FINAL TECHNICAL REPORT

CULINARY AND PRESSURE IRRIGATION WATER SYSTEM HYDROELECTRIC GENERATION

DOE AWARD #

DE-EE0003270

Prepared By:

Cory Christiansen, PE
(801) 770-1429
coryc@wwengineers.com

WATER WORKS ENGINEERS
672 W 220 S
Pleasant Grove Utah 84062

For:

PLEASANT GROVE CITY
50 South 100 East
Pleasant Grove, UT 84062

January 29, 2016

Pleasant Grove
Utah's City of Trees

WATERWORKS ENGINEERS

This report is based upon work supported by the U. S. Department of Energy
under Award No. **DE-EE0003270**

Pleasant Grove
Utah's City of Trees

WATERWORKS
ENGINEERS

Table of Contents

List of Tables

List of Appendices

City of Pleasant Grove
Battle Creek Microhydro Power Generation Project
Technical Report

Executive Summary

Pleasant Grove City owns and operates a drinking water system that included pressure reducing stations (PRVs) in various locations and flow conditions. Several of these station are suitable for power generation. The City evaluated their system to identify opportunities for power generation that can be implemented based on the analysis of costs and prediction of power generation and associated revenue. The evaluation led to the selection of the Battle Creek site for development of a hydro-electric power generating system.

The Battle Creek site includes a pipeline that carries spring water to storage tanks. The system utilizes a PRV to reduce pressure before the water is introduced into the tanks. The evaluation recommended that the PRV at this location be replaced with a turbine for the generation of electricity. The system will be connected to the utility power grid for use in the community.

A pelton turbine was selected for the site, and a turbine building and piping system were constructed to complete a fully functional power generation system. It is anticipated that the system will generate approximately 440,000 kW-hr per year resulting in $40,000 of annual revenue.

1 Introduction

Pleasant Grove City desired to investigate the feasibility of developing micro hydro-electric power stations at various locations within its existing culinary water and pressurized irrigation systems. This project fell under the scope of Project Blue Energy, which was created by Pleasant Grove to create renewable energy from existing community water sources as reflected by the goals of the U.S. Department of Energy's Wind and Hydropower Technologies Program Office.

Development of hydroelectric power within the existing system is an attractive prospect for several reasons, including:

- Provide beneficial use of available energy currently being wasted.
- Renewable energy is environmentally desirable.
- Most of the supporting infrastructure is already in place.

However, choosing the correct type of turbine for the system is an important decision as the flow rate and pressure differential in the pipeline can dictate what types of turbine to consider. Hydroelectric turbines exist as two major categories: impulse and reaction turbines. Reaction turbines create power from a combination effect of water flow and pressure - the water encounters blades in the turbine at a low pressure, high volume flow and generates power before the water returns to the pipeline with minimal pressure loss (as compared to impulse turbines). Impulse turbines dispel water pressure by directing a high pressure stream of water into the turbine blades or buckets.

Upon comparison, impulse turbines will prove the most suitable for use in replacing the pressure reducing valve (PRV) located at the Battle Creek Site in Pleasant Grove, Utah. Two types of impulse turbines were considered, Pelton and cross-flow impulse turbines. Pelton wheel turbines include a wheel with buckets around the outside diameter which are rotated by water discharged by jets to turn the turbine and produce electricity. Cross-flow impulse turbines are drum shaped, with horizontal blades that are activated by water flowing orthogonal to the drum (cross-flow). Again, the type of impulse turbines required for an application are a function of the flow rate of the water with cross-flow turbines being built to accommodate higher water flow rates. [1]

2 Background

Water Works Engineers visited Pleasant Grove during the fall of 2009 to meet with staff from Pleasant Grove's water engineers, public works and management. Potential development sites were visited and discussed. Technology from Power Innovations, Inc. was investigated. Two (2) culinary water supply sites and four (2) PRV station sites were evaluated as part of this investigation. The potential development sites were summarized as follows:

1. Battle Creek Canyon
2. Wade Springs
3. Pressurized irrigation PRV on 850 East
4. Culinary PRV on 500 North
5. Additional Pressurized Irrigation PRV's
6. Additional Culinary PRV's

2.1 Approach

The approach that was taken by Water Works Engineers to evaluate the sites for suitability for potential micro-turbine installations is summarized as follows:

- Flow and head conditions for each site were averaged using available data for the culinary and irrigation stations as recorded by the city's contract water engineering firm, Horrocks Engineers.

- Power generation potential was determined using available monthly average historical flow records for the years of 2005 thru 2008, typical generator efficiencies for micro-turbine equipment appropriate for each site, and expected efficiencies from technology developed by Power Innovations Inc.

- Field visits were made to four (4) of the six (6) sites to inspect accessibility, topographic and geologic suitability for equipment placement.

2.2 Estimated Power Generation

Historical data for each month during 2005 thru 2008 was used to estimate flow, head, and power generation in KW and kWh for four (4) of the six (6) potential sites. These figures and calculations were discussed with engineers from Water Works Engineers and Power Innovations, Inc. and then presented to engineers from Logan, Park City and Salt Lake City for critique. A summary of these calculations are presented in Table 1.

The recommendations of Water Works Engineers to the city of Pleasant Grove through the initial feasibility study were as follows:

1. The Battle Creek site should be explored for potential location of a micro hydro-electric generator.
2. Cost estimates should be developed for the Battle Creek site to include engineering, construction, equipment, installation and ongoing operations of a micro hydro-electric facility. The cost estimates should include standard as well as specialized equipment that maximizes the potential power generation.
3. A financial analysis should be conducted to determine how much of this project can be built at an approximate US$1M budget.
4. Investigation into the best use of power generated from this site should be determined. This may include selling the power to Rocky Mountain Power. Consuming the power to offset the city's electrical bill. Or any other benefit the city may derive.
5. An evaluation should be made to determine at what point in time the project recoups the cost of its investment. This should consider the highest and best value of the power generated.
6. If after completion of the above items, development of micro hydro-electric remains attractive, the city should proceed to construction of this facility and further investigate implementation of other facilities at the other five (5) sites.

TABLE 1 ESTIMATED POWER GENERATION FROM POTENTIAL SITE

BATTLE CREEK		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Ave Flow	gpm	198.2	109.8	73.5	82.9	595.7	1,097.4	1,429.9	1,408.0	1,208.0	835.7	622.5	401.1
Power Prod	kW	12	6	4	5	35	64	83	82	70	49	36	23
	kWh	8,587	4,297	3,184	3,476	25,816	46,022	61,965	59,046	50,659	36,215	26,107	17,384
											Average Power Production (kW)		39
											Estimated Annual Power Production (kWh)		342,758
WADE SPRINGS		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Av Flow	gpm	299.2	280.9	272.5	266.5	311.6	357.7	431.5	431.8	419.0	384.5	349.0	320.9
Power Prod	kW	11.6	10.9	10.6	10.3	12.1	13.9	16.8	16.8	16.3	14.9	13.6	12.5
	kWh	8,643.6	7,331.1	7,873.6	7,451.	9,001.1	9,999.9	12,466.9	12,073.3	11,713.3	11,107.	9,758.7	9,272.1
											Average Power Production (kW)		13
											Estimated Annual Power Production (kWh)		116,693
PI PRV 850E		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Ave Flow	gpm	0.0	0.0	0.0	1,000.	2,000.0	2,000.0	2,000.0	2,000.0	1,000.0	0.0	0.0	0.0
Power Prod	kW	0.0	0.0	0.0	19.4	38.8	38.8	38.8	38.8	19.4	0.0	0.0	0.0
	kWh	0.0	0.0	0.0	13,979	28,890.	27,958.2	28,890.2	27,958.2	13,979.1	0.0	0.0	0.0
											Average Power Production (kW)		16
											Estimated Annual Power Production (kWh)		141,655
CULINARY PRV 500E		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Ave Flow	gpm	200.0	200.0	200.0	200.0	250.0	300.0	300.0	250.0	200.0	200.0	200.0	200.0
Power Prod	kW	7.0	7.0	7.0	7.0	8.7	10.5	10.5	8.7	7.0	7.0	7.0	7.0
	kWh	5,200.2	4,697.0	5,200.2	5,032.	6,500.3	7,548.7	7,800.3	6,290.6	5,032.5	5,200.2	5,032.5	5,200.2
											Average Power Production (kW)		8
											Estimated Annual Power Production (kWh)		68,735
TOTAL		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Power Prod	kW	30.1	24.3	21.9	41.6	94.4	127.1	149.4	146.3	113.0	70.6	56.8	42.8
	kWh	22,430.9	16,325.3	16,258.	29,938	70,207.	91,529.2	111,122.	105,368.	81,383.5	52,522.	40,898.4	31,856.2
											Average Power Production (kW)		77
											Estimated Annual Power Production (kWh)		669,841

		kW	kWh
Cul PRV	4	16	140,160
PI PRV	5	30	262,800
		Total	402,960

	669,841
	402,960
Total Potential Annual Power Generation All Sources (KWh)	**1,072,801**

3 Results and Discussion

Upon review of the feasibility study produced by Water Works Engineers, the City of Pleasant Grove chose to construct one hydroelectric micro-turbine at the Battle Creek site. Water Works Engineers collaborated with Canyon Hydro to design the appropriate turbine for this site and incorporated the resulting proposal (Appendix 2) into the system design.

3.1 System Design

The Battle Creek water system includes a pipeline that originates at a spring located several miles within Battle Creek Canyon. The pipeline carries spring water to the Battle Creek Tanks for storage before introducing the water into Pleasant Grove's drinking water system. The system included a pressure reducing valve located near the tanks that was used to break the water pressure in the pipeline before the water enters the tanks.

The turbine system is designed to take the place of the pressure reducing valve and use the pressure generated in the pipeline to generate power. The turbine is located so that its discharge is several feet above the high water level in the tank to maintain a discharge to atmosphere and allow the use of an impulse turbine. The system is designed to back up water in the existing pipeline to generate the pressure necessary to drive the turbine. Due to site constraints and the location of the pipeline within Forest Service property, a tank could not be constructed on the system to provide a stable head condition on the turbine inlet. Stable inlet pressure is essential to the proper operation of the turbine, so a pressure sustaining system was designed. This system allows flow to bypass the turbine to relieve pressure and provide a stable system pressure at the turbine inlet. The bypass is equipped with a diaphragm style pressure sustaining valve. The valve utilizes a mechanical system to maintain a constant upstream pressure. When pressure rises, that valve allows more flow to bypass to reduce the pressure. When pressure drops, the valve holds back more water to increase the upstream pressure. The bypass is equipped with flow meter to allow the system to monitor the bypass flow. It is preferred to minimize the flow through the bypass to maximize the flow through the turbine and the associated power generation. The control system will monitor the flow through the bypass to maintain the flow within the desired range. As flow in the bypass approaches the high setpoint, the turbine flow control valves will open to allow more flow through the turbine. As flow approaches the low setpoint, the turbine flow control valves will close to allow less water through the turbine.

The turbine system is also equipped with a system bypass line and motor actuated valve that will allow the entire flow to bypass the turbine system when the turbine is shut-down for maintenance or in the event of a turbine failure. This bypass will allow the water to be directed to the storage tanks to maintain uninterrupted drinking water service.

3.2 Turbine Selection

The turbine selection for the Battle Creek site was completed based on the flow and pressure listed in the design criteria. The evaluation included various impulse turbine designs. It was concluded that a Pelton turbine was the most appropriate option due to the relatively low flow conditions that the system will experience. The Pelton turbine will allow the most efficient, continuous operation through a wide range of flow conditions, and can be designed and constructed at reasonable cost.

Appendix 2 includes specifications for the turbine as designed by Canyon Hydro. A description of the Pelton impulse turbine can be found in Appendix 3.

3.2.1 Design Criteria

The turbine system Design criteria are as follows: Drawings for the design are included in Appendix 4.

Net Head (at design flow).....460 feet
Design Flow .....1500 gpm
Turbine Type.....Custom-designed 1200 rpm double-nozzle Pelton
Configuration.....Independent bearing, direct-coupled turbine & generator
Generator Output at Design Flow .....100 kW
Mode of Operation .....Grid connected

3.2.2 Control Narrative

The power generation control panel will operate based on signals from the facility PLC. This PLC will operate to maintain the head on the turbine inlet at 400 to 500 ft using a redundant system of pressure sustaining valves. Flowing water through this bypass will maintain stable pressure on the turbine inlet – when Battle Creek flow rate decreases, the bypass flow rate decreases as to increase the turbine inlet pressure. When too much flow occurs at the inlet, more water is sent through the bypass. The control setpoints to maintain the desired head pressure can be found in Table 2.

TABLE 2 TURBINE SYSTEM CONTROL SETPOINTS

Parameter	Units	Normal Value/Range
Minimum Bypass Flow	gpm	10 + (0.25% of Total Facility Flow)
Maximum Bypass Flow	Gpm	Minimum Bypass Flow + (1.5% of Total Facility Flow)
Desired Head at Turbine Inlet	ft	400 - 500

4 Accomplishments

After construction, the hydroelectric micro-turbine at the Battle Creek site is expected to produce an average power production of 50 kW, with an estimated annual power production of 436,000 kW-hr (Appendix 5). Based on an estimated power cost from 2008 of $0.0880 per kW-hr, this amount of power production will create an annual revenue of $38,000 to the city of Pleasant Grove. This amount of revenue will be generated without any downstream modifications to the Battle Creek water system.

5 Conclusions

Hydroelectric micro-turbines can be useful tools for creating energy from a system's pre-existing water infrastructure when suitable locations can be found for power generation that provide high enough flow and pressure to make power generation cost effective. The analysis of sites at Pleasant Grove resulted in the selection of one site suitable for power production. Other sites in the distribution system may be suitable for use with a reaction turbine, but the estimated return is not large enough to make the associated costs for site development feasible. The development of a power generation system at the

Battle Creek site has been completed and the system is currently being commissioned. It is anticipated that the system will run continuously throughout the year and generate approximately 440,000 kW-hr per year that was wasted with the previous system.

6 Recommendations

Water Works Engineers has provided a hydroelectric micro-turbine design solution for the Battle Creek site. Although other sites with power generation potential were identified, these sites are not expected to generate enough power to make their development cost effective. If power costs rise significantly in the future, these sites should be reevaluated to determine if they are suitable for development.

References

[1] http://energy.gov/eere/water/types-hydropower-turbines

APPENDIX A Project Blue Energy Statement of Project Objectives

STATEMENT OF PROJECT OBJECTIVES

Pleasant Grove City, Utah --- Project Blue Energy

A. PROJECT OBJECTIVES

The goal of Project Blue Energy is to create responsible, renewable energy from existing community water sources. The project objectives are to demonstrate the value of harnessing clean and renewable energy sources, storing and deploying the electricity in an innovative community model.

The expected outcomes are:

1) **Technical Innovation**: Incorporate innovative technologies in a demonstration project that could include turbine, generator, storage, distribution, etc, to demonstrate community based clean power with the aim to develop a specification or technical model that can be replicable;

2) **Replicable Models**: Develop financial and policy models, which may be replicated and adapted by other communities looking to implement micro hydro systems. Adopt innovative design and technological templates/models that can be incorporated into various conditions in existing community water system.

3) **Outreach**: Develop web-based and on-site educational materials and resources directed at community outreach.

B. PROJECT SCOPE

Consistent with the goals of the U.S. Department of Energy's Wind and Hydropower Technologies Program Office, the project will demonstrate how communities can utilize renewable energy resources to provide environmentally responsible and cost-effective incremental power, while incorporating outreach and educational programs. The project will be located at the mouth of Battle Creek Canyon where the city's culinary water supply is stored and distributed. The project will design, test, install, document, and develop a micro hydro-electric generator system. The project will be a proof of concept that the deployed innovative technology will generate electricity and can be installed in locations where pressure reducing valves are traditionally used within the community water systems.

The project aims to:

1) Generate electricity more efficiently than traditional micro hydro-electric systems by generating electricity throughout a broad range of water flow and pressure conditions;

2) Function as a pressure reducing valve by regulating the water pressure differential at varying flows; and

3) Provide technical, financial and policy templates for other communities to replicate;

C. TASKS TO BE PERFORMED

PHASE 1 – DESIGN AND BID

Task 1.0: Design

1.1 Conceptual Design: Complete calculations, equipment research and create conceptual level drawings for a system that is capable of generating power using existing infrastructure and allows for the study and evaluation of the effectiveness, efficiency and operability of the system in both pressure regulation and power generation.

1.1.1 Equipment Procurement: Prepare equipment procurement documents, evaluate proposals from equipment suppliers, and select power generation equipment that will be included in the project.

1.1.2 Environmental Permitting: Identify and apply for required environmental permitting.

1.2 Preliminary Design: Create preliminary level site, structural, mechanical, electrical, and instrumentation drawings showing the integration of the selected equipment into the design of the facility, and the integration of the new facility into the existing water storage and distribution system.

1.3 Final Design: Complete final design drawings and specifications for all engineering disciplines for use as contract documents in obtaining bids from contractors for the construction of the power generation facility and the installation of the power generation equipment.

Task 2.0: Bidding

2.1 Final Bid Documents: Finalize contract language and documents for release to contractors for bidding.

2.2 Bid Opening and Review: Collect bids for public opening. Review the apparent low bid for completeness and adherence to all contract requirements.

2.3 Contract Finalization: Finalize contract with general contractor for the construction of the facility and installation of the power generation equipment.

PHASE 2 - CONSTRUCTION

Task 3.0: Sitework

3.1 Site Preparation/Excavation: Complete rough grading of site and excavation required for the construction of the new building.

3.2 Yard Piping: Install yard piping necessary of integration of new facility into the existing water storage and distribution system.

3.3 Final Grading and Paving: Complete grading of site following construction of new building and installation of yard piping to provide a finished site with proper drainage and access.

Task 4.0: Structural

4.1 Rough Structural: Complete placement and installation of concrete, masonry, structural steel, doors, windows, and decking for new building. Complete construction of any required retaining walls or support structures.

4.2 Building Finish: Complete building roofing, sealing, architectural trim, and appurtenances to complete building construction.

Task 5.0: Mechanical

5.1 Piping and Valves: Install piping valves and equipment interior to the power generation building including all necessary equipment pads, supports, protective coatings, process instrumentation and appurtenances.

5.2 Turbine Installation: Install and connect turbine equipment within the power generation system.

5.3 HVAC Installation: Complete installation of air handling, heating, and ventilation equipment.

Task 6.0: Electrical and Instrumentation

6.1 Conduit and Wire Installation: Install conduit and wire for power supply and controls for all equipment and process instruments.

6.2 Switchgear Installation: Install all necessary power control switchgear within the electrical room of the power generation building.

6.3 PLC Programming and Installation: Complete programming of PLC according to process design and control strategies developed in the project design phase. Install PLC within the electrical room of the power generation building.

6.4 Wire Termination and Testing: Complete connection of wire to all equipment, instruments, switchgear, motor control center, PLC, and appurtenances. Test power and function of all power supply equipment, verify proper rotation of powered equipment where appropriate, verify function of all safety equipment, and certify proper installation and function. Test instruments and PLC to verify proper communication and function of process control equipment, debug PLC programming, and certify proper installation and function.

Task 7.0: Facility Commissioning

7.1 Electrical Testing and Start-up: Complete full functional testing of power supply and control systems. Verify that system functions as required by design documents, equipment protection systems are functioning and that all powered equipment functions properly. Certify that the entire electrical power system is installed properly and is ready for operation.

7.2 I&C Testing and Start-up: Complete full functional test of process control and instrumentation system. Verify that all equipment functions as designed within the system. Verify setpoints and equipment limits are effective and appropriate. Test and debug PLC programming for the control and data collection of entire system. Certify that the entire process control and data acquisition system is installed properly and is ready for operation.

7.3 Turbine Testing and Start-up: Inspect and certify the proper installation of the power generation turbines. Test and verify operation is within parameters established by the equipment supplier, and meets the requirements of the design documents. Verify all equipment protection and safety equipment are properly installed and operational. Certify that the power generation equipment is installed properly and ready for operation.

PHASE 3 – EVALUATION AND TESTING

Task 8.0: Evaluation

8.1 Process and Control Evaluation: Perform inspection, testing, data collection and evaluation of process control equipment, Modify and optimize process controls to create a system that functions smoothly and meets the objectives of the process design. System will be evaluated specifically to determine its effectiveness in utilizing variable flows to efficiently generate power, its applicability to function as a pressure reducing device within a water distributions system, and to evaluate the system's ease of operation and maintenance requirements.

8.2 Turbine Evaluation: Inspection, testing, data collection and evaluation will be conducted to determine the installed turbines' ability to meet the objectives of the system design. Specifically turbines will be evaluated to determine their power generation efficiency throughout the expected flow range, suitability for use to break pressure within a water distribution system, ease of operation and maintenance requirements, and integration within the power generation system.

8.3 Generator and Electrical Evaluation: Perform inspection, testing, data collection and evaluation of power generation and system power equipment to determine the equipments ability to meet the objectives established in the system design. System will be evaluated to determine its ability to provide clean power efficiently and reliably. Equipment operation and maintenance requirements will be documented and evaluated.

PHASE 4 – REPORTING AND TEMPLATE DEVELOPMENT

Task 9.0: Template Development

9.1 Financial Template: A standardized financing template will be developed to assist in future implementation to assist in future implementation inside and outside the city.

9.2 Permitting and Regulatory Template: A standardized template for permitting and regulatory policy will be developed to assist in future implementation inside and outside the city.

9.3 Technology Template: A standardized template of technologies and their application will be developed for use in future power generation projects inside and outside of the city.

10

Task 10.0: Reporting

10.1 Federal Funding Reports: Reports and other deliverables will be provided in accordance with the Federal Assistance Reporting Checklist following the instructions included therein.

10.2 Final Technical Report: A final report will be developed documenting the evaluation and optimization of the power generation system..

APPENDIX B Canyon Hydro Battle Creek Hydroelectric Project Technical Proposal

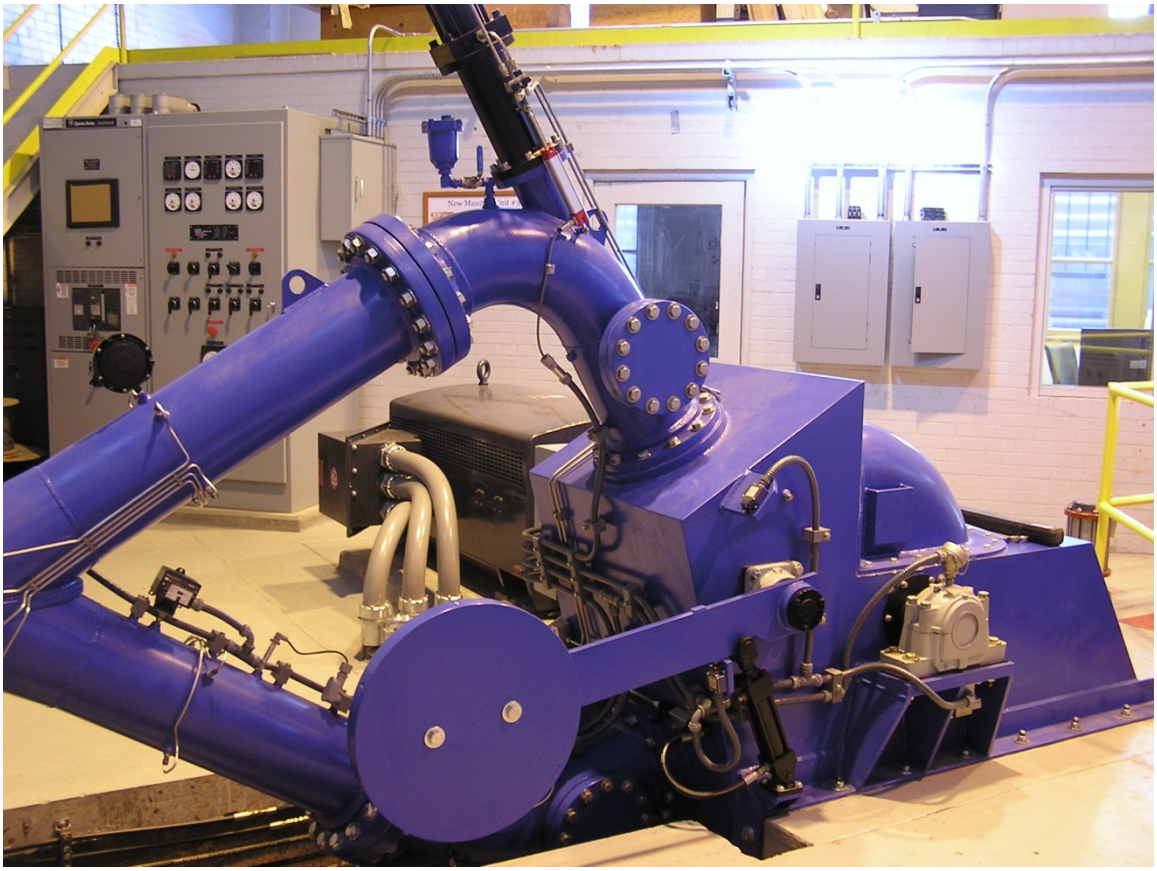
June 5, 2014

Technical Proposal

Battle Creek Hydroelectric Project

Prepared for:

Pleasant Grove City
C/O Water Works Engineers, LLC.
233 South Pleasant Grove Blvd.
Ste 103
Pleasant Grove, UT 84062
(801) 785-4105



500kW Canyon Hydro Pelton Turbine, Colorado Springs Utilities

Canyon Hydro Contact:
Brett Bauer, Vice President
(360) 592-5552
brett.bauer@canyonhydro.com

DOCUMENT 00410

PROPOSAL FORM

ARTICLE 1 – PROPOSAL RECIPIENT

1.01 Project Identification: Pleasant Grove City

Battle Creek Microhydro Power Generation Project

1.02 This Proposal is submitted to: Pleasant Grove City, Utah

(C/O: Water Works Engineers)

233 South Pleasant Grove Blvd

Suite 103

Pleasant Grove, Utah 84062

1.03 This PROPOSAL is Submitted By:

Canyon Industries, Inc.

(SUPPLIER)

5500 Blue Heron Lane, Deming, WA 98244

(SUPPLIER ADDRESS)

1.04 The undersigned Proposer agrees, if this Proposal is accepted, to enter into an Agreement with Owner in the form included in the Procurement Documents to perform and furnish all Goods and Services as specified or indicated in the Procurement Documents for the prices and within the times indicated in this Proposal and in accordance with the other terms and conditions of the Procurement Documents, including all applicable taxes, fees, shipping, and delivery costs.

ARTICLE 2 – PROPOSER'S ACKNOWLEDGEMENTS

2.01 Proposer accepts all of the terms and conditions of the Instructions to Proposers, including without limitation those dealing with the disposition of Proposal Security. This Proposal will remain subject to acceptance for 60 days after the Proposal opening, or for such longer period of time that Proposer may agree to in writing upon request of Owner.

ARTICLE 3 – PROPOSER'S REPRESENTATIONS

3.01 In submitting this Proposal, Proposer represents that:

A. Proposer has examined and carefully studied the Procurement Documents, other related data identified in the Procurement Documents, and the following Addenda, receipt of which is hereby acknowledged:

Addendum No.	Addendum Date

B. Proposer is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance and furnishing of the goods and services.

C. Based on the information and observations referred to above, Proposer does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Proposal for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Procurement Documents.

D. Proposer is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Procurement Documents.

E. Proposer has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Proposer has discovered in the Procurement Documents, and the written resolution thereof by Engineer is acceptable to Proposer.

1. The Procurement Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Proposal is submitted.

ARTICLE 4 – PROPOSER'S CERTIFICATION

4.01 Proposer certifies that:

A. This Proposal is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Proposer has not directly or indirectly induced or solicited any other Proposer to submit a false or sham proposal;

C. Proposer has not solicited or induced any individual or entity to refrain from proposing; and

D. Proposer has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the proposal process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the proposal process to the detriment of Owner, (b) to establish proposal prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Proposer, with or without the knowledge of Owner, a purpose of which is to establish proposal prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the proposal process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF PROPOSAL

5.01 Proposer will supply the Goods and Services in accordance with the Contract Documents for the Lump Sum Price of:

$ 186,405.00

One hundred, eighty-six thousand, four hundred and five dollars and no cents

(Words)

ARTICLE 6 – GUARANTEED POWER OUTPUT

6.01 Proposer guarantees that the turbine and generator system will produce the following power generation output at the listed operating conditions:

Flow (gpm)	**Head at Turbine Inlet (ft)**	**Guaranteed Power Output * (kW)**
1,500	460	98
900	460	56
300	460	18**

* Expected values are 1% higher than guaranteed

** Outputs below 25% rated are estimated since generator data is not available

ARTICLE 7 – TIME OF COMPLETION

7.01 Proposer agrees that the Goods and Services will be provided within the times after Notice to Proceed as defined in the General Conditions within the number of calendar days following receipt of Notice to Proceed indicated in the Agreement.

A. Delivery of Submittal Package (Design Drawings, Manufacturers Data, etc.): 30 days

B. Delivery of Preliminary Operation and Maintenance Manuals: 45 days

C. Delivery of Equipment to the Site: 160 days

D. Delivery of Final Operation and Maintenance Manuals: 160 days

7.02 Proposer further agrees that performance of manufacturer's field services (including installation check, startup assistance, and certification of acceptable installation and operation) to final completion will be coordinated with the Contractor to the satisfaction of the Engineer.

7.03 Proposer accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 8 – PROPOSAL SUBMITTAL

7.01 This Proposal is submitted by:

Company Name (typed or printed): Canyon Industries, Inc.

By: Brett Bauer

(Individual's signature)

Title: Vice President

Proposer's Business Address 5500 Blue Heron Lane
Deming, WA 98244

Phone No. 360-592-5552 Fax No. 360-592-2235

E-mail brett.bauer@canyonhydro.com

SUBMITTED on June 5, 2014.

++ END OF DOCUMENT ++

Comments and Exceptions

Pleasant Grove Hydroelectric Project

Section 00520 Article 6.02A. Canyon Hydro call exception to the requested payment terms and offers the following as an alternative.

Goods and Services Provided Payment	(Cumulative %)
Receipt of Signed Agreement and Authorization to Proceed with Design	10
Submittal Package Approval	35
Notification equipment is ready to ship	90
Receipt and acceptance of all equipment in acceptable condition including Operations and Maintenance Manuals, Completion of Start-up, Field Testing, Installation Check Training, etc., and Final Acceptance by OWNER	100

Section 00700 Article 4. Canyon Hydro offers our proposal based on the attached insurance levels that we currently maintain.

Section 00700 Article 5.10. Canyon Hydro offers our proposal based on our standard warranty included with our proposal.

Section 00700 Article 11. The project schedule will be affected if contractual payments are delayed.

Section 01610 Article 1.12. Canyon will make field service technicians or engineers available on an as needed basis for supervision of installation following our included Field Service Rates. We have not included these costs in our base price. Canyon would be pleased to offer a separate bid for the mechanical installation of the equipment, if you are interested.

Section 01750. Canyon will make field service technicians or engineers available on an as needed basis for testing, training and startup following our included Field Service Rates. We have not included these costs in our base price.

Section 15645 Part 2.2 D, Canyon proposed a runner machined from CF8M to A743 rather than the CA6NM requested. If CA6NM is technically required, please allow for an adder of $4,000.00.

Section 15645 Part 2.2 E. It is not clear to us what the discharge chamber is. Our intent is for the turbine housing to set over the concrete tailrace well.

Section 15645 Part 2.3 Canyon offers a NIDEC generator according to the attached generator submittals.

Section 15645 Part 3.4 Canyon will make field service technicians or engineers available on an as needed basis startup and initial operation services following our included Field Service Rates. We have not included these costs in our base price.

OP ID: MH

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 11/16/12

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Inland Insurance Inc. 9016 E Indiana Ave., Suite A Spokane Valley, WA 99212 John L Green Phone: 509-456-2648 Fax: 509-456-3432	CONTACT NAME: PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS: PRODUCER CUSTOMER ID #: CANYO-2
INSURED Canyon Industries, Inc. dba Canyon Hydro PO Box 36 Deming, WA 98244	INSURER(S) AFFORDING COVERAGE — NAIC # INSURER A : Depositors Insurance Company — 42587 INSURER B : Chartis Specialty Insurance Co INSURER C : INSURER D : INSURER E : INSURER F :

COVERAGES CERTIFICATE NUMBER: REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
B	GENERAL LIABILITY [X] COMMERCIAL GENERAL LIABILITY [ ] CLAIMS-MADE [X] OCCUR [X] Incl Pollution [ ] GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC			EG 13579318	11/23/12	11/23/13	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 1,000,000 $ 300,000 $ 25,000 $ 1,000,000 $ 2,000,000 $ 2,000,000
A	AUTOMOBILE LIABILITY [X] ANY AUTO [ ] ALL OWNED AUTOS [ ] SCHEDULED AUTOS [ ] HIRED AUTOS [ ] NON-OWNED AUTOS [ ]			ACP7524779901	11/23/12	11/23/13	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ $ $
B	[ ] UMBRELLA LIAB [X] OCCUR [X] EXCESS LIAB [ ] CLAIMS-MADE [ ] DEDUCTIBLE [ ] RETENTION $			EGU 13579377	11/23/12	11/23/13	EACH OCCURRENCE AGGREGATE	$ 4,000,000 $ 4,000,000
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) [ ] Y/N If yes, describe under DESCRIPTION OF OPERATIONS below	N/A		EG 13579318 WA STOP GAP	11/23/12	11/23/13	[ ] WC STATU-TORY LIMITS [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 1,000,000 $ 1,000,000 $ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

TOWHOM

To Whom it May Concern

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

John L. Green

Technical Proposal

Battle Creek Hydroelectric Project

Table of Contents

Section 1: Business Information

Battle Creek Hydroelectric Project

Project Summary

Net Head (at design flow)	460 feet
Design Flow	1500 gpm
Turbine Type	Custom-designed 1200 rpm double-nozzle Pelton
Configuration	Independent bearing, direct-coupled turbine & generator
Generator Output at Design Flow	100 kW
Mode of Operation	Grid connected

Section Contents

Canyon Company Profile

Resumes

Reference Listing

General Provisions for Field Service

Standard Warranty

Company Profile

Canyon Industries, Inc. has been involved in the manufacture of hydroelectric systems since 1976. The company was incorporated under the laws of the State of Washington in 1982. All manufacturing facilities and offices are located in the United States, near Deming, Washington.

The company currently employs approximately 50 full time employees and has two manufacturing centers: a 24,000 square foot fabrication facility in Deming, Washington, and a 15,000 square foot CNC Machining Center near Sumas, Washington. Canyon has extensive machining and fabrication capabilities, and handles all aspects of turbine construction except foundry castings. Castings are managed in three independent foundries, all of which have been trained by Canyon personnel to handle the unique casting requirements of hydraulic turbines.

Pelton and Francis turbines, as well as Kaplan and Crossflow turbines, are designed and manufactured under the trade name "Canyon Hydro." Turbines are offered as independent units or as part of complete hydroelectric systems. Canyon Hydro turbines are designed for either "stand alone" operation, providing power to remote communities, or as "grid interface" systems, connecting directly to the local or national grid. Canyon customers include utility companies, private power developers, communities, and individual landowners.

Canyon Industries is a family-owned, profit sharing business with low employee turnover. The company emphasizes environmental responsibility through recycling programs and selective purchasing, and maintains its own onsite hydroelectric system delivering 30 kW of renewable energy.

Richard A. New, President and co-owner, joined Canyon in 1978 and oversees all manufacturing and field service operations. Richard has extensive background in hydraulics and metallurgy, and has onsite experience with a wide array of hydroelectric projects.

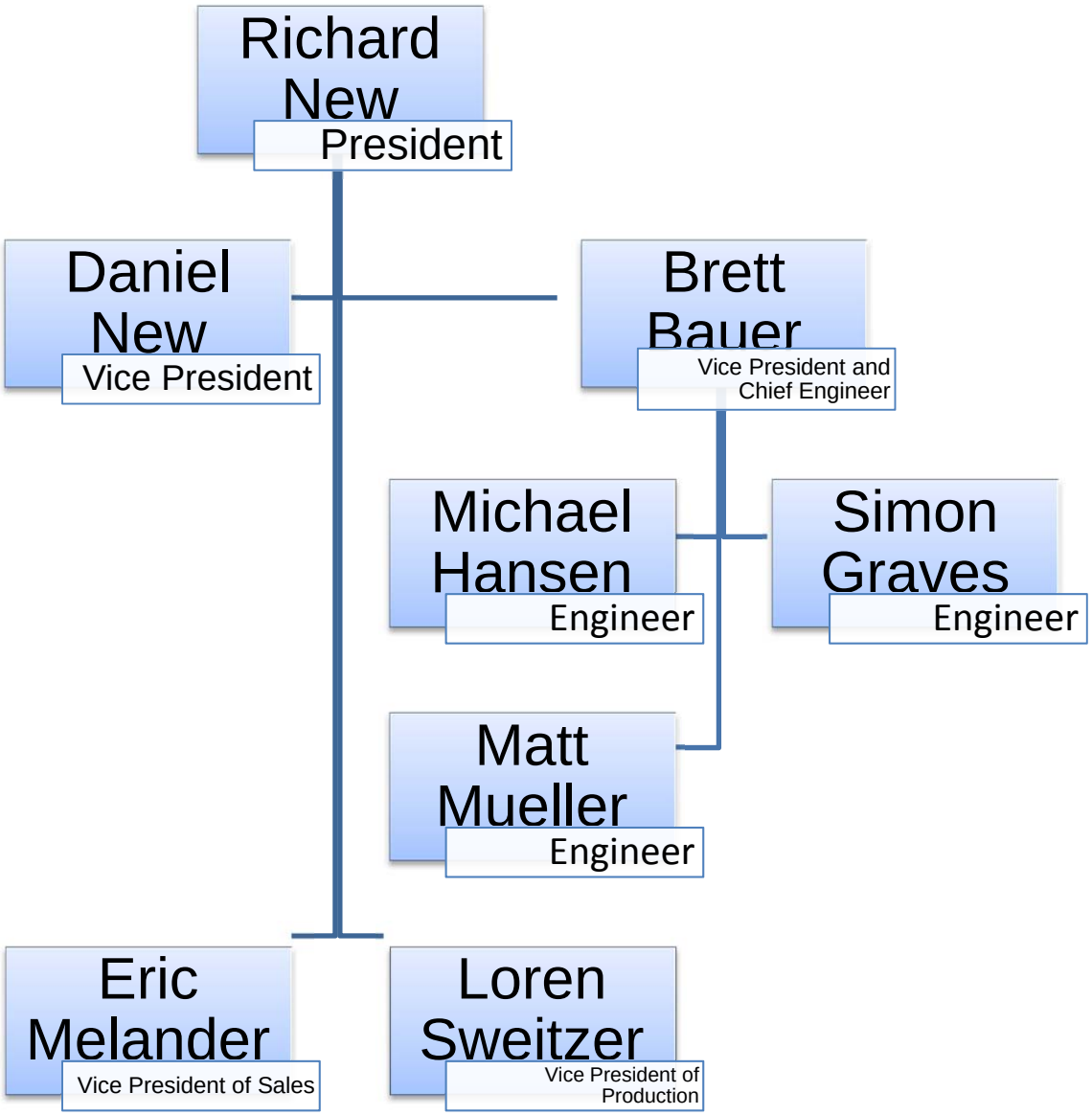
Daniel A. New, Vice President, founded Canyon Industries in 1976. Dan participates in turbine design, production procedures, sales, as well as company management and planning.

Brett W. Bauer, M.E., Vice President and Chief Engineer, joined the company in 1995. Brett works closely with Canyon customers and oversees all specification development, system design, and project management.

Eric Melander, Vice President of Sales, joined the company in 2005. Eric has a deep knowledge of turbine design and works closely with customers through all stages of the production process to ensure the proper system is chosen and built to the customer’s specifications.

Canyon Industries' annual gross sales have averaged $10 - $12 million for the past few years. The company is current on all suppliers' accounts and has no other debt. All production and support equipment is owned without attachment by the company. Corporate occupied land and buildings are presently leased. Canyon Industries Inc. has no claims or lawsuits pending.

Canyon Industries, Inc.
Management Organization



RICHARD A. NEW

Richard New is President and co-owner of Canyon Industries, Inc., and has been employed with the company since it was founded in 1976. Richard New oversees manufacturing and field services. He is actively involved with site assessment, as well as turbine installation and startup.

Mr. New possesses a thorough understanding of hydroelectric turbine systems: their design, manufacture, and maintenance. He is also an expert in the field of modern fabrication techniques, including the casting and forging of special-purpose alloys, CNC machining, and component heat treating.

Richard is a champion of the hydropower industry. He sponsored and directed the development of a website called whyhydropower.com, aimed at educating and shaping the opinions of the general public and government officials. He has also taught college courses in basic and advanced hydraulics.

Mr. New has domestic and international experience in site assessment, installation and refurbishment of hydropower systems. Projects include:

- Hystad, Canada
- Cascade-CSU, Colorado
- Falls Creek, Alaska
- Cajon de Pena, Mexico
- Southern Nevada Water Authority, Nevada
- Upper Swift Creek, Wyoming
- District of Lake Country, Canada
- Tyson, Canada
- GE, Big Creek #3, California
- City of Santa Fe, New Mexico
- Swalley Water District, Oregon
- Combie North-Nevada Irrigation District, California
- DeWitt Pipeline, Utah

DANIEL A. NEW

Daniel A. New is the Vice President of Canyon Industries, Inc. and has participated in hydroelectric projects for more than 35 years. Mr. New oversees all business and production operations. His background and education are in mechanical and hydraulic engineering.

Canyon Industries, incorporated by Mr. New in 1976, is dedicated to the manufacture and service of high quality turbines and hydroelectric systems. The company supplies turbines, components, water-to-wire packages and field machining services to customers worldwide. Mr. New has been the driving factor in the growth of Canyon Industries, as well as its reputation for exceptionally high quality products and customer support.

Mr. New places heavy emphasis on hydropower education for professionals and the general public. He has presented hydroelectric classes in North and Central America, with emphasis on "hands on" participation. Instruction covers site analysis, equipment selection, design basics, and efficient operation of hydroelectric systems.

Mr. New has been personally involved in the specification, production and installation of well over 100 hydroelectric projects, among them:

- Mauka Hydro, Hawaii
- Middle Fork Irrigation, Oregon
- Nooksack Falls Hydro, Washington
- Cwmorthin, Wales
- La International, Ecuador
- Bahio Solano, Colombia
- Deseret GT, Utah
- City of Cove, Oregon
- Mt. Pleasant, Utah
- La Esperanza, Honduras

BRETT W. BAUER

Brett Bauer is Vice-President and Head of Engineering at Canyon Industries, Inc. He oversees the specification and design for all hydropower systems supplied by Canyon Industries, and actively manages projects as they move through production. He has been employed by Canyon Industries for more than fifteen years.

Mr. Bauer was trained as Mechanical Engineer and received a BSME from the University of Washington. He has been personally involved with the design of more than 50 hydro projects including new installations, turbine refurbishment, nozzle repair, and replacement runners. He is trained in Computer Aided Design, Computational Fluid Dynamics, Finite Element Analysis, and Project Management.

Mr. Bauer has domestic and international experience in the design, installation and supervision of turbines projects, among them:

- LaGrande Dam, Washington
- South Sutton/Marion Creek, Canada
- Malibu, Canada
- La Esperanza, Honduras
- Glen Lyon, Scotland
- Southern Nevada Water Authority, Nevada
- Upper Swift Creek, Wyoming
- Tyson, Canada
- Middle Creek-Dasque Cluster, Canada

ERIC C. MELANDER

Eric Melander is Vice-President of Sales at Canyon Industries, Inc. He has a widespread knowledge of turbine design and works closely with customers through all stages of the production process to ensure the proper system is chosen and built to the customer's specifications.

Mr. Melander earned his BA at Western Washington University and joined Canyon in 2005. He has sold and provided project management for more than 60 projects to date. He is trained in Pelton and Crossflow turbine design, comprehends pump turbine applications and works closely with top engineering firms.

Mr. Melander has domestic and international experience in the design and supervision of turbines projects, including:

- Los Corrales, Chile
- Hamakua Springs, Hawaii
- Struy Hydro Scheme, Scotland
- Southern California Edison – South Lake Tunnel, California
- City of Whitefish, Montana
- El Montazo, Dominican Republic
- City of Frostburg, Maryland

MICHAEL R. HANSEN

Michael Hansen is a Design, Manufacturing, and Quality Control Engineer at Canyon Industries, Inc. Formed in 1976, Canyon Industries is a manufacturer of Pelton turbines and small hydroelectric systems with a recent opening of a CNC division with involvement in the aerospace industry.

Mr. Hansen was trained as Manufacturing Engineer and received a BS from Western Washington University. Mr. Hansen has been employed by Canyon Industries for five and a half years as a design and project engineer and currently has branched out as the quality control engineer and programmer in the CNC division.

Michael Hansen has design experience on over 30 hydro projects including new turbine designs, turbine refurbishment, nozzle rebuilds, and replacement Pelton runners. He also has experience in Quality Control on 10 new construction turbine projects and 3 aerospace projects. He is trained in Computer Aided Design, Finite Element Analysis, Solid Modeling, CNC Programming, and Quality Control.

Mr. Hansen has domestic and international experience in the design of turbines. Projects include:

- Tolt Dam, Washington
- Mumba Hydro, Africa
- Afton Culinary, Wyoming
- Cajon de Pena, Mexico
- Inverinian, Scotland
- Williams Fork Dam, Colorado
- Upper & Lower Swift Creek, Wyoming
- Ushmil Hydro, India
- Tyson Creek, Canada
- Rush Creek, California
- Olivenhain MWD, California

SIMON J. GRAVES

Simon Graves has been playing the role of hydropower design engineer at Canyon Industries since 2011. His main focus at Canyon is the design of custom Pelton turbines and water-to-wire systems. This includes system and subsystem design, component design, 3D modeling and analysis (including finite element analysis and computational fluid dynamics), drafting, testing, documentation, coordinating with manufacturing, and customer support.

Simon also conducts performance analysis and predictions for existing and potential projects. He enjoys using spreadsheet-based number-crunching to help customers determine system design parameters that will obtain the highest return on their investment in hydropower.

In 1999 Simon earned a B.S. in mechanical engineering at the University of California, San Diego. Before bringing his expertise to Canyon, he designed automated fare collection systems (ticket vending machines and entry gates) for mass transit, and rooftop PV modules for commercial-scale solar energy installations.

He has orchestrated the design of turbines worldwide, including:

- Pencaligue, Honduras
- Middle Creek, British Columbia, Canada
- Haa-ak-Suuk, Vancouver Island, Canada
- Fish Lake, Yukon, Canada
- Monar, Scotland, UK
- Olson Trust, Hawaii, USA
- Cadair, Scotland, UK
- Whitefish, Montana, USA
- Strata Florida, Wales, UK

MATT R. MUELLER

Matt Mueller is a Design, Project and Metrology engineer at Canyon Industries, Inc. Formed in 1976, Canyon Industries is a manufacturer of Pelton, Francis and Kaplan turbines ranging in size from 10kW to 20MW. With the recent opening of a CNC machining center in Sumas, WA, Canyon Industries is expanding its capabilities in Hydro as well as the Marine and Aerospace industries

Mr. Mueller has been trained as an Aerospace Engineer and has received a BS from the University of Minnesota, Twin Cities. Matt has been with Canyon Industries for one year working as a design and project engineer with prior experience in composites process engineering and research and development within the aerospace industry. Currently Matt also works as a metrology engineer and employs the latest laser metrology technology for inspection and electronic re-construction of aging hydro-turbine components and systems.

Matt has a growing resume of Hydro projects including design of new pump turbine systems, Pelton runner rebuilds, turbine sub-component system design and construction as well Francis runner design and optimization. Mr. Mueller also has experience with onsite inspection and data acquisition for reverse engineering operations. He is trained in multiple Computer Aided Design software packages as well as laser metrology data acquisition and re-engineering software.

Mr. Mueller has been personally involved in the specification, and design of multiple projects including:

- Black Creek, Washington
- Middle Creek, British Columbia
- Rancho California Water District, California
- Edwards Air Force Base, California
- Pelican, Alaska
- Malibu, British Columbia, Canada
- Glen Affric, Scotland
- Daltote, Scotland
- Deer Creek, Utah
- Navajo Dam, New Mexico

CANYON INDUSTRIES, INC.
PAST PERFORMANCE FACTORS
(Partial Listing)

Project Name	Description of Work	KW	Award Date	Customer Name/Address	# JETS	HEAD	FLOW
Malibu Club Camp Job 033054	Custom Pelton turbine/generator with flywheel, hydraulic power supply, inlet piping & valve	580	2003	Young Life, Harold Richert 271 Gower Point Rd, Box 1503 Gibson, BC, Canada B0N 1V0 604-886-7300	1	316M	227 l/s
South Sutton Creek Job 033064	Custom double nozzle Pelton turbine/generator with hydraulic power supply	5400	2003	Executive Power Corp. Mr. Sam Jackson 777 Douglas Street Victoria, BC, Canada V0R 2P0 250-709-1736 samdjackson@yahoo.com	2	329M	2.0 m^3/s
Marion Creek Job 033065	Custom double nozzle Pelton turbine/generator with hydraulic power supply	4500	2003	Executive Power Corp. Mr. Sam Jackson 777 Douglas Street Victoria, BC, Canada V0R 2P0 250-709-1736 samdjackson@yahoo.com	2	467.2M	1.17 m^3/s
GlenLyon Job 043012	Custom double nozzle Pelton turbine with hydraulic power supply	942	2004	I. Wootherspoon Kilmartin Property Group 11 Glenfinlas Street Edinburgh, Scotland EH3 6AQ abs@fsbdial.co.uk	2	312M	0.35 cms
La Esperanza II Job 043064	Twin Custom Pelton turbine/generator/governor	2 x 6,150	2004	Consorcio de Inversiones S.A. Ron Turner Apartado Postal #53 Villa Las Olominas #22, Aldea Santa Anita La Esperanza, Intibuca Honduras, CA 504-783-1452 trrnald@cs.com	2	370 M	2.0 m^3/s
Hauer Creek Job 053095	Custom Pelton turbine/generator with hydraulic power unit Bat Electric switchgear	3100	2005	Norm Lorenz Lorenz Holdings General Delivery Dunster, BC, Canada V0J 1J0 250-968-4419 norm@valemont.com	2	1287 FT	32 cfs
Falls Creek Job 073028	Custom double nozzle Pelton, TIV, HPU,Generator and governor	936	2007	Gustavus Electric Company PO Box 102 Gustavus, AK 99826 Richard Levitt 907-697-2299	2	554 FT	23 cfs
Coronado Job 073086	(2) Custom single nozzle Pelton turbines, HPU	2 x 3050	2007	Energisa, SA, Hector Borjas Apdo Postal 20524, Casa #3911, Bloque F Colonia Los Girasoles Tegucigalpa, Honduras 504-221-5088 energhjb@hondutel.hn	1	510 M	1.4 m^3/s

Project Name	Description of Work	KW	Award Date	Customer Name/Address	# JETS	HEAD	FLOW
Tyson Creek Job 073106	Custom double nozzle Pelton, TIV, Generator, HPU	9300	2007	Tyson Creek Hydro Corp. Peter Schober Box 1611 Gibsons, BC, Canada V0N 1V0 604-886-9062 pschober@dccnet.com	2	812 M	1.36 cms
Eldorado Job 083015	Custom double nozzle Pelton Generator, TIV, HPU	1140	2008	District of Lake Country Jack Allingham 10150 Bottom Wood Lake Road Lake Country, BC, Canada V4V 2M1 250-766-5650 jallingham@lakecountry.bc.ca	2	186 M	0.7cms
Castle Creek Job 083018	Custom vertical 5 jet Pelton Generator, TIV, HPU, Controls	1210	2008	City of Aspen, Colorado Rob Covington 130 South Galena Street Aspen, CO 81611-1902 970-920-5212 robert.covington@ci.aspen.co.us	5	325 FT	52 cfs
Innerhadden Job 083031	Custom double nozzle Pelton turbine, HPU	1435	2008	Richard Barclay Kinlock Rannoch by Pitlochry Perthshire, Scotland, U.K. PH16 5QD 44-870-160-1559 richard@rannochsmokery.co.uk	2	289 M	0.57cms
Keltneyburn Job 093006	(2) Custom Peltons, HPU	2 x 1000	2009	Jimmy Stewart Keltney House, Keltneyburn Aberfeldy, Perthshire Scotland, UK PH15 2LF sandie@wordwright.info	2	231 M	1.0 cms
Los Corrales I Job 093020	Custom Pelton, 2NN, Generator Controls, HPU	878	2009	Alejandro Ponce El trovador 4285 piso 11 Las Condes Santiago de Chile 56-2-429-7900 alejandro.ponce.p@gmail.com	2	258.9 M	400 l/s
Canoe Creek Job 093024	Custom double nozzle Pelton TIV, HPU, Generator	5500	2009	Canoe Creek Hydro Company Ltd Iain Cuthbert Unit B - 6451 Portsmounth Road Nanaimo, BC Canada V9V 1A3 250-390-2627 icuthbert@shaw.ca	2	465 M	1.45 m^3/s
Innerwick Job 093048	Custom double nozzle Pelton HPU	995	2009	Lairig a Mhuic LLP c/o Managed Estates W.N.B. Bateman Meggernie Estate 1 Springkerse Road Stirling, Scotland, UK FK7 7SN 1786-462519 me@managed-estates.co.uk	2	183 M	0.626 cms

CANYON INDUSTRIES, INC.
PAST PERFORMANCE FACTORS
(Partial Listing)

Project Name	Description of Work	KW	Award Date	Customer Name/Address	# JETS	HEAD	FLOW
Castles Estate Job 103007	Custom double nozzle Pelton HPU	1014	2010	David Reese c/o Managed Estates 1 Springkerse Road Stirling, Scotland, UK FK7 7SN 1786-462519	2	165 M	0.73 cms
Roromore Job 103030	Custom double nozzle Pelton HPU	995	2010	Edwin Thompson Company Elizabeth Cruickshank 76 Overhaugh Street Galsahiels, UK TD1 1DP 1896-751330 E.Cruickshank@edwin-thompson.co.uk	2	195 M	0.59 cms
GE - Big Creek #3 Job 103056	Machine Francis Runner Onsite Reassemble Turbine	50 MW	2010	Michael Mann General Electric 47369 Lower Redinger Road Auberry, CA 93602 801-796-8770 michael.mann@ge.com	N/A		
City of Boulder Job 103116	Custom double nozzle Pelton HPU, NN, Generator Spare Runner	6000	2010	City of Boulder, Colorado Joe Taddeucci Dept. of Public Works/Utilities Division PO Box 791 1739 Broadway, 2nd Floor Boulder, CO 80306 (303) 441-3266 taddeuccij@bouldercolorado.gov	2	1820.5 FT	37.7 cfs
ATCO - Fishlake Job 113019	Custom double nozzle Pelton HPU, Generator	975	2011	The Yukon Electric Company Limited Chris Cullingham Whitehorse Service Center 205 Tungsten Road Whitehorse, YT Y1A 3T4, Canada chris.cullingham@atco.com	1	412.09 FT	25.07 cfs
Los Corrales II Job 113028	Custom double nozzle Pelton HPU, Generator, Switch Gear	1035	2011	Alejandro Ponce El trovador 4285 piso 11 Las Condes Santiago de Chile 56-2-429-7900 alejandro.ponce.p@gmail.com	2	1167.96 FT	14.124 cfs
Olivenhain Job 113036	Dual Unit Francis Turbines HPU, Generator	2 x 350	2011	George Briest Olivenhain Municipal Water District David C. McCollum Water Treatment Plant 1966 Olivenhain Road Encinitas, CA 92024 760-753-6466 gbriest@olivenhain.com	N/A	180 FT	26.3 cfs

CANYON INDUSTRIES, INC.
PAST PERFORMANCE FACTORS
(Partial Listing)

Project Name	Description of Work	KW	Award Date	Customer Name/Address	# JETS	HEAD	FLOW
Middle Creek Job 113063	Custom five nozzle Pelton HPU, Generator, Cooling Water System	8200	2011	Don Hague Veresen Inc. 669 Howe Street, Suite 650 Vancouver, BC Canada V6C 0B4 604-637-6393 dhague@veresenинc.com	5	331.5 M	2.9 cms
Deer Creek Job 133009	Replacement Francis Runners	2 x 5400	2013	Jeff Budge Provo River Water Users Association 285 West 1100 North Pleasant Grove, UT 94062 801-796-8770 jdb@prwua.com	N/A	525 FT	135 cfs

General Provisions for Field Service

Field Service Rates

Technician $1,400 per day

Overtime/weekends $200 per hour

Engineer or Executive $2,000 per day

Overtime/weekends $285 per hour

Transportation

Personal or Corporate automobile mileage charged at $0.51/mile.

