfrac{3\cdot\cos(\beta)}{4}\cdot\left(\dfrac{\sin(\beta)}{\beta}\right)^2 - \dfrac{5\cdot\sin(\beta)\cdot\cos(\beta)^2}{4\cdot\beta} + \dfrac{\cos(\beta)^3}{2} - \dfrac{\sin(\beta)}{4\cdot\beta} \ldots + \dfrac{\cos(\beta)}{4} - \beta\cdot\sin(\beta)\cdot\left[\left(\dfrac{\sin(\beta)}{\beta}\right)^2 - \dfrac{1}{2} - \dfrac{\sin(2\cdot\beta)}{4\cdot\beta}\right]\right]}{2\cdot\pi\cdot\left[\left(\dfrac{\sin(\beta)}{\beta}\right)^2 - \dfrac{1}{2} - \dfrac{\sin(2\cdot\beta)}{4\cdot\beta}\right]} = 0.03788$$

Maximum reaction at saddle support from all loads

$M_\beta := K_3 \cdot Q \cdot R_m = 5409.44\,\text{lbf} \cdot \text{k} \cdot \text{ft}$ — *Maximum circumferential bending moment of the shell at the saddle (eqn. 4-19)*

$x := 0.78 \cdot \sqrt{R_m \cdot t} = 1.57 \cdot \text{in}$ — *Maximum width of the penstock shell that contributes to the strength of the shell at the saddle (eqn. 4-21)*

$K_2 := \dfrac{1 + \cos(\alpha)}{\pi - \alpha + \sin(\alpha)\cdot\cos(\alpha)} = 0.69711$ *Coefficient (Fig. 4-9)*

$k_o := 1.0$ *Factor to account for the support condition (1.0=resting on support, 0.1=welded to support, per page 242)*

$\sigma_6 := \dfrac{-K_2\cdot Q\cdot k_o}{t\cdot(b + 2\cdot x)} = -68106.93\ \text{psi}$ *Maximum circumferential compressive stress in the shell at the base of the saddle support (eqn. 4-22)*

$K_{A2} := \min(4\cdot R_m, L_s) = 14.02\ \text{ft}$

$\sigma_7 := \dfrac{-Q}{4\cdot t\cdot(b + 2\cdot x)} - \dfrac{3\cdot K_3\cdot Q}{2\cdot t^2}\cdot\dfrac{4\cdot R_m}{K_{A2}} = -1940533.47\ \text{psi}$ *Max compressive stress in shell at horn of saddle*

$\sigma_{max} := \max(|\sigma_6|, |\sigma_7|) = 1940533.47\ \text{psi}$ *Max absolute circumferential stress in shell*

$\text{Check} := \text{if}(\sigma_{max} \le 3S_A, \text{"Okay"}, \text{"Not Okay"}) = \text{"Not Okay"}$ $3S_A = 76250.00\ \text{psi}$ *per ref. 3 for stress concentrations*

APPENDIX F

1999 DWIGHT STATION UNIT 2 PENSTOCK CONDITION ASSESSMENT – EXCERPT

CONSOLIDATED EDISON ENERGY, INC.

DWIGHT STATION UNIT 2
PENSTOCK CONDITION ASSESSMENT

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ESSENTIAL POWER MASSACHUSETTS, LLC

DWIGHT STATION UNIT 2
PENSTOCK CONDITION ASSESSMENT

1.0 GENERAL

1.1 Station and Penstock Description

As shown in the enclosed drawing, the Dwight Station consists of an intake structure connected to a power canal, three buried steel penstocks, three turbine generator units (Numbered 2, 3, and 4), and a tailrace structure. As indicated by Exhibit A of the Exemption Order, each unit has a hydraulic capacity of 254 CFS and a static head of 19 ft. The penstocks are located through an active mill building and are buried between the mill and the project powerhouse.

Each penstock is 7-feet in diameter and has a length of approximately 172 feet from the downstream face of the head gate to the upstream face of the most upstream turbine stay vane. The original shell had a thickness of 3/8 - inch. The steel penstocks have both longitudinal and circumferential lapped, riveted seams. Each seam consists of a single row of rivets with head diameters of 1¼ inches and a pitch of 2½ inches. The steel shell is supported by concrete saddles with a center to center spacing of approximately 18 ft. The contact angle between the shell and the saddle is between 140 and 150 degrees.