Air, rail, rental car, etc. will be charged at cost plus 15% processing charge.

Lodging & Meals

Charged at cost plus 15% processing charge.

Travel

Travel time will be billed at the straight time hourly rate Mondays through Fridays and at the weekend rate for Saturdays, Sundays, and Holidays.

General Provisions

Standby Time

Any waiting time when the Representative is available to work, up to a maximum of eight (8) hours on any one working day, shall be regarded as time actually worked, even though the services are not actually utilized. The rate may not be prorated for partial days.

Delays

Canyon Industries, Inc. shall not be liable for delay in performance when such delay is occasioned by causes beyond its reasonable control, including but not limited to acts of God, acts of the customer, material shortages, transportation difficulties, flood, strikes, epidemics, war (declared or undeclared), riot, etc.

Emergency Work

The minimum time off for a representative during any 24 hour period must be eight (8) consecutive hours.

Terms of Payment

A deposit equal to 50% of anticipated charges due upon request for a field representative. Payment for services and material will be due upon presentation of invoices.

Rates subject to change without notice.

Canyon Hydro– the water power division of Canyon Industries, Inc. • 5500 Blue Heron Lane • P.O. Box 36 • Deming WA 98244
360.592-5552 • Fax: 360.592.2235 • email: turbines@canyonhydro.com • www.canyonhydro.com

Standard Warranty

Canyon Industries, Inc. (Seller) warrants that as to fabrication and assemblies all material and equipment purchased by it and incorporated in or becoming a part of the work shall be new, unless otherwise directed in writing by the Buyer. Seller warrants that all material and equipment manufactured by it shall be free from injurious defect, latent or otherwise, and shall conform to the specifications provided. If within 18 months after shipment of any such material or equipment, or within one year after such material or equipment is placed in use or operation, whichever first occurs, Buyer (or Buyer's successor in interest) shall discover a defect or defects therein other than those resulting from either ordinary wear and tear, defects resulting from improper use thereof, and additions or alterations made by persons other than Seller, and shall notify Seller thereof, in writing, within such period, Seller will repair or replace such defective material or equipment or the defective portion or part thereof free of charge to Buyer (or Buyer's successor in interest) FOB Seller's plant, except for costs of removal and installation.

Seller does not warrant or guarantee materials or equipment which it does not design, but will use its best efforts to obtain for Buyer such guarantees as requested by Buyer. Unless otherwise advised, in writing by Buyer, Seller shall incorporate in every purchase order to suppliers of material and equipment for Buyer, its customary warranty and guarantee requirements.

Except as above specified, Seller will not be liable upon any guarantees or warranties, expressed or implied, statutory or by operation of law or otherwise, in any manner or form whatsoever, including but not limited to warranties of merchantability and/or fitness for purpose.

Except as above specified, Seller will not be liable for any costs, expenses or damages whatsoever, including but not limited to loss of interest, earnings, profits or other special indirect or consequential damages.

Section 2: Technical Information

Battle Creek Hydroelectric Project

Project Summary

Net Head (at design flow)	460 feet
Design Flow	1500 gpm
Turbine Type	Custom-designed 1200 rpm double-nozzle Pelton
Configuration	Independent bearing, direct-coupled turbine & generator
Generator Output at Design Flow	100 kW
Mode of Operation	Grid connected

Section Contents

Preliminary Design Specifications

BATTLE CREEK HYDROELECTRIC PROJECT
UTAH

Specifications

1.0 Impulse Turbine Runner

1.1. Material
Stainless steel alloy CF8M, high abrasion resistance, high tensile strength.

1.2. Construction
Buckets, disc, and hub integrally cast. Machined or ground to template.

1.3. Finish
All surfaces hand-polished to optimize hydraulic and aerodynamic efficiency.

1.4. Balance
Runner statically balanced while on runner shaft, then dynamically balanced to speed exceeding runaway speeds according to ISO 1940 G. 6.3.

1.5. Shaft Coupling

Flender (Siemens) elastomeric shaft coupling, or equivalent

2.0 Nozzle Assembly

2.1. Number and Type
Two (2) infinitely variable flow needle type nozzles, custom-designed for project head and flow.

2.2. Materials
Nozzle assembly body of fabricated ASTM A106 steel. Nozzle needle and beak of 300 series stainless steel. Highly polished.

2.3. Actuator
Nozzle assembly provided with hydraulic nozzle actuator, including visual nozzle position indicator and 4-20mA position transducer.

3.0 Jet Deflectors

3.1. Construction
Constructed of high strength carbon steel, stainless steel shaft, mounted on sealed ball bearings.

3.2. Actuator
Failsafe jet deflector lifted by hydraulic actuator, held open by solenoid valve, closed in 1-2 seconds by weighted jet deflector control arm. Includes 4-20mA position transducer.

4.0 Turbine Housing

4.1. Design
Turbine housing designed for maximum efficient escape of water and minimum aerodynamic drag.

4.2. Materials
Housing weld-fabricated of ASTM A36 plate steel, gusseted and reinforced. Frame constructed of welded structural steel for maximum rigidity and strength.

4.3. Bearings
Pillow block mounted double row spherical roller bearings, grease or oil lubricated. Designed for minimum B10 life of 100,000 hours. Fitted with PT100 RTD's and vibration transducers (one per bearing).

4.4. Coating System
Outside and inside, and turbine piping, sandblasted to near white surface. Inside and outside coating Ameron Amerlock 2 epoxy, color medium blue.

4.5. Turbine embedded mounting frame is included.

5.0 Generator

5.1. Manufacturer .....NIDEC (USEM), or equivalent

5.2. Specifications: Induction 100 kW, 1200 rpm, double bearing with shaft extension suitable for flexible coupling (provided by Canyon). Rated for 180% no-load overspeed for 5 minutes. Generator mounting frame is included. See attached description.

6.0 Control and Switchgear Package

6.1 Manufacturer .....Bat Electric, Redding, CA

6.2 Complete control and switchgear package per attached description.

7.0 Operation and Maintenance

7.1. Complete Operator instructions and maintenance manuals will be provided for turbine, generator, and related components.

7.2. At additional cost, a Canyon Hydro factory representative can be made available at turbine site for system installation, testing, adjustment, and to instruct local personnel in operation and maintenance. Current rates are described in the attached "General Provisions for Field Service".

8.0 Technical Attachments

Generator Description
Control and Switchgear Description
Turbine Elevation Proposal Drawing
Equipment Plan Proposal Drawing

NIDEC MOTOR CORPORATION
8050 WEST FLORISSANT AVE.
ST. LOUIS, MO 63136

DATE: 4/29/2014

P.O. NO.: 150HP - RFQ
Order/Line NO.: 1004240 IN 100

TO: Canyon Ind Inc *
5500 Blue Heron Lane
Deming, WA, 98244
ATTN: BRETT BAUER

Model Number: NA
Catalog Number: D150P3Z-P
Horiz. ODP Pre. Eff. Config.
CONF,MOTOR,HORIZ ODP PRE EFF

REVISIONS:

ALL DOCUMENTS HEREIN ARE CONSIDERED TYPICAL BY NIDEC MOTOR CORPORATION.
THANK YOU FOR YOUR INQUIRY AND THE OPPORTUNITY TO SERVE YOU.

Features:

```
Temporary - DO NOT COPY
Horsepower ..............  00150.00 ~ KW: 111.9
Enclosure ...............  ODP
Poles ...................  06 ~ RPM: 1200
Frame Size ..............  445~T
Phase/Frequency/Voltage..  3~060~480 ~ Random Wound
Service Factor ..........  1.15
Insulation Class ........  Class "F" ~ Insulife 1000
Altitude In Feet (Max) ..  5500 Ft.
Ambient In Degree C (Max)  +40 C
Assembly Position .......  "F-1" Assembly Position
Efficiency Class ........  Premium Efficiency
Application .............  Induction Generator
Customer Part Number ....
"AK" Dimension (Inches)..  NA
Temperature Rise (Sine Wave): "B" Rise @ 1.0 SF (Resist)
Starting Method .........  Direct-On-Line Start
Duty Cycle ..............  Continuous Duty
Load Inertia (lb-ft2): NEMA ~ NEMA Inertia: 1718.00 ~ 1.00
Number Of Starts Per Hour: NEMA
Motor Type Code .........  RE
Rotor Inertia (LB-FT²)        53.7 LB-FT²
Qty. of Bearings PE (Shaft)   1
Qty. of Bearings SE (OPP)     1
Bearing Number PE (Shaft)     6220-J
Bearing Number SE (OPP)       6313-J
```

NIDEC MOTOR CORPORATION
8050 WEST FLORISSANT AVE.
ST. LOUIS, MO 63136

DATE: 4/29/2014

P.O. NO.: 150HP - RFQ
Order/Line NO.: 1004240 IN 100

TO: Canyon Ind Inc *
5500 Blue Heron Lane
Deming, WA, 98244
ATTN: BRETT BAUER

Model Number: NA
Catalog Number: D150P3Z-P
Horiz. ODP Pre. Eff. Config.
CONF,MOTOR,HORIZ ODP PRE EFF

REVISIONS:

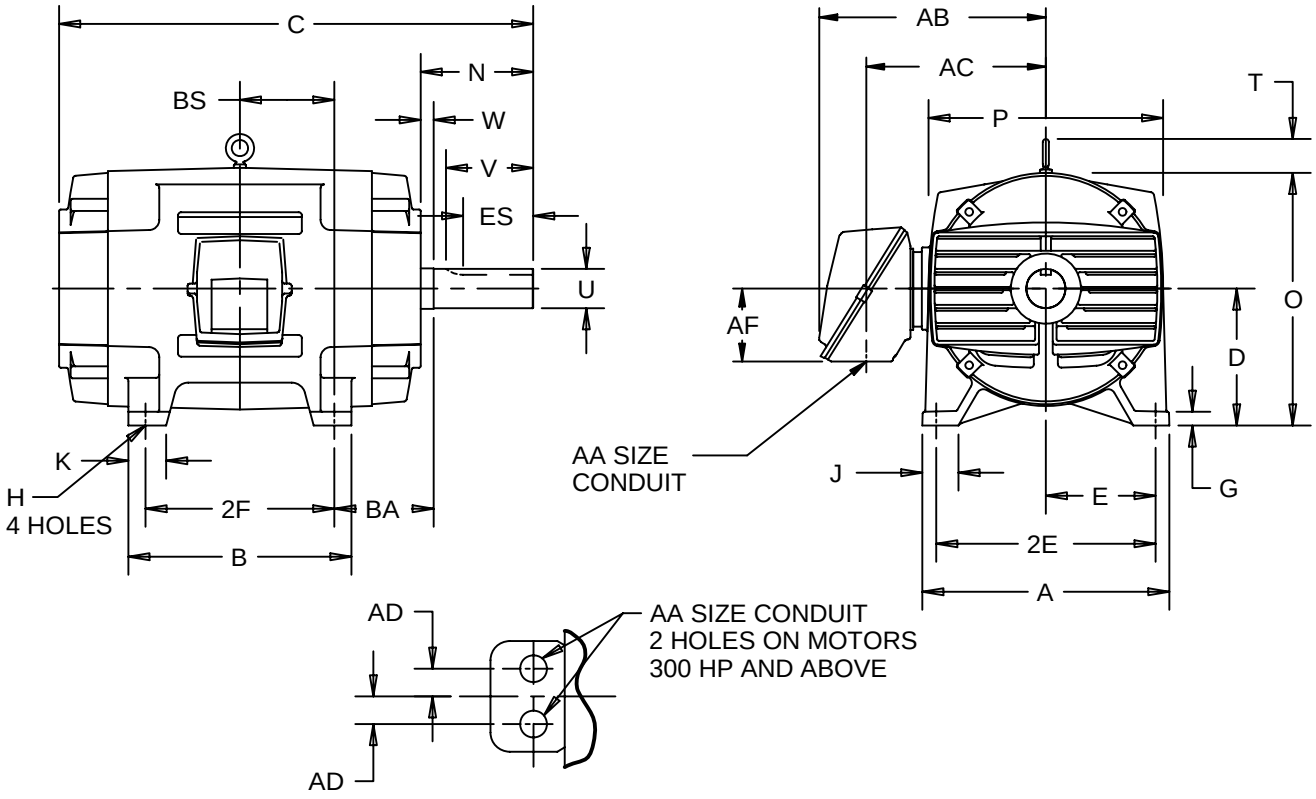
ALL DOCUMENTS HEREIN ARE CONSIDERED TYPICAL BY NIDEC MOTOR CORPORATION.
THANK YOU FOR YOUR INQUIRY AND THE OPPORTUNITY TO SERVE YOU.

Accessories:
Direct Connected To Load
.

USE THE DATA PROVIDED BELOW TO SELECT THE APPROPRIATE DIMENSION PRINT

Horsepower	150
Pole(s)	06
Voltage(s)	480
Frame Size	445T
Shaft U Diameter	3.375
Outlet Box AF	4.72
Outlet Box AA	3.00

EFFECTIVE: 05-MAR-12	HORIZONTAL MOTORS OPEN DRIP PROOF FRAME: 444T THRU 447TS BASIC TYPE: R	PRINT: 07-1988
SUPERSEDES: 05-AUG-11		SHEET: 1 OF 1



ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS

	UNITS	A	D -.06	E	2E ±.03	G	H +.05	J	O	P [2]	T	W	BA
	IN	22.00	11.00	9.00	18.00	1.38	.81	4.00	22.06	22.94	3.25	.25	7.50
	MM	559	279	229	457	35	21	102	560	583	83	6	191

	FRAME	UNITS	B	C	K	N	2F ±.03	U -.001	V MIN	BS	ES MIN	SQ KEY
	444T	IN	17.75	37.75	3.25	8.75	14.50	3.375	8.25	7.25	6.91	.875
		MM	451	959	83	222	368	85.73	210	184	176	22.23
	444TS	IN	17.75	34.00	3.25	4.97	14.50	2.375	4.50	7.25	3.03	.625
		MM	451	864	83	126	368	60.33	114	184	77	15.88
	445T	IN	19.75	39.75	3.25	8.75	16.50	3.375	8.25	8.25	6.91	.875
		MM	502	1010	83	222	419	85.73	210	210	176	22.23
	445TS	IN	19.75	36.00	3.25	5.00	16.50	2.375	4.50	8.25	3.03	.625
		MM	502	914	83	127	419	60.33	114	210	77	15.88
	447T	IN	23.25	43.25	3.25	8.75	20.00	3.375	8.25	10.00	6.91	.875
		MM	591	1099	83	222	508	85.73	210	254	176	22.23
	447TS	IN	23.25	39.50	3.25	5.00	20.00	2.375	4.50	10.00	3.03	.625
		MM	591	1003	83	127	508	60.33	114	254	77	15.88

	FULL LOAD AMPS	HP	UNITS	AA	AB	AC	AD	AF
	UP TO 250	---	IN	3.00	19.81	15.31	---	4.72
			MM		503	389	---	120
	251 AND UP	≤250	IN	3 1/2 NPT	22.44	16.81	---	8.06
			MM		570	427	---	205
		≥300	IN	3 NPT	22.44	16.81	2.75	8.06
			MM		570	427	70	205

1: ALL ROUGH CASTING DIMENSIONS MAY VARY BY .25" DUE TO CASTING AND/OR FABRICATION VARIATIONS.
2: LARGEST MOTOR WIDTH.

3: CONDUIT BOX MAY BE LOCATED ON EITHER SIDE OF MOTOR. CONDUIT OPENINGS MAY BE LOCATED IN STEPS OF 90 DEGREES REGARDLESS OF LOCATION. STANDARD AS SHOWN WITH CONDUIT OPENING DOWN.

07-1988/E

Nidec Motor Corporation
St. Louis, Missouri

US MOTORS

ISSUED BY R. KING
APPROVED BY J. HAGENE

IHP_DP_NMCA (MAR-2011) SOLIDEDGE

NAMEPLATE DATA

CATALOG NUMBER:	D150P3Z-P			NAMEPLATE PART #:	370780-004		
MODEL		FR	445T	TYPE	RE	ENCL	ODP
SHAFT END BRG	6220-J - QTY 1			OPP END BRG	6313-J - QTY 1		
PH	3	MAX AMB	40 C	ID#	(ref: Order#: 1004240, Type: IN, Line#: 100)		
INSUL CLASS	F	Asm. Pos.	F1	DUTY	CONT		

HP	150	RPM	1210	HP		RPM	
VOLTS	480			VOLTS			
FL AMPS	175.7			FL AMPS			
SF AMPS	209.0			SF AMPS			
SF	1.15	DESIGN	B	CODE	G	SF		DESIGN		CODE	
NEMA NOM EFFICIENCY	95.4	NOM PF	76.6	KiloWatt	111.900	NEMA NOM EFFICIENCY		NOM PF			
GUARANTEED EFFICIENCY	94.5	MAX KVAR	58.4	HZ	60	GUARANTEED EFFICIENCY		MAX KVAR		HZ	

HAZARDOUS LOCATION DATA (IF APPLICABLE):

DIVISION		CLASS I		GROUP I	
TEMP CODE		CLASS II		GROUP II	

VFD DATA (IF APPLICABLE):

VOLTS			
AMPS			
TORQUE 1		TORQUE 2	
VFD LOAD TYPE 1		VFD LOAD TYPE 2	
VFD HERTZ RANGE 1		VFD HERTZ RANGE 2	
VFD SPEED RANGE 1		VFD SPEED RANGE 2	
SERVICE FACTOR		FL SLIP	
NO. POLES	6	MAGNETIZING AMPS	82.6
VECTOR MAX RPM		Encoder PPR	
Radians / Seconds	1	Encoder Volts	

TEAO DATA (IF APPLICABLE):

HP (AIR OVER)		HP (AIR OVER M/S)		RPM (AIR OVER)		RPM (AIR OVER M/S)	
FPM AIR VELOCITY		FPM AIR VELOCITY M/S		FPM AIR VELOCITY SEC			

ADDITIONAL NAMEPLATE DATA:

Decal / Plate	WD=499495	Customer PN	
Notes		Non Rev Ratchet	
Max Temp Rise	80C RISE/RES@1.00SF	OPP/Upper Oil Cap	GREASE
Thermal (WDG)		SHAFT/Lower Oil Cap	GREASE
Altitude	05500		
Regulatory Notes		Regulatory Compliance	CC 030A
COS		Marine Duty	
Balance		Arctic Duty	
3/4 Load Eff.	95.9	Inrush Limit	
Motor Weight (LBS)	1200	Direction of Rotation	
Sound Level		Special Note 1	
Vertical Thrust (LBS)		Special Note 2	
Thrust Percentage		Special Note 3	
Bearing Life		Special Note 4	
Starting Method		Special Note 5	
Number of Starts		Special Note 6	
200/208V 60Hz Max Amps		SH Max. Temp.	
190V 50 hz Max Amps		SH Voltage	
380V 50 Hz Max Amps		SH Watts	
NEMA Inertia		Load Inertia	
Sumpheater Voltage		Sumpheater Wattage	
Special Accessory Note 1		Special Accessory Note 16	
Special Accessory Note 2		Special Accessory Note 17	
Special Accessory Note 3		Special Accessory Note 18	
Special Accessory Note 4		Special Accessory Note 19	
Special Accessory Note 5		Special Accessory Note 20	
Special Accessory Note 6		Special Accessory Note 21	
Special Accessory Note 7		Special Accessory Note 22	
Special Accessory Note 8		Special Accessory Note 23	
Special Accessory Note 9		Special Accessory Note 24	
Special Accessory Note 10		Special Accessory Note 25	
Special Accessory Note 11		Special Accessory Note 26	
Special Accessory Note 12		Special Accessory Note 27	
Special Accessory Note 13		Special Accessory Note 28	
Special Accessory Note 14		Special Accessory Note 29	
Special Accessory Note 15		Special Accessory Note 30	

NIDEC MOTOR CORPORATION

ST. LOUIS, MO

TYPICAL NAMEPLATE DATA
ACTUAL MOTOR NAMEPLATE LAYOUT MAY VARY
SOME FIELDS MAY BE OMITTED

MOTOR PERFORMANCE

MODEL NO.	CATALOG NO.	PHASE	TYPE	FRAME
NA	D150P3Z-P	3	RE	445T

ORDER NO.	1004240	LINE NO.	100

MPI:	183146
HP:	150
POLES:	6
VOLTS:	480
HZ:	60
SERVICE FACTOR:	1.15
EFFICIENCY (%):	
S.F.	95
FULL	95.4
3/4	95.9
1/2	95.7
1/4	93.5
POWER FACTOR (%):	
S.F.	77.9
FULL	76.6
3/4	71.9
1/2	61.3
1/4	39.4
NO LOAD	2.3
LOCKED ROTOR	27.6
AMPS:	
S.F.	209
FULL	184
3/4	146
1/2	115
1/4	91
NO LOAD	82.6
LOCKED ROTOR	1039.5
NEMA CODE LETTER	G
NEMA DESIGN LETTER	B
FULL LOAD RPM	1190
NEMA NOMINAL EFFICIENCY (%)	95.4
GUARANTEED EFFICIENCY (%)	94.5
MAX KVAR	58.4
AMBIENT (°C)	40
ALTITUDE (FASL)	6000
SAFE STALL TIME-HOT (SEC)	30
SOUND PRESSURE (DBA @ 1M)	69
TORQUES:	
BREAKDOWN{% F.L.}	120
LOCKED ROTOR{% F.L.}	200
FULL LOAD{LB-FT}	663.4

NEMA Nominal and Guaranteed Efficiencies are up to 3,300 feet above sea level and 25 ° C ambient

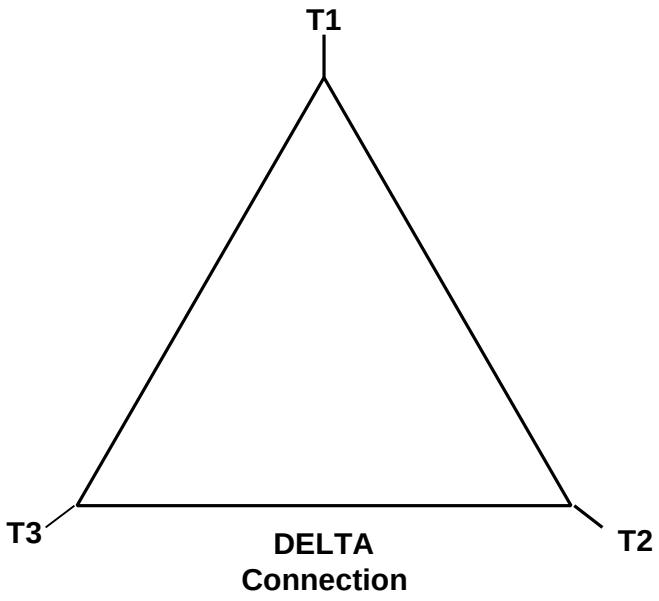
The Above Data Is Typical, Sinewave Power Unless Noted Otherwise

NIDEC MOTOR CORPORATION

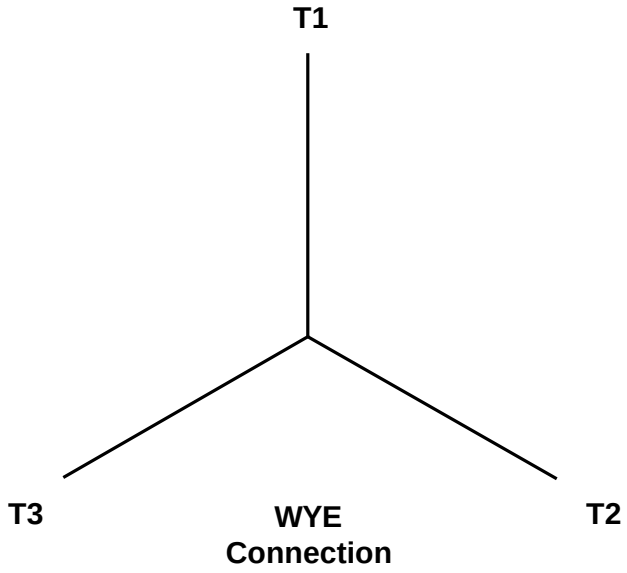
ST. LOUIS, MO

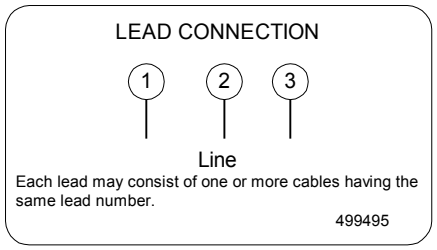
499495

Motor Wiring Diagram



or





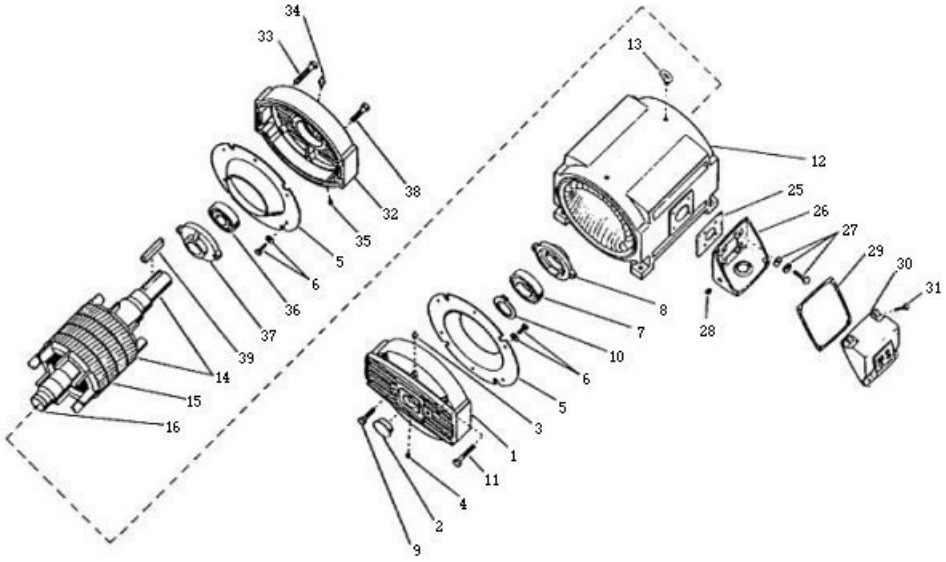
To reverse direction of rotation interchange connections L1 and L2.

Each lead may be comprised of one or more cables.
Each cable will be marked with the appropriate lead number.

EFFECTIVE: 2/27/96
SUPERCEDES: X736618, 96441, 179879, 284138
Connection Plate: 499495
Connection Decal: 912113

RENEWAL PARTS

FRAMES 444 THRU 449 - OPEN DRIPPROOF
TYPES: FR, R, RE, RI



ITEM NO.	QTY	NAME OF PART
1	1	Bracket (Short End)
2	1	Bracket Plug
3	1	Grease Fitting
4	1	Countersunk Hex Pipe Plug
5	2	Air Deflector Assembly
6	12	Hex Head Cap Screw & Lockwasher
7	1	Ball Bearing (Short End) (Refer to section 775)
8	1	Bearing Cap
9	2	Hex Head Cap Screw
10	1	Retaining Snap Ring
11	4	Hex Head Cap Screw (Bracket to Stator)
12	1	Wound Stator Assembly
13	2	Eyebolt
14	1	Rotor Assembly (Includes Items 15 & 16)
15	1	Rotor Core
16	1	Rotor Shaft

ITEM NO.	QTY	NAME OF PART
17-24	-	Not Used This Assembly
25	1	Gasket (Base to Frame)
26	1	Outlet Box Base
27	4	Hex Head Cap Screw, Pain Washer, & Lockwasher
28	1	Countersunk Hex Head Plug
29	1	Gasket (Cover to Base)
30	1	Outlet Box Cover
31	4	Hex Head Cap Screw (Qty. 6 on some units)
32	1	Bracket (Pulley End)
33	4	Hex Head Cap Screw (Bracket to Stator)
34	1	Grease Fitting
35	1	Countersunk Hex Pipe Plug
36	1	Ball Bearing (Pulley End) (Refer to section 775)
37	1	Bearing Cap
38	2	Hex Head Cap Screw
39	1	Square Key

WARNING:
Any disassembly or repair work on explosionproof motors will void the Underwriters Laboratories, Inc. label unless done by the manufacturer, or a facility approved by the Underwriters Laboratories, Inc. Refer to your nearest sales office for assistance.

BEARINGS:
Refer to motor nameplate for the bearing numbers.

PRICES:
Parts stocking distributors: refer to renewal parts numerical index. All Others: refer to your nearest parts distributor.

Suitability of Integral Horsepower (IHP)* Motors on Variable Frequency Drives

Variable Frequency Drives (VFD)

All Nidec Motor Corporation inverter duty motors have 40°C ambient, 1.0 SF on Inverter Power, 3300 ft. max altitude, 460 voltage or less line power, up to 10:1 speed range on Variable Torque and Class F Insulation.

Nidec Motor Corporation's INVERTER GRADE® insulated motors exceeded NEMA®† MG-1 Part 30 & 31 before the standards were established.

We are a leader in the development of electric motors to withstand pulse width modulated (PWM) drives evolution from power transistors to higher switching frequency insulated gate bipolar transistors (IGBTs).

Today, as the need for medium duty motor inverter applications grows, Nidec Motor Corporation provides products to meet these demands.

Through continued research and development, Nidec Motor Corporation has included the insulation wire from its INVERTER GRADE® motors in all Premium Efficient motors, enhancing their potential inverter compatibility.

Inverter compatibility with motors is complex. As a result, many variables must be considered when determining the suitability of certain types of motors. These variables include:

- Torque requirements (Constant or Variable)
- Speed Range
- Line/System Voltage
- Cable Length between VFD & Motor
- Drive Switching (Carrier) Frequency Motor Construction
- VFD dv/dt
- High Temperatures High Humidity

Wider speed ranges, higher voltages, higher switching frequencies and increased cable lengths all add to the severity of the application and therefore the potential for premature motor failure. Nidec Motor Corporation has differentiated its products into families for your ease of selection for various inverter applications.

Warranty Guidelines

The information within this section refers to the motor and drive application guidelines and limitations for warranty.

Hazardous Location Motors

Use of a variable frequency drive with the motors in this catalog, intended for use in hazardous locations, is only approved for Division 1, Class I, Group D hazardous location motors with a T2B temperature code, with a limitation of 2:1 constant torque or 10:1 variable torque output. No other stock hazardous location motors are inherently suitable for operation with a variable frequency drive. If other requirements are needed, including non-listed Division 2, please contact your Nidec Motor Corporation territory manager to conduct an engineering inquiry.

575 Volt Motors

575 volt motors can be applied on inverters when output filters are used.

Applying INVERTER GRADE® Insulated Motors on Variable Frequency Drives (2, 4, 6 pole)

The products within this catalog labeled "Inverter Duty" or "Vector Duty" are considered INVERTER GRADE® insulated motors. INVERTER GRADE® motors exceed the NEMA®† MG-1 Part 31 standard.

Nidec Motor Corporation provides a three-year limited warranty on all NEMA®† frame INVERTER GRADE® insulated motors and allows long cable runs between the motor and the VFD (limited to 400 feet typical without output filters). Cable distance can be further limited by hot and humid environments and VFD manufacturers cable limits. These motors may be appropriate for certain severe inverter application or when the factors relating to the end use application are undefined (such as spares).

Nidec Motor Corporation's U.S. Motors® brand is available in the following INVERTER GRADE® insulated motors:

- Inverter Duty NEMA®† frame motors good for 10:1 Variable Torque & 5:1 Constant Torque, including Vertical Type RUSI
- Inverter Duty motors rated for 10:1 Constant Torque
- ACCU-Torq® and Vector Duty Motors with full torque to 0 Speed
- 841 Plus® NEMA®† Frame Motors

Applying motors that do not have INVERTER GRADE® insulation on Variable Frequency Drives (2, 4, 6 pole)

Meet NEMA®† MG-1, Section IV, Part 31.4.4.2. They can be used with adjustable frequency drives under the following parameters: On NEMA®† frame motors, 10:1 speed rating on variable torque loads & 4:1 speed range on constant torque loads. On TITAN® frame motors, 10:1 speed rating on variable torque loads. On TITAN® frame motors, inquiry required for suitability on constant torque loads. Cable distances are for reference only and can be further limited by hot and humid environments. Refer to specific VFD manufacturers cable limits.

Cable Distances			
Maximum Cable Distance VFD to Motor			
Switching Frequency	460 Volt	230 Volt	380 Volt
3 Khz	127 ft	400 ft	218 ft
6 Khz	90 ft	307 ft	154 ft
9 Khz	73 ft	251 ft	126 ft
12 Khz	64 ft	217 ft	109 ft
15 Khz	57 ft	194 ft	98 ft
20 Khz	49 ft	168 ft	85 ft

Applying Standard & Energy Efficient Motors on Variable Frequency Drives is not recommended. VFD related failures on standard and energy efficient motors 444 frame and above will not be covered under warranty.

*This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.

Motor / Inverter Compatibility

Thermal Overloads and Single Phase Motors

Motors with thermal overloads installed may not operate properly on a VFD. The current carrying thermal overload is designed for sine wave power. Operation on a VFD may cause nuisance tripping or potentially not protect the motor as would be expected on line power. Thermo-stats or thermistors installed in the motor and connected properly to the VFD may provide suitable thermal overload protection when operating on a VFD. (Consult Codes)

Single phase motors and other fractional horsepower ratings are not designed to be operated on a VFD. Within Nidec Motor Corporation standard products, all motors NEMA®† 48 frame (5.5" diameter) and smaller are not suitable for VFD applications. Three phase 56 and 143/145 frame applications should be noted on the catalog price page; or if in doubt ask an Nidec Motor Corporation technical representative for recommendations on compatibility with a VFD.

Slow Speed Motors

Motors with a base design of slower than six poles require special consideration regarding VFD sizing and minimizing harmonic distortion created at the motor terminals due to cable installation characteristics. Additional external PWM waveform filters and shielded motor cables designed for PWM power may be required to provide acceptable motor life. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%).

690V Applications

Motors that will be applied to 690VAC PWM VFDs require the use of an external filter to limit peak voltage spikes and the use of an INVERTER GRADE® motor. Where available, an alternative to using an output filter is to upgrade to a 2300V insulation system.

Low Voltage TITAN® Motors

When using 449 frame and larger motors on PWM type VFDs consider the use of an external filter and shielded motor cables designed for PWM power to minimize harmonic distortion and peak voltages at the motor terminals. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%).

Bearing Currents related to PWM waveform

Due to the uniqueness of this condition occurring in the field, protection of the motor bearings from shaft currents caused by common mode voltages is not a standard feature on sine wave or Inverter Duty motor products, unless explicitly noted. Some installations may be prone to a voltage discharge condition through the motor bearings called fluting.

Fluting damage is related to characteristics of the PWM waveform, VFD programming and characteristics and installation.

Bearing fluting as a result of VFD waveform characteristics may be prevented by the installation of a shaft grounding device such as a brush or ring and/or correction of the installation characteristics causing the shaft voltage condition. Insulated bearing(s) may be required. VFD filters may be needed if bearing fluting is to be avoided.

Multiple Motors on a Single VFD

Special considerations are required when multiple motors are powered from a single VFD unit. Most VFD manufacturers can provide guidelines for proper motor thermal considerations and starting/stopping of motors. Cable runs from the VFD and each motor can create conditions that will cause extra stress on the motor winding. Filters may be required at the motor to provide maximum motor life.

Grounding and Cable Installation Guidelines

Proper output winding and grounding practices can be instrumental in minimizing motor related failures caused by PWM waveform characteristics and installation factors. VFD manufacturers typically provide detailed guidelines on the proper grounding of the motor to the VFD and output cable routing. Cabling manufacturers provide recommended cable types for PWM installations and critical information concerning output wiring impedance and capacitance to ground.

Vertical Motors on VFDs

Vertical motors operated on VFD power present unique conditions that may require consideration by the user or installation engineer:

- Non-reversing-ratchet operation can interfere at low speeds (up to 300 RPM) causing locked rotor and drive tripping.
- Unexpected / unacceptable system vibration and or noise levels caused by the torque pulsation characteristics of the PWM waveform, a system critical frequency falling inside the variable speed range of the process or the added harmonic content of the PWM waveform exciting a system component
- Application related problems related to the controlled acceleration/ deceleration and torque of the motor on VFD power and the building of system pressure/ load.
- The impact the reduction of pump speed has on the down thrust reflected to the pump motor and any minimum thrust requirements of the motor bearings
- Water hammer during shutdown damaging the non-reversing ratchet

Humidity and Non-operational Conditions

The possible build-up of condensation inside the motor due to storage in an uncontrolled environment or non-operational periods in an installation, can lead to an increased rate of premature winding or bearing failures when combined with the stresses associated with PWM waveform characteristics. Moisture and condensation in and on the motor winding over time can provide tracking paths to ground, lower the Megohm resistance of the motor winding to ground, and lower the Corona Inception Voltage level of the winding.

Proper storage and maintenance guidelines are important to minimize the potential of premature failures. Space heaters or trickle voltage heating methods are the preferred methods for drying out a winding that has low megaohm readings. Damage caused by these factors are not covered by the limited warranty provided unless appropriate heating methods are properly utilized during non-operational periods and prior to motor start-up.

NEMA®† Application Guide for AC Adjustable Speed Drive Systems: http://www.nema.org/stds/acadjustable.cfm#download

*This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.

Control/Switchgear Description

We are pleased to offer the following quotation for the proposed 100kW Pleasant Grove Hydro Project's electrical controls and switchgear. Intertie utility is Rocky Mountain Power. Was not supplied with interconnect requirements for Rocky Mountain Power, will utilize IEEE 1547 as a guideline. This quotation is offered based on standard requirements for a project of this size. Project requirements may cause changes to the proposed equipment list and thus alter final prices.

Project General Information

The power plant will consist of one Pelton turbine-driven generator. The Pelton turbine will have hydraulically operated dual needle nozzles and deflector. The generator will be of the induction type, rated 480V, 3Ø, 60Hz, and rated 100kW. The controls will consist of manual hardwire control and PLC based automatic control. Automatic control will consist of auto start and auto nozzle position control. The generator will be placed on line when the unit is at rated speed by a dedicated main contractor.

Switchgear/Control Equipment List

Qty
- 1- Double-Door, NEMA 12, Free-Standing Enclosure, painted with ASA61 gray paint
- 1- Main Circuit Breaker, 175AT/250AF, 480V, 35kA 3-pole fixed mount
- 1- Generator Main Contactor, 480V, 3 Pole, Rated 180A
- 2- (BPT) Bus Potential Transformer (4/1)
- 1- (CPT) Control Power Transformer (1000VA)
- 3- (CT) Current Transformers (200/5)
- 1- (12/13) Speed Relay/Tachometer
- 1- (MFR) Multifunction Protective Relay: (27/59) Under Over Voltage, (32R) Reverse Power, (40) Loss of Excitation, (47) Phase Sequence, (51V) Volt Restrained Overcurrent, (59G) Ground Overvoltage, (81O/U) Over/Under Frequency (utility grade)
- 1- (86) Lockout
- 1- (86V/F) Volt/Frequency Lockout Relay
- 2- (39) Vibration Trip Circuit
- 1- (63) Hydraulic Low Pressure Trip Circuit
- 1- (AM) Ammeter, 3½ in., 2%, (0-200A)
- 1- (DMM) Digital Multimeter (V, A, kW, PF, kVAR, Hz, kWH)
- 1- (HM) Hourmeter, 3½ in., 2%
- 2- (NM) Nozzle Meter, 3½", 2% (0-100%)
- 1- (VM) Voltmeter, 3½ in., 2% (0-600V)
- 1- (1CS) Start-Stop Control Switch
- 1- (AS) Ammeter Switch, 3-position with off
- 1- (DCS) Deflector Control Switches (Close-Open)
- 1- (ES) Emergency Stop
- 1- (MS) Mode Switch (Off-Local-Remote)
- 2- (NCS) Nozzle Control Switches (Open-Close)
- 1- (VS) Voltmeter Switch, 3-position with off
- 2- Breaker Indicating Lights (Open/Close)
- 2- Deflector Position Indicating Lights (Close-Open)
- 4- Nozzle Position Indicating Lights (Close/Open)
- 2- Start/Stop Indicating Lights
- 1- (PLC) Programmable Logic Controller

1- (OIU) Operator Interface Unit (6” Color Touch Screen)
1- Lot Nozzle Position Control
1- Fault Annunciator, 15-point
1- Lot Auxiliary Relays, Timers, and Controls
1- Lot Field Interconnect Terminal Blocks
1- Lot Test Switches
1- Lot Engraved Nameplates
1- Lot Control Fuses
1- Lot Interface with Turbine Hydraulic Pump Unit (HPU supplied by others)
1- Lot Interface with Penstock Pressure Transducer
1- Lot Interface with Facility PLC (supplied and programmed by others)

Miscellaneous Ship Loose Equipment

Qty 1- Magnetic Speed Pickup

Equipment Dimensions

The proposed dimensions for the switchgear and control panel are as follows:

Switchgear/Control Cubicle 72”(H) x 60”(W) x 12”(D)

Equipment Manufacturers

The following equipment manufacturers are proposed. BAT ELECTRIC reserves the right to substitute equipment of equal quality at time of manufacturer.

Generator Circuit Breaker, 600V	General Electric
Protective Relay	Beckwith
Digital Multi Meter	Multitek
Meters, 3½”, 2%	Crompton
Switches	Shallco/General Electric
Instrument Transformers	GE-ITI
Indicating Lights	General Electric
Auxiliary Relays	General Electric/Idec
Programmable Logic Controller	Automation Direct DL205

Optional Equipment

1. 4 Point RTD Input Module for DL205 PLC. Temperature status, alarm and trip displayed on OIU.

Net Adder.....**$ 1,300.00 Each**

2. 24VDC VRLA Battery Bank 100AH with 20 amp charger and rack.

Net Adder..... **$ 6,875.00**

3**.** Power Factor Corrective Capacitor Bank (max. 30kVAR) switched with a 60Amp Contactor. Generator Power Factor to be corrected from 0.80PF to 0.92PF.

Net Adder..... **$ 1,860.00**

4. Add dedicated ground over current relay with test block.

Net Adder..... .**$ 1,600.00**

5. Supply Software for PLC and OIU Programming.

PLC Software..... **$ 650.00**
OIU Software.....**$ N/C**

6. Bench Test Multi Function Protective Relay

Net Adder..... **$ 1,875.00**

7. Supply 4 Channel or 8 Channel Dialer with Rechargeable Battery.
Net Adder 4 Channel..... **$ 1,625.00**
Net Adder 8 Channel..... **$ 2,200.00**

This quote has not allowed any provisions for taxes or duties required in shipping into or out of the State of California. Any extra charges incurred by BAT ELECTRIC for shipping or taxes will be billed on a cost basis. The prices listed in this quotation are effective for six (6) months from the date of this letter.

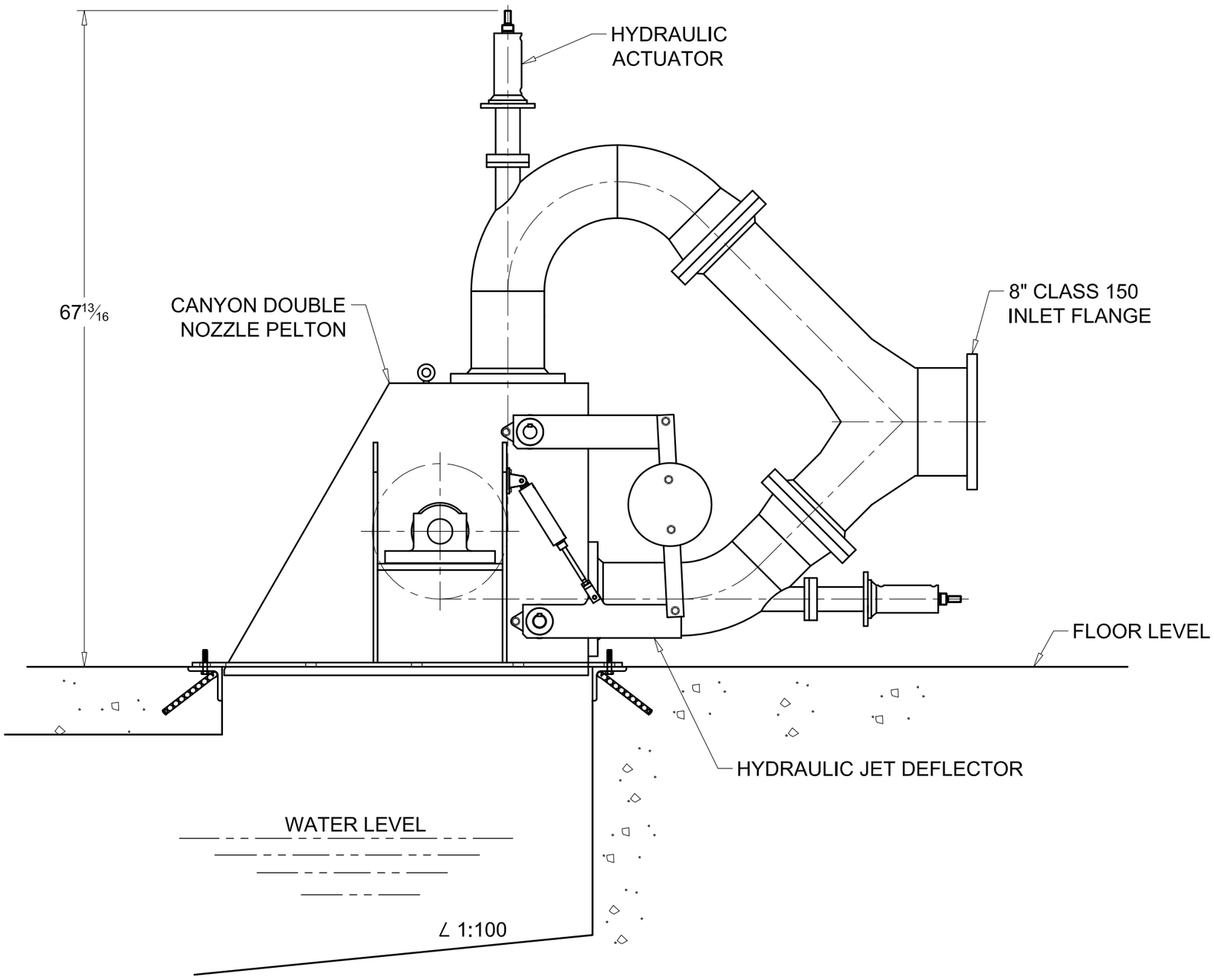
The control panel and switchgear will include four (4) sets of as-built drawings and manuals. The manuals will include manufacturers' published instructions, operation sequence, standard maintenance guideline, material list, suggested spare parts list, and terminal block interconnect diagrams.

The switchgear and controls will be completely shop tested before shipment. One site relay calibration and high potential testing is not included in this quotation. Bat Electric has offered as an option to have the multifunction protective relay bench tested. This includes supplying a certified test report by an independent third party.

This switchboard panel is not configured to be shop UL Labeled. If panel labeling is required, panel will have to be reconfigured into an MCC (Motor Control Center) line up, price of panel will be affected. The other option is to have panel ETL field inspected, customer should allow between $3,000.00-$5,000.00 for third party inspection.

Startup service is available at the rate of $1,000.00 per day, plus expenses. For a project of this size, you should allow approximately 3-6 days to verify installation, start up the units, parallel to utility and tune auto restart. Will need to allow additional field service days for OIU programmer if changes to OIU screens are required.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



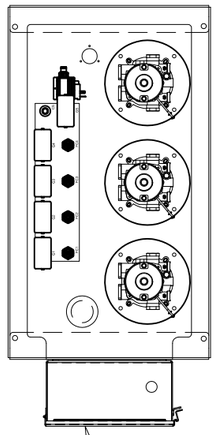
DIMENSIONS IN INCHES ARE APPROXIMATE
NOT INTENDED FOR CONSTRUCTION

PLEASANT GROVE REV1

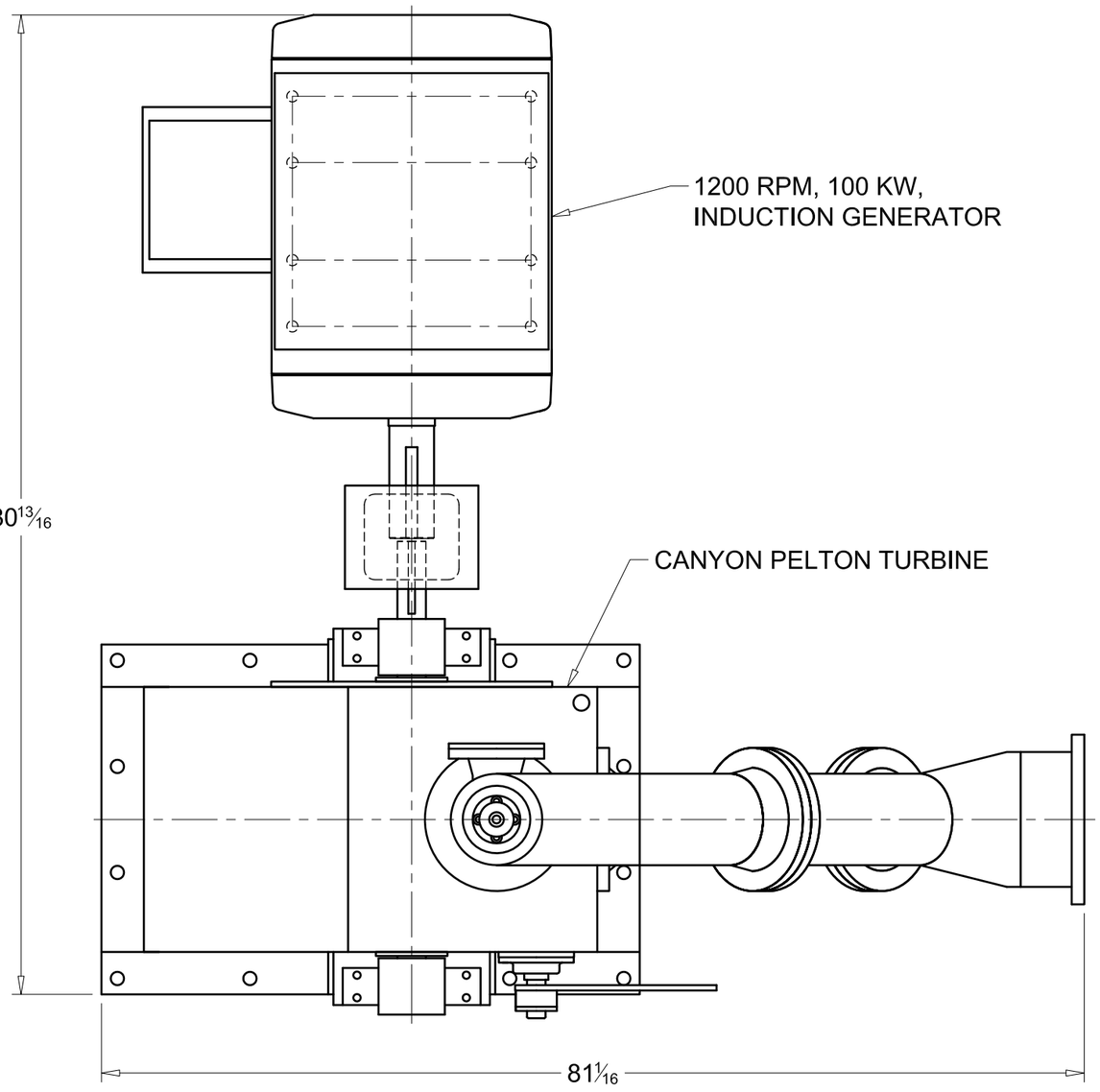
Canyon Hydro
5500 Blue Heron Lane
Deming, Washington 98244
(360) 592-5552
the water power division of Canyon Industries, Inc

FILE: ELEVATION VIEW | DATE: 2014-06-05

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



HYDRAULIC
POWER UNIT



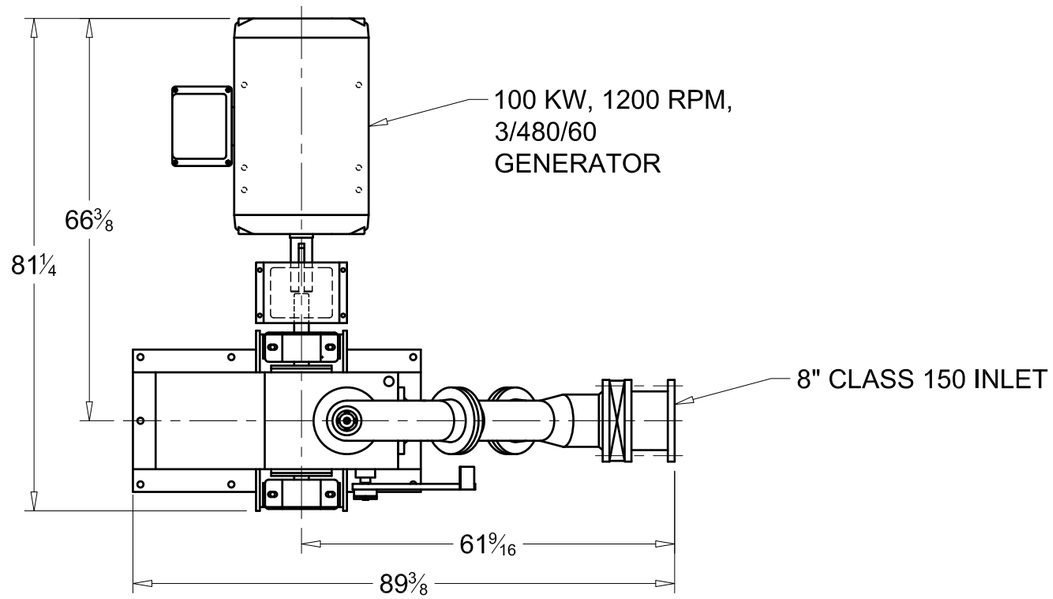
DIMENSIONS IN INCHES ARE APPROXIMATE
NOT INTENDED FOR CONSTRUCTION

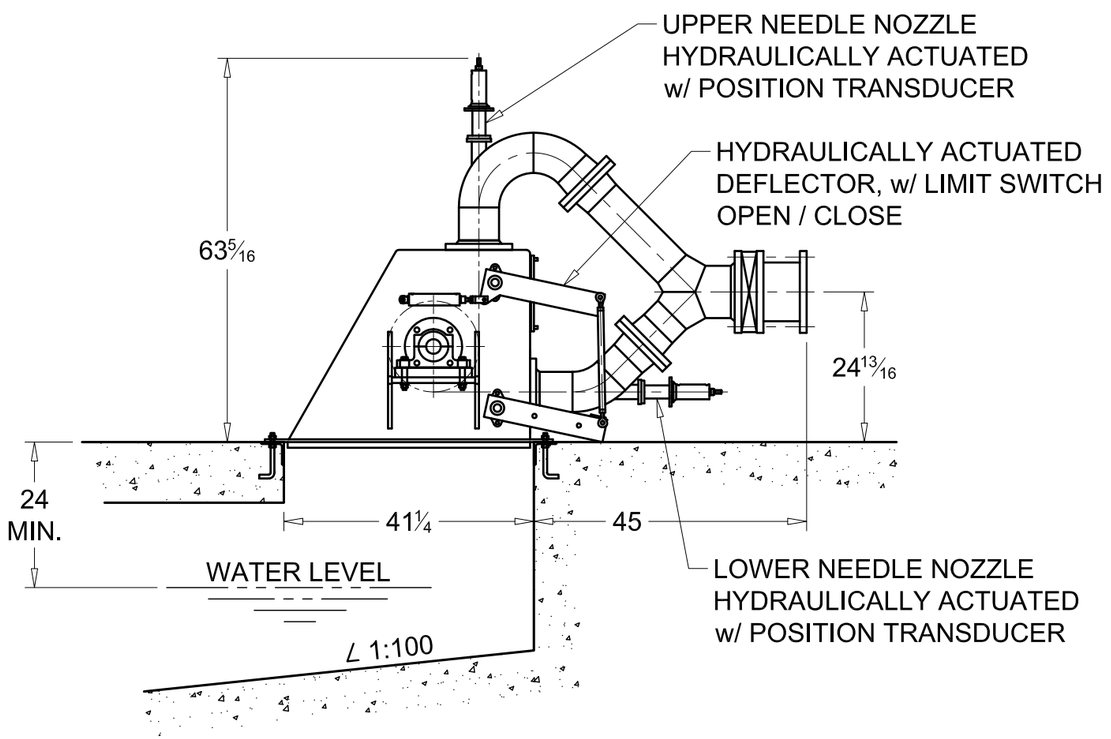
PLEASANT GROVE REV1

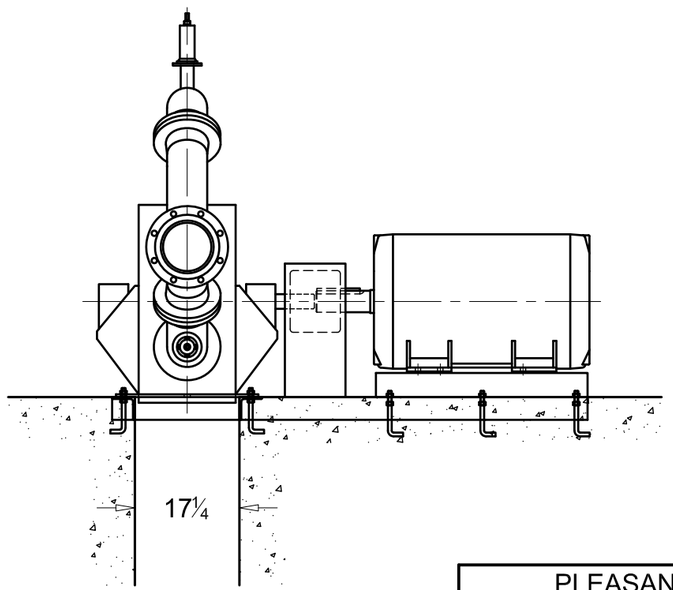
Canyon Hydro
the water power division of Canyon Industries, Inc
5500 Blue Heron Lane
Deming, Washington 98244
(360) 592-5552

FILE: PLAN VIEW | DATE: 2014-06-05

APPENDIX C Canyon Hydro Turbine Generator Drawing







DIMENSIONS IN INCHES ARE APPROXIMATE
NOT INTENDED FOR CONSTRUCTION

REV	DESCRIPTION	DATE	APPROVED

PLEASANT GROVE REV. 1

Canyon Hydro
5500 Blue Heron Lane
Deming, Washington 98244
(360) 592-5552
the water power division of Canyon Industries, Inc

FILE:

DATE: 2014-04-28

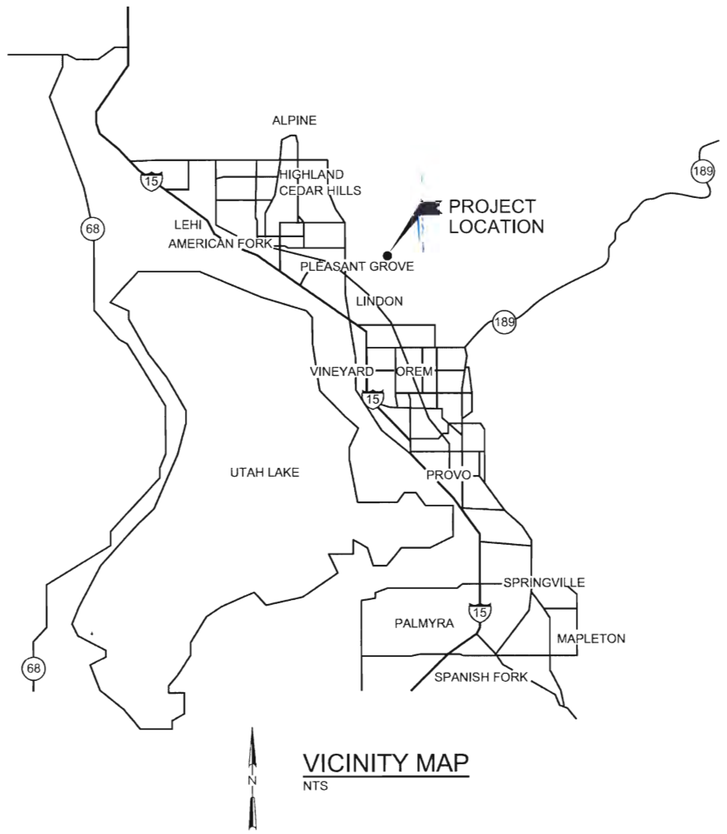
APPENDIX D Battle Creek Microhydro Power Generation Bid Drawings

PLEASANT GROVE

BATTLE CREEK MICRO-HYDRO POWER GENERATION PROJECT

VOLUME 2 - DRAWINGS

FOR CONSTRUCTION
FEBRUARY 2015



VICINITY MAP
NTS

LOCATION MAP
NTS

WATERWORKS ENGINEERS

DRAWING INDEX

SHEET NUMBER	DRAWING NUMBER	TITLE
	GENERAL	
1	00-G-001	COVER SHEET
2	00-G-002	SHEET INDEX
3	00-G-003	ABBREVIATIONS
4	00-G-004	STANDARD DESIGNATIONS
5	G-00-005	PROCESS FLOW DIAGRAM
	DEMOLITION	
6	00-D-100	DEMOLITION PLAN
	CIVIL	
7	00-C-001	LEGEND
8	00-C-100	SITE PLAN
9	10-C-101	TURBINE BUILDING GRADING AND PAVING PLAN
10	10-C-102	TURBINE BUILDING YARD PIPING PLAN
11	10-C-301	IRRIGATION BOX PLAN AND SECTIONS
12	NOT USED	
13	NOT USED	
14	NOT USED	
15	NOT USED	
	ARCHITECT/STRUCTURAL	
16	00-AS-001	GENERAL STRUCTURAL NOTES 1
17	00-AS-002	GENERAL STRUCTURAL NOTES 2
18	00-AS-003	GENERAL STRUCTURAL SPECIAL INSPECTION NOTES
19	00-AS-004	ARCHITECTURAL LEGEND AND MATERIAL SYMBOLS
20	10-AS-101	TURBINE BUILDING FOUNDATION AND SECOND FLOOR PLAN
21	10-AS-102	TURBINE BUILDING ROOF PLAN
22	10-AS-201	TURBINE BUILDING SECTION
23	10-AS-202	TURBINE BUILDING SECTION
24	10-AS-401	TURBINE BUILDING ELEVATIONS
25	10-AS-402	TURBINE BUILDING ELEVATIONS
26	NOT USED	
27	NOT USED	
28	NOT USED	
	MECHANICAL	
29	00-M-001	MECHANICAL LEGEND
30	10-M-101	TURBINE BUILDING PLAN
31	10-M-201	TURBINE BUILDING SECTIONS
32	10-M-202	TURBINE BUILDING SECTIONS
33	10-M-203	TURBINE BUILDING SECTIONS
34	NOT USED	
	ELECTRICAL	
35	00-E-001	SYMBOLS AND LEGEND 1
36	00-E-002	SYMBOLS AND LEGEND 2
37	00-E-003	SYMBOLS AND LEGEND 3
38	00-E-100	SITE PLAN
39	00-E-200	CONDUIT BLOCK DIAGRAM
40	10-E-101	POWER SINGLE LINE DIAGRAM 1
41	10-E-102	POWER SINGLE LINE DIAGRAM 2
42	10-E-103	PANEL SCHEDULES
43	10-E-110	TURBINE BUILDING POWER AND GROUNDING PLAN
44	10-E-111	TURBINE BUILDING LIGHTING PLAN
45	10-E-200	SCHEMATIC AND CONNECTION DIAGRAMS 1
46	10-E-201	SCHEMATIC AND CONNECTION DIAGRAMS 2
47	10-E-210	MASTER PLC PANEL SCHEMATIC AND CONNECTION DIAGRAM 1
48	10-E-211	MASTER PLC PANEL SCHEMATIC AND CONNECTION DIAGRAM 2
49	10-E-212	MASTER PLC PANEL SCHEMATIC AND CONNECTION DIAGRAM 3
50	10-E-213	MASTER PLC PANEL SCHEMATIC AND CONNECTION DIAGRAM 4
51	NOT USED	
	INSTRUMENTATION	
52	00-N-001	LEGEND AND ABBREVIATIONS 1
53	00-N-002	LEGEND AND ABBREVIATIONS 2
54	00-N-003	NETWORK BLOCK DIAGRAM
55	00-N-004	PROCESS AND INSTRUMENTATION DIAGRAM SHEET 1
56	00-N-005	PROCESS AND INSTRUMENTATION DIAGRAM SHEET 2
	STANDARD DETAILS	
57	00-SD-301	STANDARD DETAILS
58	00-SD-302	STANDARD DETAILS
59	00-SD-303	STANDARD DETAILS
60	00-SD-304	STANDARD DETAILS
61	00-SD-305	STANDARD DETAILS
62	00-SD-306	STANDARD DETAILS
63	00-SD-307	STANDARD DETAILS
64	00-SD-308	STANDARD DETAILS
65	00-SD-309	STANDARD DETAILS
66	00-SD-310	STANDARD DETAILS
67	00-SD-311	STANDARD DETAILS
68	00-SD-312	STANDARD DETAILS
69	00-SD-313	STANDARD DETAILS
70	00-SD-314	STANDARD DETAILS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS
2313 Pleasant Grove Blvd. Suite 100 • Pleasant Grove UT • 801-763-4100

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

GENERAL
SHEET INDEX

LICENSED PROFESSIONAL ENGINEER ★ STATE OF UTAH ★ 2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-G-002
SHEET 2 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00G002.dgn PLOT DATE: 2/12/2015 PLOT TIME: 9:24:01 AM SCALE: 1:0.166667

ABBREVIATIONS

@	AT
AB	ANCHOR BOLT, AGGREGATE BASE
AC	ASPHALTIC CONCRETE
ACI	AMERICAN CONCRETE INSTITUTE
ADD	ADDITIONAL
ADH AB	ADHESIVE ANCHOR BOLT
ADJ	ADJACENT, ADJUSTABLE
AFF	ABOVE FINISH FLOOR
AFG	ABOVE FINISH GRADE
AHP	AIR: HIGH PRESSURE
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AL, ALUM	ALUMINUM
ALP	AIR LOW PRESSURE
ALTN	ALTERNATE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
APVD	APPROVED
APWA	AMERICAN PUBLIC WORKS ASSOCIATION
ARCH, A	ARCHITECTURAL
ARV	AIR RELEASE VALVE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AUTO	AUTOMATIC
AUX	AUXILIARY
AV	AIR/VACUUM ASSEMBLY
AVE	AVENUE
AWG	AMERICAN WIRE GAGE
AWWA	AMERICAN WATER WORKS ASSOCIATION
B	BORING
BC	BEGIN CURVE, BOTTOM OF CURB
BF	BLIND FLANGE, BOTTOM FACE
BFD	BUTTERFLY VALVE DAMPER
BFV	BUTTERFLY VALVE
BLDG	BUILDING
BLM	BUREAU OF LAND MANAGEMENT
BM	BENCH MARK, BEAM
BO	BLOW OFF
BOO	BOTTOM OF OPENING
BOT	BOTTOM
BRG	BEARING
BAV	BALL VALVE
BVC	BEGINNING OF VERTICAL CURVE
BYP	BYPASS
C to C, CC	CENTER TO CENTER
C	CHANNEL (BEAM)
CAA/ARV	COMBINATION AIR ADMISSION/ AIR RELEASE VALVE
CARV	COMBINATION AIR RELEASE VALVE
CATH	CATHODIC PROTECTION
CATV	CABLE TELEVISION
CB	CATCH BASIN
CCP	CONCRETE CYLINDER PIPE
CCS	CENTRAL CONTROL SYSTEM
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CHEM	CHEMICAL
CI	CAST IRON
CIGC	CAST IRON GROOVED COUPLING
CIMJ	CAST IRON MECHANICAL JOINT
CIP	CAST IRON PIPE
CIRJ	CAST IRON RESTRAINED JOINT
CISP	CAST IRON SOIL PIPE
CJ	CONSTRUCTION JOINT, CONTRACTION JOINT
CLDIP	CEMENT-LINED DUCTILE IRON PIPE
CLG	CEILING
CLR	CLEAR, CLEARANCE
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CL	CENTERLINE
CML, CSP	CONCRETE MORTAR LINED AND COATED STEEL PIPE
CMLSP	CEMENT MORTAR LINED STEEL PIPE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COL	COLUMN
COM	COMMUNICATION
COMB	COMBINED
CONC	CONCRETE
CONN	CONNECTION
CONT	CONTINUOUS, CONTINUATION
COORD	COORDINATE
CU	COPPER
CPLG	COUPLING
CTD	CENTERED
CTR	CENTER
CU FT	CUBIC FOOT
CU IN	CUBIC INCH
CU YD	CUBIC YARD
CULV	CULVERT
CV	CHECK VALVE
°C	CELSIUS
d	PENNY
DBA	DEFORMED BAR ANCHOR
DR	DRAIN
DBL	DOUBLE
DEC	DECANT
DET	DETAIL
DF	DOUGLAS FIR/LARCH
DI	DROP INLET, DUCTILE IRON
DIA	DIAMETER
DIAG	DIAGONAL
DIL	DILUTE
DIM	DIMENSION
DIMJ	DUCTILE IRON MECHANICAL JOINT
DIP	DUCTILE IRON PIPE
DIPPL	DUCTILE IRON PIPE, POLYETHYLENE LINED
DIR	DIRECTION
DIST	DISTANCE
DN	DOWN
do	DITTO
DWG	DRAWING
E	EAST, ELECTRIC, ELECTRICAL
EA	EACH
EC	END CURVE
ECC	ECCENTRIC
EF	EACH FACE, EXHAUST FAN
EFL	EFFLUENT
EJ	EXPANSION JOINT
EL	ELEVATION
ELB, ELL	ELBOW
ELC	ELECTRICAL LOAD CENTER
ELEC	ELECTRIC, ELECTRICAL
ENGR	ENGINEER
EO	EMERGENCY OVERFLOW
EP	EDGE OF PAVEMENT
EQL SP	EQUALLY SPACED
EQPT	EQUIPMENT
ESC	EROSION SEDIMENT CONTROL
ERW	EFFLUENT REUSE WATER
ESA	ENVIRONMENTALLY SENSITIVE AREA
EVC	END OF VERTICAL CURVE
EW	EACH WAY
EWEF	EACH WAY, EACH FACE
EXC	EXCAVATE
EXP	EXPOSED, EXPANSION
EXP JT	EXPANSION JOINT
EXST	EXISTING
FB	FLAT BAR
FC	FLEXIBLE COUPLING
FCA	FLANGED COUPLING ADAPTER
FCO	FLOOR CLEAN OUT
FD	FLOOR DRAIN
FDA	FLOOR DRAIN W/INTEGRAL TRAP
FDN	FOUNDATION
FES	FLARED END SECTION
FEXT	FIRE EXTINGUISHER
FF	FINISH FLOOR
FG	FINISH GRADE
FHY	FIRE HYDRANT
FIG	FIGURE
FL	FLOOR, FLOW LINE
FLG	FLANGE
FLH	FLAT HEAD
FLL	FLOW LINE
FLTR	FILTER
FNSH	FINISH
FOC	FACE OF CONCRETE
FP	FENCE POST
FRP	FIBERGLASS REINFORCED PLASTIC
FT	FOOT OR FEET
FTG	FOOTING
FWD	FORWARD
°F	DEGREE FAHRENHEIT
G	GAS
GA	GAGE
GAL	GALLON
GALV	GALVANIZED
GB	GRADE BREAK
GC	GROOVED COUPLING
GCO	GRADE CLEAN OUT
GCF	GROOVED COUPLING FITTING
GE	GROOVED END
GL	GLASS
GP	GATE POST
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GRTG	GRATING
GSP	GALVANIZED STEEL PIPE
GV	GATE VALVE
GVL	GRAVEL
GW	GROUND WATER
HD	HUB DRAIN
HDPE	HIGH DENSITY POLYETHLENE PIPE
HDR	HEADER
HDW	HARDWARE
HGT	HEIGHT
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HP	HORSEPOWER
HPT	HIGH POINT
HR	HANDRAIL
HSS	HOLLOW STRUCTURE STEEL
HV	HOSE VALVE
HWY	HIGHWAY
HYD	HYDRANT
I&C	INSTRUMENTATION & CONTROL
ID	INSIDE DIAMETER
IF	INSIDE FACE
IN	INCH
INFL	INFLUENT
INSTM	INSTRUMENTATION
INSUL	INSULATE, INSULATION
INV	INVERT
INVERT EL	INVERT ELEVATION
IP	IRON PIPE
IR	IRON ROD
JT	JOINT
KIP	THOUSAND POUNDS
KW	KILOWATT
L	LEFT, ANGLE, LENGTH
LAB	LABORATORY
LAT'L	LATERAL
LB	POUNDS
LB/CU FT	POUNDS PER CUBIC FOOT
LF	LINEAR FEET
LG	LONG
LONG	LONGITUDINAL
LP	LOW POINT
LR	LONG RADIUS
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MCJ	MASONRY CONTROL JOINT
MECH	MECHANICAL
MFR	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIN	MINIMUM, MINUTE
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MPH	MILES PER HOUR
MSNRY	MASONRY
MSP	MILL STEEL PIPE, MANUAL OF STANDARD PRACTICE
MTL	MATERIAL
MWS	MAXIMUM WATER SURFACE
N	NORTH
NC	NORMALLY CLOSED
NE	NORTHEAST
NIC	NOT IN CONTRACT
NO	NUMBER, NUMBERING
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
NW	NORTHWEST
OC	ON CENTER
OD	OUTSIDE DIAMETER, OVERFLOW DRAIN
OF	OUTSIDE FACE, OVERFLOW
OFR	OVERFLOW RETURN
OG	ORIGINAL GROUND
OHE	OVERHEAD ELECTRIC
OMRF	ORDINARY MOMENT RESISTING FRAME
O TO O	OUT TO OUT
OPNG	OPENING
OPP	OPPOSITE
OZ	OUNCE
PC	POINT OF CURVE
PE	PLAIN END, POLYETHYLENE AND PERMANENT EASEMENT
PENT	PENETRATION
PI	POINT OF INTERSECTION
PJF	PREMOLDED JOINT FILLER
PL	PLATE, PROPERTY LINE
PLYWD	PLYWOOD
POB	POINT OF BEGINNING
POC	POINT OF CONNECTION
POE	POINT OF ENDING
PP, P&P	PLAN AND PROFILE, POWER POLE
PPM	PARTS PER MILLION
PRC	POINT OF REVERSE CURVE
PRCST	PRECAST
PREFAB	PREFABRICATED
PREFAB	PREFABRICATED
PRESS	PRESSURE
PRC	POINT OF REVERSE CURVE
PRI	PRIMARY
PROP	PROPERTY
PRV	PRESSURE RELEASE VALVE
PSF	POUNDS PER SQUARE FOOT
PS	PUMP STATION
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH, GAUGE
PT	POINT OF TANGENCY
P.U.E.	PUBLIC UTILITY EASEMENT
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE PLASTIC POINT OF VERTICAL CURVE
PVCGS	POLYVINYL CHLORIDE PLASTIC- GRAVITY SEWER TYPE
PVCW	POLYVINYL CHLORIDE PLASTIC- WATER DISTRIBUTION SERVICE TYPE
PVMT	PAVEMENT
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY, PRIVATE
PW	POTABLE WATER
R, RAD	RADIUS
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD, ROOF DRAIN
RDCR	REDUCER
REF	REFER OR REFERENCE
REINF	REINFORCED, REINFORCING, REINFORCE
REQD	REQUIRED
RJ	RESTRAINED JOINT
RLS	RUBBER LINED STEEL
RM	ROOM
RMJ	RESTRAINED MECHANICAL JOINT
RO	ROUGH OPENING
RP	RADIUS POINT
R/R	REMOVE AND REPLACE
RST	REINFORCING STEEL
RT	RIGHT
RTN	RETURN
RV	ROOF VENT
RW	RAW WATER
R/W	RIGHT-OF-WAY
S	I-BEAM, SOUTH, SLOPE
S =	SLOPE EQUALS
SA	SAMPLE
SAT	SUSPENDED ACOUSTIC TILE
SC	SCUM
SCFH	STANDARD CUBIC FEET PER HOUR
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SD	STORM DRAIN
SE	SOUTHEAST
SEC	SECONDARY
SECT	SECTION
SH	SHEET
SIM	SIMILAR
SLD	SLUDGE
SLP	SLOPE
SOLN	SOLUTION
SP	SPACE OR SPACES
SPD	SUMP PUMP DRAIN
SPEC	SPECIFICATIONS
SPLY	SUPPLY
SQ	SQUARE
SQ FT	SQUARE FOOT
SQ IN	SQUARE INCH
SS	SANITARY SEWER
SSH	SAFETY SHOWER
SST	STAINLESS STEEL
ST	STRAIGHT, STREET
STA	STATION
STD	STANDARD
STIF	STIFFENER
STL	STEEL, STEEL PIPE
STLS	STEEL PIPE (SPECIAL)
STR	STRAIGHT
STRL	STRUCTURAL
STRUCT	STRUCTURE
SUBFL	SUBFLOOR
SUSP	SUSPEND
SW	SOUTHWEST
SYMM	SYMMETRICAL
T	TANGENT, TELEPHONE LINE, TOP
TBG	TUBING
T&B	TOP AND BOTTOM
TC	TOP OF CURB, TOP OF CONCRETE
TCE	TEMPORARY CONSTRUCTION EASEMENT
TDH	TOTAL DYNAMIC HEAD
TECH	TECHNICAL
TEL	TELEPHONE
TEMP	TEMPORARY, TEMPERATURE
TF	TOP FACE
T&G	TONGUE AND GROOVE
THD	THREAD
THK	THICK
TP	TURNING POINT, TEST PIT
TRANS	TRANSITION
TRANSV	TRANSVERSE
TS	TUBE STEEL
TST	TOP OF STEEL
TT	THRUST TIE
TW	TOP OF WALL
TWS	TRACER WIRE STATION
TYP	TYPICAL
t, T	THICKNESS
UBC	UNIFORM BUILDING CODE
UD	UNDERDRAIN
UG	UNDERGROUND
UH	UNIT HEATER
UNK	UNKNOWN
UNO	UNLESS NOTED OTHERWISE
V	VENT, VOLT, VALVE
VAC	VACUUM
VAR	VENT ACID RESISTANT
VC	VERTICAL CURVE
VERT	VERTICAL
VPI	VERTICAL POINT OF INTERSECTION
VPS	VENEER PLASTER SYSTEM
VTR	VENT THRU ROOF
W/	WITH
W	WIDE FLANGE (BEAM), WEST, WATER
WC	WATER CLOSET
WD	WOOD
WH	WATER HEATER
WM	WATER METER
WR	WATER RESISTANT
WS	WATER SURFACE, WATER STOP
W SH ST	WEATHERING SHEET STEEL
WSP	WELDED STEEL PIPE
WT	WATER TIGHT
WTR	WATER
WW	WASHWATER
WWF	WELDED WIRE FABRIC
YD	YARD

NOTES

1. FOR ELECTRICAL AND INSTRUMENTATION ABBREVIATIONS, SEE ELECTRICAL AND INSTRUMENTATION DRAWINGS.
2. CONTACT THE ENGINEER FOR ABBREVIATIONS NOT LISTED.
3. THIS IS A STANDARD LEGEND SHEET, THEREFORE, SOME SYMBOLS OR ABBREVIATIONS MAY APPEAR ON THIS SHEET AND MAY NOT BE UTILIZED ON THIS PROJECT.

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

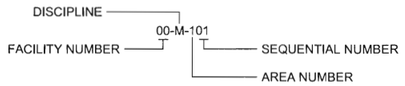
GENERAL
ABBREVIATIONS

LICENSED PROFESSIONAL ENGINEER CORY L. CHRISTIANSEN NO. 5102978 2/4/15 STATE OF UTAH

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-G-003
SHEET 3 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00G003.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:31:22 AM SCALE: 1:0.166667

DRAWING NUMBER



DISCIPLINE

LETTER	DISCIPLINE
G	GENERAL
C	SITE CIVIL
Y	YARD PIPING
D	DEMOLITION
A	ARCHITECTURAL
S	STRUCTURAL
M	MECHANICAL
H	HEATING, VENTILATION AND COOLING
P	PLUMBING
E	ELECTRICAL
I	INSTRUMENTATION

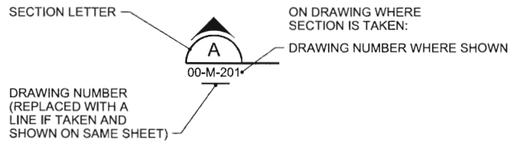
DRAWING NUMBERING

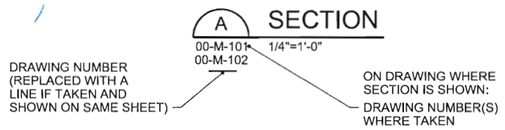
AREA NUMBER	AREA DESCRIPTION
000	GENERAL / OVERALL
100	PLANS
200	SECTIONS
300	DETAILS
400	ELEVATIONS
500	SCHEDULES

FACILITY NUMBERING

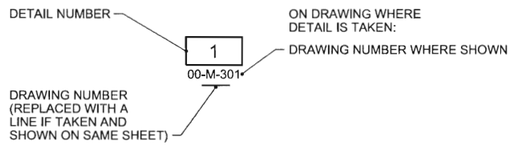
FACILITY NUMBER	FACILITY DESCRIPTION
00	GENERAL / OVERALL
10	TURBINE BUILDING
20	RESTROOM
30	SEWER EXTENSION

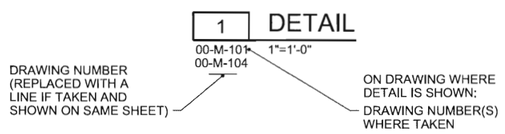
SECTION



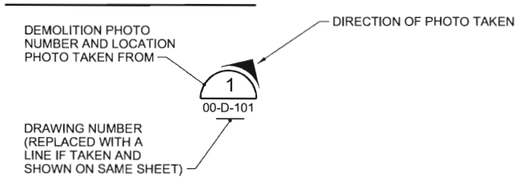


DETAIL





DEMOLITION PHOTO

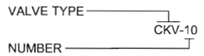


STANDARD DETAIL

NOTES:

1. STANDARD DETAIL CALLOUTS ARE SHOWN TO INDICATE DETAIL REQUIRED AT SPECIFIC LOCATIONS. DETAILS ARE NOT CALLED OUT AT ALL LOCATIONS. WHERE A STANDARD DETAIL CALLOUT IS NOT SHOWN, THE CONTRACTOR SHALL USE THE STANDARD DETAIL MOST APPLICABLE AND CONSISTENT WITH OTHER WORK UNDER THIS CONTRACT.

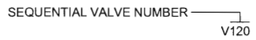
STANDARD VALVE AND OPERATOR



NOTES:

1. SEE SPECIFICATION SECTION 15200.

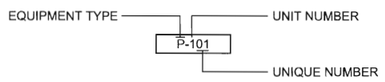
UNIQUE VALVE AND OPERATOR



NOTES:

1. SEE SPECIFICATION SECTION 15200 FOR VALVE SCHEDULE.

EQUIPMENT DESIGNATION



LINE TYPE APPEARANCE

———	BLACK	NEW 'ON' DISCIPLINE
·····	LIGHT OR MEDIUM GRAY OR SCREENED	EXISTING 'ON' OR 'OFF' DISCIPLINE
———	DARK GRAY	NEW 'OFF' DISCIPLINE

GENERAL SYMBOLOGY

▨	STRUCTURE OR EQUIPMENT TO BE SALVAGED OR DEMOLISHED

LICENSED PROFESSIONAL ENGINEER — GARY CHRISTIANSEN NO. 5102948 — STATE OF UTAH — 2/4/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC | DRAWN VP | CHECKED CC | APPROVED CC

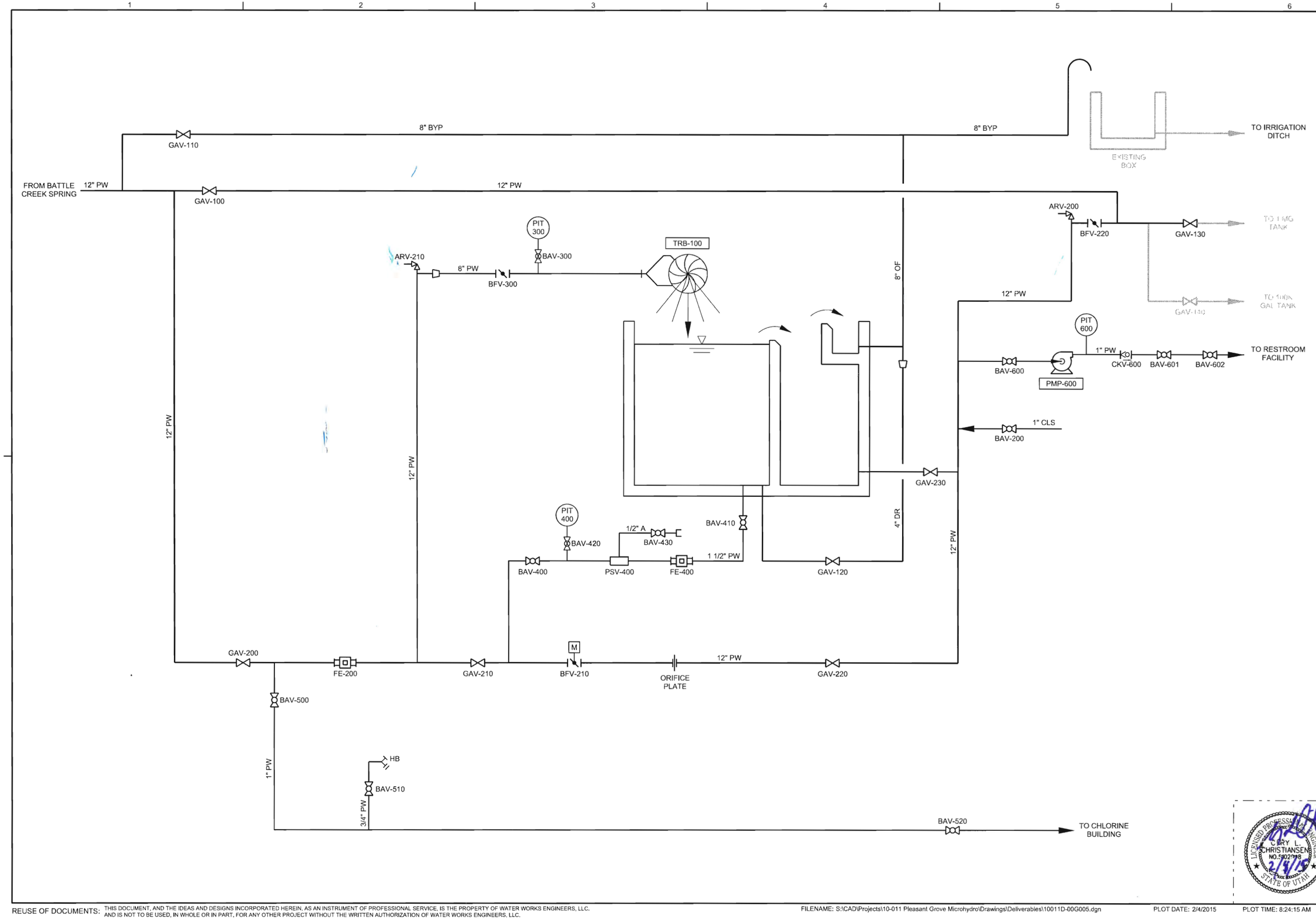
WATERWORKS ENGINEERS
333 S. Pleasant Grove Blvd. Suite 102 • Pleasant Grove, UT • 801.785.4102

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

GENERAL
STANDARD DESIGNATIONS

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-G-004
SHEET 4 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00G004.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:25:45 AM SCALE: 1:0.166667



VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC | DRAWN AA | CHECKED CC | APPROVED CC

WATERWORKS ENGINEERS

225 S. Pleasant Grove Blvd. Suite 103 • Pleasant Grove, UT • 801-785-4105

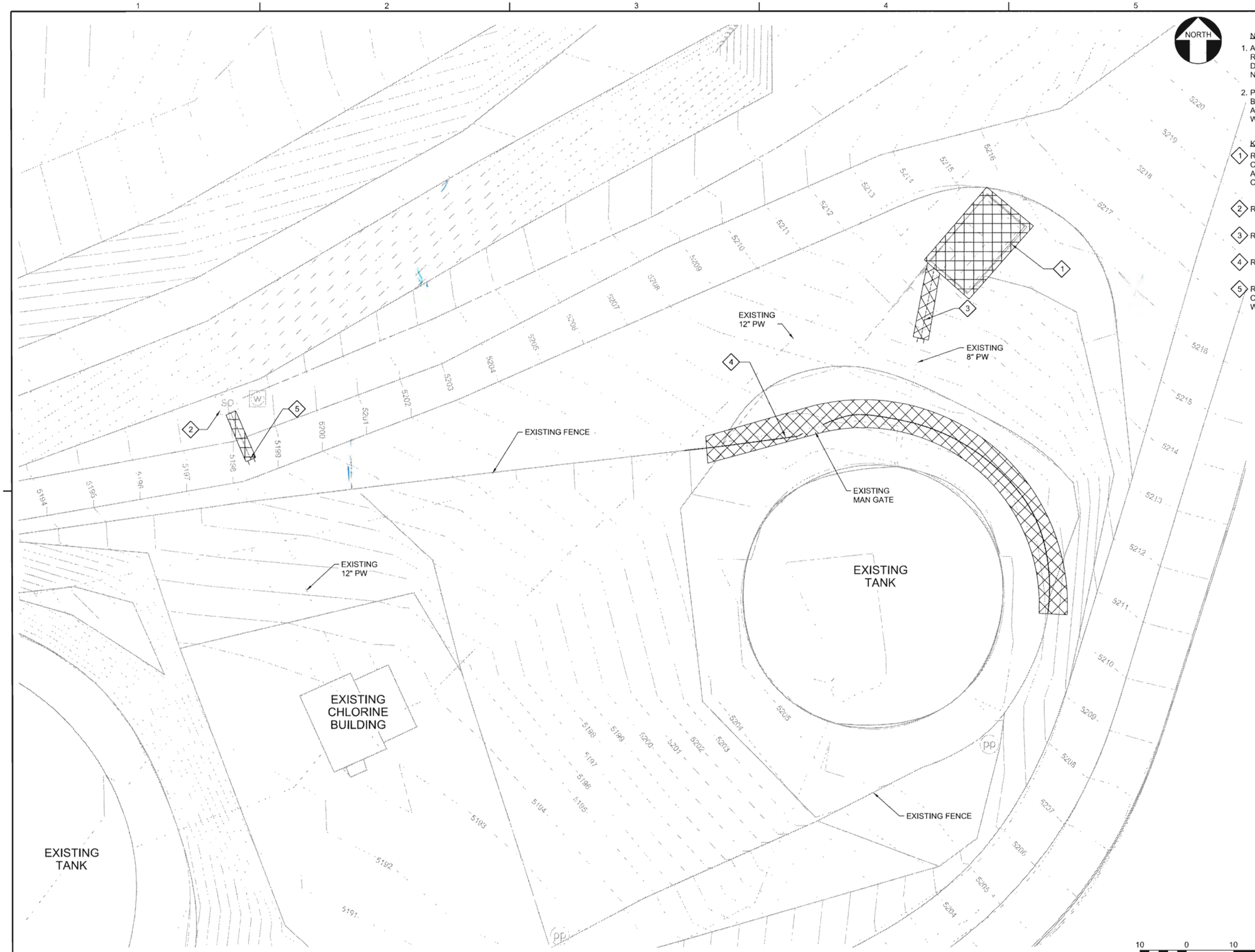
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

GENERAL

PROCESS FLOW DIAGRAM

DATE	FEB 2015
PROJECT NUMBER	10-011
DRAWING NUMBER	00-G-005
SHEET	5 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00G005.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:24:15 AM SCALE: 1:0.166667



NOTES:

1. ALL CONCRETE AND DEBRIS ARE TO BE REMOVED FROM SITE AND PROPERLY DISPOSED OF BY CONTRACTOR UNLESS NOTED OTHERWISE.
2. PROTECT ALL EXISTING TANKS, PIPES VALVES, BUILDINGS, FENCES, UTILITY AND APPURTENANCES DURING PERFORMANCE OF WORK.

KEY NOTES:

1. REMOVE EXISTING CONCRETE FOUNDATION. CONCRETE WALLS AND DECKS ARE APPROXIMATELY 12" THICK. REMOVE CONCRETE TO ELEVATION 5203.
2. REMOVE EXISTING CHECKER PLATE LID.
3. REMOVE AND CAP EXISTING 8" PW.
4. REMOVE EXISTING FENCE AND MAN GATE.
5. REMOVE AND CAP EXISTING 12" PW. PLUG CONNECTION TO IRRIGATION BOX AND FINISH WITH NON-SHRINK GROUT.

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC | DRAWN VP | CHECKED CC | APPROVED CC

WATERWORKS ENGINEERS
220 S. Western Grove Blvd, Suite 105 • Pleasant Grove, UT • 801-785-4105

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DEMOLITION
DEMOLITION PLAN

LICENSED PROFESSIONAL ENGINEER
CORY L. CHRISTIANSEN
NO. 5102648
STATE OF UTAH
2/4/15

DATE	FEB 2015
PROJECT NUMBER	10-011
DRAWING NUMBER	00-D-100
SHEET	6 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00D100.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:30:41 AM SCALE: 1:20

CIVIL LEGEND

EL 158.5 — EL 158.5	SPOT ELEVATION
155	CONTOUR LINE
4:1	CUT SLOPE (HORIZ:VERT)
4:1	EMBANKMENT - FILL SLOPE (HORIZ:VERT)
	DRAINAGEWAY OR DITCH
	DIRECTION OF FLOW
	CENTER LINE, BUILDING, ROAD
	PROPERTY LINE
	RIGHT OF WAY, EASEMENT OR SETBACK
	STAGING OR WORK AREA LIMITS
N 1000.00 E 1000.00	STRUCTURE, BUILDING OR FACILITYLOCATION POINT COORDINATES
OR	STRUCTURE, BUILDING OR FACILITY
	RETAINING WALL
	CONCRETE CURB
	ARCHITECTURAL FENCE
	GUARD RAIL/BARRICADE
OX	CHAIN LINK FENCE WITH 3 STRAND BARBED WIRE TOPPING
	ARCHITECTURAL FENCE
	CHAIN LINK FENCE
X X	BARBED WIRE
X X	SINGLE SWING GATE
	DOUBLE SWING GATE
	SLIDING GATE
	CULVERT
	WALL
	BRUSH/TREE LINE
	TREE
	DEMOLITION
	ABANDON IN PLACE
	AUTOMATIC AIR RELEASE VALVE
	MANUAL AIR RELEASE VALVE
	WATER SURFACE
GB	GRADE BREAK

CIVIL LEGEND (CONTINUED)

	BEDROCK
	ROCKS OR RIPRAP
	SAND
	AGGREGATE BASE
	NATURAL SOIL
	COMPACTED SOIL
	CONCRETE
	GROUT
	CONTROLLED LOW STRENGTH MATERIAL (CLSM)
	PAVEMENT
	GRATING

MAPPING LEGEND

	AIR RELEASE VALVE
	ASPHALT PAVEMENT
	BOLLARD
CT	CABLE TELEVISION
	CATCH BASIN
EM	ELECTRIC METER
EP	ELECTRIC PULLBOX
ER	ELECTRIC RISER
ES	ELECTRIC SWITCHBOX
ET	ELECTRIC TRANSFORMER
	FIRE HYDRANT
	GAS VALVE
	GRAY PVC CONDUIT PIPES
	GUARD POST
	GUY WIRE
IB	IRRIGATION BOX
I	IRRIGATION VALVE
	LIGHT POLE WITH NO ARM
	LIGHT POLE WITH ARM ATTACHED TO UTILITY POLE
	REBAR
R/W	RIGHT-OF-WAY
	SEWER CLEANOUT
S	SEWER MANHOLE
	SOLAR PANEL
	STORM DRAIN MANHOLE
	STREET SIGN
	SURVEY CONTROL POINT OR POINT OF INTERSECTION
	TELEPHONE BOX
	TRAFFIC CONTROL BOX
	TRAFFIC SIGNAL BOX
	TRAFFIC SIGNAL WITH ARM
	TRAFFIC SIGNAL WITH NO ARM
	TRAFFIC WALK SWITCH
	UTILITY POLE
	WATER VALVE
W	WATER MANHOLE
WM	WATER METER
	WELL

SITE UTILITIES INDENTIFICATION

Aband	ABANDON
TV	CABLE TELEVISON - OVERHEAD
T-BUR	CABLE TELEVISION - BURIED
UGE UGE	BURIED POWER
OHW OHW	OVERHEAD POWER
F/O	FIBER OPTIC
GAS GAS	NATURAL GAS
GS	NATURAL GAS SERVICE
O	PETROLEUM
SD	STORM DRAIN
SS SS	SANITARY SEWER
T-OVH	TELEPHONE - OVERHEAD
T-BUR	TELEPHONE - BURIED
W	WATER

NOTES:

1. EXISTING PIPING, EQUIPMENT, AND TOPOGRAPHY IS SHOWN SCREENEDAND/OR LIGHT-LINED. NEW PIPING, EQUIPMENT, STRUCTURE, AND FINISHED GRADE IS SHOWN HEAVY-LINED.
2. THIS IS A STANDARD LEGEND SHEET. SOME SYMBOLS MAY APPEAR ON THIS SHEET AND NOT BE USED ON THE PLANS.

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS
235 Pleasant Grove Blvd, Suite 101 • Pleasant Grove, UT • (801) 763-5105

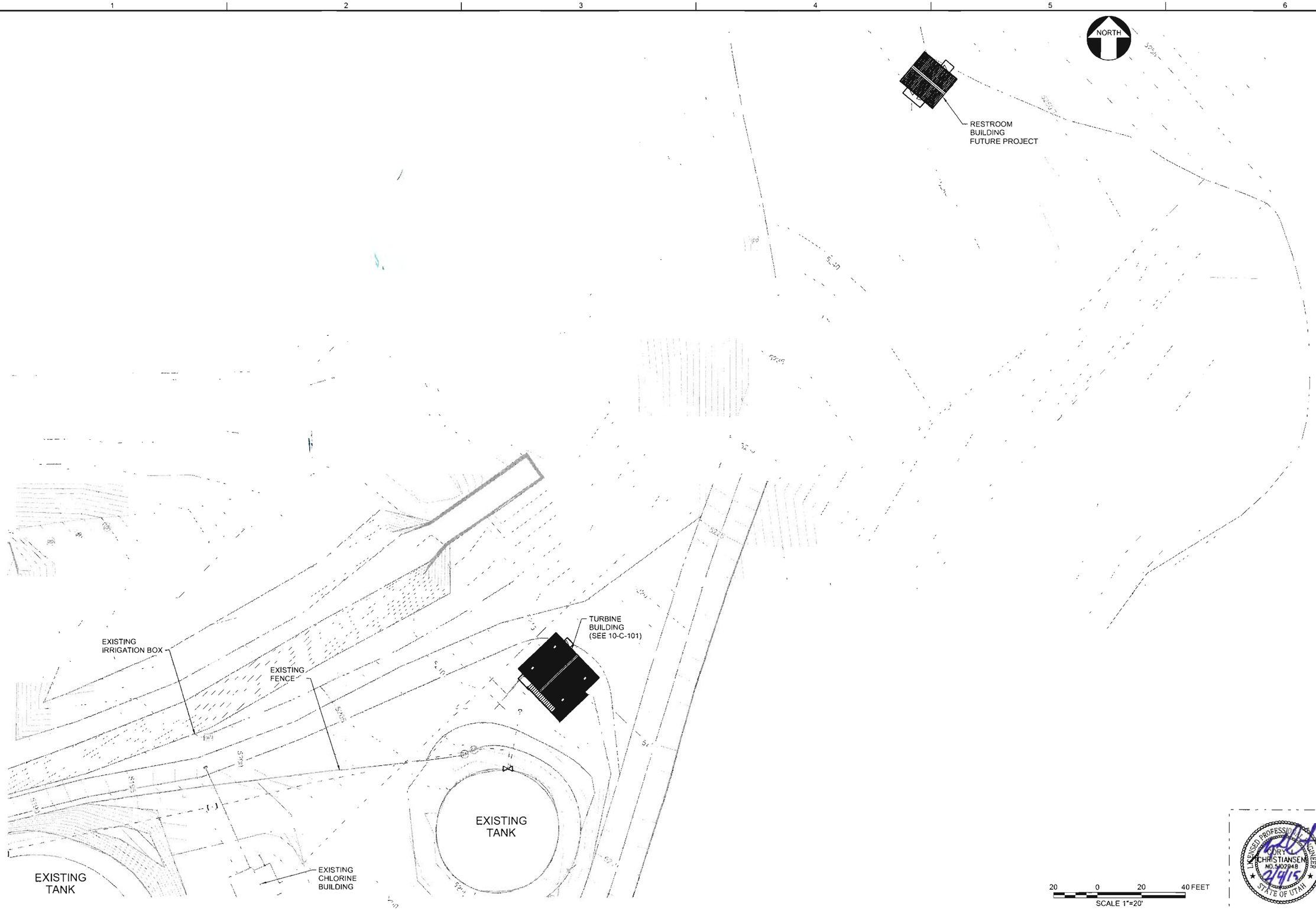
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

CIVIL
LEGEND

LICENSED PROFESSIONAL ENGINEER — MARK C. TIANSEN — NO. 5102948 — STATE OF UTAH — 2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-C-001
SHEET 7 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00C001.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:29:17 AM SCALE: 1:0.166667



VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN DT
DRAWN VP
CHECKED DT
APPROVED CC

WATERWORKS ENGINEERS
205 S. Pleasant Grove Blvd Suite 103 • Pleasant Grove, UT • 801-785-1705

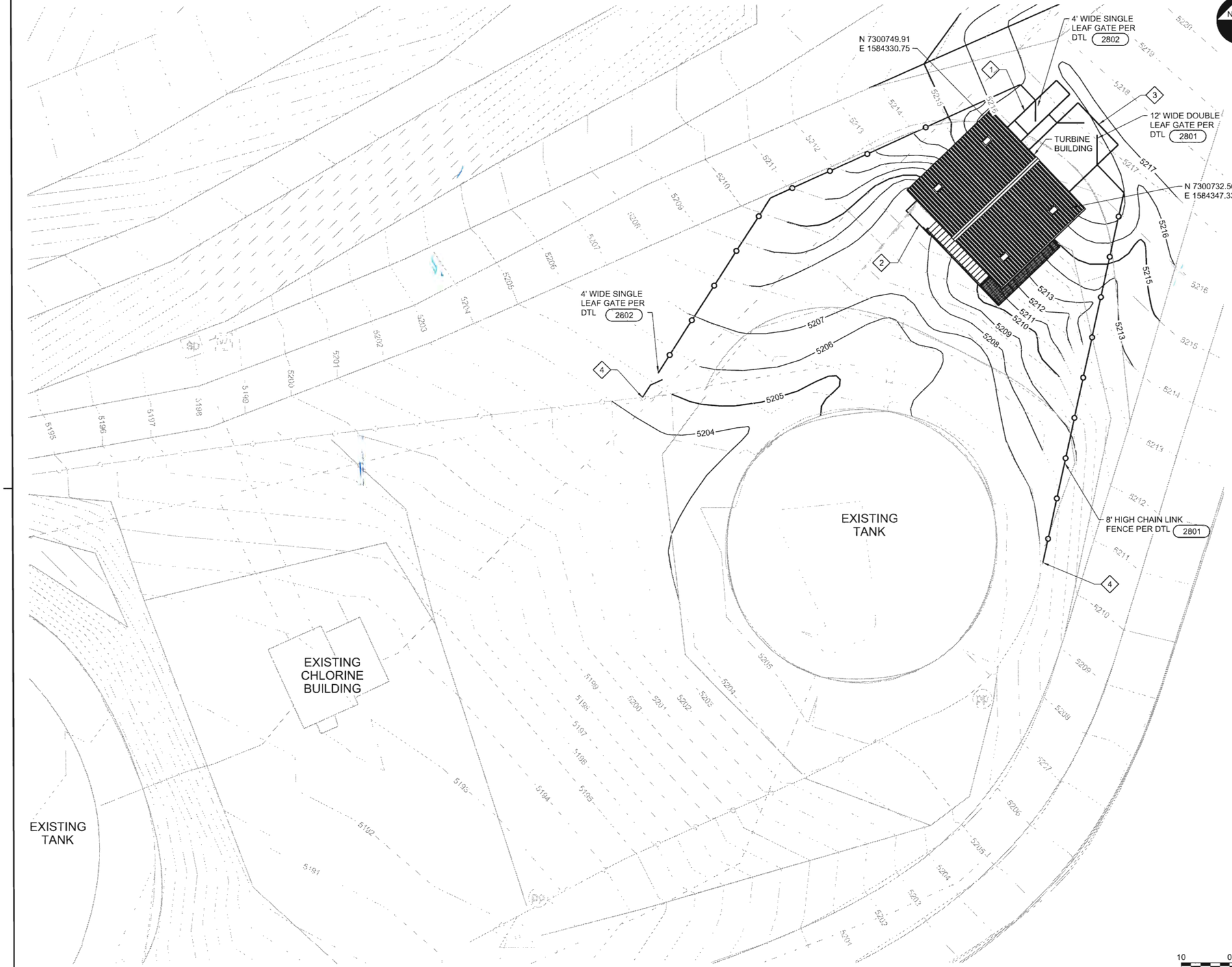
PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

CIVIL
SITE PLAN

LICENSED PROFESSIONAL ENGINEER
CORY
CHRISTIANSEN
NO. 5107848
2/4/15
STATE OF UTAH

DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
00-C-100
SHEET 8 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00C100.dgn PLOT DATE 2/4/2015 PLOT TIME 8:28:35 AM SCALE 1.40



KEY NOTES:

1. PROVIDE 4'x10' CONCRETE PAD PER DTL 3201
2. PROVIDE 5'x8' CONCRETE PAD PER DTL 3201
3. RPOVIDE 12'x10' CONCRETE PAD PER DTL 3201
4. TIE NEW FENCE TO EXISTING FENCE.