1.2 Previous Penstock Repair

On August 2, 1993, the Dwight canal was refilled after being empty for three weeks for its annual inspection and maintenance. Unit 4 began operation immediately whereas Units 2 and 3 were delayed. Approximately 2½ hours after the penstocks were refilled, the ground above Unit 2 began settling and water appeared in local sink holes. An investigation of the Unit 2 penstock revealed a small perforation in the interior. Appendix C contains details of this incident and the subsequent investigation. Material testing during the investigation concluded that the steel had a yield strength of 51,000 psi and a tensile strength of 61,000 psi.

To stop the leakage, a patch consisting of latex modified concrete was installed to the bottom of the penstock from the 3-o'clock position to 9-o'clock. The patch extended from approximately 61 ft to 81 ft upstream of the turbine. Unit 2 resumed operation in 1995.

Documentation of any other Penstock leaks or repairs could not be found and none are known to exist.

1.3 1999 Penstock Leak

The Dwight Station canal and penstocks were dewatered on Tuesday, July13, 1999 to allow the local municipality to repair a water main leak. On the morning of Thursday, July 15th the canal and penstocks were rewatered. Before the units returned to service, factory workers observed water in the courtyard area between the Dwight Station and the adjacent mill building. Upon notification, station operators began immediate dewatering of the canal and penstocks.

On Friday, July 16, a 9'x12' oblong area (Photo 1) in the courtyard where the water had been seen Thursday was depressed 6" to 12". In this area were three distinct sinkholes where piping of the soil had occurred. The largest of the sinkholes (Photo 2), which appeared against the mill building, was approximately 3' long by 1½' wide by 3'+ deep. The other two holes were approximately 1½' long by 1' wide and shallower than the large hole. Piping of materials in all three holes appeared to be from a west to east direction.

2.0 SITE INVESTIGATION

The dewatered penstock for Unit 2 was inspected on Monday, July 19, 1999.

2.1 Shell Thickness

Shell thickness measurements were taken at 35 locations throughout the penstock to get a thorough range of thickness readings. These measurements were taken approximately every 10 ft. at various positions in the pipe (12-o'clock, 3-o’clock, 6-o’clock, etc.). More measurements were taken around the existing patch and other suspicious areas in an attempt to find the minimum thickness of the penstock. Appendix A summarizes the thickness measurements.

Measurements were made using a Panametrics Model 36DL Plus Ultrasonic Gage in Standard mode. The gage was calibrated prior to the inspection to within an accuracy of 0.001 inch.

The tests resulted in a minimum thickness of 0.112 inches, a maximum thickness of 0.271 inches, and an average thickness of 0.190 inches. The average thickness is similar to the 1994 inspection results which indicated an average thickness of 0.20 inches.

2.2 Visual Inspection

A previous visual inspection on July 16, 1999 of the courtyard between Unit 2 and the adjacent mill building indicated that water was coming to the surface and causing sinkholes in the soil. The sinkholes appeared to be near the location of the existing patch.

However, during the July 19, 1999 interior inspection, the patch appeared to be in good condition. Also, no cracks or holes in the steel were apparent. The steel above the patch was slightly wet, but this may have been caused by water being trapped behind the rusted surface after the penstock was dewatered. As shown in photo No. 3, although the interior steel surface was rough it did not appear to be significantly pitted. Many of the rivets in the penstock appeared to have lost approximately 50% of their head and photo No. 4 shows a portion of some of the more deteriorated rivets. Riverhead sounding with a geologist hammer did not reveal any looseness. The penstock did not exhibit any shell deformation or buckling.

3.0 DESIGN ANALYSIS

A stress analysis of the penstock was performed to calculate actual stress values. These calculated stress values were then compared to allowable stress values commonly used for penstock design.

3.1 Method

The analysis method followed the procedures contained in the American Society of Civil Engineers (ASCE), "Steel Penstocks, ASCE Manuals and Reports on Engineering Practice No. 79" and American Iron and Steel Institute (AISI) "Buried Steel Penstocks, Steel Plate Engineering Data, Volume 4." Appendix B contains the detailed calculations. The previously discussed field measurements and material properties were used in the calculations.

3.2 Description of Loads:

Circumferential Shell (Hoop) Stress: The internal pressure induced hoop stresses were calculated based upon normal working pressures and water hammer pressure. The water hammer pressure rise was based on the fastest possible load rejection closure time of 3 seconds. The hoop stresses were calculated for every thickness reading taken during the inspection. The results are shown in Table 3 of Appendix B.