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd., Suite 103 • Pleasant Grove, UT • 801.785.1428

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

CIVIL
TURBINE BUILDING GRADING AND PAVING PLAN

LICENSED PROFESSIONAL ENGINEER CORY L. CHRISTIANSEN NO. 5102148 STATE OF UTAH
2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-C-101
SHEET 9 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10C101.dgn PLOT DATE: 2/4/2015 PLOT TIME: 10:17:54 AM SCALE: 1:20

NOTES:

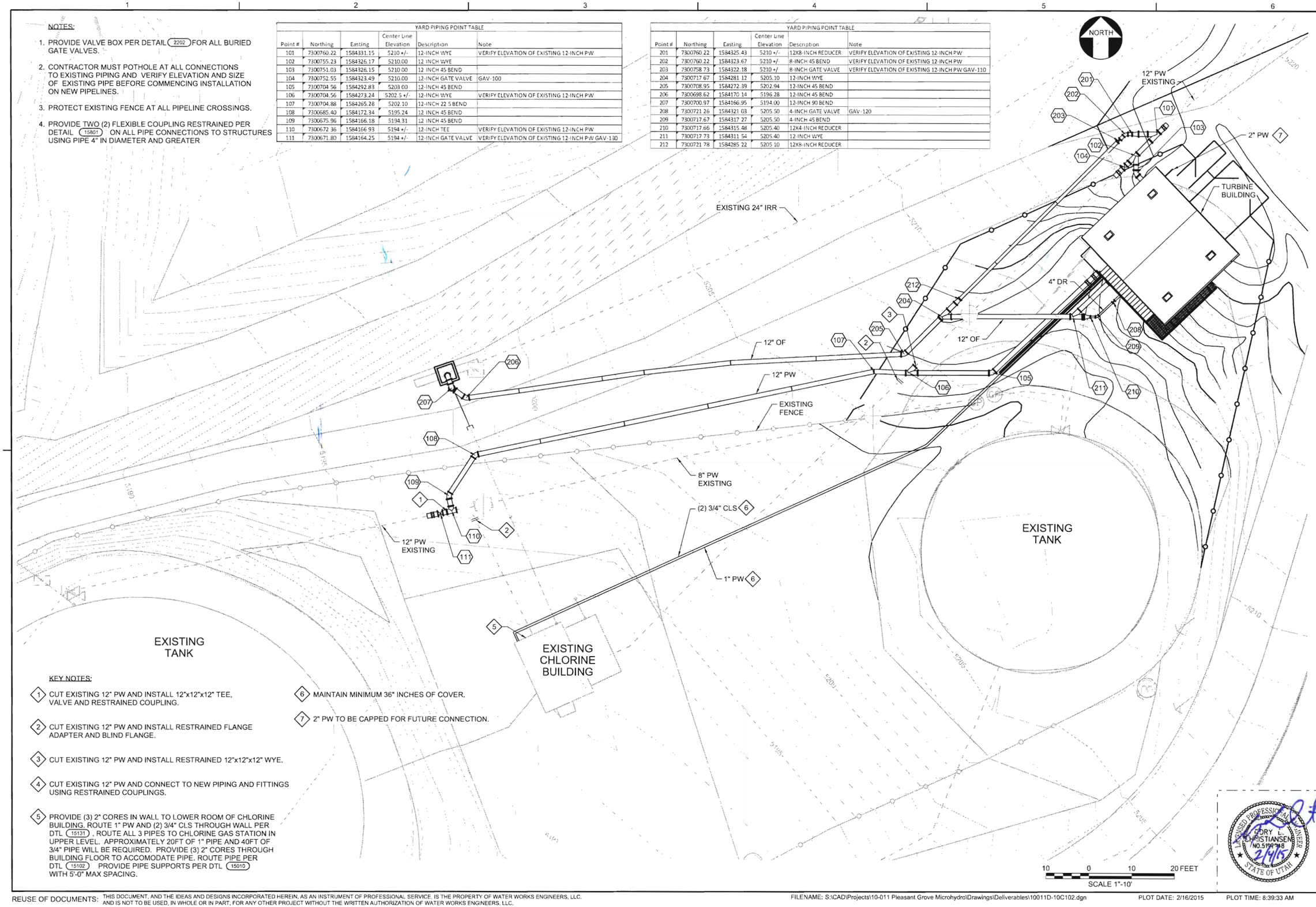
1. PROVIDE VALVE BOX PER DETAIL (2202) FOR ALL BURIED GATE VALVES.
2. CONTRACTOR MUST POTHOLE AT ALL CONNECTIONS TO EXISTING PIPING AND VERIFY ELEVATION AND SIZE OF EXISTING PIPE BEFORE COMMENCING INSTALLATION ON NEW PIPELINES.
3. PROTECT EXISTING FENCE AT ALL PIPELINE CROSSINGS.
4. PROVIDE TWO (2) FLEXIBLE COUPLING RESTRAINED PER DETAIL (15801) ON ALL PIPE CONNECTIONS TO STRUCTURES USING PIPE 4" IN DIAMETER AND GREATER

YARD PIPING POINT TABLE

Point #	Northing	Easting	Center Line Elevation	Description	Note
101	7300760.22	1584331.15	5210 +/-	12-INCH WYE	VERIFY ELEVATION OF EXISTING 12-INCH PW
102	7300755.23	1584326.17	5210.00	12 INCH WYE	
103	7300751.03	1584326.15	5210.00	12 INCH 45 BEND	
104	7300752.55	1584323.49	5210.00	12-INCH GATE VALVE	GAV-100
105	7300704.56	1584292.83	5203.00	12-INCH 45 BEND	
106	7300704.56	1584273.24	5202.5 +/-	12-INCH WYE	VERIFY ELEVATION OF EXISTING 12-INCH PW
107	7300704.88	1584265.28	5202.10	12-INCH 22.5 BEND	
108	7300685.40	1584172.34	5195.24	12 INCH 45 BEND	
109	7300675.96	1584166.18	5194.31	12 INCH 45 BEND	
110	7300672.36	1584166.93	5194 +/-	12-INCH TEE	VERIFY ELEVATION OF EXISTING 12-INCH PW
111	7300671.80	1584164.25	5194 +/-	12-INCH GATE VALVE	VERIFY ELEVATION OF EXISTING 12-INCH PW GAV-130

YARD PIPING POINT TABLE

Point #	Northing	Easting	Center Line Elevation	Description	Note
201	7300760.22	1584325.43	5210 +/-	12X8-INCH REDUCER	VERIFY ELEVATION OF EXISTING 12-INCH PW
202	7300760.22	1584323.67	5210 +/-	8-INCH 45 BEND	VERIFY ELEVATION OF EXISTING 12-INCH PW
203	7300758.73	1584322.18	5210 +/	8-INCH GATE VALVE	VERIFY ELEVATION OF EXISTING 12-INCH PW GAV-110
204	7300717.67	1584281.12	5205.10	12-INCH WYE	
205	7300708.95	1584272.39	5202.94	12-INCH 45 BEND	
206	7300698.62	1584170.14	5196.28	12-INCH 45 BEND	
207	7300700.97	1584166.95	5194.00	12-INCH 90 BEND	
208	7300721.26	1584321.03	5205.50	4-INCH GATE VALVE	GAV-120
209	7300717.67	1584317.27	5205.50	4-INCH 45 BEND	
210	7300717.66	1584315.48	5205.40	12X4-INCH REDUCER	
211	7300717.73	1584311.54	5205.40	12-INCH WYE	
212	7300721.78	1584285.22	5205.10	12X8-INCH REDUCER	



KEY NOTES:

1. CUT EXISTING 12" PW AND INSTALL 12"x12"x12" TEE, VALVE AND RESTRAINED COUPLING.
2. CUT EXISTING 12" PW AND INSTALL RESTRAINED FLANGE ADAPTER AND BLIND FLANGE.
3. CUT EXISTING 12" PW AND INSTALL RESTRAINED 12"x12"x12" WYE.
4. CUT EXISTING 12" PW AND CONNECT TO NEW PIPING AND FITTINGS USING RESTRAINED COUPLINGS.
5. PROVIDE (3) 2" CORES IN WALL TO LOWER ROOM OF CHLORINE BUILDING. ROUTE 1" PW AND (2) 3/4" CLS THROUGH WALL PER DTL (15131). ROUTE ALL 3 PIPES TO CHLORINE GAS STATION IN UPPER LEVEL. APPROXIMATELY 20FT OF 1" PIPE AND 40FT OF 3/4" PIPE WILL BE REQUIRED. PROVIDE (3) 2" CORES THROUGH BUILDING FLOOR TO ACCOMODATE PIPE. ROUTE PIPE PER DTL (15102) PROVIDE PIPE SUPPORTS PER DTL (15010) WITH 5'-0" MAX SPACING.
6. MAINTAIN MINIMUM 36" INCHES OF COVER.
7. 2" PW TO BE CAPPED FOR FUTURE CONNECTION.

10 0 10 20 FEET
SCALE 1"-10'

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS
2213 S. Pleasant Grove Blvd. Suite 150 • Pleasant Grove, UT • 801-763-1166

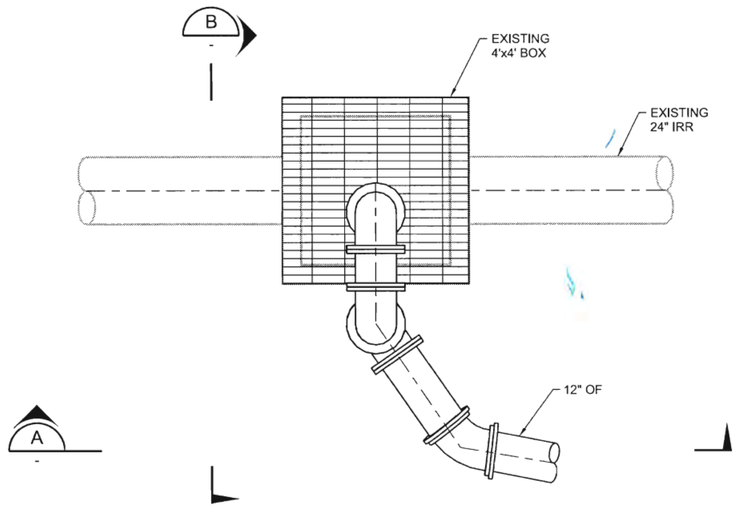
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

CIVIL
TURBINE BUILDING YARD PIPING PLAN

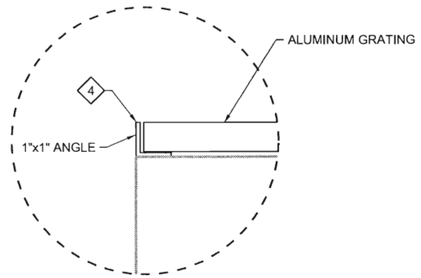
GREGORY L. CHRISTIANSEN NO.5199248 STATE OF UTAH 2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-C-102
SHEET 10 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10C102.dgn PLOT DATE: 2/16/2015 PLOT TIME: 8:39:33 AM SCALE: 1:20



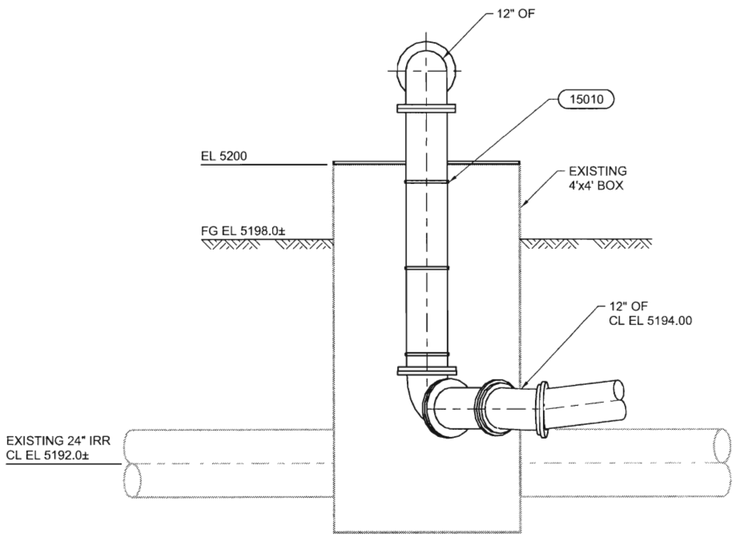
PLAN
1/2" = 1'-0"



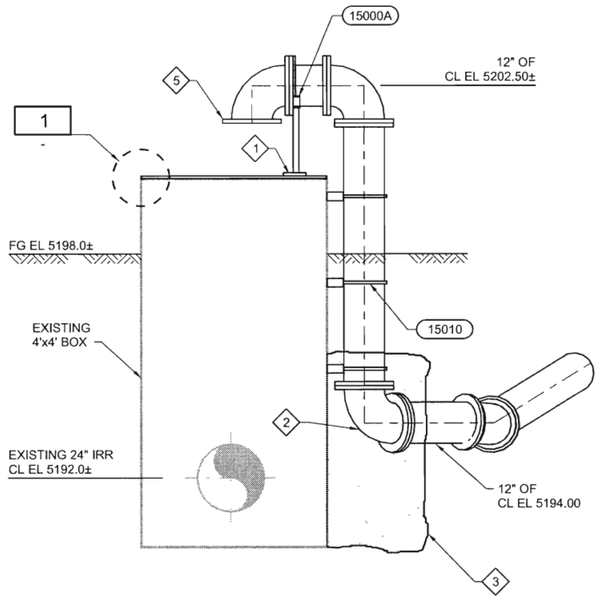
1 DETAIL
NTS

NOTES:

1. NOTCH GRATING AND 1"x1" ANGLE TO ACCOMODATE PIPE SUPPORT.
2. PROVIDE 1/2" TAP IN 90° BEND COVER HOLE WITH FILTER FABRIC.
3. PROVIDE 2'x2'x3' DEEP PEA GRAVEL.
4. ANCHOR 1"x1" ANGLE TO EXISTING CONCRETE BOX USING 1/4" ANCHOR BOLTS. SPACE ANCHOR BOLTS AT 1'-0" MAXIMUM.
5. PROVIDE 1/4" SST MESH SCREEN.



A SECTION
1/2" = 1'-0"



B SECTION
1/2" = 1'-0"

2 0 2 4 FEET
SCALE 1/2"=1'-0"

CHRISTIANSEN
NO. 5102148
2/4/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd. Suite 102 • Pleasant Grove, UT • 801.785.4105

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

CIVIL
IRRIGATION BOX
PLAN AND SECTIONS

DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
10-C-301
SHEET 11 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10C301.dgn PLOT DATE: 2/4/2015 PLOT TIME: 10:17:02 AM SCALE: 1:4

DESIGN CRITERIA:

1. APPLICABLE CODE: 2012 INTERNATIONAL BUILDING CODE (IBC).

2. REFER TO THE SPECIFICATIONS FOR ADDITIONAL AND SPECIFIC STRUCTURAL LOADINGS AND REQUIREMENTS.

3. ROOF LOAD:
   - MINIMUM LIVE LOAD 20 psf
   - FLAT ROOF SNOW LOAD, P 30 psf

4. FLOOR LOAD:
   - LIGHT MANUFACTURING 125 psf
   - STAIRS AND EXISTS 100 psf

5. WIND LOAD:
   - BASIC WIND SPEED (ASCE 7-10) 120 psf
   - EXPOSURE CATEGORY C
   - DESIGN METHOD DIRECTIONAL PROCEDURE

6. SEISMIC LOAD:
   - RISK CATEGORY III
   - IMPORTANCE FACTOR I_e 1.25
   - S_S: 1.129 S_{DS}: 0.753
   - S_1: 0.422 S_{D1}: 0.388
   - SITE CLASS C
   - SEISMIC DESIGN CATEGORY D

7. LATERAL FORCE RESISTING SYSTEM:
   - TURBINE BUILDING
     - SPECIAL REINFORCED CONCRETE/MASONRY SHEAR WALLS
     - $V = C_sW$
     - $C_s = 0.188$
     - R = 5
     - ANALYSIS PROCEDURE = EQUIVALENT LATERAL FORCE
   - RESTROOM BUILDING
     - SPECIAL REINFORCED MASONRY SHEAR WALLS
     - $V = C_sW$
     - $C_s = 0.188$
     - R = 5
     - ANALYSIS PROCEDURE = EQUIVALENT LATERAL FORCE

GENERAL INFORMATION:

1. ALL CONSTRUCTION SHALL CONFORM TO THE 2012 EDITION OF THE BUILDING CODE.

2. DESIGN DETAILS ARE INTENDED TO BE TYPICAL AND SHALL APPLY TO ALL SIMILAR SITUATIONS OCCURRING THROUGHOUT THE PROJECT, WHETHER OR NOT THEY ARE KEYED IN EACH LOCATION. CONSULT THE ENGINEER FOR REVIEW PRIOR TO CONSTRUCTION.

3. VERIFY ALL OPENING DIMENSIONS IN WALLS, SLABS, AND DECKS WITH THE ARCHITECTURAL, MECHANICAL, HVAC AND ELECTRICAL DRAWINGS.

4. FOR NUMBER, TYPE, SIZE, ARRANGEMENT, AND/OR LOCATION OF EQUIPMENT PADS AND OPENINGS SEE ARCHITECTURAL, MECHANICAL, ELECTRICAL, HVAC AND PLUMBING DRAWINGS. COORDINATE ALL OPENINGS AND EQUIPMENT PADS WITH OTHER DISCIPLINES AND EQUIPMENT SUPPLIERS PRIOR TO PLACING SLABS, WALLS AND FOUNDATIONS.

5. NO STRUCTURAL MEMBER SHALL BE CUT FOR PIPES, DUCTS, ETC UNLESS SPECIFICALLY DETAILED OR APPROVED IN WRITING BY THE ENGINEER.

FOUNDATIONS:

1. IN ACCORDANCE WITH THE BATTLE CREEK IRRIGATION WATER TANK GEOTECHNICAL INVESTIGATION REPORT BY EARTHTEC TESTING AND ENGINEERING, FOUNDATIONS HAVE BEEN DESIGNED FOR THE FOLLOWING VALUES:
   - ALLOWABLE BEARING, DEAD + LIVE LOADS 1,500 psf
   - LATERAL EARTH PRESSURES (DRAINED)
     - AT-REST 92 pcf
     - SEISMIC 116 pcf
   - SLIDING FRICTION COEFFICIENT 0.25

2. NO BACKFILL SHALL BE PLACED BEHIND CANTILEVERED, FREE TOP WALLS UNTIL THE CONCRETE HAS ATTAINED 100% OF ITS SPECIFIED COMPRESSIVE STRENGTH.

3. NO BACKFILL SHALL BE PLACED BEHIND WALLS THAT ARE CONNECTED TO ELEVATED FLOOR OR ROOF SLABS OR DECKS UNTIL THE FLOOR OR ROOF SLAB HAS ATTAINED 100% OF ITS SPECIFIED COMPRESSIVE STRENGTH AND ALL ROOF AND FLOOR DECKING IS IN PLACE AND WELDED, SCREWED, OR NAILED AS APPROPRIATE.

4. GRADE TO DRAIN AWAY FROM STRUCTURES A MINIMUM GRADE OF 5% FOR A MINIMUM OF 10'-0" FROM STRUCTURE PERIMETER.

5. THE CONTRACTOR SHALL PROVIDE THE ENGINEER AT LEAST 48 HOURS NOTICE FOLLOWING EXCAVATION FOR FOUNDATIONS AND PRIOR TO THE PLACEMENT OF FORMWORK, REINFORCING STEEL AND CONCRETE.

FORMWORK, SHORING AND BRACING:

1. THE STRUCTURES SHOWN ON THE DRAWINGS HAVE BEEN DESIGNED FOR STABILITY UNDER FINAL CONDITIONS ONLY. THE DESIGN SHOWN DOES NOT INCLUDED THE NECESSARY COMPONENTS OR EQUIPMENT FOR THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION. THE CONTACTOR IS RESPONSIBLE FOR ALL WORK RELATING TO CONSTRUCTION ERECTION METHODS, BRACING, SHORING, RIGGING, GUYS SCAFFOLDING, FORMWORK, AND OTHER WORK AIDS REQUIRED TO SAFELY PERFORM THE WORK SHOWN. CONSTRUCTION OF SHORING AND BRACING OF FORMWORK SHALL BE IN ACCORDANCE WITH ACI 347 "GUIDE TO FORMWORK FOR CONCRETE".

CONCRETE:

1. STRUCTURAL CONCRETE SHALL HAVE A MINIMUM OF COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS AND A SLUMP AS SPECIFIED IN SECTION 03300 - CAST-IN-PLACE CONCRETE.

2. THE CONTRACTOR SHALL SUBMIT THE CONCRETE MIX DESIGNS TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO USE.

3. HORIZONTAL CONSTRUCTION JOINTS SHALL BE PREPARED TO EXPOSE CLEAN, SOLIDLY EMBEDDED AGGREGATE OVER THE ENTIRE JOINT INTERFACE.

4. PLACEMENT OF PIPES, CONDUITS OR OTHER EMBEDDED ITEMS IN THE CONCRETE SHALL BE IN ACCORDANCE WITH THESE DRAWINGS OR SHALL BE APPROVED BY THE ENGINEER.

5. NO ALUMINUM OR ANY OTHER MATERIAL INJURIOUS TO CONCRETE SHALL BE EMBEDDED IN THE CONCRETE.

6. CONCRETE SHALL BE MIXED AND DELIVERED IN ACCORDANCE WITH ASTM C94.

7. THE REQUIREMENTS FOR CONCRETE MIXES, PLACING, TESTING AND CURING ARE CONTAINED IN ACI 318 CHAPTER 5 AND THE PROJECT SPECIFICATIONS.

8. PORTLAND CEMENT SHALL CONFORM TO ASTM C150 TYPE II, AGGREGATE SHALL CONFORM TO ASTM C33.

9. CONTINUOUS WATERSTOP, AS SPECIFIED, SHALL BE INSTALLED IN ALL EXPANSION, CONTRACTION, CONTROL AND CONSTRUCTION JOINTS IN WALLS AND SLABS OF CONTAINMENT STRUCTURES, WATER HOLING BASINS, CHANNELS, AND BELOW GRADE STRUCTURES, EXCEPT WHERE SPECIFICALLY NOTED OTHERWISE.

10. THE CONCRETE JOINTS IN SLABS AND WALLS, AS SHOWN, ARE MINIMUM REQUIREMENTS. CONTRACTOR MAY SUBMIT ALTERNATE CONSTRUCTION JOINT LAYOUT DRAWINGS, SUBJECT TO SPECIFIED REQUIREMENTS, TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.

CONCRETE REINFORCING:

1. PROVIDE LARGER SIZES AND MORE REINFORCING IN ALL SECTIONS OF CONCRETE WHERE REQUIRED BY THE DETAILS ON THE DRAWINGS OR BY THE SPECIFICATIONS.

2. CLEARANCE FOR REINFORCEMENT BARS, UNLESS SHOWN OTHERWISE, SHALL BE: CAST AGAINST EARTH = 3", CONCRETE SURFACES OF CONTAINMENT STRUCTURES = 2", ALL OTHER CONCRETE SURFACES: #5 BAR OR SMALLER = 1 1/2", #6 BAR OR LAGER = 2".

3. REFER TO WALL CORNER AND WALL INTERSECTION REINFORCING DETAIL 3303. WALL CORNER REINFORCING SIZES AND SPACINGS SHALL BE AS SHOWN ON THE DRAWINGS AND REFERENCED TO THIS DETAIL. TYPICAL HORIZONTAL WALL REINFORCING SHALL LAP WITH THE CORNER HORIZONTAL REINFORCING.

4. PROVIDE A MINIMUM OF TWO VERTICAL WALL BARS WITH MATCHING DOWELS AT WALL ENDS, CORNERS AND INTERSECTIONS WITH SIZE TO MATCH TYPICAL VERTICAL REINFORCING STEEL AS SHOWN. VERTICAL WALL BARS SHALL BE LAPPED WITH DOWELS FROM BASE SLABS AND EXTENDED INTO THE TOP FACE OF ROOF SLABS AND LAPPED WITH TOP SLAB REINFORCEMENT.

5. ALL BENDS, UNLESS OTHERWISE SHOWN, SHALL BE 90 DEGREE ACI 318 STANDARD HOOKS.

6. ALL REINFORCING BENDS AND LAPS, UNLESS OTHERWISE NOTED, SHALL SATISFY THE FOLLOWING MINIMUM REQUIREMENTS:

CONCRETE DESIGN STRENGTH = 4,000 PSI		GRADE 60 REINF STEEL					
BAR SIZE		#3	#4	#5	#6	#7	#8
LAP SPLICE LENGTH							
	TOP BAR *	1'-4"	2'-0"	3'-0"	4'-0"	5'-10"	6'-8"
	OTHER BAR	1'-4"	1'-7"	2'-4"	3'-1"	4'-6"	5'-2"

* TOP BARS SHALL BE DEFINED AS ANY HORIZONTAL BARS PLACED SUCH THAT MORE THAN 12" OF CONCRETE IS CAST IN THE MEMBER BELOW THE BAR IN ANY SINGLE POUR. HORIZONTAL WALL BARS ARE CONSIDERED TOP BARS.

\# WHERE 3,000 PSI CONCRETE IS USED, INCREASE ABOVE LENGTHS BY 16%.

MASONRY:

1. SOLID GROUT ALL CELLS UNLESS INDICATED OTHERWISE.

2. MORTAR SHALL CONFORM TO ASTM C270, TYPE S, HYDRATED AND SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 1,900 PSI.

3. GROUT SHALL CONFORM TO ASTM C476 AND SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 2,000 PSI CONTAINING NO MASONRY CEMENT.

4. CONCRETE BLOCK UNITS SHALL BE MEDIUM WEIGHT AND CONFORM TO ASTM C90 GRADE N-1 AND SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 1,900 PSI. LINEAR SHRINKAGE SHALL NOT EXCEED 0.065 PERCENT.

5. PLACE COURSES IN RUNNING BONG PATTERN, UNLESS SPECIFICALLY INDICATED OTHERWISE.

6. REINFORCING STEEL FOR MASONRY SHALL CONFORM TO ASTM A615, GRADE 60 FOR DEFORMED BARS. LAP VERTICAL REINFORCING 48 BAR DIAMETERS WITH DOWELS AT BUILDING WALLS. LAP ALL OTHER VERTICAL BARS 72 BAR DIAMETERS. LAP VERTICAL BARS IN CANTILEVER WALLS 72 BAR DIAMETERS. STAGGER ADJACENT LAP SPLICES BY 24 INCHES, WHEN SEPARATED BY 3 INCHES OR LESS. REFERENCE STANDARD DETAIL 4002 - REINFORCED CMU WALL.

MASONRY CONTINUED:

7. HORIZONTAL REINFORCING BARS SHALL BE CONTINUOUS AROUND WALL CORNERS AND THROUGH WALL INTERSECTIONS AND HOOKED AT WALL ENDS AS SHOWN IN THE DETAILS.

8. VERTICAL REINFORCING SHALL BE PLACED AT CORNERS, EACH SIDE OF OPENINGS, END WALLS (INCLUDING EACH SIDE OF CONTROL JOINTS), AT A MAXIMUM SPACING INDICATED IN THE DRAWINGS, AND CONTINUOUS FROM FOUNDATION TO TOP OF WALL.

9. CMU REINFORCING AT WALL INTERSECTIONS AND CORNERS SHALL BE AS INDICATED IN STANDARD DETAIL 4001 - CMU WALL CORNERS, UNLESS INDICATED OTHERWISE.

10. CMU REINFORCING AT ALL WALL ENDS, JAMBS AND DOOR OPENINGS, WINDOW LINTELS, LOUVERS AND PENETRATIONS SHALL BE INDICATED IN STANDARD DETAIL 4004 - CMU OPENINGS GREATER THAN 3'-0" OR STANDARD DETAIL 4003 - CMU OPENINGS LESS THAN 3'-0", UNLESS INDICATED OTHERWISE.

ROUGH CARPENTRY:

1. STRUCTURAL FRAMINGS SHALL BE DOUGLAS FIR (DF) OF THE GRADES INDICATED OR BETTER (WWPA GRADING RULES):
   BEAMS AND STRINGERS:
   - 4x NO. 1
   - 6x NO. 1
   - STUDS, SILL & PLATES: 2x4 STUD
   - 2x6 AND LARGER NO. 1
   - MISC. FRAMING LUMBER NOT NOTED NO. 2

2. SILLS BE APPROVED PRESSURE TREATED DF. EACH PIECE SHALL BEAR THE AWPA STAMP. CUTS AND BORED HOLES OF TREATED DF SHALL BE TREATED WITH COPPER GREEN.

3. FASTENERS FOR PRESERVATIVE-TREATED WOOD SHALL BE OF HOT DIPPED ZINC-COATED GALVANIZED STEEL, STAINLESS STEEL, SILICON BRONZE OR COPPER. THE COATING WEIGHTS FOR ZINC-COATED FASTENERS SHALL BE IN ACCORDANCE WITH ASTM A153. HARDWARE SHALL BE COATED PER SIMPSON STRONG TIE 'CORROSION INFORMATION'.

4. WOOD SILLS FOR BEARING SHEATHED WALLS OR TRUSS SUPPORT BEARING ON MASONRY OR CONCRETE SHALL BE BOLTED WITH 5/8"φ X 1'-0" BOLTS WITH 8" EMBEDMENT AT 4'-0" MAXIMUM SPACING, UNLESS OTHERWISE SHOWN, AND WITHIN 9" MAX, 5" MIN, OF END OF EACH PIECE. USE 5/8"φ X 1'-6" BOLTS @ 6" CURBS.

5. WOOD STRUCTURAL MEMBERS SHALL NOT BE DRILLED OR NOTCHED EXCEPT AS SHOWN OR AS APPROVED BY THE ENGINEER.

6. FRAMING HARDWARE NOTED IS SIMPSON STRONG-TIE AND SHALL BE INSTALLED WITH CONNECTORS SPECIFIED FOR EACH SPECIFIC DEVICE BY THE MANUFACTURER'S CURRENT CATALOG. EQUIVALENT DEVICES APPROVED BY THE ENGINEER MAY BE SUBSTITUTED. SINKERS SHALL NOT BE USED.

7. BOLT HOLES IN WOOD AND/OR STEEL SHALL BE 1/16" LARGER THAN BOLTS. STANDARD CUT WASHERS SHALL BE PROVIDED UNDER THE HEADS AND NUTS OF ALL BOLTS BEARING ON WOOD. 3"x3"x¼" PLATE WASHERS SHALL BE USED UNDER ALL ANCHOR BOLTS.

8. ALL NUTS SHALL BE TIGHTENED WHEN PLACED AND RETIGHTENED PRIOR TO APPLICATION OF FINISH OR AT COMPLETION OF JOB.

LICENSED PROFESSIONAL ENGINEER
JEREMY A. KELLOGG
NO.8464725
STATE OF UTAH
2/5/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

WATERWORKS ENGINEERS

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

ARCHITECTURAL / STRUCTURAL
GENERAL
STRUCTURAL NOTES 1

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-AS-001
SHEET 16 OF 70
SCALE: 1:0.166667

WOOD NAILING:

1. NAILS SHALL BE "COMMON" WIRE NAILS, UNLESS OTHERWISE SPECIFIED. NAILS SHALL BE PREDRILLED, IF REQUIRED, TO AVOID SPLITTING THE MEMBER. NAILS SHALL BE THE FOLLOWING SIZES:
   - 10d COMMON = 0.148"φx 3"
   - 16d COMMON = 0.162"φ x 3 1/2"
2. THE EDGE DISTANCE FOR NAILING IN MEMBERS WHERE PLYWOOD PANELS ARE TO ABUT SHALL BE 3/4" FOR 3x OR WIDER AND 3/8" FOR 2x NOMINAL MEMBERS.
3. FASTENERS FOR PRESERVATIVE-TREATED AND FIRE RETARDANT-TREATED WOOD SHALL BE OF HOT DIPPED ZINC-COATING. FASTENERS SHALL BE IN ACCORDANCE WITH ASTM A153.
4. NAILS IN STRUCTURAL WOOD PANELS SHALL BE DRIVEN SO THAT THEIR HEADS ARE FLUSH WITH THE PANEL SURFACE.
5. USE OF MACHINE NAILING IS SUBJECT TO A SATISFACTORY JOB SITE DEMONSTRATION AND ENGINEER'S APPROVAL. APPROVAL IS SUBJECT TO SATISFACTORY PERFORMANCE. IF NAIL HEADS PENETRATE THE FACE PLY MORE THAN WOULD BE NORMAL FOR A HAND HAMMER, OR IF MINIMUM ALLOWABLE EDGE DISTANCES ARE NOT MAINTAINED, THE PERFORMANCE WILL BE DEEMED UNSATISFACTORY.
6. SHEATHING PANELS SHALL BUTT AT CENTERLINE OF A SINGLE SUPPORTING MEMBER WITH EDGE NAILING FROM EACH PANEL INTO THAT MEMBER.
7. PIECES OF WALL, ROOF OR FLOOR SHEATHING SHALL BE NO LESS THAN 12" IN LEAST DIMENSION. PIECES LESS THAN 24" SHALL HAVE 3x4 FLAT MIN BLKG @ UNSUPPORTED PANEL EDGES.
8. UNLESS NOTED ON DRAWINGS, FASTENING SHALL BE AS SPECIFIED BELOW:

BLOCKING BETWEEN JOIST OR TRUSSES:	
TO JOIST OR TRUSS EACH END	2 - 16d EN OR 4 - 10d TN
BRIDGING TO JOIST OR TRUSS, TO NAIL END EACH	2 - 8d
SILL PLATE TO TRUSS OR BLOCKING, FACE NAIL	16d @ 16" O.C.
DOUBLED STUDS OR JOISTS, FACE NAIL	16d @ 12" O.C.

ALUMINUM:

1. ALUMINUM CONSTRUCTION SHALL CONFORM TO THE LATEST EDITION OF THE ALUMINUM CONSTRUCTION MANUAL OF THE ALUMINUM ASSOCIATION.
2. UNLESS OTHERWISE INDICATED, STRUCTURAL ALUMINUM MEMBERS SHALL BE ALLOY 6061-T6.
3. WHERE ALUMINUM IS IN CONTACT WITH CONCRETE OR MASONRY SURFACES, CONTACT SURFACES SHALL BE COATED WITH HEAVY ALKALI-RESISTANT BITUMINOUS PAINT.
4. GRATING AND CHECKERED PLATE SHALL BE ALUMINUM, UNLESS NOTED OTHERWISE. PROVIDE FULLY BANDED ALUMINUM GRATING WITH NON-SKID SURFACE OVER AREAS INDICATED ON THE DRAWINGS. MATERIAL SHALL BE 6061-T6 OR 6063-T6 PROVIDED WITH AN ANODIZED FINISH AND MEET THE STRENGTH AND DEFLECTION REQUIREMENTS.
5. THE ALUMINUM FABRICATOR/CONTRACTOR SHALL FURNISH SHOP DRAWINGS OF ALL ALUMINUM MEMBERS AND GRATING FOR ENGINEERS REVIEW AND APPROVAL PRIOR TO FABRICATION.

ADHESIVE ANCHORS:

1. THE ADHESIVE ANCHOR SYSTEM USED FOR POST-INSTALLED ANCHORAGE TO CONCRETE SHALL CONFORM TO THE REQUIREMENTS OF THE MOST RECENTLY PUBLISHED ACI 355.4, ACCEPTANCE CRITERIA FOR QUALIFICATION OF POST-INSTALLED ADHESIVE ANCHORS IN CONCRETE AND COMMENTARY. THE ANCHOR SYSTEM SHALL BE ONE OF THE FOLLOWING:
   - HILTI HIT-HY 200.
   - SIMPSON SET-XP.
2. ADHESIVE ANCHORS SHALL BE SUPPLIED AS AN ENTIRE SYSTEM INCLUDING, BUT NOT LIMITED TO, THE NEW ADHESIVE CARTRIDGE, A CLEAN MIXING NOZZLE, EXTENSION TUBE, A DISPENSING GUN, AND ALL MANUFACTURER RECOMMENDED SUPPLIES FOR PROPERLY CLEANING THE DRILLED HOLE.
3. ALL-THREAD ROD TO BE USED IN ADHESIVE ANCHOR ASSEMBLIES SHALL CONFORM TO ASTM A36, A193 (GR B7), A307, OR F1554. STAINLESS STEEL ANCHOR RODS SHALL BE TYPE 316. NUTS, WASHERS, AND OTHER HARDWARE USED WITH AN ALL-THREAD SHALL HAVE A MATERIAL OR ALLOY DESIGNATION THAT MATCHES THE ALL-THREAD MATERIAL / ALLOY.
4. REINFORCING BARS SHALL BE ASTM A615 OR A706.
5. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2,500 PSI AT THE TIME OF ADHESIVE ANCHOR INSTALLATION. CONCRETE SHALL HAVE A MINIMUM AGE OF 21 DAYS AT THE TIME OF ADHESIVE ANCHOR INSTALLATION.
6. CONCRETE TEMPERATURE AT THE TIME OF ADHESIVE ANCHOR INSTALLATION SHALL BE AT LEAST 50 F.
7. EMBEDMENT DEPTH AND ANCHOR PROJECTION FROM THE CONCRETE SURFACE SHALL BE AS SHOWN ON THE DRAWINGS FOR THE PARTICULAR ANCHOR OR GROUP OF ANCHORS BEING INSTALLED. ABSENT ANY INFORMATION, THE MINIMUM EMBEDMENT DEPTH SHALL BE 12d WHERE "d" IS THE ANCHOR DIAMETER.
8. ADHESIVE ANCHORS SHALL BE INSTALLED BY QUALIFIED PERSONNEL TRAINED TO INSTALL ADHESIVE ANCHORS IN ACCORDANCE WITH THE SPECIFICATIONS. POST-INSTALLED ADHESIVE ANCHORS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS.
9. INSTALLATION OF ADHESIVE ANCHORS HORIZONTALLY OR UPWARDLY INCLINED TO SUPPORT SUSTAINED TENSION LOADS SHALL BE PERFORMED BY PERSONNEL CERTIFIED BY ACI/CRSI ADHESIVE ANCHOR INSTALLER CERTIFICATION PROGRAM. THESE ANCHORS ARE DESIGNATED WITH A (CERT) AFTER THE ANCHOR CALL-OUT.
10. THE INSTALLER'S QUALIFICATIONS SHALL BE SUBMITTED AND APPROVED IN ACCORDANCE WITH SECTION 05051 OF THE SPECIFICATIONS.

ADHESIVE ANCHORS CONTINUED:

11. WHEN DRILLING HOLES IN EXISTING CONCRETE, USE CARE AND CAUTION TO AVOID CUTTING OR DAMAGING THE EXISTING REINFORCING BARS. MAINTAIN A REASONABLE CLEARANCE BETWEEN REINFORCEMENT AND THE DRILLED-IN ANCHOR.
12. SPECIAL INSPECTION IS REQUIRED PER IBC SECTION 1705 AND THE REQUIREMENTS OF THE ICC REPORT. THE SPECIAL INSPECTOR MUST BE PERIODICALLY ON THE JOBSITE DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE CLEANLINESS, EMBEDMENT DEPTH, CONCRETE TYPE, DRILL BIT DIAMETER, HOLE DEPTH, EDGE DISTANCE, ANCHOR SPACING, AND CONCRETE THICKNESS.
13. ADHESIVE ANCHORS INSTALLED IN HORIZONTAL OR UPWARDLY INCLINED ORIENTATIONS TO RESIST SUSTAINED TENSION LOADS SHALL BE CONTINUOUSLY INSPECTED DURING INSTALLATION BY AN INSPECTOR SPECIALLY APPROVED FOR THAT PURPOSE BY THE BUILDING OFFICIAL.

DEFERRED SUBMITTALS:

1. PER 2012 IBC 107.3.4.1 THE FOLLOWING ITEMS, DRAWINGS AND CALCULATIONS, SHALL BE STAMPED BY AN ENGINEER REGISTERED IN THE STATE OF THE PROJECT. ITEMS SHALL BE SUBMITTED TO THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE FOR REVIEW AND APPROVAL. FOLLOWING APPROVAL BY THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE, THE CONTRACTOR SHALL SUBMIT THE ITEMS TO THE BUILDING OFFICIAL WITH A NOTATION INDICATING THAT THE DEFERRED SUBMITTAL DOCUMENTS HAVE BEEN REVIEWED AND FOUND TO BE IN GENERAL CONFORMANCE TO THE DESIGN OF THE STRUCTURE. THE CONTRACTOR SHALL NOT START FABRICATION OR ERECTION PRIOR TO REVIEW AND APPROVAL BY THE BUILDING OFFICIAL. THE CONTRACTOR SHALL INCLUDE IN HIS BID ALL TIME AND EFFORT REQUIRED TO OBTAIN A BUILDING OFFICIAL REVIEW/PERMIT FOR THE FOLLOWING PREFABRICATED STRUCTURAL COMPONENTS:
   - HANDRAIL AND GUARDRAIL
   - PIPE SUPPORT SYSTEM
   - ANCHORAGE OF MECHANICAL EQUIPMENT OVER 400 POUNDS
   - WOOD TRUSSES

STRUCTURAL OBSERVATION:

1. STRUCTURAL OBSERVATION SHALL BE IN ACCORDANCE WITH THE 2012 IBC SECTION 1704.5 TOGETHER WITH LOCAL AND STATE AMENDMENTS.
2. THE OWNER SHALL EMPLOYEE A REGISTERED DESIGN PROFESSIONAL TO PERFORM STRUCTURAL OBSERVATIONS FOR GENERAL CONFORMANCE TO THE APPROVED CONSTRUCTION DOCUMENTS. STRUCTURAL OBSERVATION DOES NOT WAIVE THE RESPONSIBILITY FOR ANY REQUIRED SPECIAL INSPECTIONS OR INSPECTIONS BY THE BUILDING OFFICIAL.
3. ONSITE STRUCTURAL OBSERVATION SHALL BE PERFORMED AT LEAST ONCE A MONTH, PLUS AT COMPLETION, FOR EACH SEISMIC FORCE OR WIND FORCE RESISTING SYSTEM IDENTIFIED, INCLUDING FOUNDATIONS AND CONNECTIONS.
4. AT THE CONCLUSION OF CONSTRUCTION, THE STRUCTURAL OBSERVER SHALL SUBMIT TO THE BUILDING OFFICIAL A WRITTEN STATEMENT THAT THE SITE VISITS HAVE BEEN MADE AND IDENTIFY ANY REPORTED DEFICIENCIES WHICH, TO THE BEST OF THE STRUCTURAL OBSERVER'S KNOWLEDGE, HAVE NOT BEEN RESOLVED.
5. STRUCTURAL OBSERVATION SHALL INCLUDE VISUAL OBSERVATION OF THE STRUCTURAL SYSTEM AT SIGNIFICANT CONSTRUCTION STAGES AND AT COMPLETION OF THE STRUCTURAL SYSTEM FOR EACH STRUCTURE CONTAINED IN THE WORK. THE CONTRACTOR SHALL SCHEDULE AND FACILITATE STRUCTURAL OBSERVATION INCLUDING THE FOLLOWING:
   - FOUNDATION REINFORCING STEEL, WATERSTOPS, EMBEDS, AND SIMILAR ITEMS PRIOR TO CONCRETE PLACEMENT.
   - WALL TO FOUNDATION CONNECTIONS PRIOR TO FORM CLOSURE FOR ALL MATERIALS.
   - ELEVATED CONCRETE SLABS AND BEAMS PRIOR TO CONCRETE PLACEMENT.
   - MASONRY WALL REINFORCING STEEL PRIOR TO GROUTING AND PRIOR TO CLOSING OF CLEANOUTS.
   - SYSTEM CONNECTION EMBEDS PRIOR TO GROUT OR CONCRETE PLACEMENTS.
   - ALL OTHER WALL ANCHORAGE CONNECTIONS FOR MATERIALS NOT SPECIFICALLY INDENTIFIED ABOVE.

LICENSED PROFESSIONAL ENGINEER
JEREMY A. KELLOGG
NO.8464725
STATE OF UTAH
2/5/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

WATERWORKS
ENGINEERS

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

ARCHITECTURAL / STRUCTURAL
GENERAL
STRUCTURAL NOTES 2

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-AS-002
SHEET 17 OF 70
SCALE: 1:0.166667

STATEMENT OF SPECIAL INSPECTIONS:

1. SPECIAL INSPECTION IS IN ADDITION TO THE INSPECTIONS REQUIRED BY SECTION 110 OF THE IBC. THE OWNER OR CONTRACTOR SHALL EMPLOY A SPECIAL INSPECTOR DURING CONSTRUCTION ON THE TYPES OF WORK INDICATED BELOW. REFERENCE THE PROJECT SPECIFICATIONS FOR DETERMINATION OF WHO IS RESPONSIBLE TO PAY FOR SPECIAL INSPECTIONS SERVICES AND ASSOCIATED TESTS.

2. SPECIAL INSPECTIONS SHALL BE PERFORMED BY AN INDEPENDENT QUALIFIED PERSON WHO IS ACCEPTABLE TO THE ENGINEER AND BUILDING DEPARTMENT. THE INSPECTORS FOR EACH SYSTEM AND MATERIAL WILL BE ICC CERTIFIED OR OTHERWISE APPROVED BY THE BUILDING OFFICIAL. THE SPECIAL INSPECTOR SHALL OBSERVE THE INDICATED WORK FOR COMPLIANCE WITH THE APPROVED CONTRACT DOCUMENTS AND SUBMIT RECORDS OF INSPECTION.

3. INSPECTION RECORDS AND TESTING REPORTS SHALL BE SUBMITTED TO THE ENGINEER, OWNER, AND BUILDING OFFICIAL WITHIN ONE WEEK OF INSPECTION OR WITHIN ONE WEEK OF TEST COMPLETION.

4. AT THE CONCLUSION OF CONSTRUCTION, A FINAL REPORT DOCUMENTING REQUIRED SPECIAL INSPECTIONS AND CORRECTION OF DISCREPANCIES SHALL BE SUBMITTED.

5. PERIODIC SPECIAL INSPECTION IS DEFINED AS SPECIAL INSPECTION BY THE SPECIAL INSPECTOR WHO IS INTERMITTENTLY PRESENT WHERE THE WORK TO BE INSPECTED HAS BEEN OR IS BEING PERFORMED.

6. SPECIAL INSPECTION IS REQUIRED PER CHAPTER 17 OF THE IBC FOR THE FOLLOWING ITEMS:
   - SOILS
   - CONCRETE CONSTRUCTION
   - MASONRY CONSTRUCTION

REQUIRED VERIFICATION AND SPECIAL INSPECTION OF SOILS

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD	2012 IBC REFERENCE
1. VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY	-	X	SECTION 02300 - EARTHWORK	1705.6, 1804
2. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL	-	X	SECTION 02300 - EARTHWORK	1705.6
3. PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS	-	X	SECTION 02300 - EARTHWORK	1705.6
4. VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF COMPACTED FILL	X	-	SECTION 02300 - EARTHWORK	1705.6
5. PRIOR TO PLACEMENT OF COMPACTED FILL, OBSERVE SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY	-	X	SECTION 02300 - EARTHWORK	1705.6

REQUIRED SPECIAL INSPECTION OF CONCRETE CONSTRUCTION

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD	2012 IBC REFERENCE
1. INSPECTION OF REINF STEEL AND PLACEMENT	-	X	ACI 318: 3.5, 7.1-7.7	1910.4
2. INSPECTION OF REINF STEEL WELDING	-	-	AWS D1.4, ACI 318: 3.5.2	-
3. INSPECTION OF ANCHORS TO BE CAST IN CONCRETE	-	X	ACI 318: 8.1.3, 21.1.8	1908.5, 1909.1
4. INSPECTION OF POST INSTALLED ANCHORS IN HARDENED CONCRETE	-	X	ACI 318: 3.8.6, 8.1.3, 21.1.8	1908.5, 1909.1
5. VERIFYING USE OF REQUIRED DESIGN MIX	-	X	ACI 318: Ch.4, 5.2-5.4	1904.2, 1910.2, 1910.3
6. AT THE TIME FRESH CONCRETE IS SAMPLED TO FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE.	X	-	ASTM: C172, C31 ACI318: 5.6, 5.8	1910.10
8. INSPECTION FOR MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES	-	X	ACI 318: 5.11-5.13	1910.9
12. INSPECTION FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED	-	X	ACI 318: 6.1.1	-

REQUIRED SPECIAL INSPECTION OF MASONRY CONSTRUCTION, LEVEL B

INSPECTION TASK	CONTINUOUS	PERIODIC	REFERENCE STANDARD: ACI 530/ASCE 5	REFERENCE STANDARD: ACI 530.1/ASCE 6
1. VERIFY COMPLIANCE WITH THE APPROVED SUBMITTALS	-	X	-	Art. 1.5
2. AS MASONRY CONSTRUCTION BEGINS, VERIFY THAT THE FOLLOWING ARE IN COMPLIANCE:				
2a. PROPORTIONS OF SITE-PREPARED MORTAR AND GROUT	-	X	-	Art. 2.1, 2.6 A
2b. CONSTRUCTION OF MORTAR JOINTS	-	X	-	Art. 3.3 B
2d. LOCATION OF REINF AND CONNECTORS	-	X	-	Art. 3.4, 3.6 A
3. PRIOR TO GROUTING, THE FOLLOWING SHALL BE VERIFIED TO ENSURE COMPLIANCE:				
3a. GROUT SPACE	-	X	-	Art. 3.2 D, 3.2 F
3b. GRADE, TYPE, AND SIZE OF REINF AND ANCHOR BOLTS	-	X	Sec. 1.16	Art. 2.4, 3.4
3c. PLACEMENT OF REINF AND CONNECTORS	-	X	Sec. 1.16	Art. 3.2 E, 3.4, 3.6 A
3d. PROPORTIONS OF SITE-PREPARED GROUT	-	X	-	Art. 2.6 B, 2.4 G.1.b
3e. CONSTRUCTION OF MORTAR JOINTS	-	X	-	Art. 3.3 B
4. VERIFY DURING CONSTRUCTION:				
4a. SIZE AND LOCATION OF STRUCTURAL ELEMENTS	-	X	-	Art. 3.3 F
4b. TYPE, SIZE AND LOCATION OF ANCHORS, INCLUDING OTHER DETAILS OF ANCHORAGE OF MASONRY TO STRUCTURAL MEMBERS, FRAMES OR OTHER CONSTRUCTION	-	X	Sec. 1.16.4.3, 1.17.1	-
4c. WELDING AND REINFORCING BARS	X	-	Sec. 2.1.7.7.2, 3.3.3.4 (c), 8.3.3.4 (b)	-
4d. PREPARATION, CONSTRUCTION, AND PROTECTION OF MASONRY DURING COLD WEATHER OR HOT WEATHER	-	X	-	Art. 1.8 C, 1.8 D
5. OBSERVE PREPARATION OF GROUT SPECIMENS, MORTAR SPECIMENS, AND/OR PRISMS	-	X	-	Art. 1.4 B.2.a.3, 1.4 B.2.b.3, 1.4 B.2.c.3, 1.4 B.3, 1.4 B.4
REQUIRED MINIMUM TESTS:				
1. VERIFICATION OF SLUMP FLOW AND VSI AS DELIVERED TO THE SITE FOR SELF-CONSOLIDATING GROUT	-	X	-	Art, 1.5 B.1.b.3
2. VERIFICATION OF f'm PRIOR TO CONSTRUCTION	-	X	-	Art. 1.4 B

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN JK | DRAWN VP | CHECKED JK | APPROVED CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ARCHITECTURAL / STRUCTURAL

GENERAL STRUCTURAL SPECIAL INSPECTION NOTES

JEREMY A. KELLOGG NO.8464725 LICENSED PROFESSIONAL ENGINEER STATE OF UTAH

2/5/15

DATE FEB 2015

PROJECT NUMBER 10-011

DRAWING NUMBER 00-AS-003

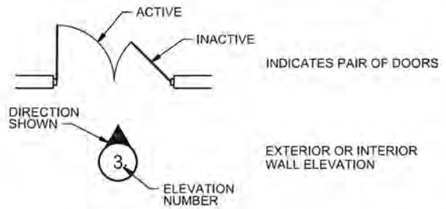
SHEET 18 OF 70

SCALE: 1:0.166667

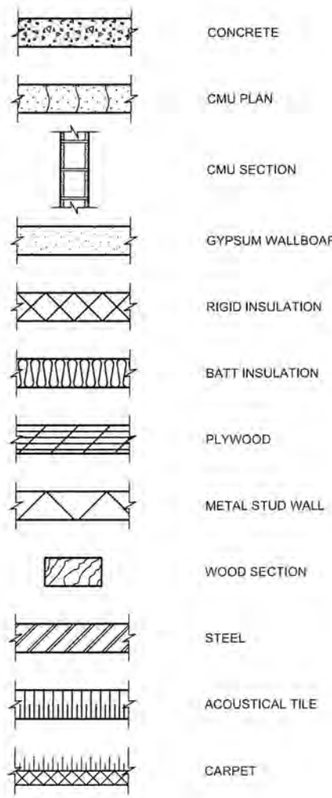
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00AS003.dgn

PLOT DATE: 2/4/2015 PLOT TIME: 11:38:27 AM

ARCHITECTURAL LEGEND



MATERIAL SYMBOLS



GENERAL ARCHITECTURAL NOTES:

1. UNLESS OTHERWISE NOTED, PLAN DIMENSIONS ARE TO NOMINAL SURFACE OF MASONRY, FACE OF STUDS AND FACE OF CONCRETE WALLS.
2. REPETITIVE FEATURES ARE NOT DRAWN IN THEIR ENTIRETY AND SHALL BE COMPLETELY PROVIDED AS IF DRAWN IN FULL.
3. VERIFY ALL ROUGH-IN DIMENSIONS FOR EQUIPMENT PROVIDED IN THIS CONTRACT, OR BY OTHERS.
4. REFER TO ARCHITECTURAL, STRUCTURAL, MECHANICAL, ELECTRICAL AND OTHER CATEGORIES OF DRAWINGS FOR ADDITIONAL NOTES.
5. VERIFY SIZE AND LOCATION OF, AND PROVIDE: ALL OPENINGS THROUGH FLOORS AND WALLS, ACCESS DOORS, FURRING, CURBS, ANCHORS AND INSERTS. PROVIDE ALL BASES, BLOCKING REQUIRED FOR ACCESSORIES, MECHANICAL, ELECTRICAL AND OTHER EQUIPMENT.

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK | DRAWN VP | CHECKED JK | APPROVED CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ARCHITECTURAL / STRUCTURAL

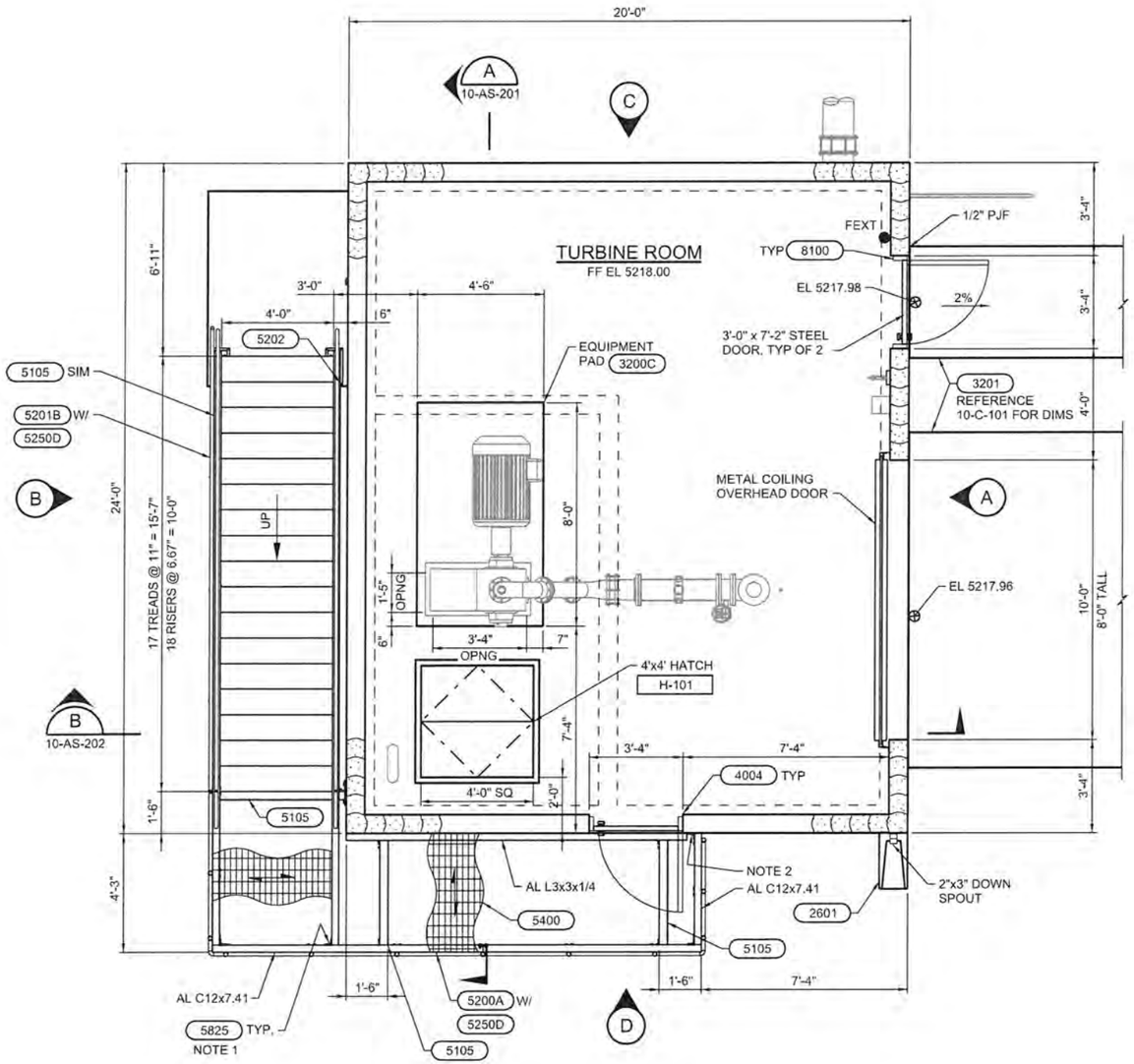
ARCHITECTURAL LEGEND AND MATERIAL SYMBOLS

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-AS-004
SHEET 19 OF 70

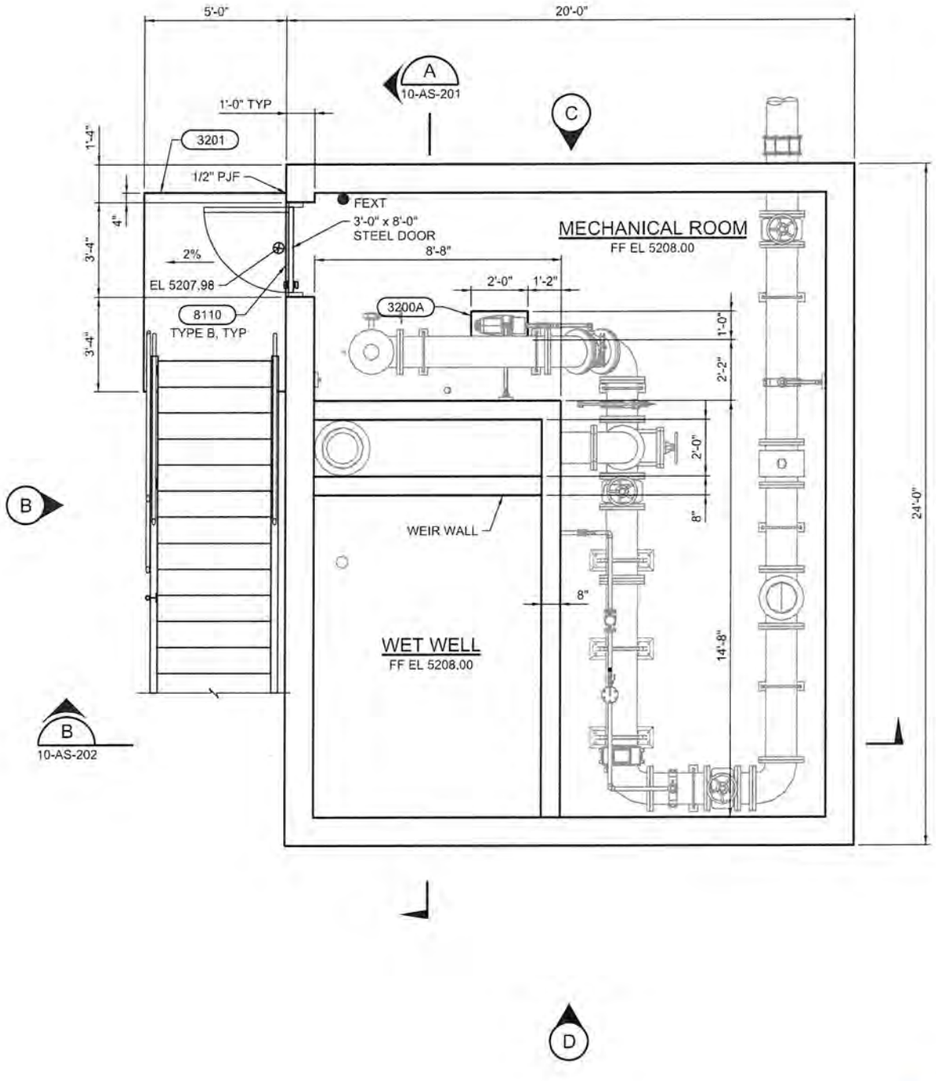
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00AS004.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:22:37 AM SCALE: 1:0.166667

NOTES

1. SIMILAR SINGLE ANGLE CONNECTION, PROVIDE ALUMINUM MEMBERS AND STAINLESS STEEL BOLTS.
2. PROVIDE 2-3/4" DIA ADHESIVE ANCHORS AT 6" GAGE, OMIT ANCHOR AT CENTER HOLE SHOWN IN (5825)
3. SEE GENERAL STRUCTURAL NOTES AND STANDARD DETAILS FOR ADDITIONAL INFORMATION.



SECOND FLOOR PLAN
3/8" = 1'- 0"



FOUNDATION PLAN
3/8" = 1'-0"

2 0 2 4 FEET
SCALE 3/8"=1'-0"

LICENSED PROFESSIONAL ENGINEER
JEREMY A. KELLOGG
NO.8464725
STATE OF UTAH
2/5/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd, Suite 103 • Pleasant Grove, UT • 801-785-4151

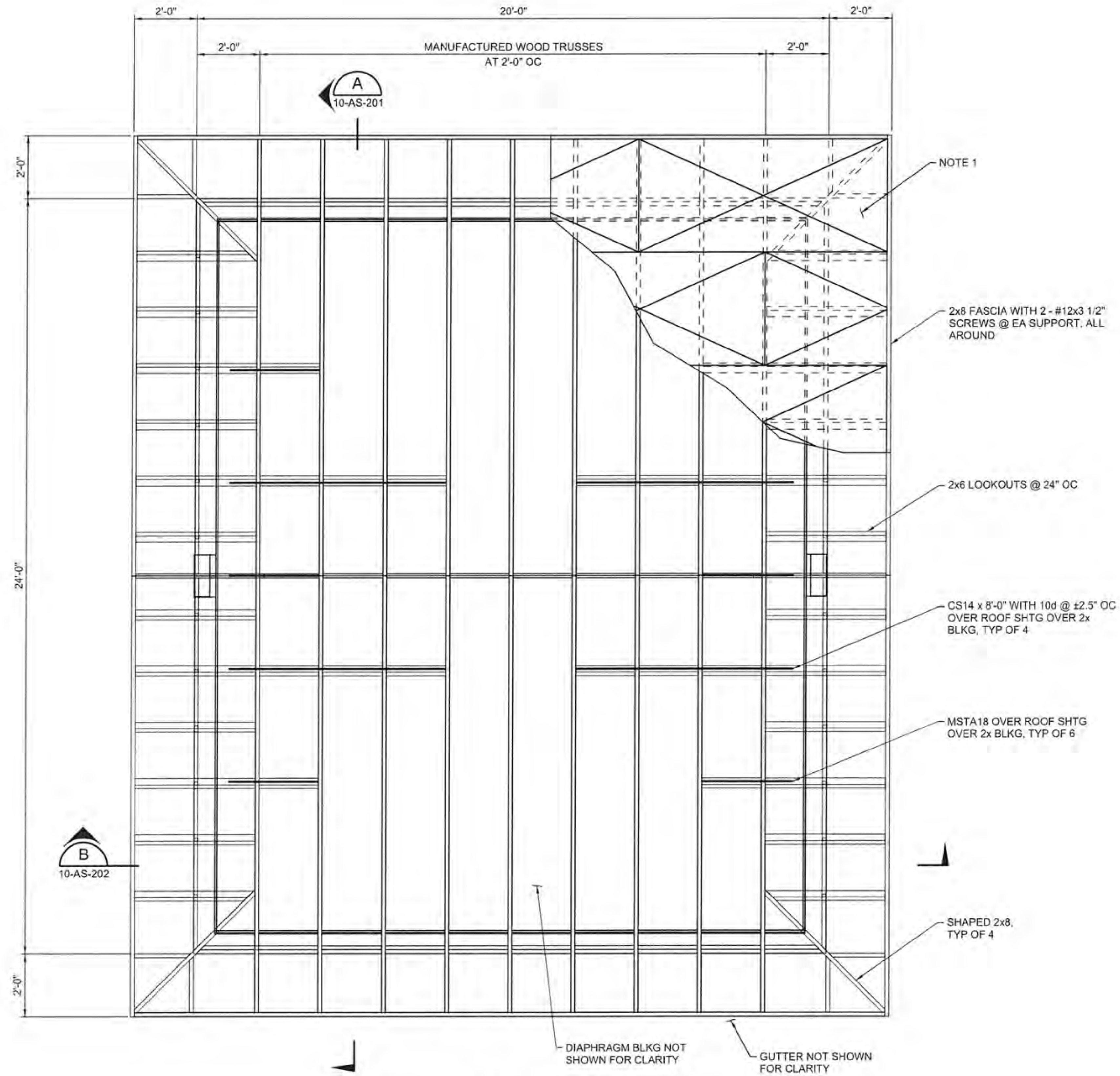
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ARCHITECTURAL / STRUCTURAL

TURBINE BUILDING FOUNDATION AND SECOND FLOOR PLANS

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-AS-101
SHEET 20 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10AS101.dgn PLOT DATE: 2/4/2015 PLOT TIME: 10:54:28 AM SCALE: 1:5.33333



PLAN

1/2" = 1'-0"

NORTH

NOTES:

1. 15/32 PLWD SHTG, CDX APA RATED EXPOSURE 1 FULLY BLOCKED. NAIL DIAPHRAGM WITH 10d @ 2 1/2" OC AT CONTINUOUS PANEL EDGES AND PERIMETER BLKG, 4" OC AT REMAINING PANEL EDGES AND 12" OC IN FIELD.
2. CONTRACTOR SHALL FINISH SUBMITTAL OF TRUSS DRAWINGS AND CALCULATIONS TO THE ENGINEER FOR REVIEW AND APPROVED PRIOR TO TRUSS FABRICATION.
3. NOTES TO TRUSS MFR:
   A. ROOF DL = 15 psf
   B. ROOF LL = 20 psf
   C. ROOF SL = 30 psf
   D. NET UPLIFT = 30 psf
   E. AXIAL FORCE = 0.5k (SEISMIC, ASD)
4. PROVIDE 2x6 TOP CHORD AT ROOF TRUSSES.

2 0 2 4 FEET
SCALE 1/2"=1'-0"

JEREMY A. KELLOGG NO.8464725 STATE OF UTAH — LICENSED PROFESSIONAL ENGINEER

2/5/15

VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN	DRAWN	CHECKED	APPROVED
JK	VP	JK	CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

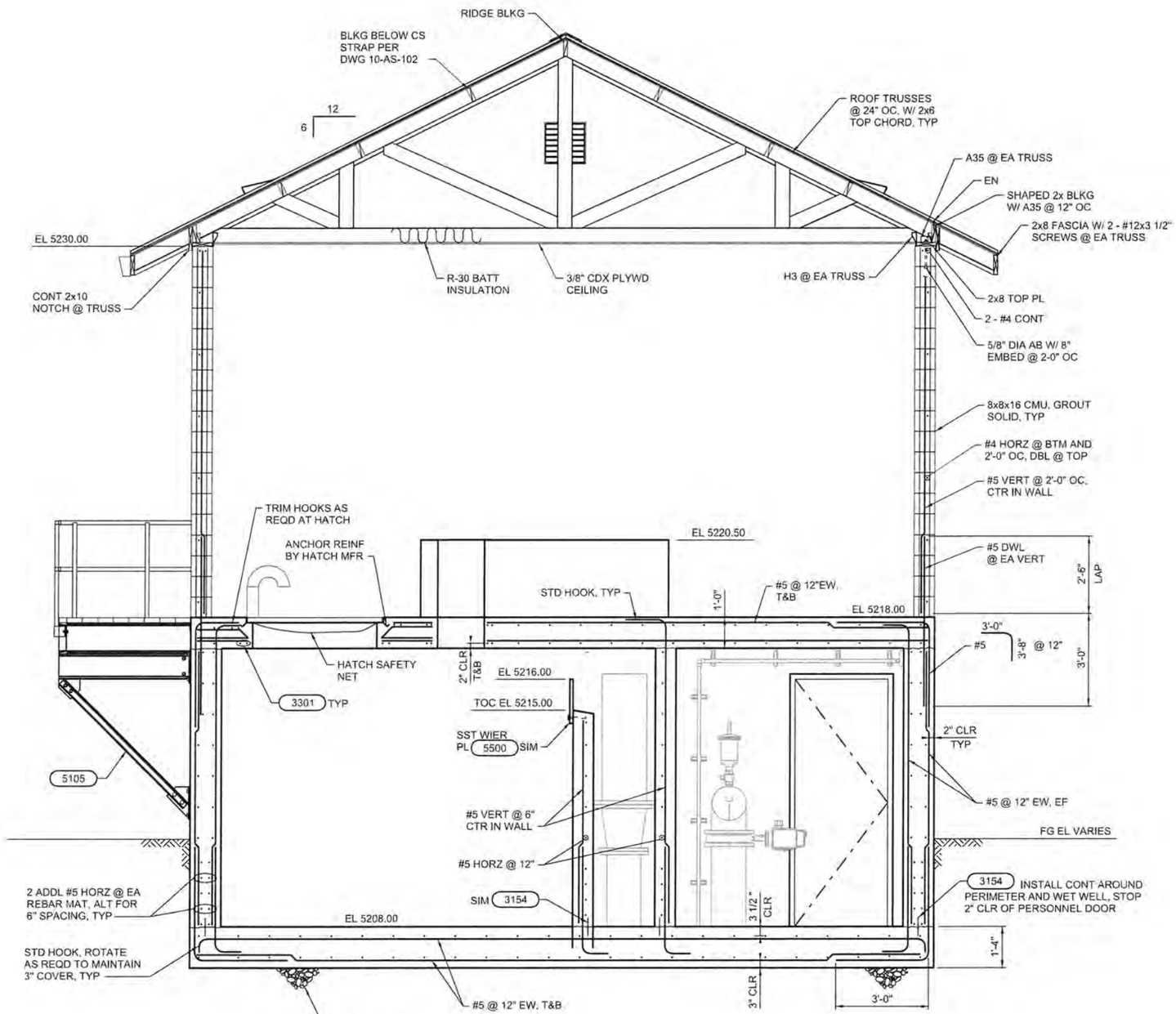
ARCHITECTURAL / STRUCTURAL

TURBINE BUILDING ROOF PLAN

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-AS-102
SHEET 21 OF 70
SCALE: 1:4

NOTES:

1. SEE 3000 AND 4000 SERIES STANDARD DETAILS FOR ADDITIONAL INFORMATION.



A SECTION
10-AS-101 1/2" = 1'-0"
10-AS-102

2 0 2 4 FEET
SCALE 1/2"=1'-0"

JEREMY A. KELLOGG NO.8464725 LICENSED PROFESSIONAL ENGINEER STATE OF UTAH
2/5/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN CC | DRAWN VP | CHECKED CC | APPROVED CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ARCHITECTURAL / STRUCTURAL

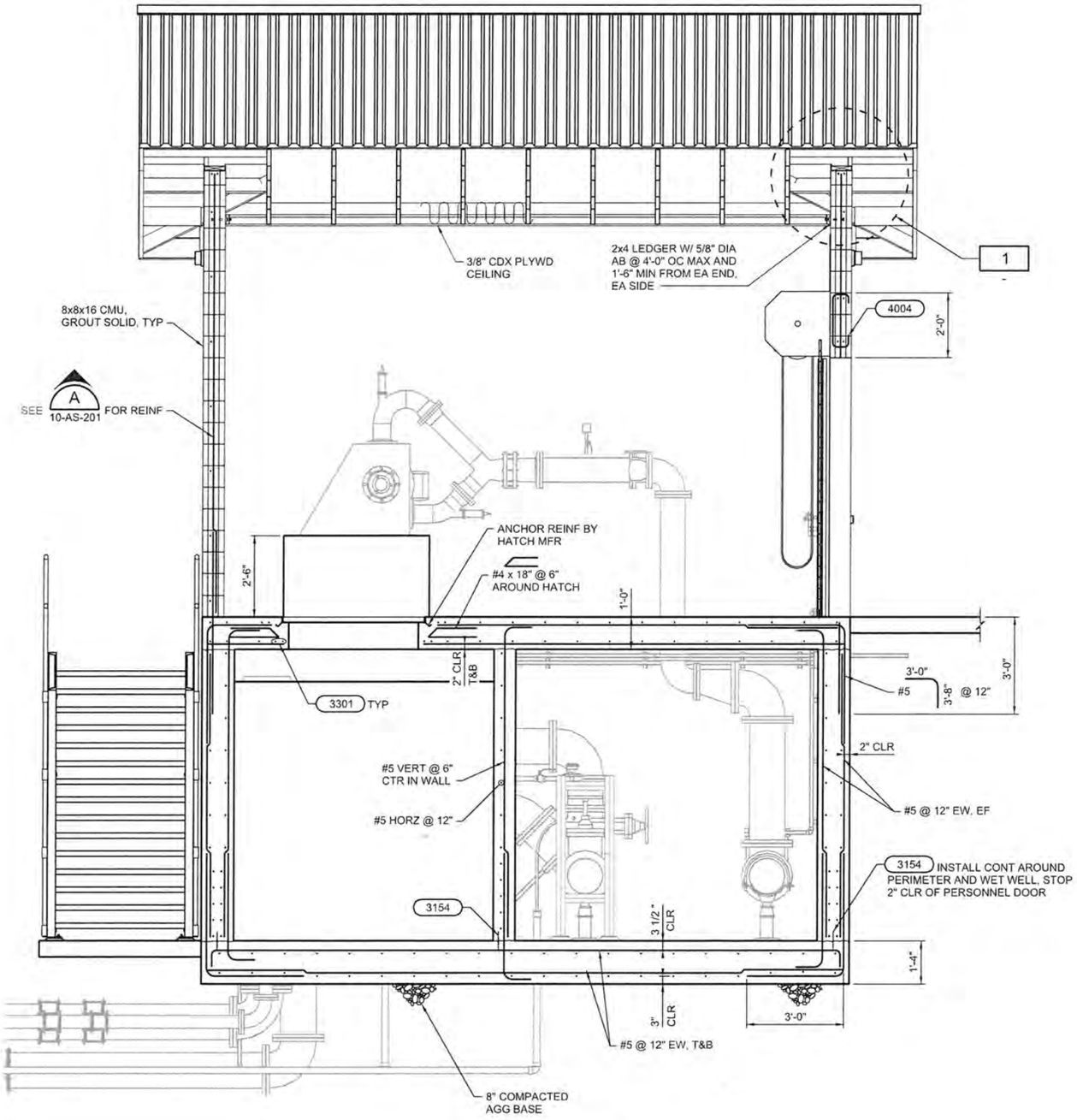
TURBINE BUILDING SECTION

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-AS-201
SHEET 22 OF 70

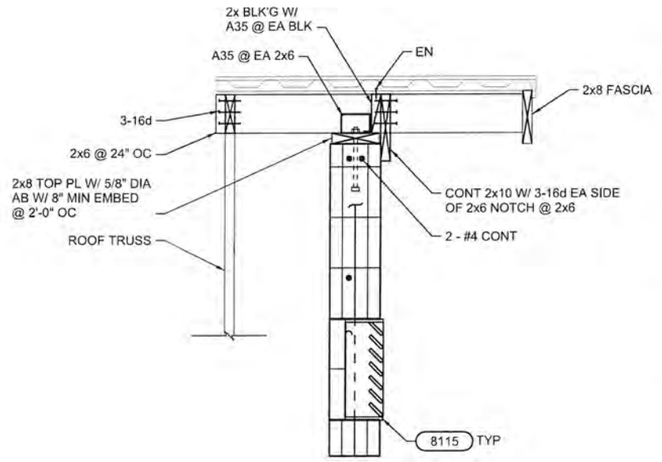
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10AS201.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:02:59 AM SCALE: 1:4

NOTES:

1. SEE 3000 AND 4000 SERIES STANDARD DETAILS FOR ADDITIONAL INFORMATION.



B SECTION
10-AS-101 10-AS-102 1/2" = 1'-0"



1 DETAIL
1" = 1'-0"

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK | DRAWN VP | CHECKED JK | APPROVED CC

WATERWORKS ENGINEERS
2315 Pinyon Canyon Blvd. Suite 100 • Moab, Utah 84532 • 435.259.4115

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ARCHITECTURAL / STRUCTURAL

TURBINE BUILDING SECTION

JEREMY A. KELLOGG NO.8464725 LICENSED PROFESSIONAL ENGINEER STATE OF UTAH
2/5/15

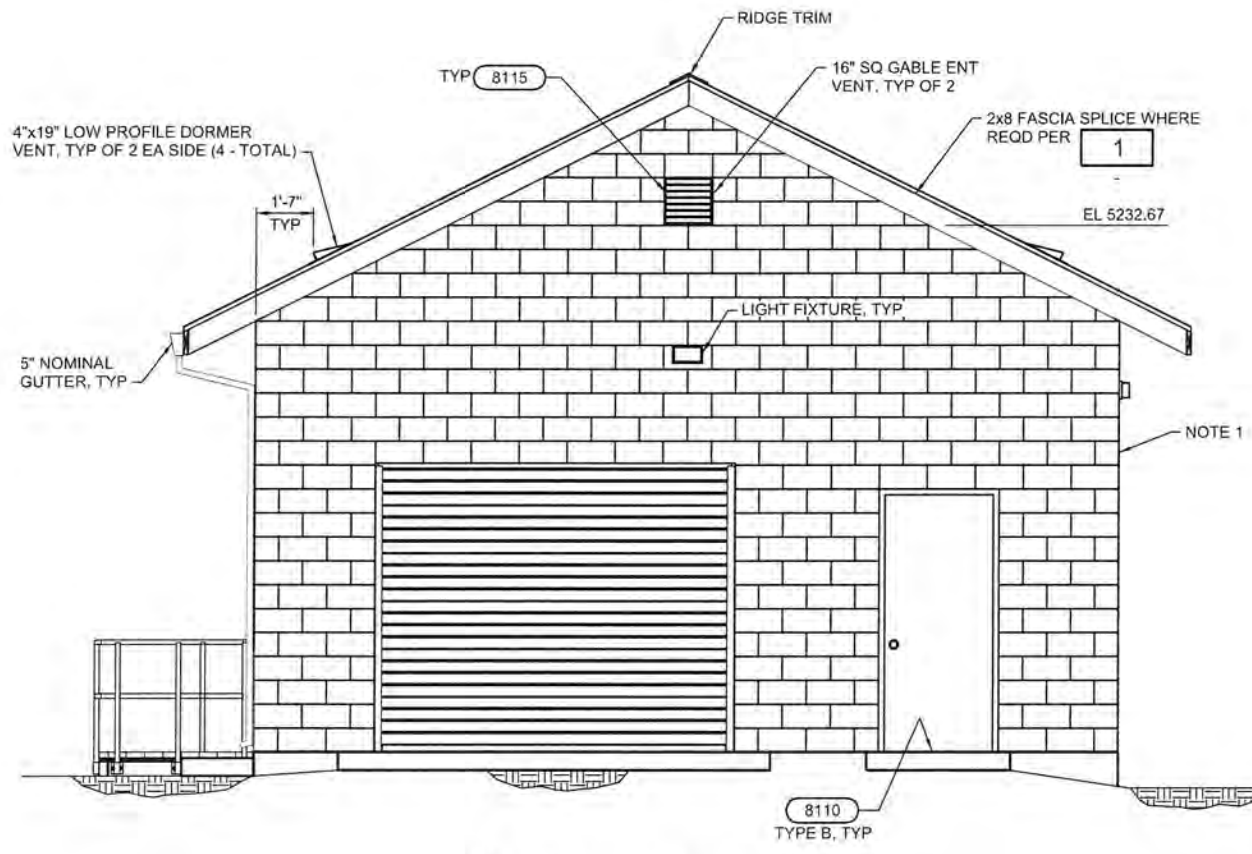
DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-AS-202
SHEET 23 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10AS202.dgn PLOT DATE: 2/4/2015 PLOT TIME: 10:50:19 AM SCALE: 1:4

NOTES:

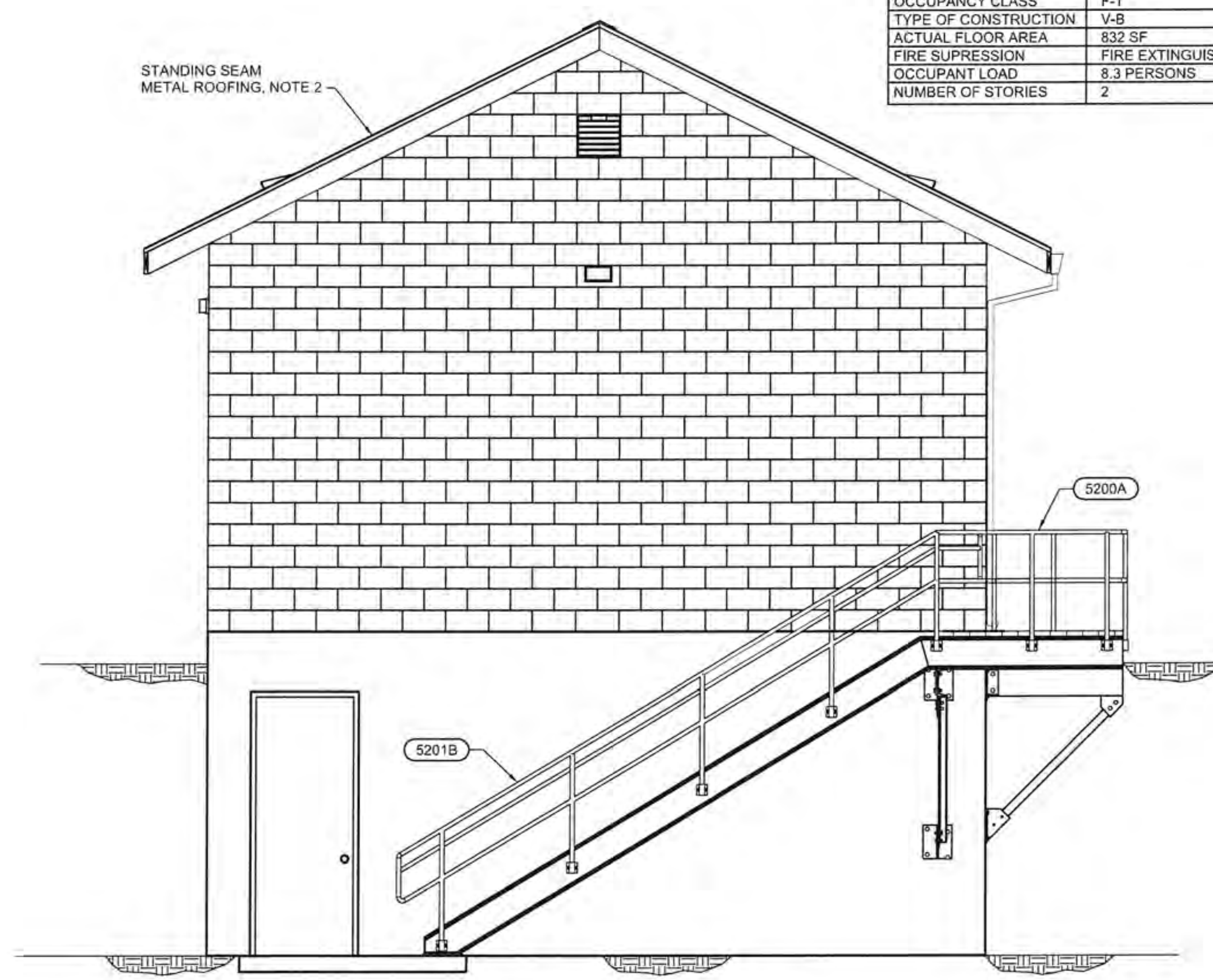
1. ALL CMU TO BE SPLIT-FACED BLOCK WITH COLOR SELECTED BY OWNER.
2. ALL DOORS, LOUVERS, ROOFING TO BE MATCHING COLOR, AS APPROVED BY OWNER.

BUILDING CODE INFORMATION	
BUILDING CODE	2012 IBC
OCCUPANCY CLASS	F-1
TYPE OF CONSTRUCTION	V-B
ACTUAL FLOOR AREA	832 SF
FIRE SUPRESSION	FIRE EXTINGUISHERS
OCCUPANT LOAD	8.3 PERSONS
NUMBER OF STORIES	2



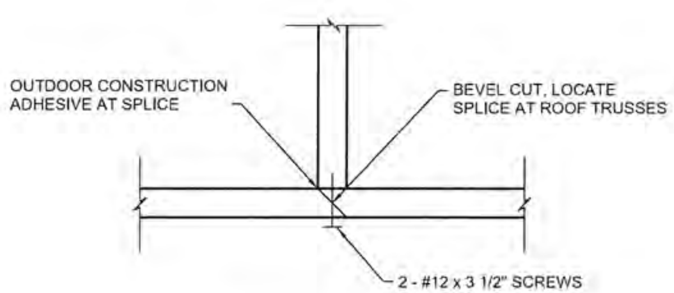
A EAST ELEVATION

3/8" = 1'-0"



B WEST ELEVATION

3/8" = 1'-0"

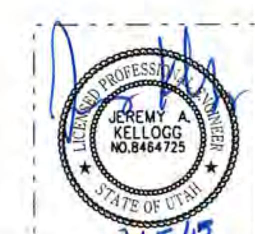


1 DETAIL

NTS

2 0 2 4 FEET

SCALE 3/8"=1'-0"



VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN	DRAWN	CHECKED	APPROVED
JK	VP	JK	CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ARCHITECTURAL / STRUCTURAL

TURBINE BUILDING ELEVATIONS

DATE FEB 2015

PROJECT NUMBER 10-011

DRAWING NUMBER 10-AS-401

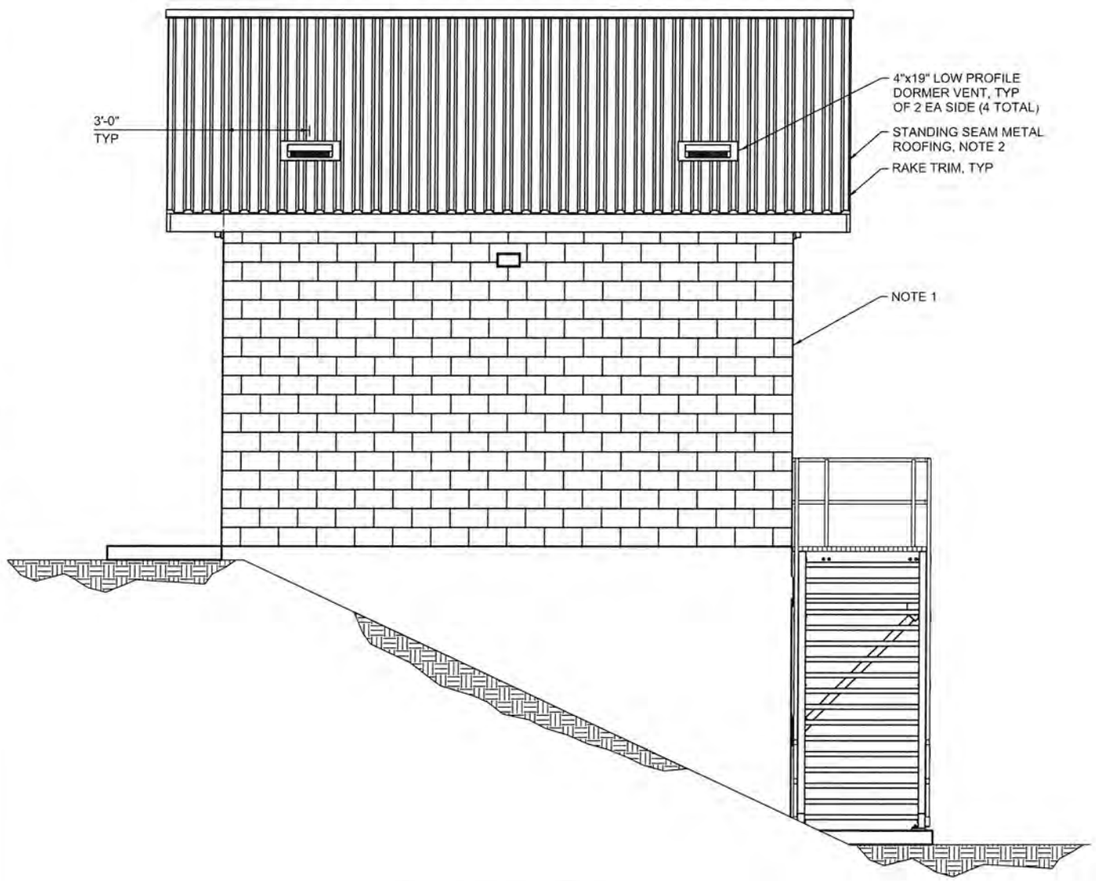
SHEET 24 OF 70

SCALE: 1:5.33333

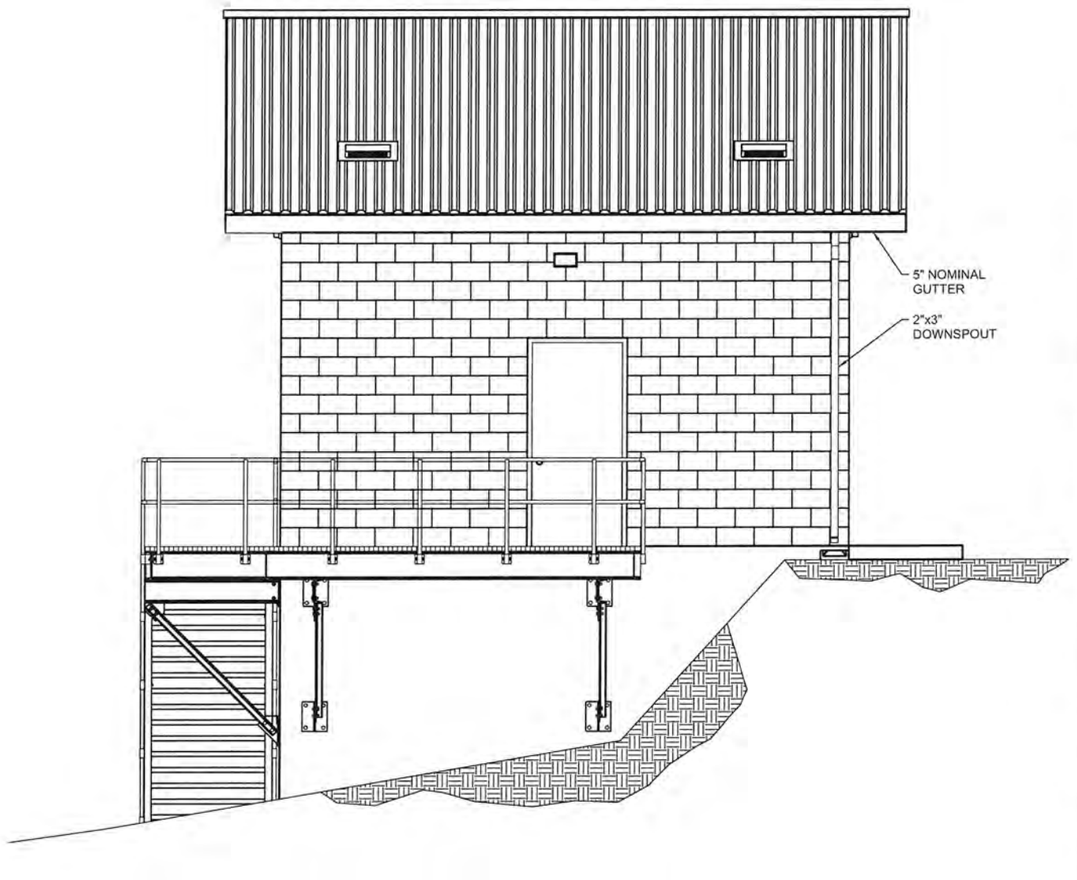
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10AS401.dgn PLOT DATE: 2/4/2015 PLOT TIME: 10:56:59 AM

NOTES:

1. ALL CMU TO BE SPLIT-FACED BLOCK WITH COLOR SELECTED BY OWNER.
2. ALL DOORS, LOUVERS, ROOFING TO BE MATCHING COLOR, AS APPROVED BY OWNER.



C NORTH ELEVATION
3/8" = 1'-0"



D SOUTH ELEVATION
3/8" = 1'-0"

2 0 2 4 FEET
SCALE 3/8"=1'-0"

JEREMY A. KELLOGG NO.8464725 LICENSED PROFESSIONAL ENGINEER STATE OF UTAH
2/5/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK | DRAWN VP | CHECKED JK | APPROVED CC

WATERWORKS ENGINEERS
(801) Pleasant Grove Blvd, Suite 100 • Pleasant Grove, UT • 84062

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ARCHITECTURAL / STRUCTURAL

TURBINE BUILDING ELEVATIONS

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-AS-402
SHEET 25 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10AS402.dgn PLOT DATE: 2/4/2015 PLOT TIME: 10:59:08 AM SCALE: 1:5.33333

PIPE AND FITTING SYMBOLS

DOUBLE LINE	SINGLE LINE	
		EXISTING PIPE (SCREENED)
		NEW PIPE
		EXISTING PIPE TO BE ABANDONED
	XXXXXXXXXX	EXISTING PIPE TO BE REMOVED
		WELDED JOINT
		GROOVED END JOINT - FLEXIBLE
		GROOVED END JOINT - RIGID
		FLANGED JOINT
		MECHANICAL JOINT
		HUB & SPIGOT JOINT (RUBBER GASKET PUSH-ON)
		BALL JOINT
		FLANGE COUPLING ADAPTER
		FLEXIBLE COUPLING
		FLEXIBLE COUPLING WITH THRUST TIES
		DISMANTLING JOINT
		STEEL BELLOWS EXPANSION JOINT
		ELASTOMER BELLOWS EXPANSION JOINT
		ELBOW - 90 DEGREE
		ELBOW UP - 90 DEGREE
		ELBOW DOWN - 90 DEGREE
		ELBOW - 45 DEGREE
		ELBOW UP - 45 DEGREE
		ELBOW DOWN - 45 DEGREE
		TEE
		TEE UP
		TEE DOWN
		CROSS
		LATERAL
		LATERAL UP
		LATERAL DOWN
		REDUCER - CONCENTRIC

PIPE AND FITTING SYMBOLS (CONTINUED)

DOUBLE LINE	SINGLE LINE	
		REDUCER - ECCENTRIC
		UNION
		BLIND FLANGE
		PLUG
		CAP

VALVE SYMBOLS

DOUBLE LINE	SINGLE LINE	
		GATE
K	K	KNIFE GATE
		BUTTERFLY
		GLOBE
		BALL
V	V	VEE BALL
		PLUG OR COCK
SEAT PORT	SEAT PORT	ECCENTRIC PLUG WITH REQUIRED SEAT LOCATION
FP	FP	FULL PORT PLUG
		NEEDLE
		DIAPHRAGM
		PINCH VALVE
		SWING CHECK
		DOUBLE DISK OR SILENT CHECK
		BALL CHECK
		HOSE VALVE
	X	NON FREEZE HOSE VALVE X=NUMBER IN SPECIFICATIONS
	X	NON FREEZE HOSE VALVE WITH HOSE RACK X=NUMBER IN SPECIFICATIONS
	S	SAMPLE
		MUD
		PRESSURE RELIEF
		AIR AND OR VACUUM RELEASE
REGULATED SIDE	REGULATED SIDE	PRESSURE CONTROL
		MULTI-PORT VALVE ARROWS INDICATE FLOW PATTERN. SEAT PORTS ARE IMPLIED BY INDICATED FLOW PATTERN. BALL VALVE SHOWN. FOR OTHER VALVE TYPES, APPROPRIATE VALVE SYMBOL SHOWN.
		FIRE HYDRANT
		CATHODIC PROTECTION TEST STATION
		CATHODIC PROTECTION ANODE

FLOW METERS

DOUBLE LINE	SINGLE LINE	
		MAGMETER
		PROPELLER METER
		INSERTION METER

PUMPS

	METERING
	DIAPHRAGM
	CENTRIFUGAL
	PERISTALTIC

MIXERS

	STATIC MIXER

ACTUATORS

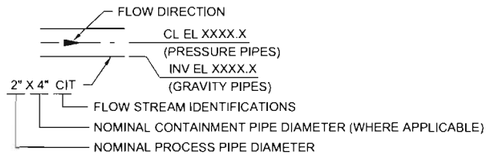
P	PNUEMATIC
M	MOTORIZED
S	SOLENOID

MISCELLANEOUS PIPING SYMBOLS

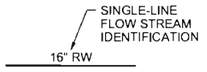
	STRAINER
	SIGHT GLASS
	FLEXIBLE (ELASTOMER) PIPE CONNECTION
	GAUGE WITH COCK
	THERMOMETER
	ROTAMETER
A	GALVANIC ANODE
XX	AIR SET XX = SUPPLY PRESSURE - PSIG
PS 26-1-2	TYPICAL INSTRUMENT SYMBOL (SEE I&C LEGEND)
	DRAIN
	DOUBLE CONTAINMENT PIPE

PIPING DESIGNATIONS

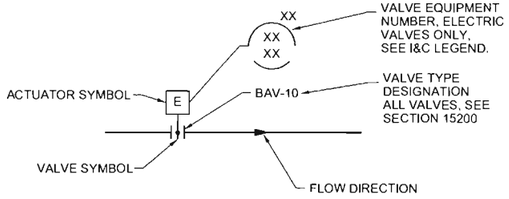
DOUBLE LINE



SINGLE LINE



VALVE DESIGNATIONS



NOTES

1. ELECTRIC VALVE SHOWN, MANUAL VALVE SIMILAR.

NOTES

1. ONLY FLANGED END CONNECTIONS ARE SHOWN HERE FOR DOUBLE LINE FITTINGS. FITTINGS WITH OTHER END PATTERNS ARE SHOWN SIMILARLY ON THE CONSTRUCTION DRAWINGS. ALSO SEE PIPING SPECIFICATIONS AND THE PIPING SCHEDULE.
2. SYMBOLS SHOWN HERE FOR SINGLE LINE FITTINGS ARE GENERIC ONLY. REFER TO PIPING SPECIFICATIONS FOR SPECIFIC END CONNECTIONS FOR SINGLE LINE PIPE AND FITTINGS.

GENERAL PIPING NOTES

1. LAY PIPE TO UNIFORM GRADE BETWEEN INDICATED ELEVATION POINTS. MINIMUM COVER SHALL BE 36 INCHES UNLESS OTHERWISE SHOWN.
2. SIZE OF FITTINGS SHOWN ON DRAWINGS SHALL CORRESPOND TO ADJACENT STRAIGHT RUN OF PIPE, UNLESS OTHERWISE INDICATED. TYPE OF JOINT AND FITTING MATERIAL SHALL BE THE SAME AS SHOWN FOR ADJACENT STRAIGHT RUN OF PIPE.
3. LOCATION AND NUMBER OF PIPE HANGERS AND PIPE SUPPORTS SHOWN IS ONLY APPROXIMATE. FINAL SUPPORT REQUIREMENTS SHALL BE DETERMINED IN THE FIELD AND APPROVED BY THE ENGINEER PRIOR TO INSTALLATION. MAXIMUM SPACING SHALL BE AS SPECIFIED.
4. APPROPRIATE STANDARD WALL PIPE DETAIL SHALL BE USED WHEREVER PIPING PASSES FROM A STRUCTURE TO BACKFILL.
5. ALL FLEXIBLE CONNECTORS OR FLANGED COUPLING ADAPTERS SHALL BE PROVIDED WITH THRUST TIES, BLOCKS, OR ANCHORS, UNLESS OTHERWISE NOTED. THRUST PROTECTION SHALL BE ADEQUATE FOR TEST PRESSURES SPECIFIED.
6. SYMBOLS, LEGENDS, AND PIPE USE IDENTIFICATIONS SHOWN SHALL BE FOLLOWED THROUGHOUT THE DRAWINGS, WHEREVER APPLICABLE. ALL OF THE VARIOUS APPLICATIONS ARE NOT NECESSARILY USED IN THE PROJECT.
7. NUMBER AND LOCATION OF UNIONS SHOWN ON DRAWINGS ARE ONLY APPROXIMATE. PROVIDE ALL UNIONS NECESSARY TO FACILITATE CONVENIENT REMOVAL OF VALVES AND MECHANICAL EQUIPMENT.
8. THE CONTRACTOR FOR THIS PROJECT IS RESPONSIBLE FOR COORDINATING AND PERFORMING THE CONNECTION OF THE PIPING AND ASSOCIATED APPURTENANCES INSTALLED UNDER THIS CONTRACT TO BOTH THE EXISTING PIPING AND FACILITIES.
9. PRIOR TO SUBMITTING PIPING DRAWINGS FOR ANY NEW PIPE THAT IS TO CONNECT TO OR CROSS AN EXISTING PIPE OR STRUCTURE, THE CONTRACTOR SHALL EXPOSE THE EXISTING PIPE OR STRUCTURE TO VERIFY ITS EXACT LOCATION, SIZE, MATERIALS, AND INVERT ELEVATIONS.
10. COMPONENTS SHOWN WITH A DOUBLE ASTERISK (**) ARE PART OF A PACKAGE SYSTEM. SEE EQUIPMENT SPECIFICATIONS.