Longitudinal Shell Stress: The shell longitudinal reactions modeled the penstock as a continuous beam supported at its saddles with the loads on it being the weight of soil above the penstock, and the dead weight of the shell and water. This is considered conservative since the supporting soil under the pipe is ignored in the calculations. The shell thickness used in this load case was the thinnest reading, 0.112", which is also conservative.

Local Saddle Stress: The shell reactions at the saddles model the penstock as spanning between the saddles and also ignores the soil supporting the penstock underneath. The thickness, 0.176", used for this calculation is the average of the thicknesses that were taken in the 4 o' clock to 8 o' clock range. This range best represent the area of where the saddles are located. Because they are buried, there is limited information about the saddles.

External Loading: External loading checked the soil weight crushing the pipe. The deflection was calculated and compared to an allowable. To determine a maximum calculated deflection the thinnest shell reading of 0.112” was conservatively used.

3.3 Results

The riveted connections were found to have a joint efficiency of 0.506. This means that the riveted joints are only 50% as strong as the unjointed base material. This results in the riveted connections being the critical structural component for many stress conditions, and have to be factored into the calculations. Although there is loss in the rivet heads, it is not a structural concern because the sections of penstock are applying a shear force on the rivets, which holds them in place. However, if the rivet heads continue to be exposed to water, the heads will deteriorate even further resulting in the penstock connections loosening causing leakage.

Table 1 summarizes the Stress Ratios, which are the ratios of the calculated stresses to the allowable stresses. It also contains the external soil pressure ratio which compares the calculated deflection to an allowable deflection. A Stress or Deflection Ratio less than 1.0 indicates that the penstock conforms to industry standard allowables. Note that the allowable stresses incorporate a safety factor of approximately 1.1 to 5.3 compared to the stresses that would cause structural failure. Because all of the calculated stress levels are below the allowable stress levels, the penstock shell is structurally competent.

Table 1

Stress Ratio Summary:

Type of Stress		*Stress Ratio* *Calculated Stress / Allowable Stress*
1.	Shell Circumferential Stress Internal Pressure (circumferential direction)	0.191 to 0.461 See Table 3 in Appendix B
2.	Shell Longitudinal (Bending) Between Supports	
	Compression	0.908
	Tension	0.512
	Combined Shell Circumferential and Longitudinal Stress	0.354
3.	Local Shell Stresses At Saddles	
	Bending Tension	0.946
	Bending Compression	0.960
	Tangential Shear	0.314
	Circumferencial Compression	0.652
4.	External Pressure Deflection	0.26 (deflection ratio)

4.0 DISCUSSION AND CONCLUSIONS

4.1 Steel Shell

The results of this investigation are:

1. The shell thickness measurements shown in Table 2 of Appendix A show the average thickness to be 0.19” and the minimum thickness to be 0.112”. Although this is below the original shell thickness, the average reading is very close to the average 1994 thickness of 0.20”. Note that because the pipe was buried, we were not able to inspect the shell exterior for pitting or active corrosion.

2. Slight interior shell material pitting (less than 1/16” deep) was observed and will continue to present potential future leakage problems. The pitting presents serviceability problems and continued maintenance expense to repair developing leaks. The pitting does not structurally jeopardize the penstock.

3. The riveted connections are the critical shell structural elements with the seams being about 50% as strong as the unjointed steel plate material. The rivet heads are about 50% deteriorated, but seem to be structurally sound at this point. Since continued rivet head deterioration may result in a loosening of the joints, it is important that further deterioration be prevented.

4. As summarized in Table 1, the penstock shell has Stress and Deflection Ratios less than 1.0. A ratio less than 1.0 means that the shell meets current penstock design guidelines.

4.2 Strength

Based on the above results, our opinion is that the penstock is currently structurally competent.

4.3 Service Life

The above results indicate that the remaining shell service life will be determined more by serviceability, rather than structural concerns. The expense of continued repair, including loss of power during station dewatering, appear to be the limitations of the penstock shell service life for the predictable future. A protection system would assist in preventing further deterioration of the rivet heads.

5.0 SUMMARY OF RECOMMENDED ACTIONS AND REPAIRS

5.1 Steel Shell Recommended Action

Because the penstock is structurally competent, yet the leakage occurs over a wide surface area, the recommended rehabilitation approach is to install a continuous internal non-structural watertight liner. This liner would prevent the seam leakage and resulting corrosion. There are several types of non-structural watertight penstock rehabilitation liners including shotcrete (spray applied concrete), fiberglass, 100% solid polyurethane, polyurethane elastomeric membranes, and most recently polyurea elastomers. Each material has its distinct advantages and disadvantages with fiberglass being the most expensive and polyurethane elastomeric membranes the least costly.