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN VP | DRAWN VP | CHECKED CC | APPROVED CC

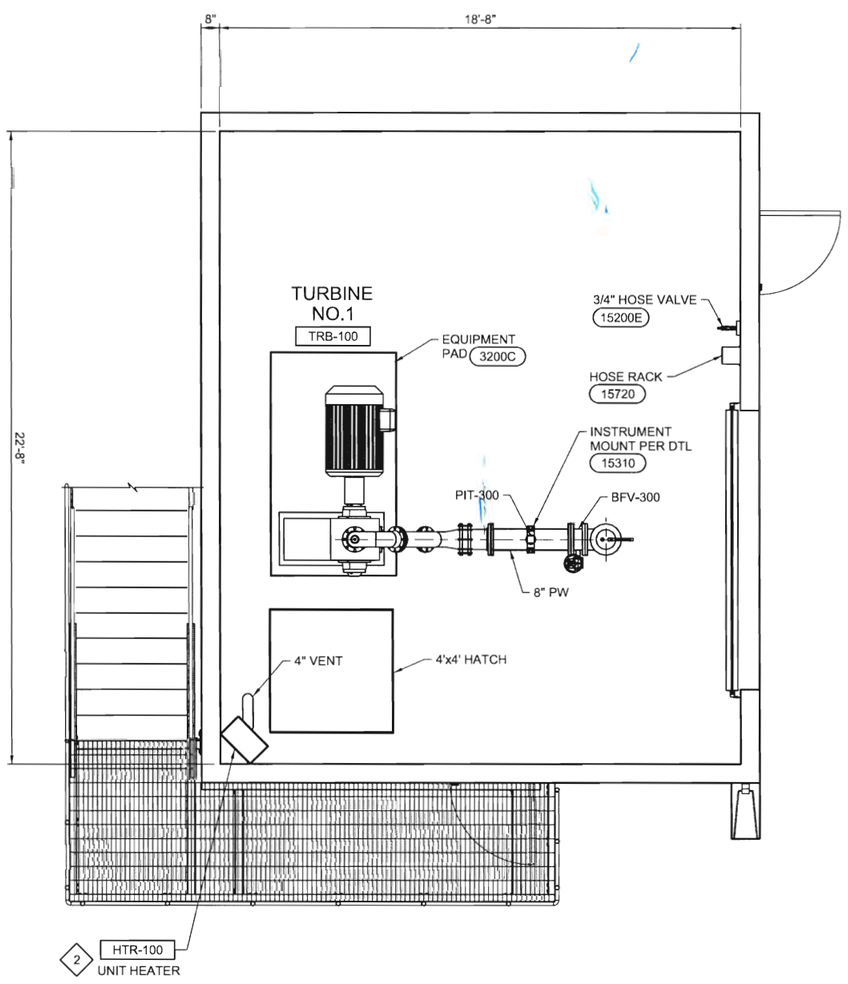
WATERWORKS ENGINEERS
235 S Mountain View Blvd Suite 100 • Pleasant Grove, UT 801-785-1705

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

MECHANICAL

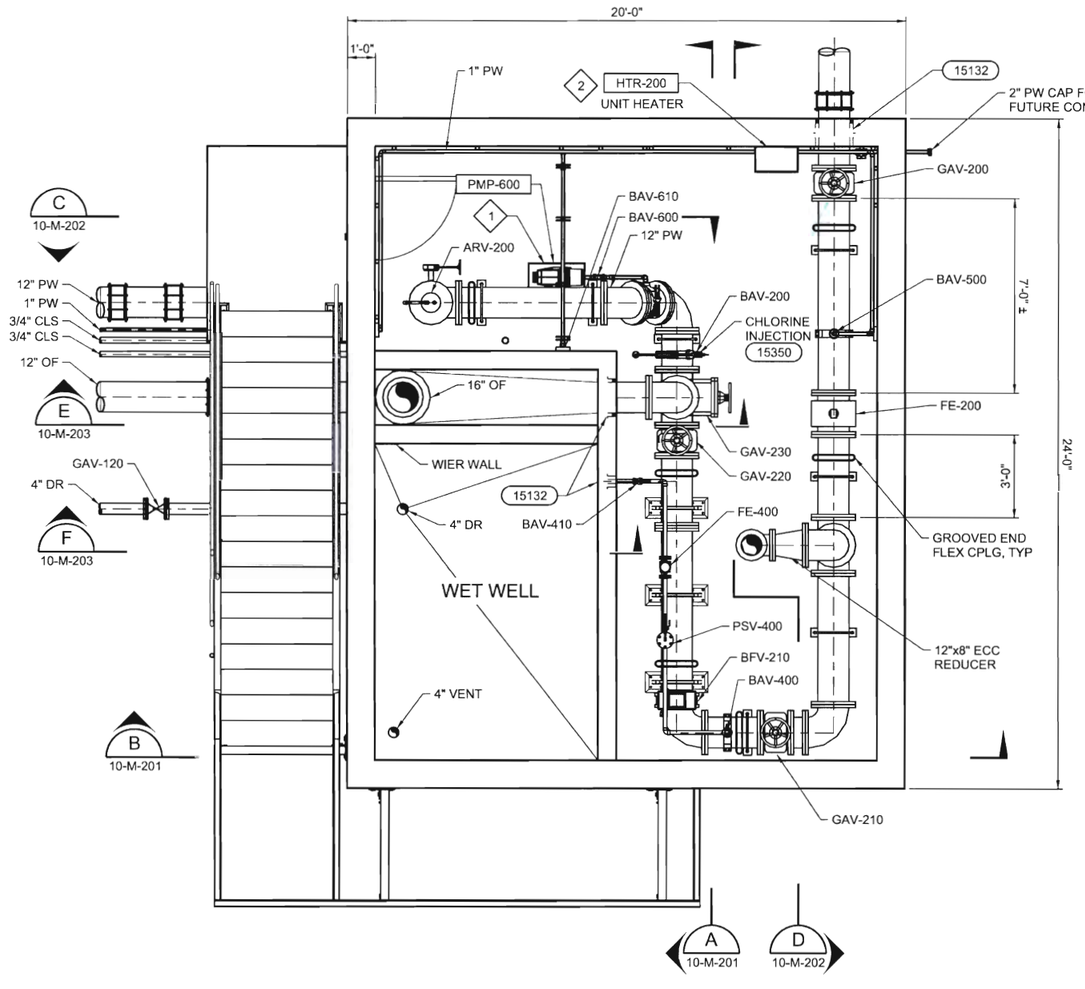
MECHANICAL LEGEND

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-M-001
SHEET 29 OF 70



UPPER PLAN

3/8" = 1'- 0"



LOWER PLAN

3/8" = 1'-0"

NORTH

KEY NOTES:

1. PROVIDE ON DEMAND SYSTEM PUMP CAPABLE OF 8 GPM AT 45 PSI PUMP DISCHARGE. GRUNDFOS MQ 3-45 A-B-A-BVBP, 230V, 1 PHASE OR EQUAL.
2. MOUNT UNIT HEATER TO WALL, APPROXIMATELY 8FT ABOVE FINISHED FLOOR. USE STANDARD WALL MOUNT SYSTEM SUPPLIED BY EQUIPMENT MANUFACTURER.

2 0 2 4 FEET

SCALE 3/8"=1'-0"

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS
2331 Pleasant Grove Blvd, Suite 100 • Pleasant Grove, UT • 801-763-5100

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

MECHANICAL

TURBINE BUILDING
PLAN

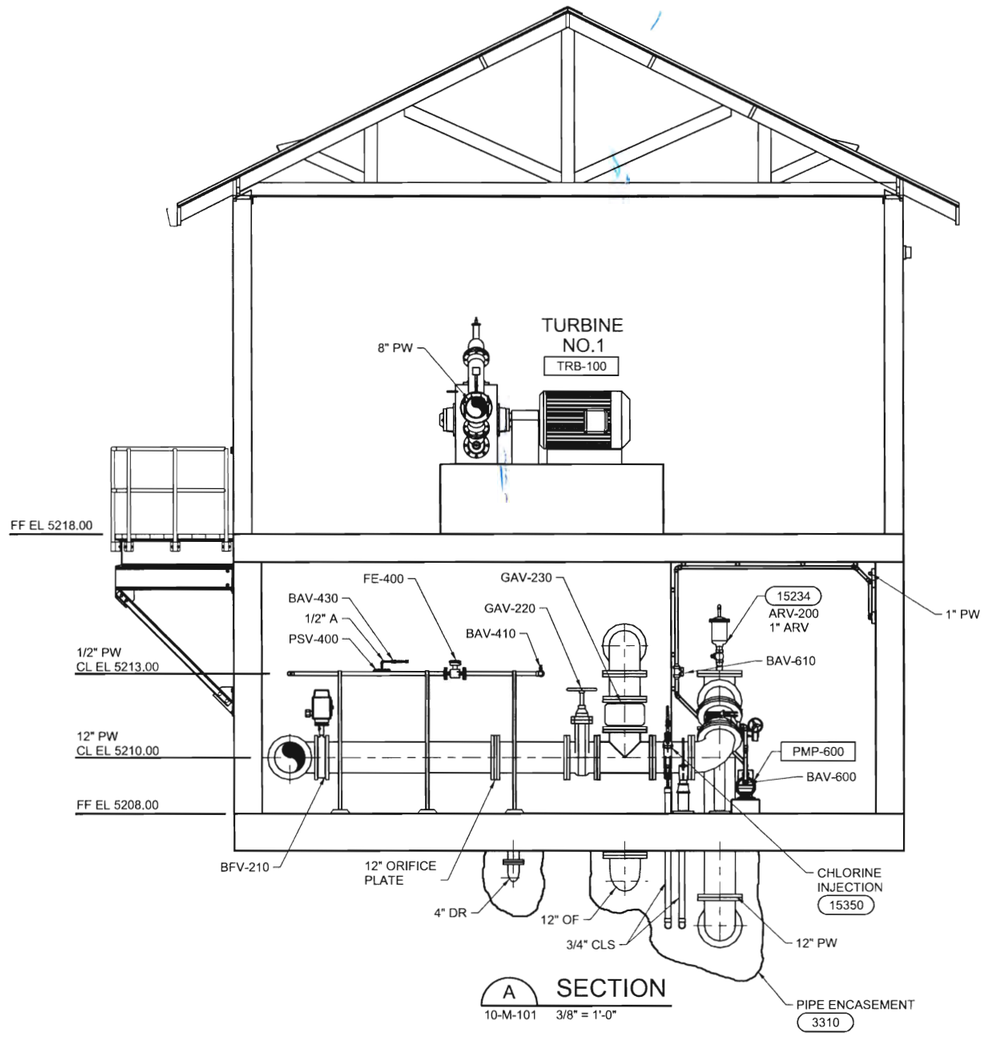
CORY L. CHRISTIANSEN
NO. 5102348
2/4/15
LICENSED PROFESSIONAL ENGINEER
STATE OF UTAH

DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
10-M-101
SHEET 30 OF 70

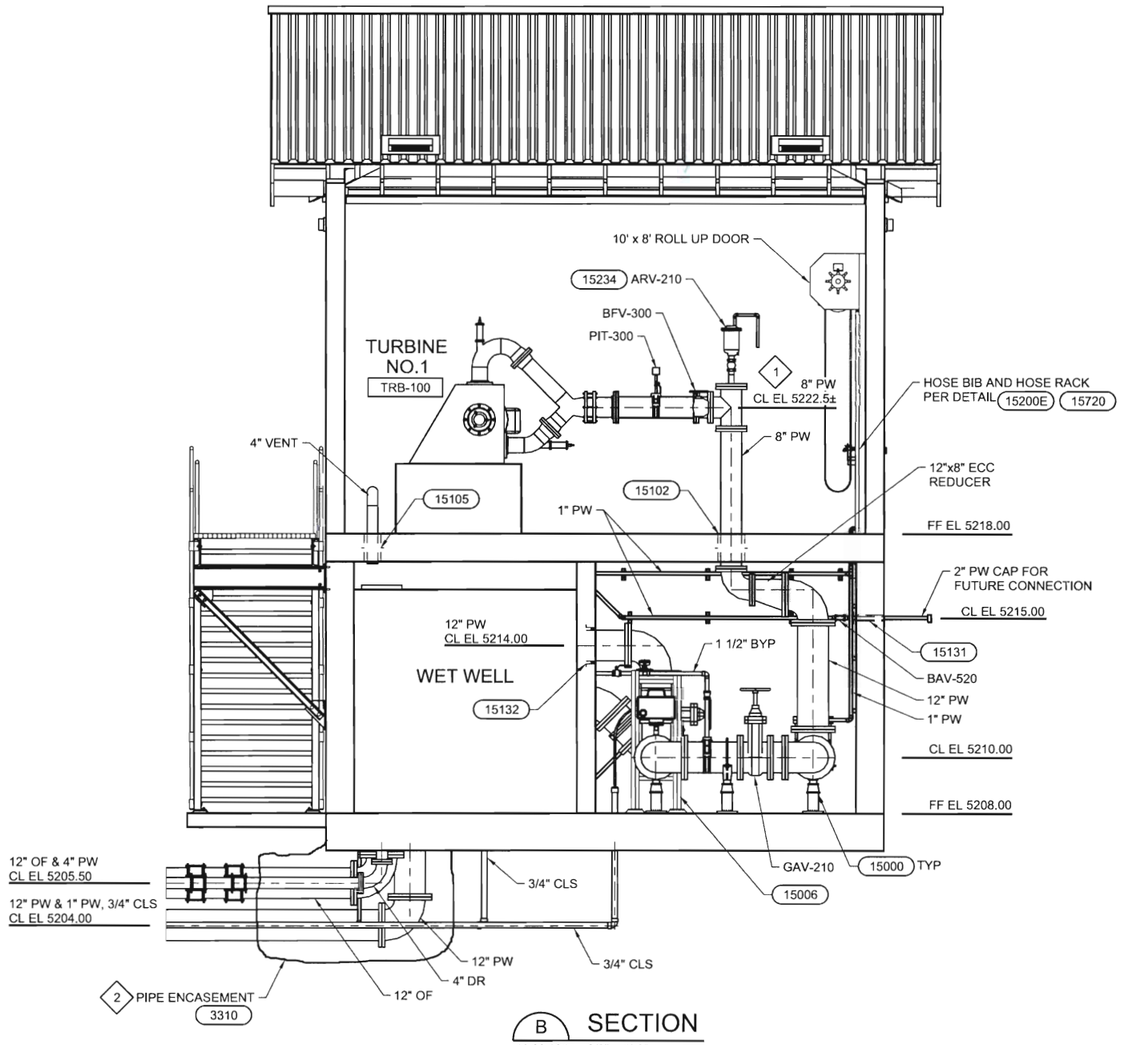
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10M101.dgn PLOT DATE: 2/16/2015 PLOT TIME: 8:33:32 AM SCALE: 1:5.33333

NOTES:

1. PIPE ELEVATION TO BE COORDINATED WITH TURBINE INSTALLATION.
2. EXTEND PIPE ENCASEMENT 3FT BEYOND OUTSIDE OF STRUCTURE.



A SECTION
10-M-101 3/8" = 1'-0"



B SECTION
10-M-101 3/8" = 1'-0"

2 0 2 4 FEET
SCALE 3/8"=1'-0"

CORY L. CHRISTIANSEN
LICENSED PROFESSIONAL ENGINEER
NO. 5402748
STATE OF UTAH
2/9/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS
2235 S. Pleasant Grove Blvd. Suite 103 • Pleasant Grove, UT • 801-785-1105

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

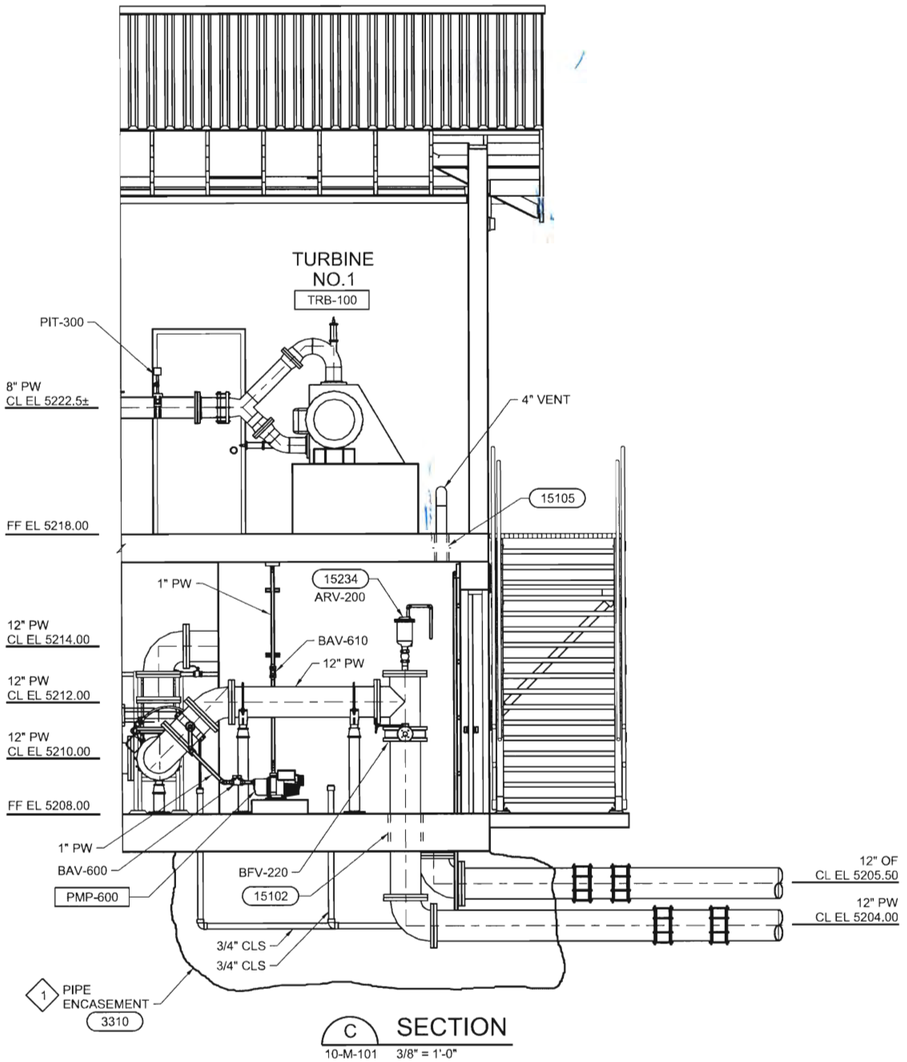
MECHANICAL
TURBINE BUILDING SECTIONS

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-M-201
SHEET 31 OF 70

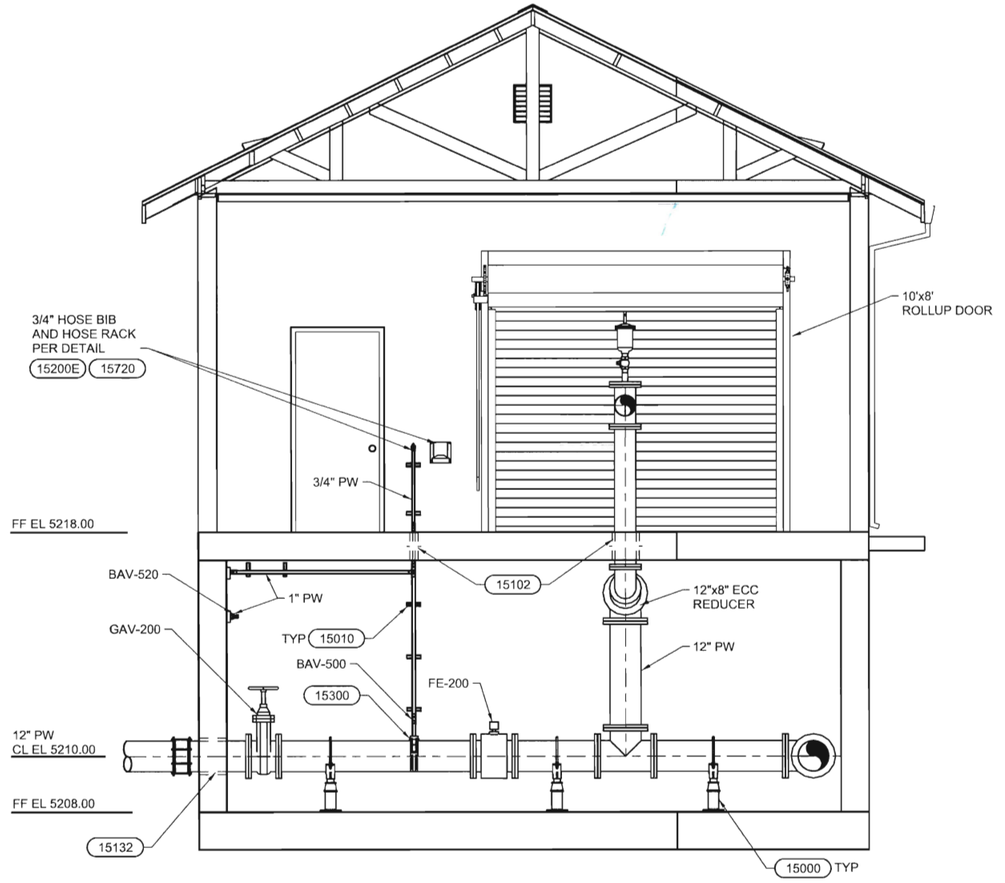
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10M201.dgn PLOT DATE: 2/16/2015 PLOT TIME: 8:36:16 AM SCALE: 1:5.33333

NOTES:

1. EXTEND PIPE ENCASEMENT MIN 3'-0" BEYOND OUTSIDE OF BLDG.



C SECTION
10-M-101 3/8" = 1'-0"



D SECTION
10-M-101 3/8" = 1'-0"

2 0 2 4 FEET
SCALE 3/8"=1'-0"

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd, Suite 102 • Pleasant Grove, UT • 801-785-4126

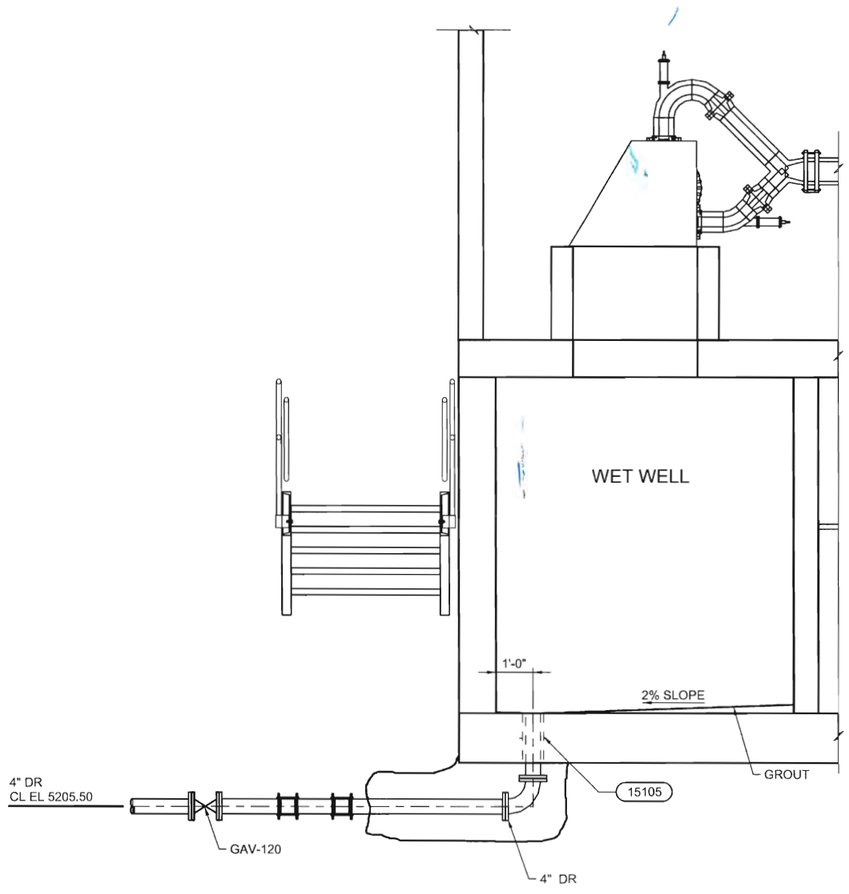
PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

MECHANICAL
TURBINE BUILDING
SECTIONS

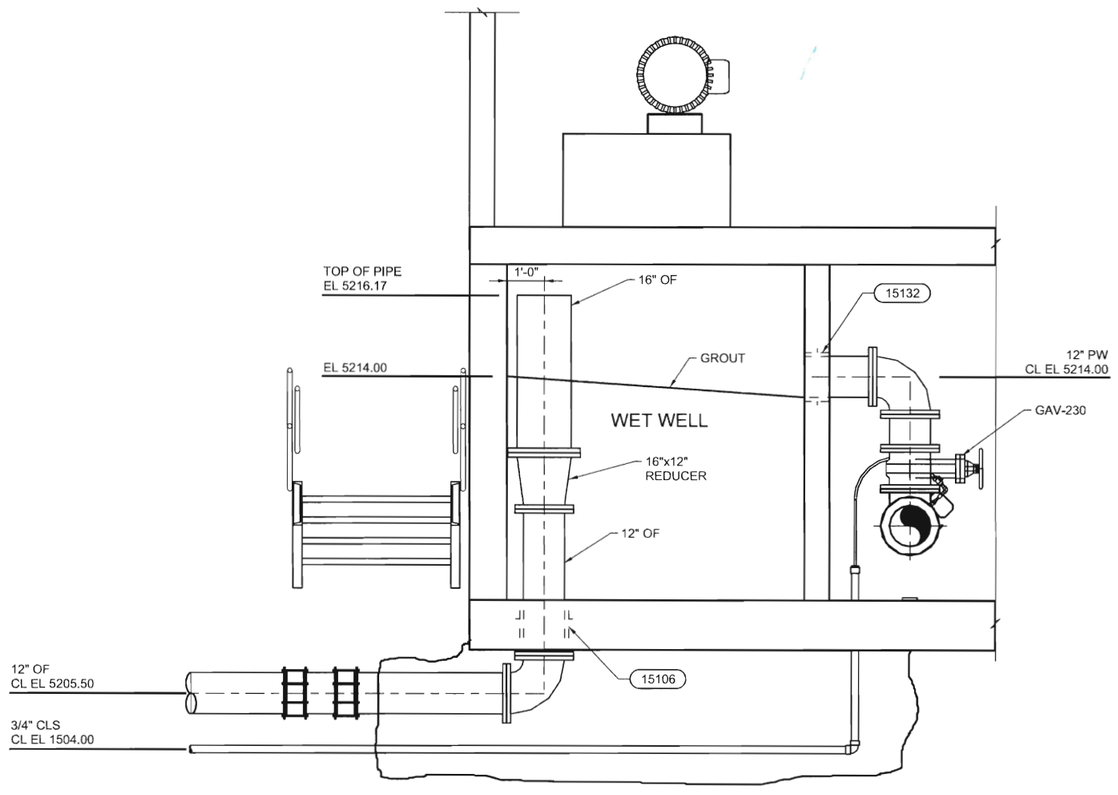
DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
10-M-202
SHEET 32 OF 70

REUSE OF DOCUMENTS: THIS DOCUMENT, AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF WATER WORKS ENGINEERS, LLC. AND IS NOT TO BE USED, IN WHOLE OR IN PART, FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF WATER WORKS ENGINEERS, LLC.

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10M202.dgn PLOT DATE: 2/4/2015 PLOT TIME: 10:05:56 AM SCALE: 1:5.33333



F SECTION
10-M-101 1/2" = 1'-0"



E SECTION
10-M-101 1/2" = 1'-0"

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN CC
DRAWN VP
CHECKED CC
APPROVED CC

WATER WORKS ENGINEERS
235 S Pleasant Grove Blvd, Suite 103 • Pleasant Grove, UT • 801-785-4100

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

MECHANICAL
TURBINE BUILDING SECTIONS

LICENSED PROFESSIONAL ENGINEER
CORY L. CHRISTIANSEN
NO. 5102948
2/4/15
STATE OF UTAH

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-M-203
SHEET 33 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10M203.dgn PLOT DATE: 2/4/2015 PLOT TIME: 10:07:18 AM SCALE: 1:4

AREA CLASSIFICATIONS

	DESCRIPTION
DAMP	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 12 CONSTRUCTION (OR GASKETED AND SUITABLE FOR USE IS A WET LOCATION WHERE NEMA STANDARDS DO NOT APPLY) UNLESS OTHER-WISE NOTED.
WET	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 4X CONSTRUCTION (OR GASKETED AND SUITABLE FOR USE IN A WET LOCATION WHERE NEMA STANDARDS DO NOT APPLY) UNLESS OTHER-WISE NOTED.
CORROSIVE	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 4X NON-METALLIC CONSTRUCTION (OR CORROSION RESISTANT CONSTRUCTION SUITABLE FOR USE IN A WET LOCATION WHERE NEMA STANDARDS DO NOT APPLY) UNLESS OTHERWISE NOTED.
CLASS 1, DIV. 1 GROUP D	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL CONFORM TO N.E.C. REQUIREMENTS FOR THE HAZARDOUS AREA CLASSIFICATION SHOWN.

52 XXXX/XXXX	DRAWOUT MEDIUM VOLTAGE POWER BREAKER UPPER NUMBER INDICATES LONG TIME TRIP SETTING LOWER NUMBER INDICATES BREAKER CONTINUOUS CURRENT RATING
XP XAT/XAF CB	THERMAL-MAGNETIC CIRCUIT BREAKER TRIP RATING ABOVE; FRAME RATING BELOW. TYPICAL FOR OTHER TYPES OF BREAKERS. BREAKER TO BE 3 POLE UNLESS NOTED OTHERWISE AS 1P OR 2P
X/MCP Z	COMBINATION MOTOR STARTER WITH MOTOR CIRCUIT PROTECTOR, MAGNETIC CONTACTOR AND OVERLOAD PROTECTION X= AMPERE SIZE Z= NEMA SIZE
Z Z	MOTOR STARTER WITH MAGNETIC CONTACTOR AND OVERLOAD PROTECTION Z= NEMA SIZE
TTB	TELEPHONE TERMINAL BOARD 4FT X 8FT X 3/4 INCH UNLESS NOTED OTHERWISE
	TELEPHONE OUTLET, WALL TYPE (MOUNT 1'-6" AFF UNO)
	TELEPHONE OUTLET AND FLOOR BOX
	TELEPHONE/DATA OUTLET, WALL TYPE (MOUNT 1'-6" AFF UNO)
	TELEPHONE/DATA OUTLET AND FLOOR BOX
S C1	PAGING SPEAKER, WALL MOUNTED "H1" AND "C1" DENOTES TYPE. H=HORN, C=CONE
S H1 / S H3	PAGING SPEAKER, WALL MOUNTED, BI-DIRECTIONAL NOTATIONS SAME AS ABOVE
S C2	PAGING SPEAKER, FLUSH MOUNTED CEILING TYPE
S	PAGING STATION, SURFACE MOUNTED
VC	REMOTE WALL MOUNTED VOLUME CONTROL. FOR CEILING SPEAKER (MOUNT UP 5'-0" AFF UNO)
A	PAGING SPEAKER AMPLIFIER ASSEMBLY

	EXPOSED CONDUIT
	UNDERGROUND DUCT BANK OR CONCEALED CONDUIT IN CONCRETE FLOOR, CEILING OR WALL UNLESS OTHERWISE INDICATED OR NOTED.
1000	CONDUITS IDENTIFIED BY A NUMBER SHALL BE LISTED IN THE CONDUIT BLOCK DIAGRAM
AA	CONDUITS IDENTIFIED BY LETTERS SHALL CONFORM TO THE TABLES IN THE LEGEND
	CONDUIT STUBBED OUT AND CAPPED
	FLEXIBLE CONDUIT OR MANUFACTURER'S CABLE(S)

	DESCRIPTION
XXXX	CONDUIT HOMERUN, XXX DENOTES DESTINATION CONTRACTOR SHALL FIELD ROUTE FROM EQUIPMENT TO DESIGNATED LOCATION
(2)-3"C, 3-#3/0, 1-#2G	DENOTES A QUANTITY OF TWO (2) 3-INCH CONDUITS EACH CONTAINING THREE NO. 3/0 AWG CONDUCTORS AND 1 NO. 2 AWG GROUND CONDUCTOR
2 PR #16 TWSH	DENOTES A QUANTITY OF TWO INSTRUMENT CABLES. EACH CABLE TO CONSIST OF TWO NO. 16 AWG CONDUCTORS TWISTED TOGETHER AND COVERED WITH A METALLIC SHIELD AND AN OVERALL PROTECTIVE JACKET. REFER TO THE SPECIFICATIONS FOR THE EXACT CABLE TO BE PROVIDED.
2 TR #16 TWSH	SAME AS ABOVE EXCEPT CABLE TO CONSIST OF THREE NO. 16 AWG CONDUCTORS TWISTED, SHIELDED AND COVERED WITH AN OVERALL PROTECTIVE JACKET. REFER TO THE SPECIFICATIONS FOR THE EXACT CABLE TO BE PROVIDED.
2 PR #16 TW	DENOTES A QUANTITY OF TWO INSTRUMENT CABLES. EACH CABLE TO CONSIST OF TWO NO. 16 AWG CONDUCTORS TWISTED TOGETHER AND AN OVERALL PROTECTIVE JACKET. REFER TO THE SPECIFICATIONS FOR THE EXACT CABLE TO BE PROVIDED.
(3)-4"C	THREE 4-INCH CONDUITS

	CONDUCTORS NOT CONNECTED
	CONDUCTORS CONNECTED
	CONDUCTOR SHIELD
	CONDUCTOR SHIELD TWISTED PAIR
	FIELD CONDUCTOR SHIELD
	FIELD CONDUCTOR SHIELD TWISTED PAIR
	EARTH GROUND
	CHASSIS GROUND
	NEUTRAL
	SEPARABLE CONNECTOR SIFICATION SHOWN.
DI	DISCRETE INPUT
DO	DISCRETE OUTPUT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
	RESISTOR OR RESISTIVE ELEMENT
	OVERLOAD RELAY THERMAL ELEMENT (HEATER)
	STRIP HEATER OR HEATING ELEMENT
	HIGH VOLTAGE, GROUP OPERATED, AIR-BREAK SWITCH * CONTINUOUS AMPERE RATING

EQUIPMENT

UH-_KW / UH-	UNIT HEATER NO. 1
WH-_KW / WH-	WATER HEATER NO. 1
DAMPER / DM	DAMPER MOTOR
MOV / MOV	MOTOR OPERATED VALVE "XXXX" DENOTES LOOP NUMBER TO BE OBTAINED FROM INSTRUMENTATION DRAWINGS
RCS	REMOTE CONTROL STATION
ITP / ITP	INTERMEDIATE TERMINAL PANEL

FIRE ALARM SYSTEMS

TYPE R	FIRE ALARM HEAT DETECTOR 135Y FIXED TEMPERATURE UNLESS OTHER- WISE NOTED. "200" DENOTES 200YF TYPE, "R" DENOTES FIXED TEMPERATURE RATE-OF-RISE TYPE.
2 I	FIRE ALARM DUCT SMOKE DETECTOR PHOTOCELL TYPE UNLESS OTHERWISE NOTED: "I" DENOTES IONIZATION TYPE.
2	FIRE ALARM DUCT SMOKE DETECTOR
FACP-	FIRE ALARM CONTROL PANEL NO. 1
FAVP-	FIRE ALARM VENTILATION PANEL NO. 1 (WITH GRAPHIC PANEL)
FARAP-	FIRE ALARM REMOTE ANNUNCIATOR NO. 1
M WP	FIRE ALARM MANUAL PULL STATION, MOUNT UP 4'-0" WP DENOTES WEATHERPROOF COVER
F	OUTDOOR WEATHERPROOF FIRE ALARM MASTER BOX
F	WP FIRE ALARM SPEAKER, MOUNT UP 7'-8"
S	FIRE ALARM STROBE, WALL MOUNT UP 6'-8" OR AT CEILING
F	FIRE ALARM HORN AND STROBE LIGHT COMBINATION, MOUNT UP 6'-8"
F	FIRE ALARM HORN AND STROBE LIGHT COMBINATION, CEILING MOUNT
	SPRINKLER VALVE SUPERVISORY SWITCH
F	FIRE ALARM BELL
FB	WEATHERPROOF HI-DENSITY FIRE ALARM STROBE LIGHT
	SPRINKLER FLOW ALARM SWITCH
CM	ADDRESSABLE CONTROL MODULE
MM	ADDRESSABLE MONITOR MODULE
SD	SMOKE DETECTOR

GROUNDING

	GROUND ROD
	GROUNDING CONDUCTOR
	GROUND ROD IN GROUNDING WELL
	GROUND ROD IN TEST WELL
	GROUND GRID CABLE CONNECTION, WELDED

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO.9062312-2202
STATE OF UTAH
2/4/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN	DRAWN	CHECKED	APPROVED
GAF	JJ	GAF	CC

WATERWORKS ENGINEERS
231 S. Pleasant Grove Blvd. S.Ste.100 • Pleasant Grove, UT • 801-785-4105

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

ELECTRICAL

SYMBOLS AND LEGEND 1

DATE	FEB 2015
PROJECT NUMBER	10-011
DRAWING NUMBER	00-E-001
SHEET	35 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00E001.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:59:21 AM SCALE: 1:0.166667

LIGHTING

$_a — SINGLE POLE SWITCH "a" INDICATES SWITCHLEG SHALL CONTROL LUMINAIRES WITH "a" DESIGNATION

$^2_b — DOUBLE POLE SWITCH "b" INDICATES SWITCHLEG SHALL CONTROL LUMINAIRES WITH "b" DESIGNATION

$^3_c — THREE WAY SWITCH "c" INDICATES SWITCHLEG SHALL CONTROL LUMINAIRES WITH "c" DESIGNATION

$^4_d — FOUR WAY SWITCH "d" INDICATES SWITCHLEG SHALL CONTROL LUMINAIRES "d" DESIGNATION

$^M — SINGLE POLE, DOUBLE THROW MOMENTARY CONTACT SWITCH, CENTER OFF

$^P — SINGLE POLE SWITCH AND PILOT LIGHT

(PB) [PB] — PULL BOX

[Ca] — LIGHTING CONTACTOR WITH NUMBER OF POLES AS INDICATED a-CONTACTOR NUMBER (C1, C2, ETC.)

[ALCP-X] OR [ALP-X] — AREA LIGHTING CONTACTOR PANEL X= PANEL NAME

[TM] — TIME SWITCH

[LP-X] OR [LP-X] — LIGHTING PANELBOARD NO. X (240/120V OR 208/120V) X= PANELBOARD NAME

[PP-X] OR [PP-X] — POWER DISTRIBUTION PANELBOARD NO. X (480V OR 480/277V) X= PANELBOARD NAME

XX (X, Y, b) NL — TYPICAL LUMINAIRES SEE SCHEDULE FOR SPECIFICS
"XX"-FIXTURE TYPE X= PANELBOARD NAME
"b"-CONTROLLED BY SWITCH Y= CIRCUIT NUMBER
"b" NL= NIGHT LIGHT (UNSWITCHED)

X, Y, b — DIRECTIONAL FLOOD LIGHT TYPE LUMINAIRES. SEE SCHEDULE FOR SPECIFICS. NOTATIONS SAME AS ABOVE.

[XX NL] (X, Y, b) — FLUORESCENT TYPE LUMINAIRES. SEE SCHEDULE FOR SPECIFICS. NOTATIONS SAME AS ABOVE.

XX NL (X, Y, b) — FLUORESCENT TYPE LUMINAIRES. SEE SCHEDULE FOR SPECIFICS. NOTATIONS SAME AS ABOVE.

[TYPE] — INDICATES ALL LUMINAIRES WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE TYPE "A" UNLESS OTHERWISE NOTED. SEE LIGHTING FIXTURE SCHEDULE FOR TYPES

(R) — ALARM BEACON. COLOR AS NOTED. SEE SPECIFICATIONS FOR REQUIREMENTS.

E1 / LP-X / Y — EMERGENCY LUMINAIRES WITH BATTERY PACK "E1" FIXTURE TYPE. SEE SCHEDULE FOR SPECIFICS.
X= PANELBOARD NAME
Y= CIRCUIT NUMBER

REM — REMOTE EMERGENCY LUMINAIRES "E2"-FIXTURE TYPE. SEE SCHEDULE FOR SPECIFICS

E1 / LP-3 / Y / * — CEILING MOUNTED EXIT SIGN "X1" LUMINAIRE TYPE. SEE SCHEDULE FOR SPECIFICS
X= PANELBOARD NAME
Y= CIRCUIT NUMBER
* SP= SELF POWERED

X2 / LP-3 / Y / * — WALL OUTLET EXIT SIGN. ARROW INDICATES DIRECTION OF EXCESS "X2" LUMINAIRE TYPE. SEE SCHEDULE FOR SPECIFICS.
X= PANELBOARD NAME
Y= CIRCUIT NUMBER
* SP= SELF POWERED

SECURITY SYSTEMS

KP — SECURITY SYSTEM KEY PAD

CR — SECURITY SYSTEM CARD ACCESS READER

MD — SECURITY ALARM MOTION DETECTOR

CCTV — CLOSED CIRCUIT TV CAMERA

PTZ — PAN, TILT, ZOOM CAMERA LENS CONTROLS

MISCELLANEOUS

CONDUCTORS OR CONDUITS CROSSING PATHS BUT NOT CONNECTED

CONDUCTORS ELECTRICALLY CONNECTED

INDICATES LIMITS OF EQUIPMENT OR WIRING ENCLOSURE

FUSE, AMPERE RATING AS NOTED

FU# / AMPS — FUSE DISCONNECT

INDUCTOR

K — KEY INTERLOCK

E K — ELECTRONIC KEY INTERLOCK

CORD AND PLUG CONNECTION.

T — THERMOSTAT

OS — OCCUPANCY SENSOR

PC — PHOTOCELL

ESA — EMERGENCY SHOWER ALARM STATION

OR — JUMPER

XXX — MOTOR SWITCH

POWER SWITCHES

NON-FUSIBLE DISCONNECT SWITCH, 600 VOLT, 2 OR 3 POLE, * AMPERE RATING

F — FUSIBLE DISCONNECT SWITCH, 600 VOLT, 3 POLE, AMPERE RATING AND FUSE SIZE AS NOTED *AMPERE RATING *FUSE RATING

MANUAL MOTOR STARTER WITH THERMAL OVERLOAD PROTECTION "P" INDICATES WITH PILOT LIGHT "2" INDICATES NUMBER OF POLES

DRAWOUT TYPE EQUIPMENT OR DEVICE

MEDIUM VOLTAGE CABLE TERMINATION

MEDIUM VOLTAGE AIR INTERRUPTER SWITCH

MEDIUM VOLTAGE FUSED AIR INTERRUPTER SWITCH

— MEDIUM VOLTAGE FUSED MOTOR CONTROLLER *AT=AUTOTRANSFORMER TYPE

T — TRANSFORMER, RATINGS AND CONNECTIONS AS NOTED. UNLESS OTHERWISE NOTED ON THE ONE LINE DIAGRAMS ALL DRY TYPE TRANSFORMERS SERVICING ADMINISTRATIVE AND LABORATORY SPACES SHALL HAVE A K FACTOR OF 13. ALL OTHER DRY TYPE TRANSFORMERS SHALL HAVE A K-4 RATING. ISOLATION TRANSFORMERS SHALL HAVE A K-20 RATING

TAG
KVA
PRIMARY
SECONDARY
PHASE

POWER SWITCHES (CONTINUED)

(M) — METER *
WM-WATTMETER
WHM-WATTHOUR METER
WHDM-WATTHOUR DEMAND METER
WHDR-WATTHOUR DEMAND RECORDER
PF-POWER FACTOR METER
TRANSDUCER *
AX-CURRENT TRANSDUCER
WX-WATT TRANSDUCER

XX/XX (*) CT — CURRENT TRANSFORMER *QUANTITY
XXXX = PRIMARY AMPERE RATING

XX/XX ** — POTENTIAL TRANSFORMER (PT) OR CONTROL POWER TRANSFORMER (CPT) *QUANTITY
XXXX = PRIMARY VOLTAGE RATING

G# — GENERATOR WITH GENERATION NUMBER, RATINGS AND CONNECTIONS AS NOTED IN CALL-OUT ON DRAWING

S N RATE ATS-# — [ATS-#] AUTOMATIC TRANSFER SWITCH (ATS) "N" INDICATES NORMAL SOURCE "S" INDICATES STANDBY SOURCE "RATE" INDICATES CONTINUOUS CURRENT RATING "#" INDICATES ATS NAME

VFD — AC MOTOR SPEED CONTROLLER (VARIABLE FREQUENCY DRIVE)

SCR — DC MOTOR SPEED CONTROLLER (SILICON CONTROLLED RECTIFIER)

MTR — MOTOR, NUMERAL INDICATES HORSEPOWER

(*) VS VM — VOLTMETER WITH SWITCH, 3 PHASE * = SCALE

VS AM — AMMETER WITH SWITCH, 3 PHASE * = SCALE

LA — LIGHTNING ARRESTOR

SURGE SUPPRESSER

TVSS — TRANSIENT VOLTAGE SURGE SUPPRESSOR (POWER DISTRIBUTION TYPE)

PILOT LIGHT, COLOR AS NOTED
A-AMBER, B-BLUE, C-CLEAR
G-GREEN, R-RED, W-WHITE

[ ] OR [SV] — SOLENOID OPERATED VALVE

ETM — ELAPSED TIME METER

RECEPTACLES

LP-X / Y — 208V, 3P, 4W, RECEPTACLE
*AMPERE RATING AS NOTED X= PANELBOARD NUMBER Y= CIRCUIT NUMBER

240V, 20, 3W, RECEPTACLE
*AMPERE RATING AS NOTED

TYPE — FLOOR OUTLET BOX WITH TYPE OUTLET INDICATED

LP-X / Y — 480V, 3P, 4W RECEPTACLE AND DISCONNECT SWITCH *AMPERE RATING AS NOTED
X= PANELBOARD NUMBER
Y= CIRCUIT NUMBER

LP-X / Y — DUPLEX RECEPTACLE, 20A, 120V, 2P, 3W UNLESS OTHERWISE NOTED * C-MOUNTED ABOVE COUNTER-TOP
GF- GROUND FAULT INTERRUPTER TYPE
WP-WEATHERPROOF
T-TRANSIENT VOLTAGE SURGE SUPPRESSER
X= PANELBOARD NUMBER
Y= CIRCUIT NUMBER

LP-X / Y — QUAD RECEPTACLE, 20A, 120V, 2P, 3W UNLESS OTHERWISE NOTED NOTATION SAME AS ABOVE

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO. 9062312-2202
STATE OF UTAH
2/4/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN JWJ
CHECKED RDB
APPROVED CC

WATERWORKS ENGINEERS
215 S. Pleasant Grove Blvd. S. ste 101 • Pleasant Grove, UT • 801-785-4175

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

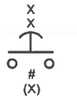
ELECTRICAL

SYMBOLS AND LEGEND 2

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-E-002
SHEET 36 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00E002.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:58:19 AM SCALE: 1:0.166667

PUSH BUTTONS



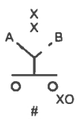
EMERGENCY STOP PUSHBUTTON WITH RED MUSHROOM HEAD OPERATOR (MAINTAINED CONTACT)

PUSHBUTTON, MOMENTARY CONTACT, SPRING RETURN, NORMALLY CLOSED

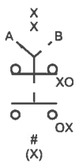
PUSHBUTTON, MOMENTARY CONTACT, SPRING RETURN, NORMALLY OPEN

START-STOP PUSHBUTTON CONTROL STATION, MAINTAINED CONTACT WITH LOCKOUT DEVICE ON STOP

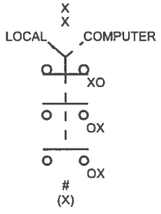
2 POSITION SELECTOR SWITCH, NORMALLY CLOSED



2 POSITION SELECTOR SWITCH, NORMALLY OPEN

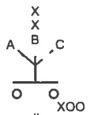


2 POSITION 2 POLE SELECTOR SWITCH



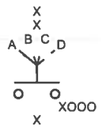
2 POSITION 3 POLE SELECTOR SWITCH

3 POSITION SELECTOR SWITCH, NORMALLY CLOSED

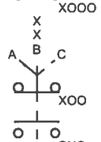


3 POSITION SELECTOR SWITCH, NORMALLY OPEN

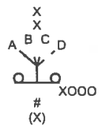
PUSH BUTTONS (CONTINUED)



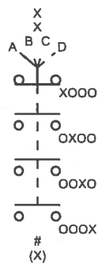
4 POSITION SELECTOR SWITCH, NORMALLY OPEN



3 POSITION 3 POLE SELECTOR SWITCH

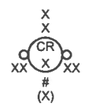


4 POSITION SELECTOR SWITCH, NORMALLY CLOSED

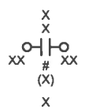


4 POSITION 4 POLE SELECTOR SWITCH

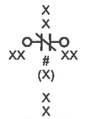
RELAY CONTACTS



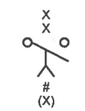
MOTOR STARTER, TIMING, OR CONTROL RELAY COIL NUMBER AS INDICATED



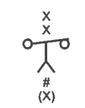
NORMALLY OPEN RELAY CONTACT



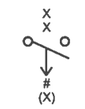
NORMALLY CLOSED RELAY CONTACT



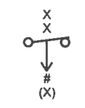
NOTC-NORMALLY OPEN TIMED CLOSING, WHEN ENERGIZED



NCTO-NORMALLY CLOSED TIMED OPENING, WHEN ENERGIZED

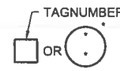


NOTO-NORMALLY OPEN, TIMED OPENING WHEN DE-ENERGIZED

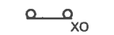


NCTC-NORMALLY CLOSED, TIMED CLOSING WHEN DE-ENERGIZED

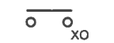
SWITCH CONTACTS



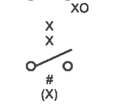
FIELD MOUNTED INSTRUMENT
X= DESIGNATION TO BE OBTAINED FROM INSTRUMENTATION DRAWINGS 0000= LOOP NUMBER TO BE OBTAINED FROM INSTRUMENTATION DRAWINGS



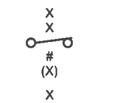
AUXILLARY SWITCH CONTACT NORMALLY CLOSED



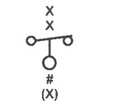
AUXILLARY SWITCH CONTACT NORMALLY OPEN



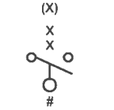
NORMALLY OPEN SWITCH



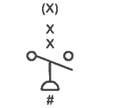
NORMALLY CLOSED SWITCH



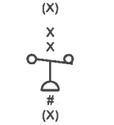
LIQUID LEVEL (FLOAT)
NORMALLY CLOSED, OPENS ON RISING LEVEL



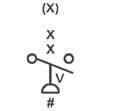
LIQUID LEVEL (FLOAT)
SWITCH NORMALLY OPEN, CLOSES ON RISING LEVEL



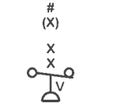
PRESSURE SWITCH NORMALLY OPEN, CLOSES ON RISING PRESSURE



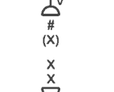
PRESSURE SWITCH NORMALLY CLOSED, OPENS ON DROPPING PRESSURE



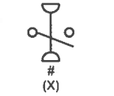
VACUUM SWITCH NORMALLY OPEN, CLOSES ON RISING PRESSURE



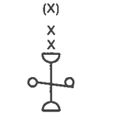
VACUUM SWITCH NORMALLY CLOSED, OPENS ON DROPPING PRESSURE



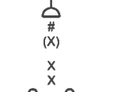
DIFFERENTIAL PRESSURE SWITCH NORMALLY OPEN, CLOSES ON RISING DIFFERENTIAL PRESSURE



DIFFERENTIAL PRESSURE SWITCH NORMALLY CLOSED, OPENS ON RISING DIFFERENTIAL PRESSURE



TEMPERATURE SWITCH NORMALLY OPEN, CLOSES ON RISING TEMPERATURE

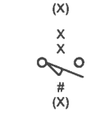


TEMPERATURE SWITCH NORMALLY CLOSED, OPENS ON RISING TEMPERATURE

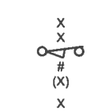
SWITCH CONTACTS (CONTINUED)

FLOW SWITCH (AIR, WATER, ETC.,) NORMALLY OPEN, CLOSES ON INCREASED FLOW

FLOW SWITCH (AIR, WATER, ETC.,) NORMALLY CLOSED, OPENS ON INCREASED FLOW



POSITION (LIMIT) SWITCH NORMALLY OPEN



POSITION (LIMIT) SWITCH NORMALLY CLOSED

POSITION (LIMIT) SWITCH NORMALLY OPEN-HELD CLOSED

POSITION (LIMIT) SWITCH NORMALLY CLOSED-HELD OPEN

TORQUE SWITCH NORMALLY OPEN, CLOSES ON HIGH TORQUE

TORQUE SWITCH NORMALLY CLOSED, OPENS ON HIGH TORQUE

PUSH-TEST, 110V S6 LAMP UNLESS NOTED,
LETTER IS LENS COLOR
* R-RED G-GREEN B-BLUE

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN JWJ
CHECKED RDB
APPROVED CC

WATERWORKS ENGINEERS
231 S. Pleasant Grove Blvd, S.Ste 103 • Pleasant Grove, UT • 801-785-4175

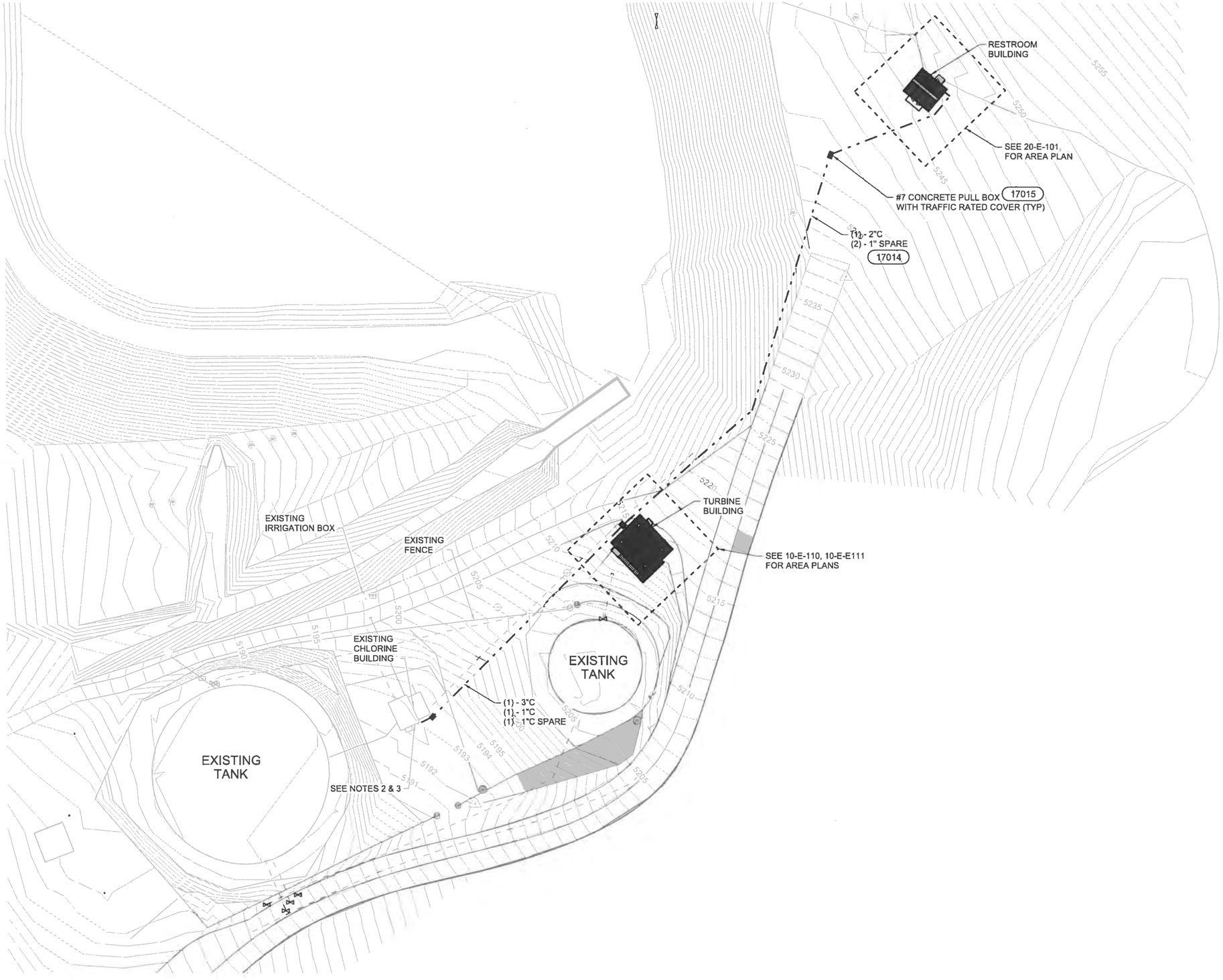
PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

ELECTRICAL

SYMBOLS AND LEGEND 3

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-E-003
SHEET 37 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00E003.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:57:13 AM SCALE: 1:0.166667



NORTH

NOTES:

1. REFER TO CONDUIT BLOCK DIAGRAM FOR CIRCUIT AND CONDUIT INFORMATION.
2. REFER TO SINGLE LINE DIAGRAM FOR POWER DISTRIBUTION. MOUNT A NEW 3PHASE 480VAC DISCONNECT ON THE CHLORINE BUILDING TO PROVIDE UTILITY ISOLATION.
3. THE EXISTING ELECTRICAL SERVICE IS TO REMAIN IS OPERATION UNTIL THE TURBINE IS OPERATIONAL. COORDINATE WITH THE UTILITY ON NEW 3PHASE, 480VAC METERING AND CONNECTION.
4. REFER TO STANDARD MOUNTING DETAILS FOR MORE INFORMATION ON 00-SD-312, 313, AND 314.