For this site we would recommend the polyurethane elastomeric, unless the work was to be scheduled during cold weather when the less temperature sensitive polyurea, would eliminate the cost of heating. To stop rivet seam or pinhole leaking either of these coatings would typically be applied 60 to 80 mills thick in either one or two coats. Either material exhibits good adhesion to the steel substrate as well as the necessary flexibility needed to respond to the soil induced dimensional changes in the buried penstock without delaminating. The polyurethane elastomeric membrane has excellent abrasion resistance, and the polyurea has good abrasion resistance. The service life of these coatings is presently unknown, but it is expected that either should exceed 25 years. Both products require that the steel substrate be cleaned down to at least an SSPC-SP-10 “near white blast”. After the shell interior has been cleaned, it would be inspected and steel patches welded where required. The cleaning cost is generally at least half the total installed cost. Although the exact schedule is contractor and cost dependant (e.g. working two versus one shift), based on other projects we would expect that one penstock would take from two to three weeks to complete.

Before an internal non-structural watertight liner is installed, we also recommend that a few select areas of the external steel shall be inspected to confirm that the shell is not pitted or subject to active corrosion. The excavated area could be located at the saddle locations to obtain additional information of the saddles.

APPENDIX G

2003 PENSTOCK CONDITION ASSESSMENT, DWIGHT HYDROELECTRIC PROJECT – EXCERPT

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

DWIGHT HYDROELECTRIC PROJECT
FERC No. 10675
2003 PENSTOCK CONDITION ASSESSMENT

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CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

DWIGHT HYDROELECTRIC PROJECT
FERC No. 10675
2003 PENSTOCK CONDITION ASSESSMENT

1.0 GENERAL NOTES

A Condition Assessment of the Unit No. 2, No. 3 and No. 4 Penstocks was performed by Kleinschmidt Associates (Kleinschmidt) as part of the Dwight Hydroelectric Project's Penstock Reliability Program and a continuation of the July 1999 Condition Assessment of the Unit No. 2 Penstock.

1.1 Station and Penstock Description

The Dwight Hydroelectric Project consists of an intake structure connected to a power canal, three buried steel penstocks, three turbine generator units (Numbered 2, 3, and 4), and a tailrace structure. Unit No. 2 is located on the right side of the powerhouse (looking downstream). Each unit has a hydraulic capacity of 254 CFS and a static head of 19 ft. The penstocks are located through an active mill building and are buried between the mill building and the project powerhouse. During the 1999 repairs to the No. 2 penstock, access manholes were added to both the No. 2 and No. 3 penstocks. A manhole was not installed on Penstock No. 4.

Each penstock is 7-feet in diameter and has a length of approximately 172 feet from the downstream face of the head gate to the upstream face of the most upstream turbine stay vane. The original penstock shell had a thickness of 3/8 - inch. The steel penstocks have both longitudinal and circumferential lapped, riveted seams. Each seam consists of a single row of rivets with head diameters of 1¼ inches and a pitch of 2½ inches. Concrete saddles spaced at approximately 18-ft. center to center support the steel shell. The contact angle between the shell and the saddle is between 140 and 150 degrees. Material testing of the penstock shell in 1994 resulted in a yield strength of 51,000 psi and a tensile strength of 61,000 psi.

1.2 Previous Evaluations and Repairs

Kleinschmidt performed an evaluation of all three penstocks between the years 1999 and 2000. Penstock No. 2 was repaired in 1999. The 1999 repairs to Penstock No. 2 consisted of welded steel plate patching and the application of an epoxy lining. The penstock drain portion of the No. 3 and 4 penstocks have been previously repaired. The previous repairs to Penstock No. 3 and No. 4 consisted of the installation of an approximately ½-inch steel plate at the drain invert and the replacement of a portion of the drain line. Additional work in Penstock No. 3 and No. 4 included removal of penstock scale from the scroll case to a point slightly upstream of the drain area. Documentation of any other penstock repairs could not be found and none are known to exist.

2.0 SITE INVESTIGATION

The inspection of the dewatered penstocks for Units No.2, No. 3, and No. 4 was conducted on October 10, 2003.

2.1 Shell Thickness

There were a total of 79 measurements taken in Unit No. 3's penstock and 42 measurements taken in Unit No. 4's penstock. Measurements were taken in increments of either ten or twenty feet- except where conditions prohibited (riveted seams or bends in the penstock). Unless otherwise noted, there were five measurements taken at each station corresponding to the following sequence 2 o'clock, 5 o'clock, 8 o'clock, 10 o'clock and 12 o'clock positions, with the orientation facing upstream.

Thickness readings were taken using a Panametrics Model 36DL Plus Ultrasonic Gage in Standard mode. Prior to the inspection the gage was calibrated to within an accuracy of 0.001 inch. The gage was again checked between the inspection of Unit No. 3 and the inspection of Unit No. 4 to ascertain that the gage was still taking accurate readings. The check indicated that the gage was still accurate to within 0.001 inch.

Appendix B provides the sequential thickness measurements and observations taken during the inspection. Tables 1 through 3 of Appendix B organizes the data into their specific stations and positions. Readings with poor waveforms were not included in the calculations. These readings are either above or below the average plus/minus 2 standard deviations (95.5% certainty). The maximum and minimum thickness readings for Penstock No. 3 was 0.34 in. and 0.09 in. respectively. The average thickness for Penstock No. 3 was 0.204 in., with the most measurable thinning (as indicated in Table 4) occurring from station 0+90 to st. 1+70 with the thinnest portion at the 10 o'clock position. Penstock No. 4 displayed a minimum thickness value of 0.12 in, a maximum thickness of 0.31, and an overall average thickness of 0.201 in. Tables 5 and 6 in Appendix C provides stress calculations based on shell thickness and ratios of calculated to allowable stress. Table 4 of Appendix C provides a copy of the thickness readings and stress ratios for Penstock No. 2, excepted from the 1999 No.2 Condition Assessment and

Evaluation report prepared by Kleinschmidt. Appendix C also provides a copy of the detailed stress calculations prepared during the 2000 penstock inspection, which uses similar wall thicknesses obtained during the 2003 penstock inspection.

2.2 Visual Inspection

Penstock No. 2

Penstock No. 2 appeared to be in very good condition. The penstock was lined in 1999 with DEVGRIP 238 Abrasion Resistant Epoxy Coating manufactured by ICI Devoe Coatings of Louisville, Kentucky. The coating is in tact and showed no signs of debonding, wearing, sagging, or tearing and was reported as appearing to be water tight from CEEMI staff.

Penstock No. 3

Penstock No. 3 displayed some of the same general characteristics as penstock No. 4, but they were not as pronounced. Overall, the condition of the No. 3 penstock was considered better than the No. 4 penstock, exhibiting slightly greater overall shell thickness.

Penstock No. 4

The prior removal of scale from penstock No. 4 from station 0+00 to station 0+20 was visually evident. Overall the remainder of the penstock, particularly along the crown (12 o'clock position), had a heavy accumulation of scale and rust. Some places exhibited approximately ¼ to ½ in. of rust layered on top of the steel. In Penstock No. 4, specifically, there was significantly more rust on the right hand side of the penstock (1 to 6 o'clock positions, looking upstream) than on the left-hand side.

Rivet heads were randomly selected and cleaned of loose material and rust with a geologist hammer. Some of the more severely deteriorated rivet heads had approximately 1/16” of head remaining above the plate surfaces. However, rivet head soundings with the hammer did not reveal any looseness.

To review the degree of soil compactness at the invert, several areas were struck with a hammer to listen for the difference in sound from the crown area (soil against the shell) and the invert area. A significant difference in sound may indicate some separation between the shell and the underlying soils. It should be noted that saddles support the penstocks and their spacing was reviewed to confirm the ability to span between saddles without the invert being supported. Several areas were noted as potentially not having constant contact with the penstock’s invert. This was particularly noted from approximately station 0+20 though 0+40 of penstock No. 4, an area underneath the “courtyard” nearer the powerhouse. The penstock did not exhibit any shell deformation or buckling in these areas or others.

Photo 1 in Appendix A shows the very good condition of the new lining of the Unit No. 2 penstock. Photo 2 shows a typical rivet head in the Unit No. 3 penstock. Photo 3 shows the general condition of the Unit No. 4 Penstock.

3.0 DESIGN ANALYSIS

A stress analysis of the penstock was performed during the 2000 Inspection to calculate actual stress values. These calculated stress values were then compared to allowable stress values. Allowable stress values were based on A30 grade plate steel, which was commonly used during the time of the original constructions. The yield strength of the A30 steel used in the calculations is less than the yield strength of actual penstock material, which was previously tested. The hoop stresses were calculated for the minimum thickness, the average thickness, and the average thickness minus any reading exceeding the mean plus/minus two standard deviations for each series of longitudinal reading by grouping readings corresponding to the same longitudinal position within the penstock. Longitudinal thinning parallel with the penstock axis could be noted. The results are summarized in Tables 4 though 6 of Appendix C.