30 0 30 60 FEET
SCALE 1"=30'

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN DT | DRAWN VP | CHECKED DT | APPROVED CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd Suite 150 • Pleasant Grove UT • 801-785-4175

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

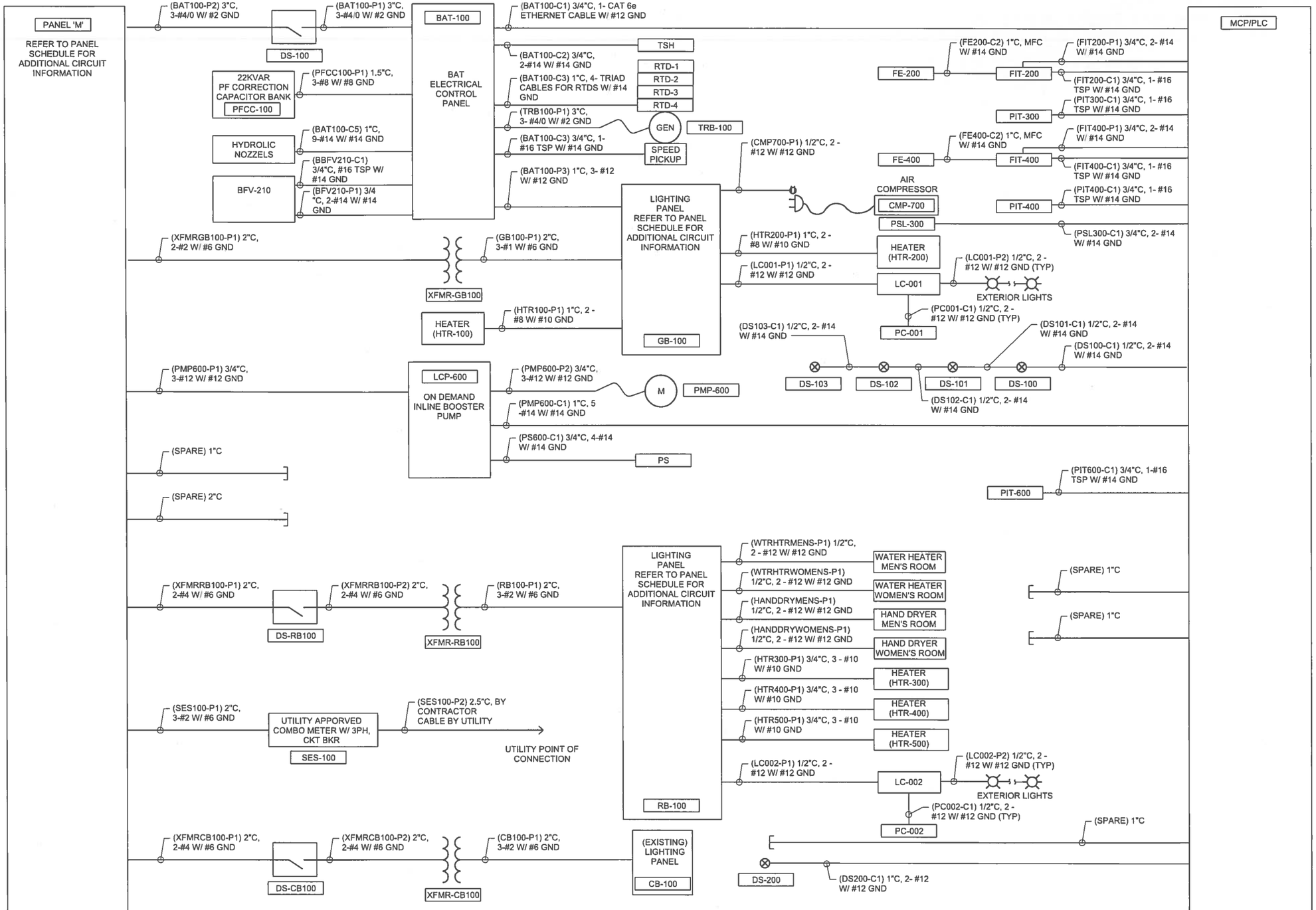
ELECTRICAL

SITE PLAN

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO. 9062312-2202
STATE OF UTAH
2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-E-100
SHEET 38 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00E100.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:56:42 AM SCALE: 1:60



NOTES:

1. CONVIENCE OUTLETS AND INTERIOR LIGHTING ARE NOT SHOWN HERE. REFER TO 10-E-103 FOR PANEL SCHEDULES WITH CIRCUIT INFORMATION.

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO.9062312-2202
STATE OF UTAH
2/4/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN DAF
DRAWN DAF
CHECKED DAF
APPROVED CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd. S Ste 103 • Pleasant Grove, UT • 801-785-4105

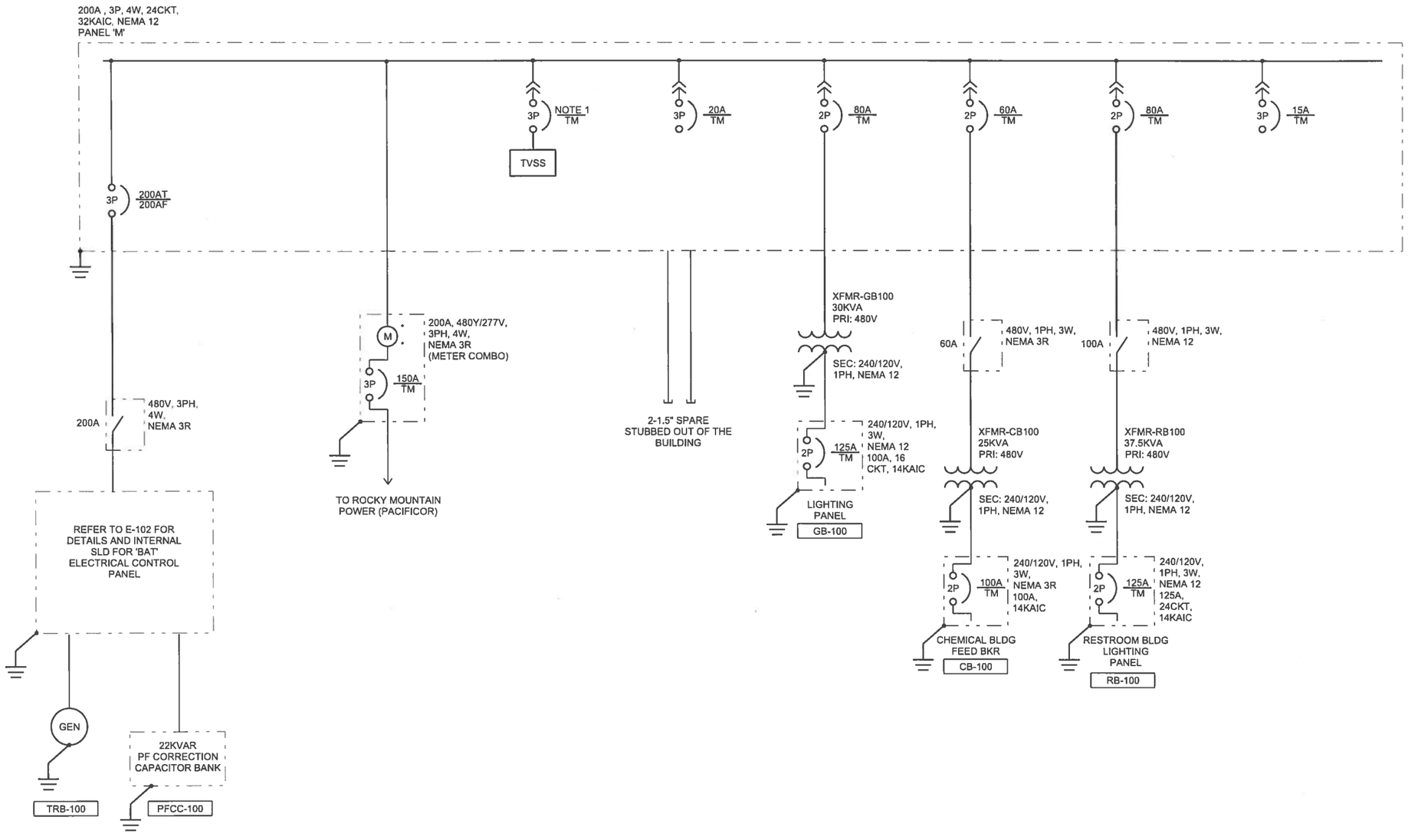
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ELECTRICAL

CONDUIT BLOCK DIAGRAM

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-E-200
SHEET 39 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00E200.dgn
PLOT DATE: 2/4/2015
PLOT TIME: 8:57:46 AM
SCALE: 1:0.166667



NOTES:

1. PROVIDE OVER CURRENT PROTECTION PER MANUFACTURER'S RECOMMENDATIONS.
2. REFER TO 00-E-103 FOR PANELS 'M', 'GB-100', 'RB-100', AND 'CB-100' SCHEDULES.

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd. S.Ste 101 • Pleasant Grove, UT • 801-785-4105

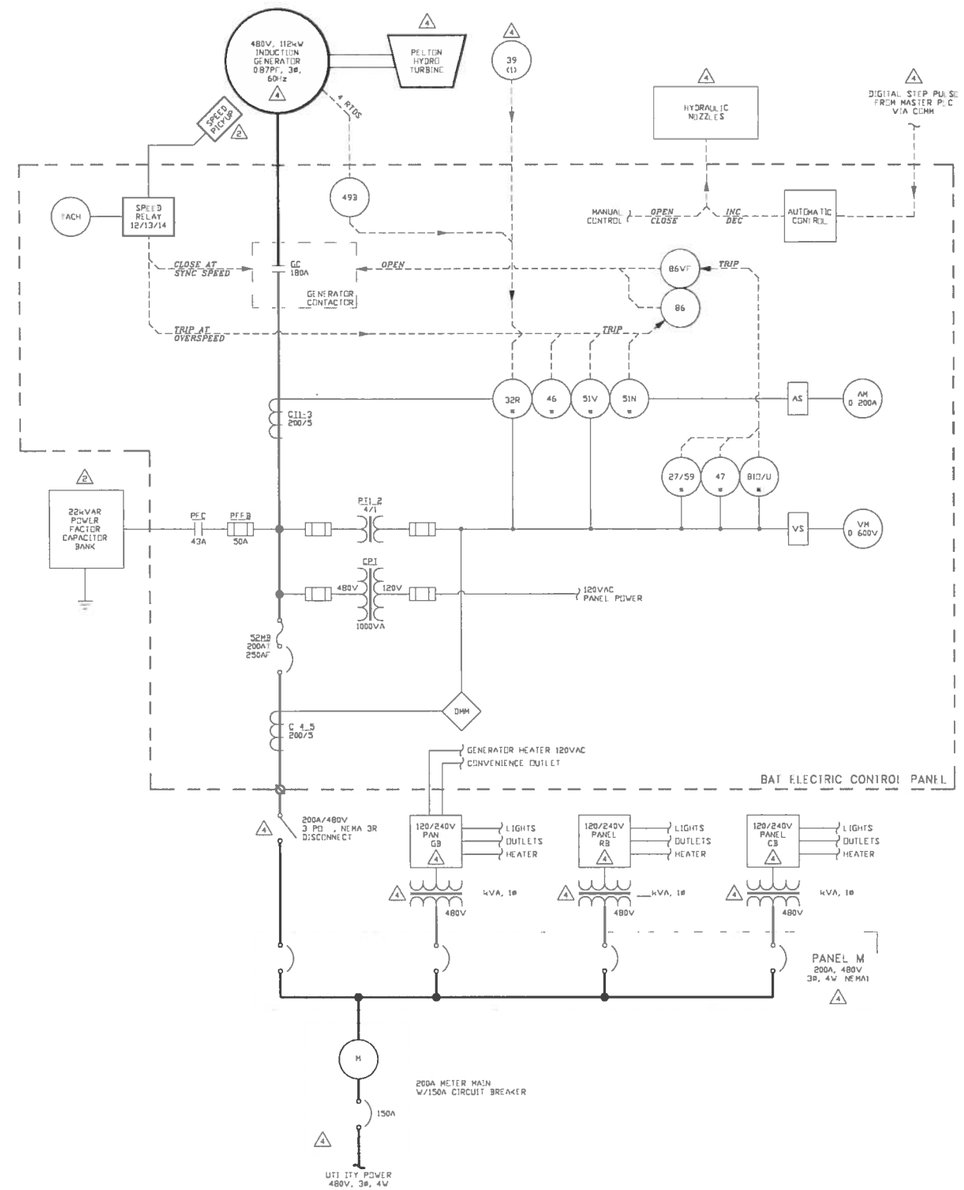
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ELECTRICAL
POWER SINGLE LINE DIAGRAM
SHEET - 1

GREGORY A. FRON NO.9062312-2202 LICENSED PROFESSIONAL ENGINEER STATE OF UTAH
2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-E-101
SHEET 40 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10E101.dgn PLOT DATE: 2/4/2015 PLOT TIME: 9:08:30 AM SCALE: 1:0.166667



ELECTRICAL RELAY AND EQUIPMENT LIST					
STYLE	FUNCTION	DESCRIPTION	SETTING	MFG.	PART No
12/13/14	SPEED RELAY	24VDC	12=OVER=120%=1440RPM 13=SYNC=100%=1200RPM	RED LION	PAXR-0030
27/59	OVER/UNDER VOLTAGE	120VAC, 3ø	27-1 88%, 120CYCLES 27-2 50%, 10CYCLES 59-1 110%, 60CYCLES 59-2 120%, 10CYCLES	BECKWITH	PART OF MFR
32R	REVERSE POWER	120VAC, 5A, 3ø	2% REV PWR 10SEC DELAY	BECKWITH	PART OF MFR
39	OVER VIBRATION	2PDT, MECHANICAL	SET AS REQUIRED	METRIX	MODEL 5550
46	CURRENT BALANCE	5A, 3ø	10%, 10SEC	BECKWITH	PART OF MFR
47	PHASE SEQUENCE	120VAC, 3ø	10%, 10SEC	BECKWITH	PART OF MFR
49B	BEARING OVER TEMP	4 POINT 100Ω PLT	ALARM 75°C TRIP 85°C	AUTOMATION DIRECT	F2-04RTD
51N	NEUTRAL OVERCURRENT	5A	20A, 1SEC	BECKWITH	PART OF MFR
51V	VOLT RESTRAINED OVERCURRENT	5A, 3ø, 120V	180A, TD 10	BECKWITH	PART OF MFR
52MB	MAIN BREAKER	480V, 3 POLE 35KAIC	200A TRIP 250A FRAME	GENERAL ELECTRIC	SRPF250A200 SFHA36AT0250
81O/U	OVER/UNDER FREQUENCY	120VAC, 1ø	81/O-1 60.5Hz, 10CYCLES 81/U-1 59.0Hz, 60CYCLES 81/U-2 57.0Hz, 10CYCLES	BECKWITH	PART OF MFR
86	LOCKOUT RELAY	24VDC, 2 DECK	NO SETTINGS	SHALLCO	76023
86VF	VOLT/FREQ LOCKOUT RELAY	24VDC, 8 POLE	NO SETTINGS	ALLEN BRADLEY	700DC-PB00Z24
DMM	DIGITAL MULTI METER	5A, 120V, 3ø, 24VDC AUX POWER	NO SETTING	MULTITEK	MB42-SB4-PE-DS
GC	GENERATOR CONTACTOR	480V, 3ø, 180A, 120V CONTROL	NO SETTING	SPRECHER & SCHUH	CA6-180-11-120D
PFC	POWER FACTOR CONTACTOR	480V, 3ø, 43A, 120V CONTROL	NO SETTING	SPRECHER & SCHUH	CA7-43-10-120
MFR	MULTI FUNCTION RELAY	120VAC, 5A, 3ø, 24VDC AUX POWER	SEE 27/32R/46/47/ 51N/51V/59/81O/81U	BECKWITH	M3410A-131P10

BUILDING LEGEND
- CB - CHLORINE BUILDING
- GB GENERATOR BUILDING
- RB RESTROOM BUILDING

LINE LEGEND
- CONTROL
- HIGHER VOLTAGE
- REGULAR WIRING
- TRIP LINE

SYMBOLS
- 2 SUPPLIED BY BAT ELECTRIC INSTALLED BY OTHERS
- 4 NOT BY BAT ELECTRIC
- * PART OF MFR

DEVICE LEGEND
- AM - AMMETER
- AS - AMMETER SWITCH
- CPT - CONTROL POWER TRANSFORMER
- CT - CURRENT TRANSFORMER
- M - METERING
- PFFB - POWER FACTOR FUSE BLOCK
- PT - POTENTIAL TRANSFORMER
- TACH - TACHOMETER
- VM - VOLTMETER
- VS - VOLTMETER SWITCH

BAT ELECTRIC, INC.
20410 MARTINEZ LANE
REDDING, CA 96002
TEL: (530) 221-1336
FAX: (530) 221-3496

CANYON INDUSTRIES, INC.
PLEASANT GROVE
100kW HYDRO PROJECT
ONE LINE DIAGRAM

DWG No.: 13P0566-01

REV	BY	DATE
A	DS	12-30-14

TEXT REV A

ENGR: D.BATDORF DRFT: DS DATE: 9-30-14

REFER TO E-101 FOR DETAILS AND CONNECTION SLD FOR 'BAT' ELECTRICAL CONTROL PANEL

GREGORY A. FRON NO.9062312-2202 LICENSED PROFESSIONAL ENGINEER STATE OF UTAH
3/4/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY.

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd. Suite 130 Pleasant Grove, UT 801-785-4175

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

ELECTRICAL
POWER SINGLE LINE DIAGRAM
SHEET - 2

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-E-102
SHEET 41 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10E102.dgn PLOT DATE: 2/4/2015 PLOT TIME: 9:05:10 AM SCALE: 1:0.166667

PANEL TAG No.	PANEL 'M'
LOCATION	GENREATOR BUILDING
BUS AMPACITY	200
VOLTS	480
PHASE/WIRE CONFIG.	3-PHASE/4-WIRE
REMARKS	
NEMA TYPE/MOUNTING	12/SURFACE
MAIN DEVICE	MCB 200A
AIC RATING	32KAIC
FED FROM	TURBINE GENERATOR -100
ACCESSORIES	TVSS, FEED THROUGH LUGS, 100% NEUTRAL, ETC...

LOAD VA PHASE A	LOAD VA PHASE B	LOAD VA PHASE C	LOAD DESCRIPTION	WIRE SIZE	DEMAND	BKR	BKR. NO.		BKR	DEMAND	WIRE SIZE	LOAD DESCRIPTION	LOAD VA PHASE A	LOAD VA PHASE B	LOAD VA PHASE C
11000			PANEL GB-100 (XFMR-GB100)	#6	1.25	60/2	1	2					0		
	11000			#6	1.25		3	4						0	
		0	SPARE			30/2	5	6	15/3						0
0							7	8				SPARE	0		
	12000		PANEL RB-100 (XFMR-RB100)	#2	1.25	80/2	9	10						0	
		12000		#2	1.25		11	12	20/1			SPARE			0
0							13	14					0		
	0						15	16						0	
		7500	CHEM BLDG (XFMR-CB100)	#4	1.25	60/2	17	18							0
7500				#4	1.25		19	20					0		
	0						21	22						0	
		0					23	24							0
18500	23000	19500	CONNECTED VA									CONNECTED VA	0	0	0
23125	28750	24375	DEMAND VA									DEMAND VA	0	0	0

	VA	AMPS
TOTAL PANEL CONNECTED LOAD	61000	73.37
TOTAL PANEL DEMAND LOAD	76250	91.71
PANEL DEMAND FACTOR	125%	

TOTAL CONNECTED VA - PER PHASE	18500	23000	19500
TOTAL DEMAND VA - PER PHASE	23125	28750	24375
TOTAL DEMAND PHASE AMPS	83.4	103.7	88.0

PANEL TAG No.	RB-100
LOCATION	RESTROOM BUILDING
BUS AMPACITY	125
VOLTS, PHASE, WIRE	240 V/1-PHASE/3-WIRE
REMARKS	
NEMA TYPE/MOUNTING	3R/SURFACE
MAIN DEVICE	125A MCB
AIC RATING	14K
FED FROM	XFMR-RB100, VIA PANEL 'M'
ACCESSORIES	TVSS

LOAD VA PHASE A	LOAD VA PHASE B	LOAD DESCRIPTION	WIRE SIZE	DEMAND	BKR	BKR. NO.		BKR	DEMAND	WIRE SIZE	LOAD DESCRIPTION	LOAD VA PHASE A	LOAD VA PHASE B
750		RECEPTACLES	#12	1.25	20/1	1	2	20/1	1.25	#12	INTERIOR LIGHTS	300	
	1500	HEATER (MENS RM) HTR-300	#12	1.25	20/2	3	4	20/1	1.25	#12	EXTERIOR LIGHTS (LC-2)		720
1500			#12	1.25		5	6	30/2	1.00	#10	WATER HEATER (WOMENS RM)	2500	
	2500	WATER HEATER (MENS RM)	#10	1.00	30/2	7	8		1.00	#10			2500
2500			#10	1.00		9	10	20/1	1.00	#12	HAND DRYER (MENS RM)	1500	
	1500	HEATER (WOMENS RM) HTR-400	#12	1.25	20/2	11	12	20/1	1.00	#12	HAND DRYER (WOMENS RM)		1500
1500			#12	1.25		13	14	20/2	1.25	#12	HEATER (CLOSET) HTR-500	1500	
	0					15	16		1.25	#12			1500
0						17	18					0	
	0					19	20						0
0						21	22					0	
	0					23	24						0
6250	5500	CONNECTED VA									CONNECTED VA	5800	6220
7188	6250	DEMAND VA									DEMAND VA	6250	6775

	VA	AMPS
TOTAL PANEL CONNECTED LOAD	23770	99.04
TOTAL PANEL DEMAND LOAD	26463	110.26
PANEL DEMAND FACTOR	111%	

TOTAL CONNECTED VA - PER PHASE	12050	11720
TOTAL DEMAND VA - PER PHASE	13438	13025
TOTAL DEMAND PHASE AMPS	112.0	108.5

PANEL TAG No.	GB-100
LOCATION	GENERATOR BUILDING
BUS AMPACITY	125
VOLTS, PHASE, WIRE	240 V/1-PHASE/3-WIRE
REMARKS	
NEMA TYPE/MOUNTING	12/SURFACE
MAIN DEVICE	125A MCB
AIC RATING	14K
FED FROM	XFMR-GB100, VIA PANEL 'M'
ACCESSORIES	TVSS

LOAD VA PHASE A	LOAD VA PHASE B	LOAD DESCRIPTION	WIRE SIZE	DEMAND	BKR	BKR. NO.		BKR	DEMAND	WIRE SIZE	LOAD DESCRIPTION	LOAD VA PHASE A	LOAD VA PHASE B
1080		UPPER LEVEL RECPTS	#12	1.00	20/1	1	2	20/1	1.25	#12	EXTERIOR LIGHTS	750	
	720	LOWER LEVEL RECPTS	#12	1.00	20/1	3	4	20/1	1.25	#12	INTERIOR LIGHTS		900
3750		BLDG HEATER (UPPER LEVEL) HTR-100	#8	1.25	40/2	5	6	20/1	1.25	#12	AREA MASTER RTU/PLC	360	
	3750		#8	1.25		7	8	20/1	1.25	#12	BAT CNT PANEL		750
500		AIR COMPRESSOR	#12	1.00	20/1	9	10	15/1	1.25	#12	EXH FAN	360	
	3750	BLDG HEATER (LOWER LEVEL) HTR-200	#8	1.25	40/2	11	12	20/2	1.00	#12	RESTROOM BLDG H2O BOOSTER PUMP (PMP-600)		750
3750			#8	1.25		13	14		1.00	#12		750	
	0					15	16						0
9080	8220	CONNECTED VA									CONNECTED VA	2220	2400
10955	10095	DEMAND VA									DEMAND VA	2588	2813

	VA	AMPS
TOTAL PANEL CONNECTED LOAD	21920	91.33
TOTAL PANEL DEMAND LOAD	26450	110.21
PANEL DEMAND FACTOR	121%	

TOTAL CONNECTED VA - PER PHASE	11300	10620
TOTAL DEMAND VA - PER PHASE	13543	12908
TOTAL DEMAND PHASE AMPS	112.9	107.6

PANEL TAG No.	CB-100 (EXISTING)
LOCATION	CHLORINE BUILDING
BUS AMPACITY	100
VOLTS, PHASE, WIRE	240 V/1-PHASE/3-WIRE
REMARKS	
NEMA TYPE/MOUNTING	3R/SURFACE
MAIN DEVICE	100A MCB
AIC RATING	14K
FED FROM	XFMR-CB100, VIA PANEL 'M'
ACCESSORIES	TVSS

LOAD VA PHASE A	LOAD VA PHASE B	LOAD DESCRIPTION	WIRE SIZE	DEMAND	BKR	BKR. NO.		BKR	DEMAND	WIRE SIZE	LOAD DESCRIPTION	LOAD VA PHASE A	LOAD VA PHASE B
0						1	2					0	
	0					3	4						0
0						5	6					0	
	0					7	8						0
0						9	10					0	
	0					11	12						0
0	0	CONNECTED VA									CONNECTED VA	0	0
0	0	DEMAND VA									DEMAND VA	0	0

	VA	AMPS
TOTAL PANEL CONNECTED LOAD	0	0.00
TOTAL PANEL DEMAND LOAD	0	0.00
PANEL DEMAND FACTOR	100%	

TOTAL CONNECTED VA - PER PHASE	0	0
TOTAL DEMAND VA - PER PHASE	0	0
TOTAL DEMAND PHASE AMPS	0.0	0.0

NOTE:

1. THIS PANEL IS EXISTING AND LOCATED WITH THE CHEMICAL BUILDING. THE CONTRACTOR SHALL IDENTIFY AND DOCUMENT THE ACTUAL CIRCUIT SCHEDULE AND PROVIDE THAT FOR FINAL RECORD DRAWINGS.

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO.9052312-2202
STATE OF UTAH
2/4/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

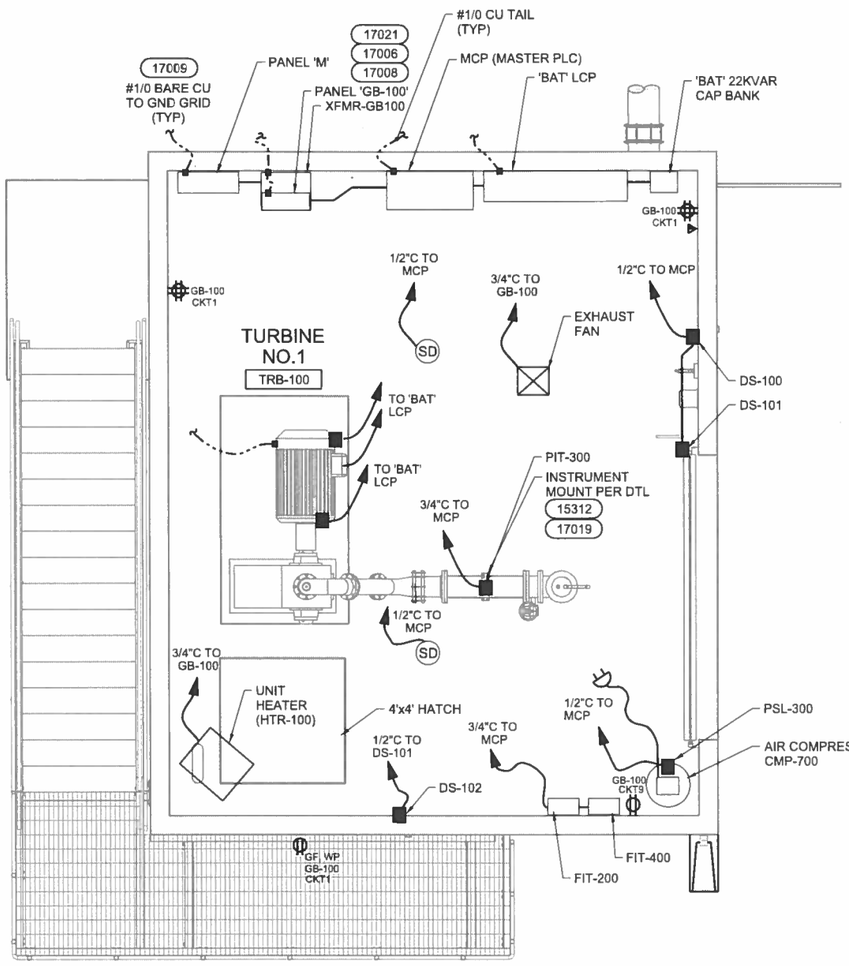
WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd. S.#130 • Pleasant Grove, UT • 801-785-4125

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ELECTRICAL

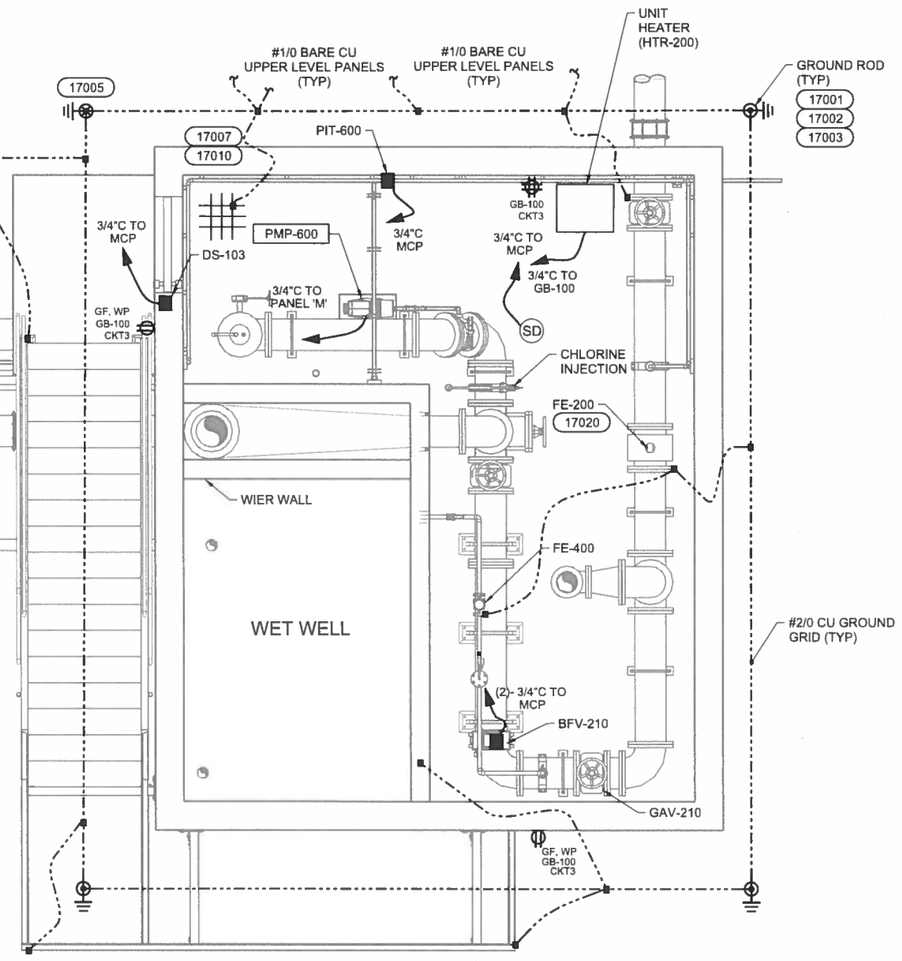
PANEL SCHEDULES

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-E-103
SHEET 42 OF 70



UPPER PLAN

3/8" = 1'- 0"



LOWER PLAN

3/8" = 1'-0"

2 0 2 4 FEET

SCALE 3/8"=1'-0"

NORTH

NOTES:

1. REFER TO CONDUIT BLOCK DIAGRAM FOR CIRCUIT AND CONDUIT INFORMATION.
2. REFER TO 10-E-103 FOR PANELS 'M', 'GB-100' SCHEDULES.
3. REFER TO STANDARD MOUNTING DETAILS FOR MORE INFORMATION ON 00-SD-312, 313, AND 314.

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY.

DESIGN CAF
DRAWN CAF
CHECKED CC
APPROVED CC

WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd. S.#103 • Pleasant Grove, UT • 801-785-4152

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

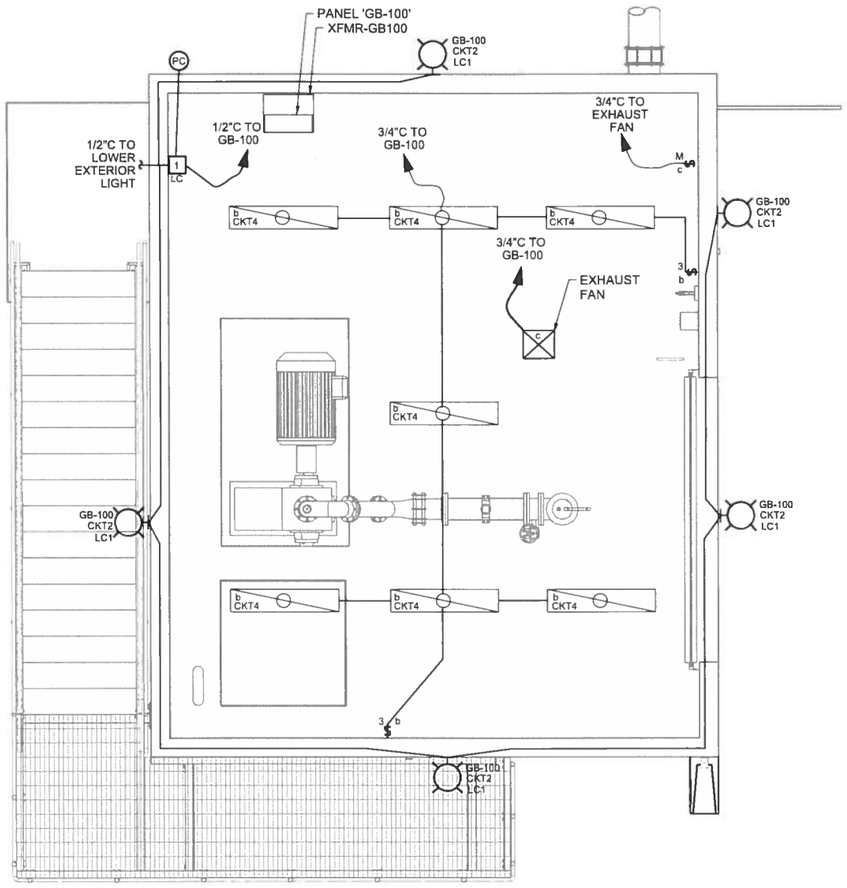
ELECTRICAL

TURBINE BUILDING POWER AND GROUNDING PLAN

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO.9062312-2202
STATE OF UTAH
2/4/15

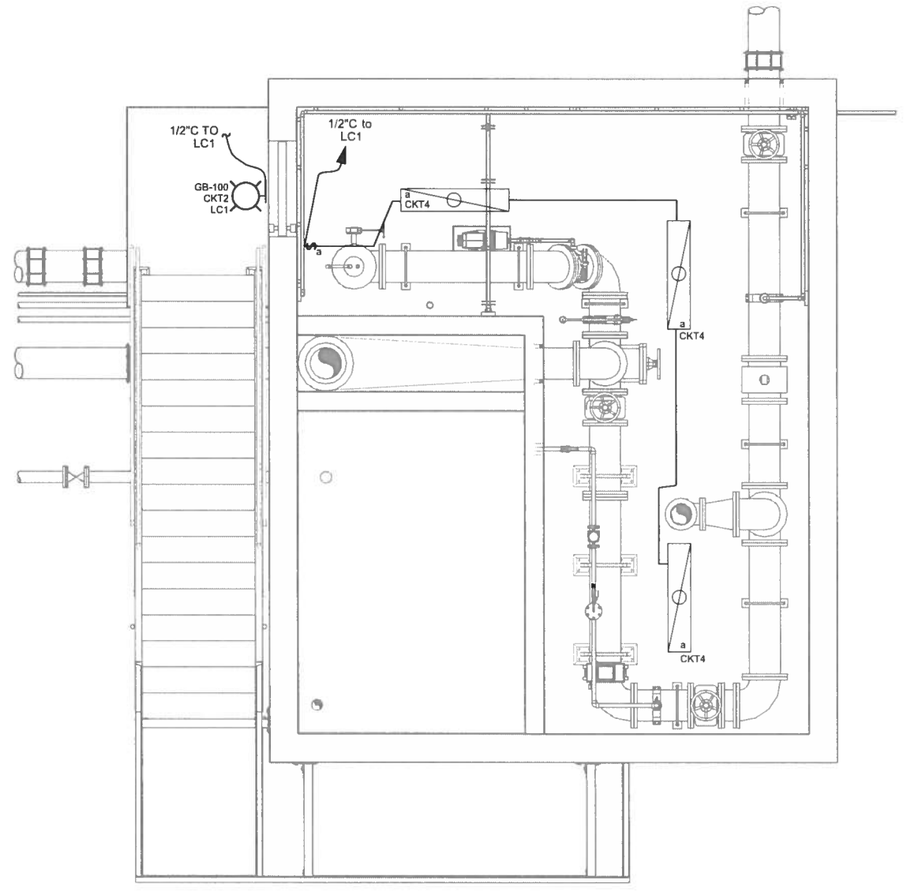
DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 10-E-110
SHEET 43 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10E110.dgn PLOT DATE: 2/4/2015 PLOT TIME: 9:03:43 AM SCALE: 1:5.33333



UPPER PLAN

3/8" = 1'- 0"



LOWER PLAN

3/8" = 1'-0"

LUMINAIRE SCHEDULE

DOWNLIGHTING

ITEM	DESCRIPTION	MOUNTING METHOD	LAMP QTY	LAMP TYPE	LUMINAIRE SPECIFICATIONS MANUFACTURER	CATALOG	VOLTS	VA
1	WP STRIP LIGHTS, 2 LAMPS, <10% THD, LISTED FOR DAMP LOCATIONS	CEILING	10	T8	LITHONIA	DMS 2 96T8 120 GEB101S	120	118
2	WALPAK LISTED FOR DAMP LOCATIONS	WALL	6	HPS	LITHONIA	TWA 70S 120 LPI	120	70

2 0 2 4 FEET

SCALE 3/8"=1'-0"

NORTH

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY.

DESIGN GAF | DRAWN GAF | CHECKED CC | APPROVED CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd S.ste 150 • Pleasant Grove UT• 801-796-4125

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ELECTRICAL

TURBINE BUILDING LIGHTING PLAN

GREGORY A. FRON NO.9062312-2202 LICENSED PROFESSIONAL ENGINEER STATE OF UTAH 2/4/15

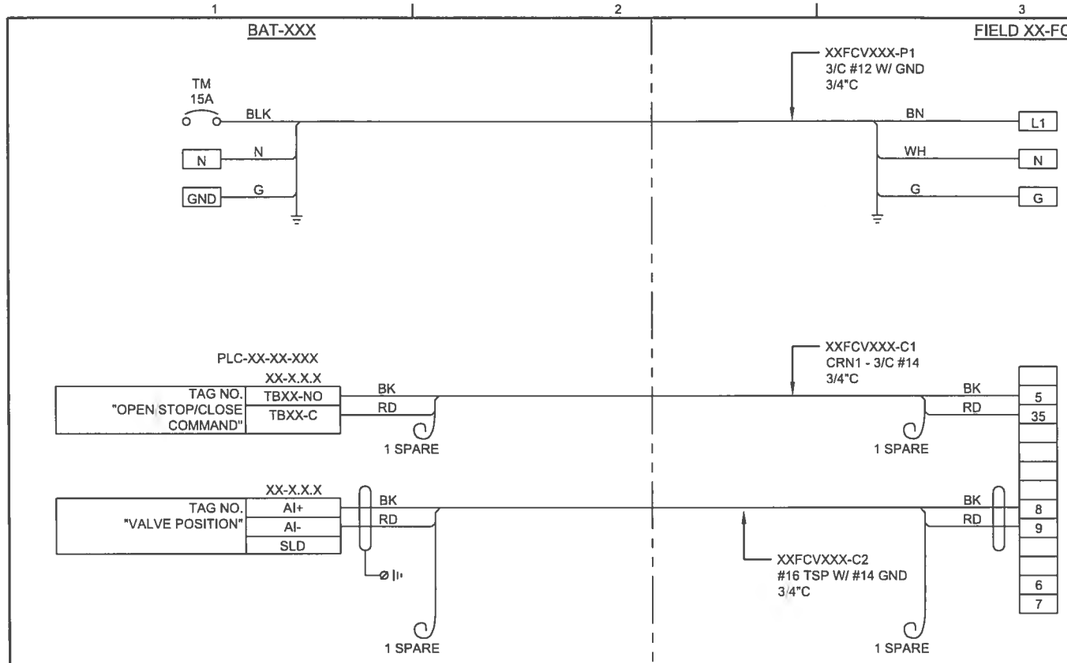
DATE FEB 2015

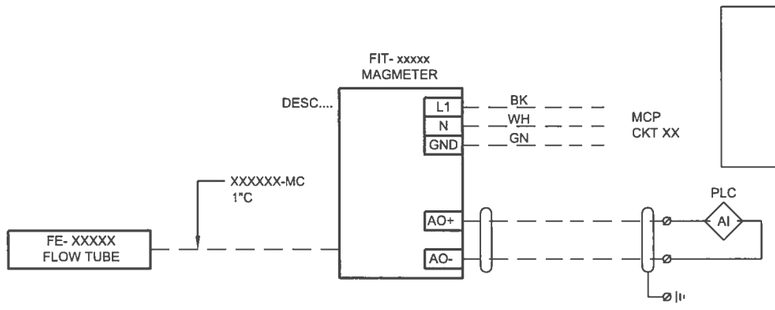
PROJECT NUMBER 10-011

DRAWING NUMBER 10-E-111

SHEET 44 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10E111.dgn PLOT DATE: 2/4/2015 PLOT TIME: 9:04:20 AM SCALE: 1:5.33333



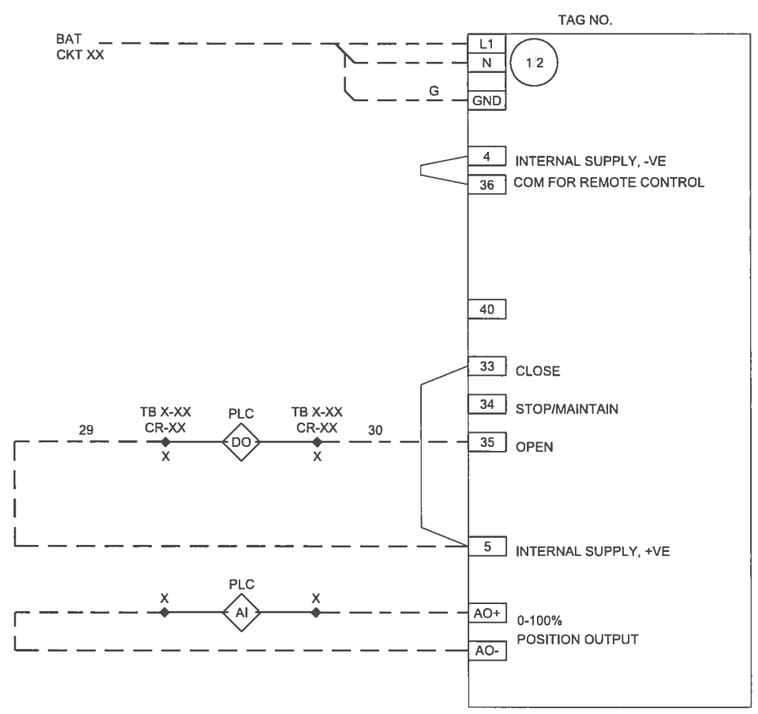


TYPICAL FOR

FIT-200
FIT-400

TYPICAL FLOW METER CONNECTION DIAGRAM

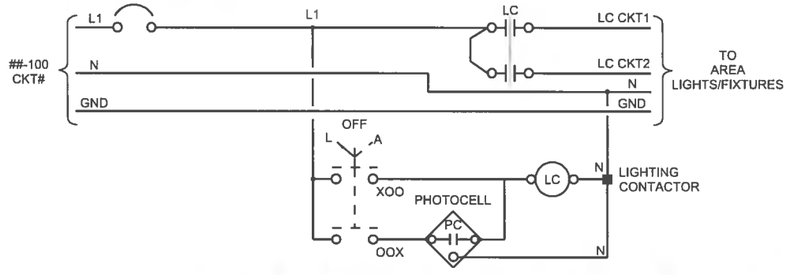
1. REFER TO CONDUIT BLOCK DIAGRAMS FOR CONDUIT AND CABLING INFORMATION.



TYPICAL FOR

BFV-210

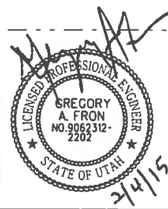
TYPICAL OPEN/CLOSE MOV CONNECTION DIAGRAM



TYPICAL FOR

LC-001
LC-002

TYPICAL AREA LIGHTING CONTACTOR CONNECTION DIAGRAM



VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN	DRAWN	CHECKED	APPROVED
GAF	GAF	GAF	CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd S #130 • Pleasant Grove, UT • 801-796-4125

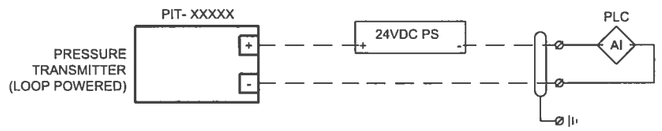
PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

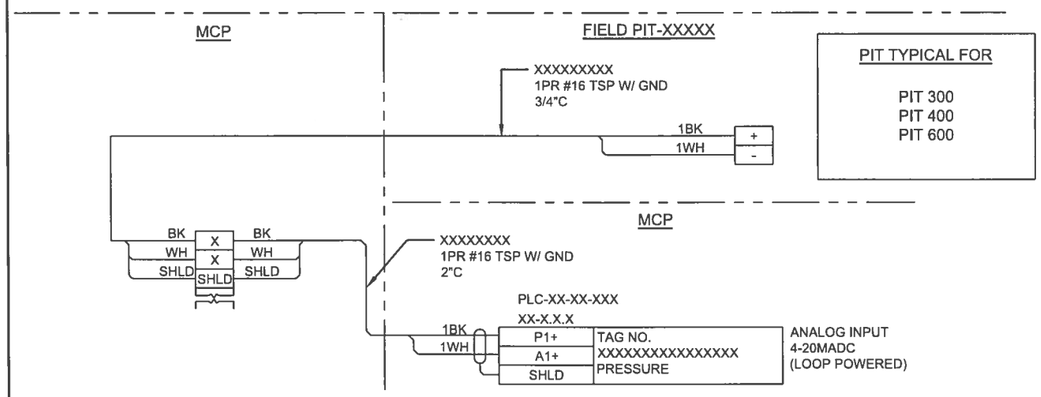
ELECTRICAL

SCHEMATIC AND CONNECTION DIAGRAMS SHEET - 1

DATE	FEB 2015
PROJECT NUMBER	10-011
DRAWING NUMBER	10-E-200
SHEET	45 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10E200.dgn PLOT DATE: 2/4/2015 PLOT TIME: 9:06:03 AM SCALE: 1:0.166667





TYPICAL PRESSURE TRANSMITTER CONNECTION DIAGRAM

1. REFER TO CONDUIT BLOCK DIAGRAMS FOR CONDUIT AND CABLING INFORMATION.

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd S #101 • Pleasant Grove, UT • 801-785-4105

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

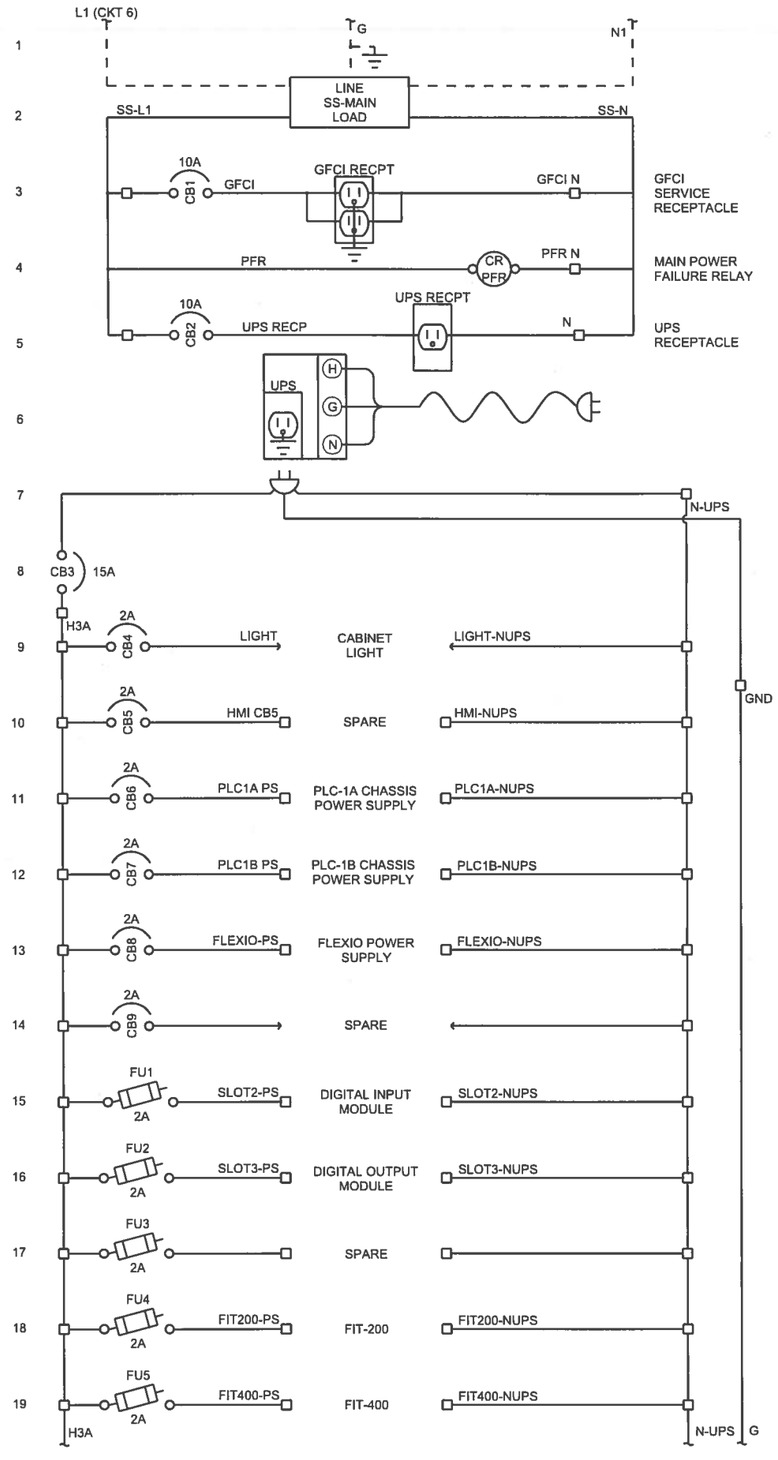
ELECTRICAL

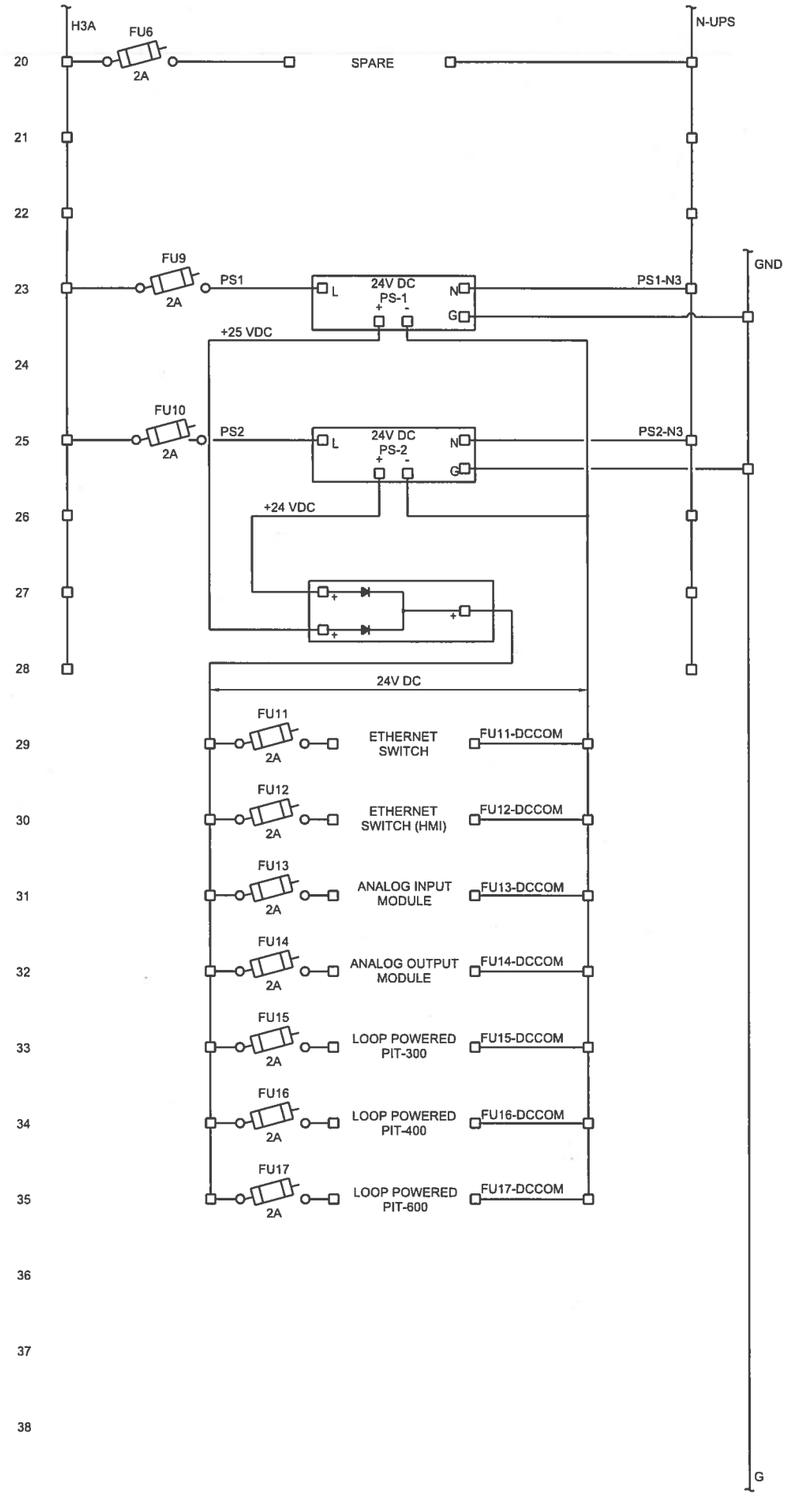
SCHEMATIC AND CONNECTION DIAGRAMS SHEET - 2