3.1 Method

The analysis method followed the procedures contained in the American Society of Civil Engineers (ASCE), "Steel Penstocks, ASCE Manuals and Reports on Engineering Practice No. 79" and American Iron and Steel Institute (AISI) "Buried Steel Penstocks, Steel Plate Engineering Data, Volume 4." Appendix C contains a copy of the detailed calculations performed for the 2000 Inspection Report by Kleinschmidt. The previously discussed field measurements and material properties were used in the calculations.

3.2 Description of Loads:

Circumferential Shell (Hoop) Stress: The internal pressure induced hoop stresses were calculated based upon normal working pressures and water hammer pressure. The water hammer pressure rise was based on the fastest possible load rejection closure time of 3 seconds.

Longitudinal Shell Stress: The shell longitudinal reactions modeled the penstock as a continuous beam supported at its saddles with the loads on it being the weight of soil above the penstock, and the dead weight of the shell and water. The additional longitudinal stress due to internal pressure was also added. These are considered conservative assumptions since the supporting soil under the pipe is ignored in the calculations. The shell thickness used in this load case was the 0.203" average reading from Penstock No. 4 in the 2000 Inspection Report. This value is 0.002" (or within 0.1%) of the average value of the thickness readings observed for Penstock No. 4 during this inspection, and is less than the average thickness readings for Penstock No. #3.

Local Saddle Stress: The shell reactions at the saddles model the penstock as spanning between the saddles and also ignores the soil supporting the penstock underneath. The shell thickness used in this load case was the 0.203" average reading from Penstock No. 4 in the 2000 Inspection Report. This value is 0.002" (or within 0.1%) of the average value of the thickness readings observed for Penstock No. 4 during this inspection, and is less than the average thickness readings for Penstock No. #3. There is limited information about the saddles because they are buried.

External Loading: External loading checked the soil weight crushing the pipe. The deflection was calculated and compared to an allowable. The shell thickness used to determine deflection was the 0.203" average reading from Penstock No. 4 in the 2000 Inspection Report. This value is 0.002" (or within 0.1%) of the average value of the thickness readings observed for Penstock No. 4 during this inspection, and is less than the average thickness readings for Penstock #3.

3.3 Results

The riveted connections were found to be in similar condition than what was reported in the 2000 Inspection Report. The riveted connections have a joint efficiency of 0.561 (refer to Appendix C for calculations). This means that the riveted joints are only 56.1% as strong as the unjoined base material. This results in the riveted connections being the critical structural component for many stress conditions, and have to be factored into the calculations. Although there is loss in the rivet heads, it is not a primary structural concern because the sections of penstock are applying a shear force on the rivets, which causes them to remain in position. However, further deterioration could result in the penstock connections loosening, causing leakage.

Tables 4 through 6 in Appendix C summarize the Stress Ratios, which are the ratios of the calculated stresses to the allowable stresses. Tables 7 and 8 of Appendix C provide a comparison between the 2003 and 2000 inspection results. Appendix C also contains the external soil pressure ratio, which compares the calculated deflection to an allowable deflection. A Stress or Deflection Ratio less than 1.0 indicates that the penstock conforms to industry standard allowable stresses. Note that the allowable stresses incorporate a safety factor of approximately 1.1 to 5.3 compared to the stresses that would cause structural failure. Table A (Stress Ratio Summary) below provides a summarization of the calculated stress ratios contained in Appendix C. Because all of the calculated stress levels are below the allowable stress levels, the penstock shell is structurally competent.

Table A: Stress Ratio Summary (worst case noted)

Type of Stress	**Stress Ratio** ***Calculated Stress/ Allowable Stress***
1. Shell Circumferential Stress internal pressure (circumferential direction)	0.34-0.82 (avg. w/ 2stdev) (see Tables 4 through 6 Appendix C)
2 Shell Longitudinal (Bending) Stress	
Between Supports	
Compression	.908
Tension	0.512
Combined Shell Circumferential and Longitudinal Stress	0.404
3. Local Shell Stresses at Saddles	
Bending Tension	0.99
Bending Compression	0.96
Tangential shear	0.47
Circumferential Compression	0.97
4. External Pressure Deflection	0.26

4.0 DISCUSSION AND CONCLUSIONS

4.1 Steel Shell

The results of this investigation are:

1. The shell thickness measurements summarized in Tables 4 through 6 of Appendix C indicate an average thickness to be 0.191” for Penstock No. 2, 0.204” for Penstock No. 3 and 0.201” for Penstock No. 4, with a minimum thickness of 0.12”, 0.09” and 0.12” for Penstocks No. 2, No. 3 and No. 4 respectively. Tables 7 and 8 of Appendix C provides a comparison of the 2003 to 2000 inspection results. Note that because the penstocks are buried, we were not able to inspect the shell exteriors for pitting or active corrosion.

2. Slight interior shell material pitting was observed in both Penstock No. 3 and Penstock No.4. The pitting does not structurally jeopardize the penstock. The pitting presents potential serviceability problems and maintenance expense if leaks develop.

3. The riveted connections are the critical shell structural elements with the seams being approximately 56% as strong as the unjoined steel plate material. The rivet heads are deteriorated, but seem to be structurally sound at this point. Since continued rivet head deterioration may result in a loosening of the joints, it is important that future inspections monitor the condition of the rivets.

4. As summarized in Table 4 through 6, the penstock shell has Stress and Deflection Ratios less than 1.0 for the average values parallel to the penstock axis. A ratio less than 1.0 means that the shell meets current penstock design allowable stresses.

5. Soundings with a hammer along the invert of the penstock indicated there might be areas of poor contact between the shell and surrounding soil. This condition is not unexpected since the penstock is supported on saddles that would not allow the penstock to move as a result of soil settlement. Since there has been no reported presence of sinkholes and no observed active ones, the voids, if present, were likely

caused over time by soil settlement. The stress analysis indicates the shell has sufficient capacity to span between the saddles without the soil support. Since the shell has sufficient strength to support the anticipated loads, no remedial work is required to address this potential condition.

4.2 Strength

Based on the above results, our opinion is that the penstock is currently structurally competent along the longitudinal axis for all three penstocks.

4.3 Service Life

The above results indicate that the remaining shell service life will be determined more by serviceability, rather than structural concerns. The expense of continued repair, including loss of power during station dewatering, appear to be the limitations of the penstock shell service life for the predictable future. A protection system would assist in preventing further deterioration of the interior shell and rivet heads.

5.0 SUMMARY OF RECOMMENDED ACTIONS AND REPAIRS

5.1 Steel Shell Recommended Action

Because the penstock is structurally competent and no leakage is currently occurring, no immediate repair or replacement is warranted. However, the penstocks appear to be in similar condition as penstock No. 2, which was relined in 1999. Penstock No. 3 exhibited slightly greater overall shell thickness than penstock No. 4.

We recommend that the current monitoring program be continued for each penstock. The current monitoring program consists of periodically walking the courtyard area (between the powerhouse and the mill building) and powerhouse basement to identify any active seeps, wet areas or sink holes. Any of these conditions may be caused by penstock leakage. As a minimum the monitoring program indicates that visual monitoring should occur twice per year, after the first frost and shortly after the end of frost. Additional monitoring is also suggested for a minimum 2-day period following any penstock dewatering of a 24-hour or longer duration and anytime the penstock is subjected to sudden load changes as would occur during unit load rejection or surcharging (vehicle traffic) of the overburden. The monitoring program should continue until the next internal inspection. If the results of the monitoring program and the next internal inspection indicate that no significant deterioration or change is occurring, the need for and details of the monitoring program should be reconsidered.

We also recommend that the current schedule of penstock inspections and thickness readings every three years be maintained until the next inspection. The period between internal inspections could potentially be extended if the next internal inspection indicates that there are insignificant changes in the material thickness, rivet head condition and the No. 2 lining. The next penstock inspection is recommended to occur by 2006, unless monitoring indicates an immediate need.

Should active leakage be discovered, the leakage could be addressed by local or continuous application of an internal non-structural watertight liner. There are several types of non-structural watertight penstock rehabilitation liners including shotcrete (spray applied concrete), fiberglass, 100% solid polyurethane, polyurethane elastomeric membranes, and most recently polyurea elastomers. Each material has its distinct advantages and disadvantages with fiberglass being the most expensive and polyurethane elastomeric membranes the least costly.

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Document Content(s)

April 11, 2014

VIA E-FILING

Mr. Gerald L. Cross, P.E.
Regional Engineer
Federal Regulatory Commission
New York Regional Office
19 West 34th Street, Suite 400
New York, NY 10001

Dwight Hydroelectric Project – FERC No. 10675-MA
NATDAM ID No. MA00721
Dwight Project – Penstock Repair Plan and Schedule

Dear Mr. Cross:

Essential Power Massachusetts, LLC (EP) submits this letter in response to your letter of February 12, 2014 requesting that we provide a plan and a schedule to structurally line or replace the penstocks, provide a more reliable means to close the Unit 2 headgate and to investigate the extent of voids beneath the penstocks.

PROPOSED REPAIR PLAN

We have retained Kleinschmidt Associates (Kleinschmidt) as of April 7, 2014 to provide engineering services for design and construction services to line or replace the three riveted steel penstocks at Dwight. As part of their services they will provide the following:

> Preliminary Design Site Visit: Two Kleinschmidt engineers will visit Dwight Station to obtain field measurements such as manhole locations, the size of the courtyard between the powerhouse and the mill, and note access constraints that may affect the design process. They will follow-up this site visit with a memorandum to EP summarizing any issues that may affect the overall replacement and modification process.
>
> Survey: Kleinschmidt will hire a local surveyor to determine the layout of the penstocks in relation to the powerhouse and mill. This information will be used to facilitate the fabrication of new penstock sections and structural linings as well as construction layout and access.

Penstock Options Report: Kleinschmidt will perform a preliminary hydraulic analysis on the penstock for various repair options including:

- comparison of steel, FRP and HDPE linings; and
- replacement of the penstocks with steel, FRP or HDPE pipe.

Kleinschmidt will perform an economic analysis of the various penstock configurations discussed above. The economic evaluation will consider the potential construction cost for each configuration and the impact of each on the station generation. They will estimate the effect on generation and include this in a report to us along with the opinions of cost for each potential configuration discussed above. With this information, we will apply applicable generation values to evaluate each option's rate of return so that we can select which option to develop.

Penstock Final Design and Technical Documents: Once EP chooses a repair/replacement option, Kleinschmidt will immediately proceed with a detailed design effort that will include the selected configuration, penstock material and pipe size. Kleinschmidt will also prepare additional technical specifications that will provide supplemental information beyond the design drawings. The technical specifications will also address penstock testing with the testing requirements specific to the penstock material selected. All of the technical documents will be incorporated into a comprehensive Project Manual.

Gate Final Design and Technical Documents: Kleinschmidt will finalize the design drawings and prepare technical specifications for the applicable rehabilitation method for the Unit 2 headgate operator.

Void Investigation: Kleinschmidt has been tasked to investigate the voids around the penstock. Their plan is to do this using either Surface Wave Seismic or Impact Echo techniques. They will hire a sub-contractor to perform the field testing investigation. Depending on the results of the investigation Kleinschmidt will provide a plan to grout the voids as necessary.

Construction Assistance: As requested by Essential Power, Kleinschmidt will provide the following services during construction.

Submittal Review: Kleinschmidt will assist EP during construction by reviewing submittals from the Material Vendor and/or the Construction Contractor. The submittals will include the major construction materials and methods for installation.

Site Visits During Construction: We have requested that Kleinschmidt closely monitor the construction process and have budgeted for semi-weekly site visits for either the Project Manager or Project Engineer. We anticipate that the construction schedule will extend over a period of approximately three months.

PROPOSED REPAIR SCHEDULE

We have devised to following anticipated schedule for the tasks. This is a preliminary and tentative schedule that will need to be updated once a final repair/replacement scheme is chosen.

TASK	ANTICIPATED	
	START DATE	END DATE
Preliminary Design Phase:		
Task 1 – Preliminary Design Site Visit	Week of April 7, 2014	
Task 2 – Survey	Week of April 14, 2014	
Task 3 – Penstock Options Report	April 11, 2014	April 23, 2014
Task 4 – FERC Preliminary Design Submittal	Week of May 12, 2014	
Final Design Phase:		
Task 5 – Penstock Final Design and Technical Documents	May 2014	June 2014
Task 6 – Gate Final Design and Technical Documents	April 11, 2014	May 12, 2014
Task 7 – Void Investigation	April 11, 2014	May 12, 2014
Construction Phase:		
Task 8 – Contractor Bidding	June 2014	July 2014
Task 9 – Construction	August 2014	October 2014

If you have any questions or require additional information regarding this filing, please contact me at 413.730.4271 (email: kim.marsili@essentialpowerllc.com). This letter was prepared in accordance with the requirements of 18 CFR 12.10(a).

Sincerely,

Kim Marsili
Station Manager

cc: John Bahrs VP Power Generation Services

Document Content(s)