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO.9062312-2202
STATE OF UTAH
2/4/15

DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
10-E-201
SHEET 46 OF 70

PANEL 'GB-100' CKT. 6
120VAC / 1Ø / 20A / 60 HZ





1. REFER TO CONDUIT BLOCK DIAGRAMS FOR CONDUIT AND CABLING INFORMATION.

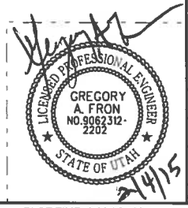
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

WATERWORKS ENGINEERS
215 S. Pleasant Grove Blvd. S.Ste 160 • Pleasant Grove, UT • 801-785-4105

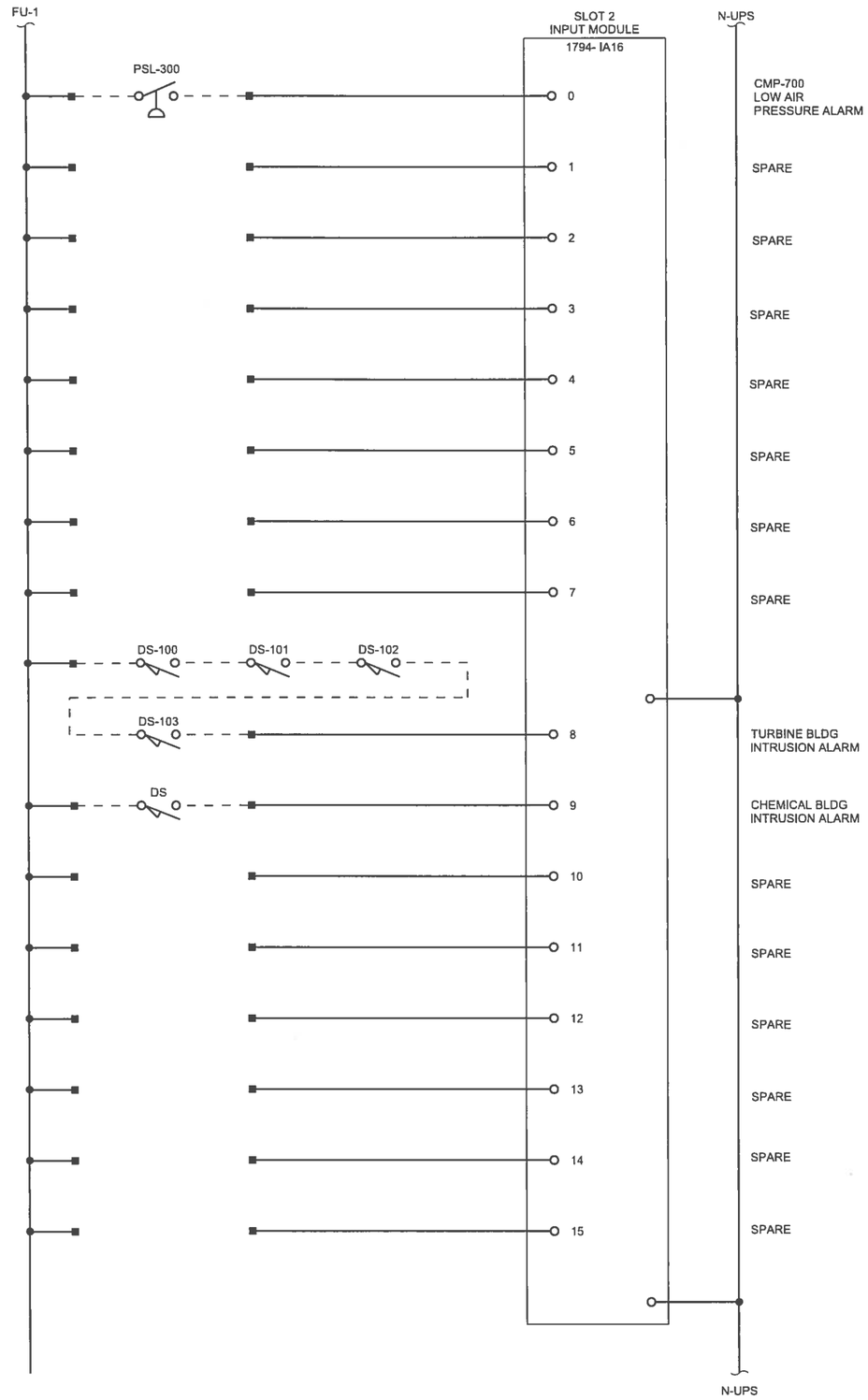
PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

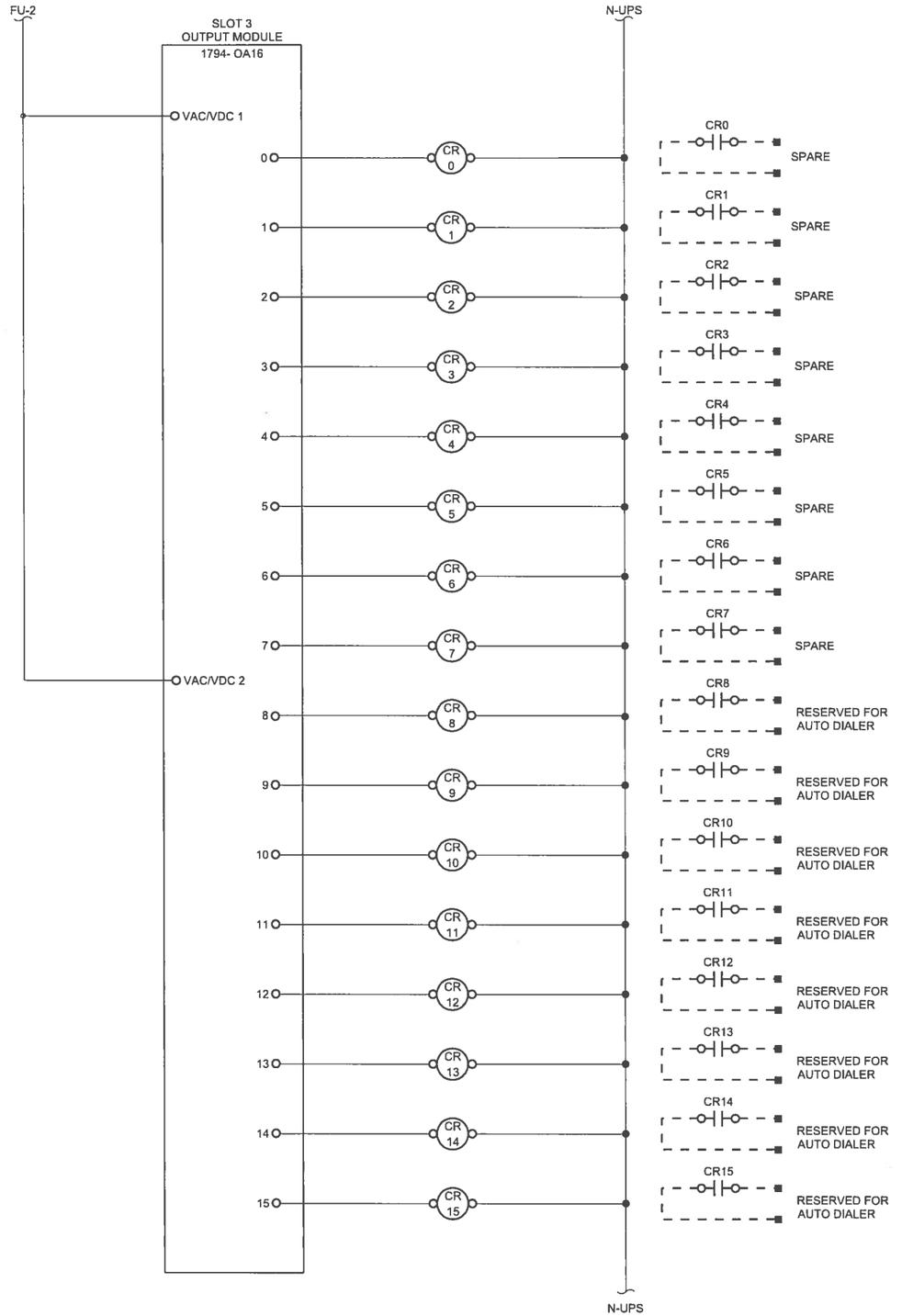
ELECTRICAL
MASTER PLC PANEL
SCHEMATIC AND CONNECTION
DIAGRAMS SHEET - 1



DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
10-E-210
SHEET 47 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10E210.dgn
PLOT DATE: 2/4/2015
PLOT TIME: 9:02:05 AM
SCALE: 1:0.166667





VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd. S #101 • Pleasant Grove, UT • 801-796-4125

ELECTRICAL

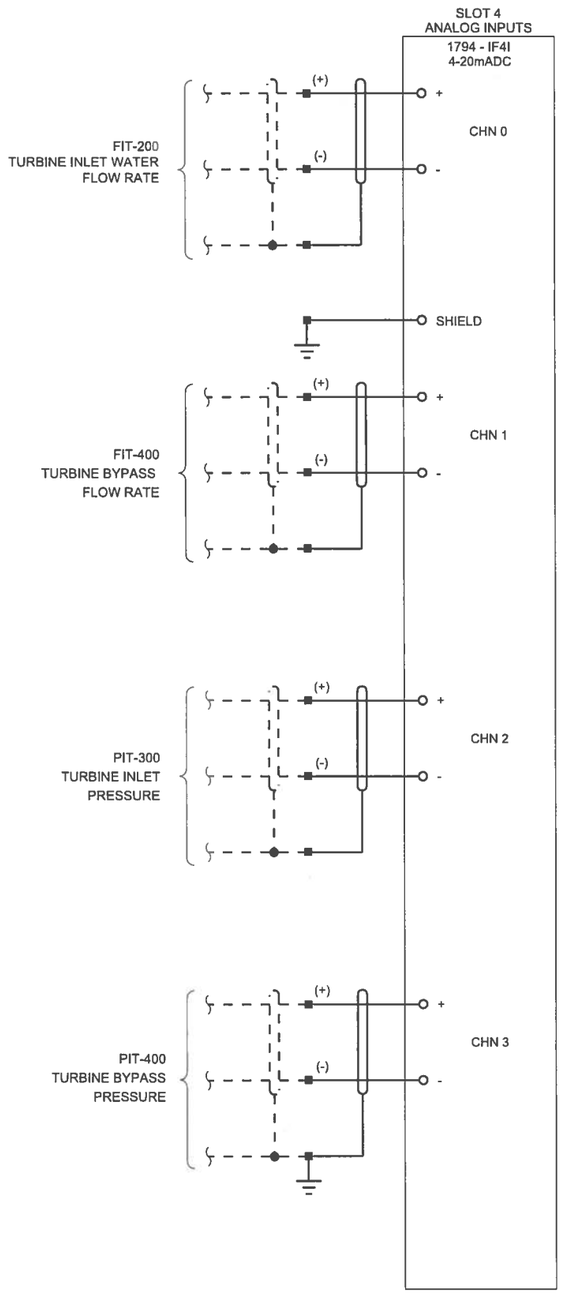
PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

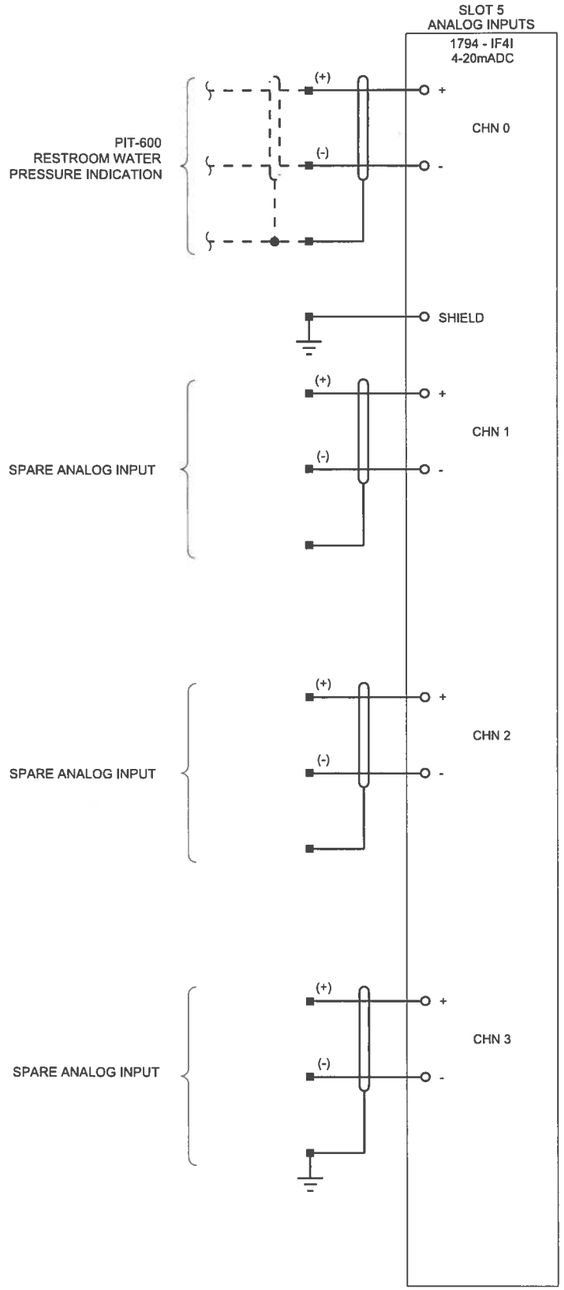
MASTER PLC PANEL
SCHEMATIC AND CONNECTION
DIAGRAMS SHEET - 2

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO. 9062312-2202
STATE OF UTAH
2/4/15

DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
10-E-211
SHEET 48 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10E211.dgn
PLOT DATE: 2/4/2015
PLOT TIME: 9:02:36 AM
SCALE: 1:0.166667





VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

WATERWORKS ENGINEERS
2315 S. Pleasant Grove Blvd. S #3 • Pleasant Grove, UT • 801-785-4173

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

ELECTRICAL

MASTER PLC PANEL
SCHEMATIC AND CONNECTION
DIAGRAMS SHEET - 3

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO. 9062312-2202
STATE OF UTAH
2/9/15

DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
10-E-212
SHEET 49 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10E212.dgn
PLOT DATE: 2/4/2015
PLOT TIME: 9:07:19 AM
SCALE: 1:0.166667

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

WATERWORKS ENGINEERS
231 S. Pleasant Grove Blvd. S. #101 • Pleasant Grove, UT • 801-785-4155

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

ELECTRICAL

MASTER PLC PANEL
SCHEMATIC AND CONNECTION
DIAGRAMS SHEET - 4

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO. 9052312-2202
STATE OF UTAH
2/4/15

DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
10-E-213
SHEET 50 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-10E213.dgn
PLOT DATE: 2/4/2015
PLOT TIME: 9:03:04 AM
SCALE: 1:0.166667

GENERAL INSTRUMENT AND DIGITAL INTERFACE SYMBOLS

	FIELD MOUNTED INSTRUMENT	PANEL MOUNTED INSTRUMENT	MCC MOUNTED INSTRUMENT	INACCESSABLE INSTRUMENT
DISCRETE INSTRUMENTS	○	⊖	⊖	⊖
SHARED DISPLAY SHARED CONTROL	◯	⊖	⊖	⊖
COMPUTER FUNCTION	⬡	⊖	⊖	⊖
PROGRAMMABLE LOGIC CONTROL	◇	⊖	⊖	⊖

PIT 34101 — INSTRUMENT WITH LONG TAG NUMBER

INSTRUMENTS SHARING COMMON HOUSING

PILOT LIGHT

A 10 — PANEL MOUNTED PATCHBOARD POINT 10

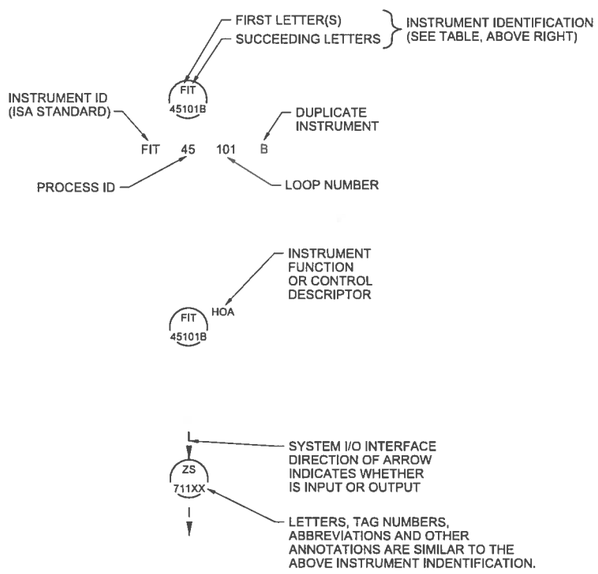
P — PURGE OR FLUSHING DEVICE

R — REST FOR LATCH-TYPE ACTUATOR

DIAPHRAGM SEAL

I — UNDEFINED INTERLOCK LOGIC

INSTRUMENT TAG NUMBERING SYSTEM



ISA INSTRUMENT SYMBOLS AND IDENTIFICATION

	FIRST LETTER (S)		SUCCEEDING LETTERS		
LETTER	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYZER		ALARM		
B	BURNER, COMBUSTION		USERS CHOICE (*)	USERS CHOICE (*)	USERS CHOICE (*)
C	CONDUCTIVITY			CONTROL	CLOSED
D	DENSITY(S.G.)	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW RATE	RATIO			
G	GAUGE		GLASS, VIEWING DEVICE		
H	HAND (MANUAL)				HIGH/HIGH-HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT(PILOT)		LOW/LOW-LOW
M	MOTION				MIDDLE
N	INTRUSION		USERS CHOICE (*)	USERS CHOICE (*)	NORMAL
O	TORQUE		ORIFICE, RESTRICTION		OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		STOP
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD OR PRINT		RUN/REMOTE
S	SPEED, FREQUENCY	SAFETY		SWITCH	START
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION(*)	MULTIFUNCTION(*)	MULTIFUNCTION(*)
V	VIBRATION			VALVE, DAMPER OR LOUVER	
W	WEIGHT		WELL		
X	MOTOR	X-AXIS			
Y	EVENT, STATE OR PRESENCE	Y-AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION	Z-AXIS		DRIVE, ACTUATOR FINAL CONTROL ELEMENT	

PROCESS SYMBOLS

- PRIMARY PROCESS LINE
- EXISTING PRIMARY PROCESS LINE
- SECONDARY PROCESS LINE
- EXISTING SECONDARY PROCESS LINE
- AUXILIARY PROCESS LINES
- EXISTING AUXILIARY PROCESS LINE
- FUTURE PROCESS LINE
- INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
- UNDEFINED SIGNAL
- PNEUMATIC SIGNAL
- ELECTRICAL SIGNAL
- HYDRAULIC SIGNAL
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (NON GUIDED)
- INTERNAL SYSTEM LINK (SOFTWARE DATA LINK)
- MECHANICAL LINK
- HEAT TRACED AND INSULATED
- RS-485 2-WIRE MODBUS
- ETHERNET CATEGORY 5E CABLE
- FO FO — FIBER OPTIC
- LINE BREAK
- SECONDARILY CONTAINED PIPING
- BOX INDICATING FUNCTIONAL GROUPS OR EQUIPEMENT THAT REPEAT
- ARROW INDICATES DIRECTION OF FLOW OF INFORMATION
- SIGNAL CONNECTION POINT
- PROCESS LINES CROSSING (NOT CONNECTED)
- I-00-502 A — PROCESS OR SIGNAL GOING TO ANOTHER SHEET (MATCH LETTERS)
- A I-00-501 — PROCESS OR SIGNAL LINE FROM ANOTHER SHEET (MATCH LETTERS)
- PROCESS LINE CONTINUED OUTSIDE SCOPE OF DRAWINGS
- ▲ ANALOG SIGNAL IN
- ▼ ANALOG SIGNAL OUT
- △ DISCRETE SIGNAL IN
- ▽ DISCRETE SIGNAL OUT
- ◬ PULSED SIGNAL IN

LICENSED PROFESSIONAL ENGINEER GREGORY A. FRON NO.9062312-2202 STATE OF UTAH 2/9/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY.

DESIGN GAF
DRAWN JWJ
CHECKED RDB
APPROVED CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd Suite 130 • Pleasant Grove, UT • 801-796-4175

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

INSTRUMENTATION

LEGEND AND ABBREVIATIONS 1

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-N-001
SHEET 52 OF 70

INSTRUMENTATION VALVE SYMBOLS

- AIR RELIEF VALVE
- AIR VACUUM VALVE
- COMBINATION AIR RELIEF AIR VACUUM VALVE
- BALL CHECK VALVE (BCV)
- BACKFLOW PREVENTER VALVE (BFP)
- BUTTERFLY VALVE (BFV) **
- BACK PRESSURE REDUCING VALVE
- BALL VALVE
- CORPORATION STOP VALVE
- DUAL DISK SWING CHECK VALVE
- DIAPHRAGM VALVE
- GLOBE VALVE
- GATE VALVE
- MUD VALVE
- MULTIPORT VALVE (MPV)
- NEEDLE VALVE (NV)
- PINCH VALVE
- PLUG VALVE
- PLUG VALVE (ECCENTRIC)
- PRESSURE REGULATING VALVE
- PRESSURE RELIEF VALVE
- RUPTURE DISK (PRESSURE)
- RUPTURE DISK (VACUUM)
- SILENT CHECK VALVE
- STOP LOG
- SLIDE GATE
- SWING CHECK VALVE
- TELESCOPING VALVE
- WEIR

INSTRUMENTATION EQUIPMENT SYMBOLS

- CENTRIFICAL PUMP
- VERTICAL TURBINE PUMP
- METERING PUMP
- PERISTALIC PUMP
- PROGRESSIVE CAVITY PUMP
- AXIAL FLOW PUMP
- CENTRIFICAL BLOWER
- BLOWER FAN
- MIXER
- AIR INTAKE FILTER
- FLOW METER
- AUTOMATIC STRAINER
- BASKET STRAINER
- FILTER
- STATIC MIXER
- MIXER
- SPRAY BAR OR DIFFUSER
- SIGHT GLASS
- CALIBRATION COLUMN
- BACK DRAFT DAMPER
- Y STRAINER
- FLOAT SWITCH
- PULSATION DAMPER
- GAUGE
- FLOW SWITCH
- ROTAMETER
- ROTAMETER WITH NEEDLE VALVE

- SCREEN
- SCREW CONVEYOR
- SCREENINGS COMPACTOR / WASHER
- DUMPSTER
- MOTOR ACTUATOR
- PNEUMATIC ACTUATOR
- SOLENOID ACTUATOR
- SAMPLE
- WATER SURFACE
- RADIO TOWER
- RADAR
- ULTRASONIC
- ORIFICE
- BLIND FLANGE OR TANK NOZZEL
- DIAPHRAGM SEAL
- EXPANSION COUPLING
- FLEXIBLE COUPLING
- UNION
- REDUCER
- CAP
- FEMALE QUICK CONNECT
- MALE QUICK CONNECT
- QUICK CONNECT WITH CAP
- QUICK CONNECT COUPLING
- DRAIN

ABBREVIATIONS

A	AMPERE
ACK	ACKNOWLEDGE
AI	ANALOG INPUT
AIC	AMPS INTERRUPTING CAPACITY
ALT	ALTITUDE VALVE
ANN	ANNUNCIATOR
AO	ANALOG OUTPUT
ARV	AIR RELIEF VALVE
AS	AIR SUPPLY
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
BAV	BALL VALVE
BDD	BACKDRAFT DAMPENER
BFP	BACKFLOW PREVENTER
BFV	BUTTERFLY VALVE
BLR	BLOWER
CARV	COMBINATION AIR RELEASE AND VACUUM VALVE
CB	CIRCUIT BREAKER
CC	CALIBRATION COLUMN
CIP	CLEAN-IN-PLACE
CKV	CHECK VALVE
CL2	CHLORINE
CMP	COMPRESSOR
CON	CONTACTOR
COND	CONDUCTIVITY
CP	CONTROL PANEL
CRP	CORPORATION VALVE
CU	COPPER, BARE
CV	CONTROL VALVE
DCL2	DECHLORINATION
DI	DISCRETE INPUT
DIA	DIAPHRAGM VALVE
DO	DISCRETE OUTPUT
DP	DIFFERENTIAL PRESSURE
DWG	DRAWING
EGO	EMERGENCY GAS OFF
ETM	ELAPSED TIME METER
ETMf	ELAPSED TIME METER (FAST SPEED)
ETMs	ELAPSED TIME METER (SLOW SPEED)
EOL	ELECTRONIC OVERLOAD
ES	EMERGENCY STOP
EXIST	EXISTING
F	FILTER
FA	FOUL AIR
FC	FAIL CLOSED
FCV	FLOW CONTROL VALVE
FE	FINAL EFFLUENT
FI	FLOW INDICATOR
FM	FLOW METER
FO	FLOW ORIFACE
FR	FORWARD-REVERSE
FS	FLOAT SWITCH, FLOW SWITCH
FVNR	FULL VOLTAGE NON-REVERSING
FW	FINISHED WATER
GAT	GATE
GND	GROUND
GAL	GALLONS
GAV	GATE VALVE
GLB	GLOBE VALVE
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
H, HI	HIGH
HMI	HUMAN MACHINE INTERFACE
HOA	HAND-OFF-AUTO
HSV	HOSE VALVE
HYD	HYDRANT
I	CURRENT
IO	INPUT/OUTPUT
IOE	INTERNAL-OFF-EXTERNAL
JB	JUNCTION BOX
JOR	JOG-OFF-REMOTE
L, LO	LOW
LCP	LOCAL CONTROL PANEL
LEAK	LEAK DETECTION
LOR	LOCAL-OFF-REMOTE
LOS	LOCK-OFF-STOP
LR	LOCAL/REMOTE
LS	LEVEL (i.e.. FLOAT) SWITCH
M	MOTOR
MA	MANUAL/AUTO
mA	MILLIAMP
MC	MANUFACTURE CABLE
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MF	MEMBRANE FILTRATION
MFR(S)	MANUFACTURER(S)
MGD	MILLION GALLONS PER DAY
MGL	MILLIGRAMS PER LITER
MH	MANHOLE
MO	MOISTURE
MOD	MODULATED
MP	METERING PUMP
MSTR	MOTOR STARTER
MTU	MASTER TELEMETRY UNIT
MV	MUD VALVE
NH3	AMMONIA
NPW	NON-POTABLE WATER
OC	OPEN-CLOSE
OCA	OPEN-CLOSE-AUTO
OCR	OPEN-CLOSE-REMOTE
OIT	OPERATOR INTERFACE TERMINAL
OL	OVERLOAD
OO	ON/OFF (MAINTAINED)
OOA	ON-OFF-AUTO
OOR	ON-OFF-REMOTE
ORP	OXIDATION REDUCTION POTENTIAL
OSC	OPEN-STOP-CLOSE
P	PUMP
PAH	PRESSURE ALARM HIGH
PART	PARTICLE COUNTER
PB	PUSHBUTTON
PC	PNEUMATIC CONTROLLER
PCV	PRESSURE CONTROL VALVE
PD	PULSATION DAMPENER
PDS	PRESSURE DIAPHRAGM SEAL
PER	PERMISSIVE
pH	HYDROGEN ION CONCENTRATION
PLC	PROGRAMMABLE LOGIC CONTROLLER
PLV	PLUG VALVE
PNL	PANEL
PMP	PUMP
PO	PULSE OUTPUT
POS	POSITIONER OR POSITION
POT	POTENTIOMETER
PPG	POUNDS PER GALLON
PPH	POUNDS PER HOUR
PPM	PARTS PER MILLION
PR	PAIR
PRES	PRESSURE
PRV	PRESSURE REDUCING/REGULATING/RELIEF VALVE
PS	PRESSURE SWITCH
PSI	POUNDS PER SQUARE INCH
RAS	RETURN ACTIVATED SLUDGE
RAW	RAW WATER
RD	RUPTURE DISK
REM	REMOTE
RF	RADIO FREQUENCY
RIO	REMOTE INPUT OUTPUT
RS	RAW SEWAGE
RSP	RAW SEWAGE PUMP
RST	RESET
RTD	RESISTANCE TEMPERATURE DEVICE
RTU	REMOTE TERMINAL UNIT
S	SUMP
SB	SLUDGE BLANKET
SBS	SODIUM BISULFITE
SEL	SELECTOR
SEQ	SERVICE ENTRANCE EQUIPMENT
SES	SERVICE ENTRANCE SECTION
SFTN	SOFTENED WATER
SHC	SODIUM HYPOCHLORITE
SLC	SINGLE LOOP CONTROLLER
SLOS	START-LOCK-OFF-STOP
SOL	SOLENOID VALVE
SP	SET POINT
SPD	SPEED
SPR	SPARE
SS	START/STOP (MAINTAINED)
SSS	SOLID STATE STARTER (SOFT START)
STR	STRAINER
T	TANK
TAH	TEMPERATURE ALARM HIGH
TCL2	TOTAL CHLORINE
T/M	TEMPERATURE AND/OR MOISTURE
TEMP	TEMPERATURE
TRV	THERMAL RELIEF VALVE
TS	TEMPERATURE SWITCH
TSS	TOTAL SUSPENDED SOLIDS
TURB	TURBIDITY
UG	UNDERGROUND
V	VOLT
VFD	VARIABLE FREQUENCY DRIVE
W	WATER
WAS	WASTE ACTIVATED SLUDGE
WW	WASTEWATER
XMTR	TRANSMITTER
ZS	POSITION (i.e. LIMIT) SWITCH

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN GAF
DRAWN JWJ
CHECKED RBB
APPROVED CC

WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd. S.#A-103 • Pleasant Grove, UT • 801-785-4175

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

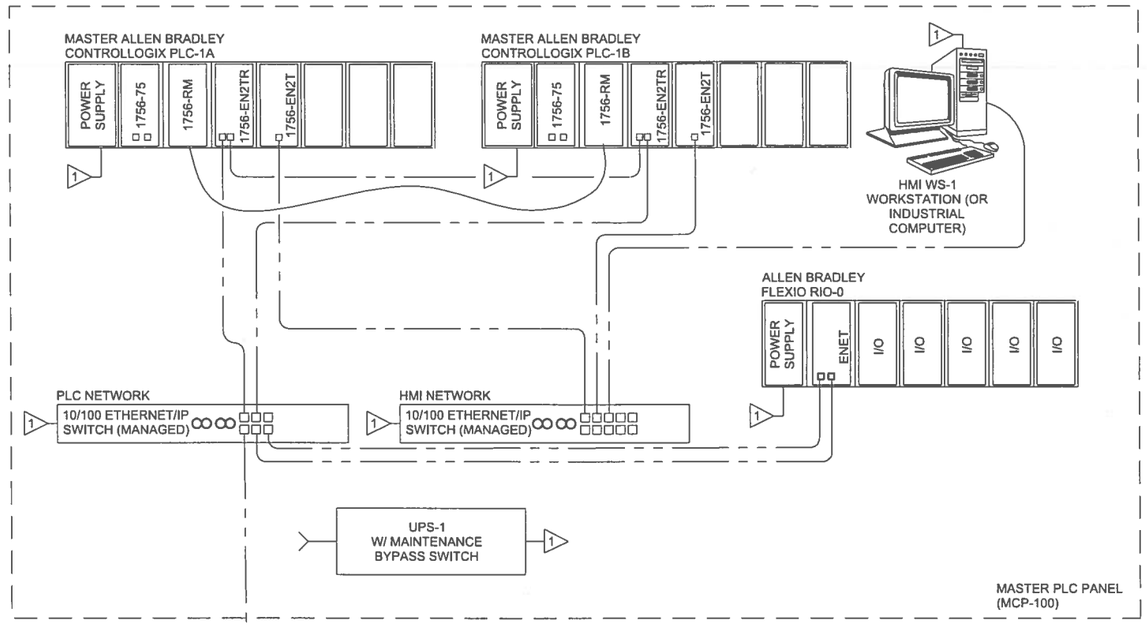
INSTRUMENTATION

LEGEND AND ABBREVIATIONS 2

GREGORY A. FRON LICENSED PROFESSIONAL ENGINEER NO.9062312-2202 STATE OF UTAH
2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-N-002
SHEET 53 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00N002.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:55:25 AM SCALE: 1:0.166667



LEGEND:

ETHERNET/IP COPPER (Cat6e)

ETHERNET/IP FO

HMI WS	OPERATOR WORKSTATION
OIT	OPERATOR LOCAL INTERFACE @ EQUIPMENT
UPS	UNINTERRUPTED POWER SUPPLY

NOTES:

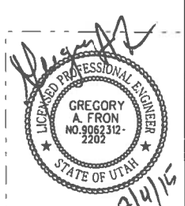
1 PROVIDE PLC CONTROL PANELS WITH UPS, TVSS POWER AND ANALOG SIGNAL PROTECTION. AS REQUIRED, SPECIFIED AND SHOWN IN DRAWINGS.

2 NUMBER OF I/O MODULES SHOWN IS APPROXIMATE.

3 THE CONTROLLOGIX ENHANCED REDUNDANCY SYSTEM UTILIZING FIRMWARE REVISION 19.52 FOR ETHERNET IP NETWORKS.

REMOTE SCADA CONNECTION OPTIONS:

1. WIRELESS RACO ALARM AGENT WITH $250/YR SERVICE FEE AND SECURED WEB SITE WITH SCADA DASHBOARDS AND TRENDING; OR APPROVED EQUAL.
2. LICENSE FREE 900MHz INDUSTRIAL ETHERNET POINT TO POINT RADIO; WITH AN ACCESS POINT RADIO AT AN OFFSITE LOCATION.
3. SATALIGHT INTERNET SERVICES, LOCAL PHONE LAND LINES OR APPROVED METHOD WITH FIREWALL SECURITY.



VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN CAF
DRAWN JWJ
CHECKED RDB
APPROVED CC

WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd. S.#210 • Pleasant Grove, UT • 801-796-4126

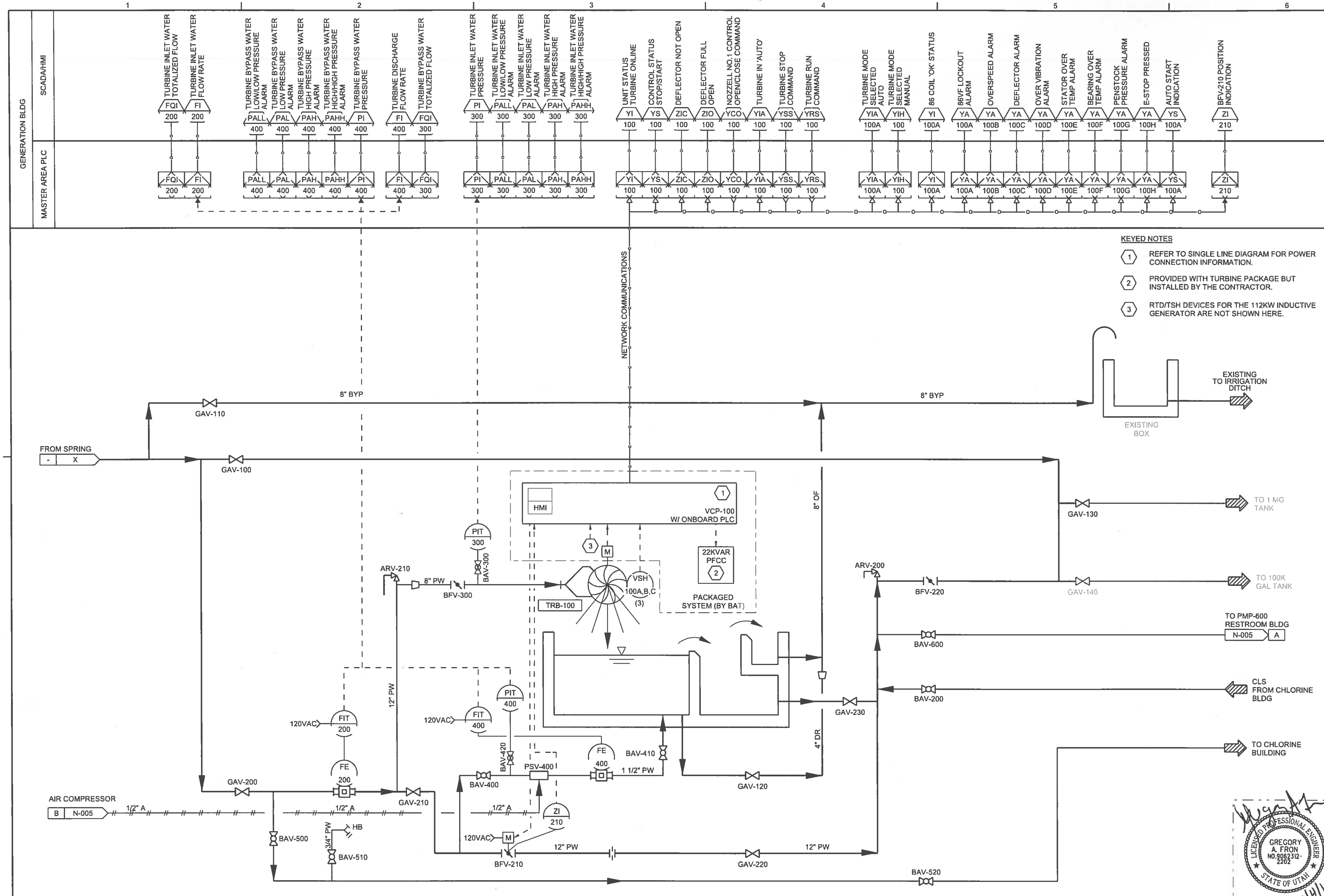
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ELECTRICAL

NETWORK BLOCK DIAGRAM

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-N-003
SHEET 54 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00N003.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:55:55 AM SCALE: 1:0.166667



VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN GAF
CHECKED XXX
APPROVED CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

INSTRUMENTATION

PROCESS & INSTRUMENTATION DIAGRAM SHEET - 1

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-N-004
SHEET 55 OF 70
SCALE: 1:0.166667

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00N004.dgn
PLOT DATE: 2/4/2015
PLOT TIME: 8:53:00 AM

GENERATION BLDG

SCADA/HMI

MASTER AREA PLC

RESTROOM WATER PRESSURE — PI 600
RESTROOM WATER LOW/LOW PRESSURE ALARM — PALL 600
RESTROOM WATER LOW PRESSURE ALARM — PAL 600
RESTROOM WATER HIGH PRESSURE ALARM — PAH 600
RESTROOM WATER HIGH/HIGH PRESSURE ALARM — PAHH 600

PRESSURE ALARM LO — PAL 700
CHEM BLDG INTRUSION ALARM — YA 200
TURBINE BLDG INTRUSION ALARM — YA 100

KEYED NOTES

1. PACKAGED ON DEMAND PRESSURE PUMP SYSTEM; SYSTEM WILL MAINTAIN WATER PRESSURE FROM 40 PSI TO 70 PSI.

DS 200
DS 100
DS 101
DS 102
DS 103

230VAC/1PH
KQI ETM
YL1 R RUNNING
START HSC 100-A
STOP HSB 100-A
RESET HSR 100-A
FAILED YA A
1

120VAC/1PH
LCP-700

PI
PSLH
PSL 300
M
PRV
AIR COMP RECEIVER TANK CMP-700
TO PSV-400 N-004 B

PS 600
PS 600
PIT 600
M
PMP-600
PW A N-004
TO RESTROOM BLDG X -
PACKAGED SYSTEM (BY VENDOR)

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN JWJ
CHECKED RDB
APPROVED CC

WATERWORKS ENGINEERS
215 S Pleasant Grove Blvd S Ste 130 • Pleasant Grove, UT • 801-796-4105

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

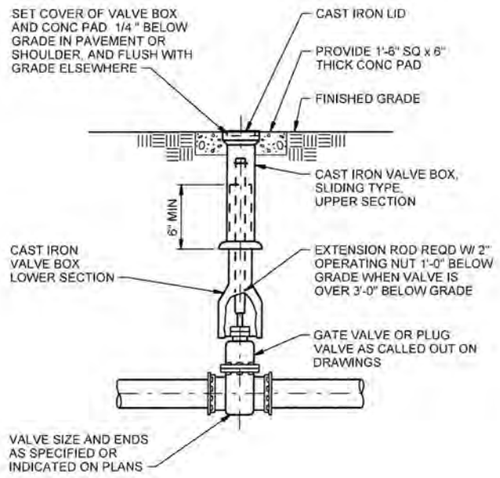
INSTRUMENTATION

PROCESS & INSTRUMENTATION DIAGRAM SHEET - 2

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO. 9062312-2202
STATE OF UTAH
2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-N-005
SHEET 56 OF 70

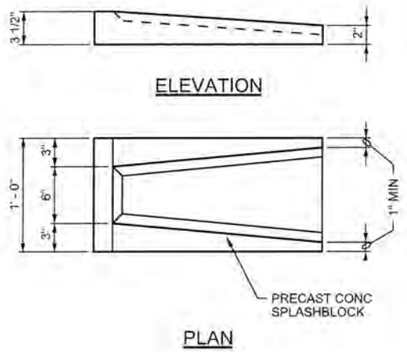
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00N005.dgn PLOT DATE: 2/4/2015 PLOT TIME: 8:52:25 AM SCALE: 1:0.166667



BURIED GATE OR PLUG VALVE BOX, TYPE 1

NTS

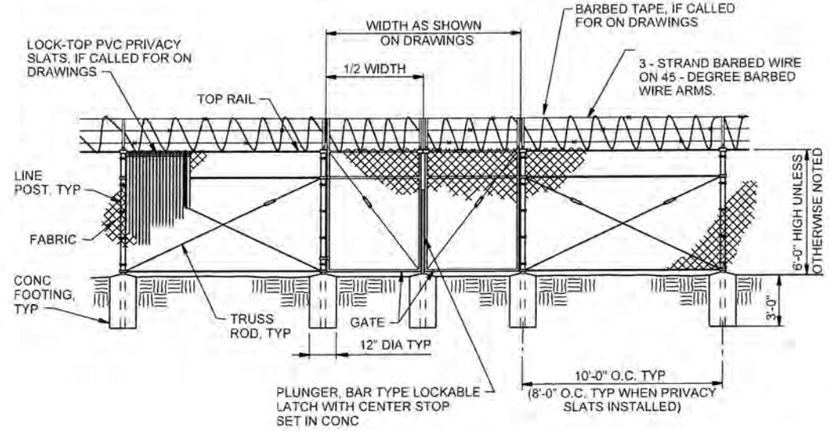
2202



SPLASH BLOCK

NTS

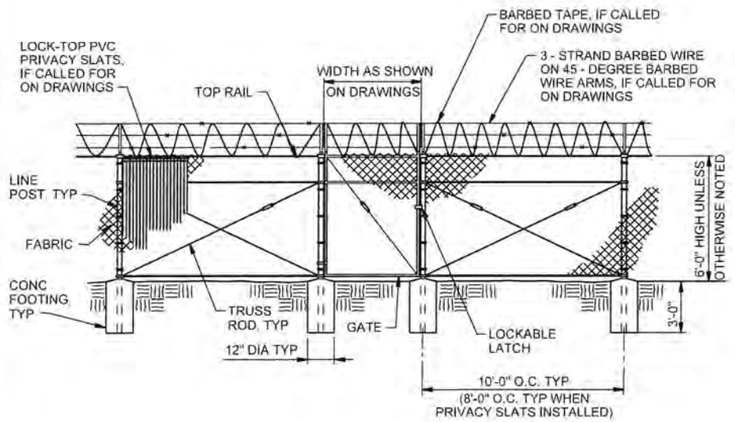
2601



CHAINLINK DOUBLE-LEAF GATE

NTS

2801



CHAINLINK SINGLE-LEAF GATE

NTS

2802

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DETAILS

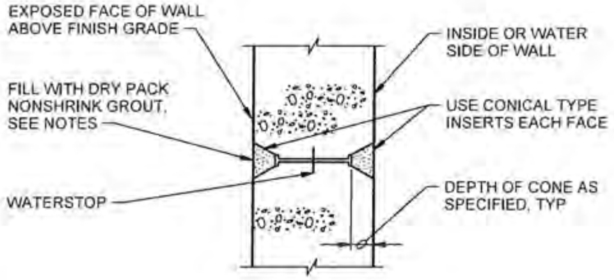
STANDARD DETAILS

LICENSED PROFESSIONAL ENGINEER
JEREMY A. KELLOGG
NO.8464725
STATE OF UTAH
2/5/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-SD-301
SHEET 57 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD301.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:58:52 AM SCALE: 1:0.166667

1 2 3 4 5 6



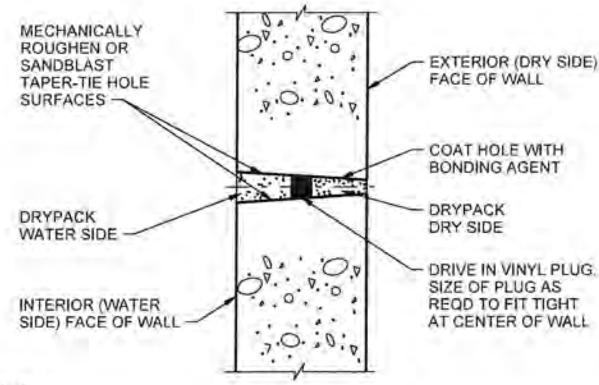
NOTES:

1. THE SPACING OF FORM TIES ON EXPOSED PORTIONS OF WALLS SHALL BE APPROXIMATELY EQUAL HORIZONTALLY AND VERTICALLY AND SHALL BE UNIFORM IN EACH DIRECTION.
2. DRY PACK METHOD SHALL BE AS SPECIFIED USING STEEL TOOLS.

FORM SNAP-TIE HOLE

NTS

3051



NOTE:

MINIMUM HOLE DIAMETER AT EXTERIOR FACE = 1". TAPER HOLE SO THAT MINIMUM HOLE DIAMETER AT INTERIOR FACE = 1 1/4"

CONSTRUCTION STEPS:

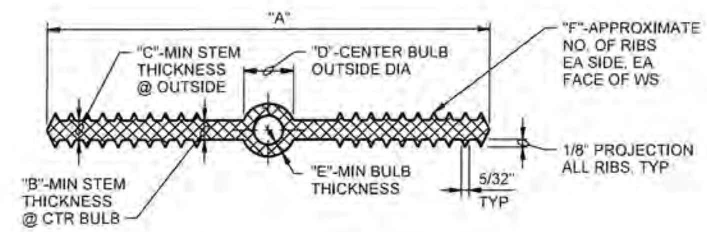
1. SANDBLAST OR MECHANICALLY ROUGHEN WITH ELECTRIC EQUIPMENT.
2. DRIVE IN VINYL PLUG.
3. COAT HOLE ON DRY SIDE OF PLUG AND WHILE BONDING AGENT IS TACKY, DRYPACK.
4. COAT HOLE ON WATER SIDE OF PLUG AND WHILE BONDING AGENT IS TACKY, DRYPACK.
5. USE TYPE II, NON-SHRINK GROUT AS SPECIFIED.

USE THIS DETAIL FOR ALL TREATMENT PLANT PROJECTS SINCE THE CONCRETE SPECIFICATIONS PERMITS THIS ALTERNATE METHOD AND REFERS TO THIS DETAIL.

ALTERNATE FORM TIE-THROUGH BOLT

NTS

3052



SIZE	"A"	"B"	"C"	"D"	"E"	"F"
4"x3/16"	4"	3/16"	3/16"	3/4"	1/4"	4
6"x3/8"	6"	3/8"	3/8"	7/8"	1/4"	6
9"x3/8"	9"	3/8"	3/8"	1"	1/4"	8

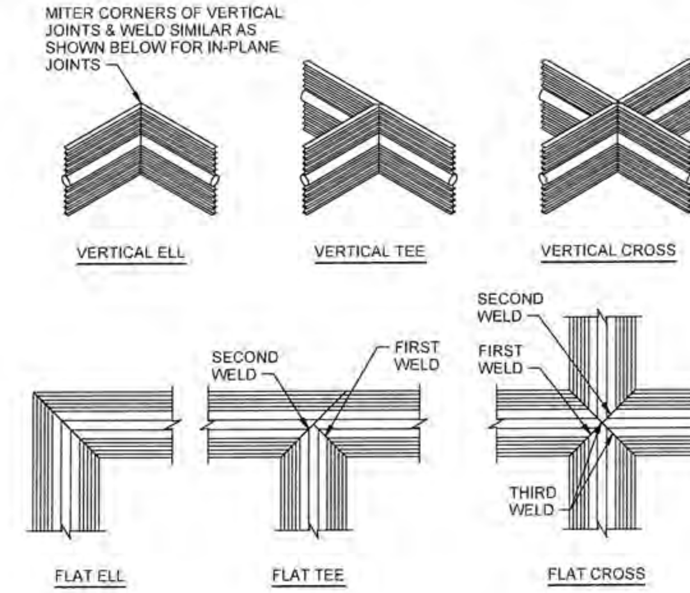
NOTES:

1. NON-ROUND CENTER BULBS SHALL HAVE A MINIMUM OUTSIDE DIMENSION OF 'D'.
2. SEE SPLICE DETAIL (3111)
3. BULB TYPE WATERSTOP SHOWN IS REQUIRED FOR EXPANSION AND CONTROL JOINTS. SIMILAR WATERSTOPS WITHOUT CENTER BULB MAY BE SUBSTITUTED AT CONSTRUCTION JOINTS.
4. USE 6 INCH WATERSTOPS IN ALL CONSTRUCTION JOINTS UNLESS SPECIFICALLY SHOWN OTHERWISE.

PLASTIC WATERSTOP

NTS

3101



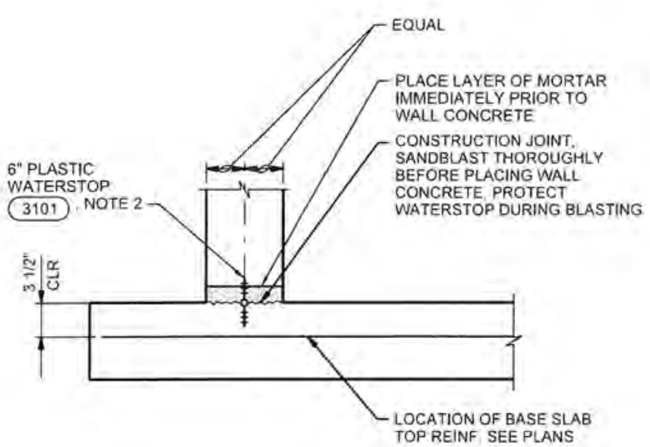
NOTE:

ALL WELDS SHALL BE PER WATERSTOP MANUFACTURER'S RECOMMENDATIONS.

WATERSTOP JOINTS

NTS

3111



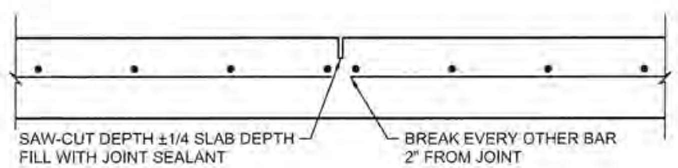
NOTES:

1. FOR WALLS WITH SINGLE MAT OF REINFORCING LOCATE WATERSTOP ON LIQUID FACE, 1" CLEAR OF REINFORCEMENT.
2. SECURE WATERSTOP IN-PLACE AS SPECIFIED.

WALL BASE CONSTRUCTION JOINT

NTS

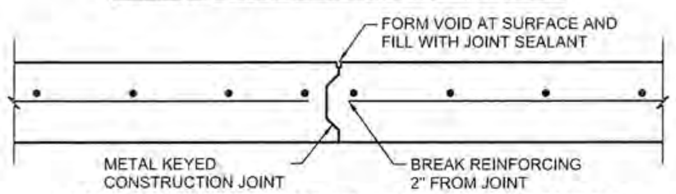
3154



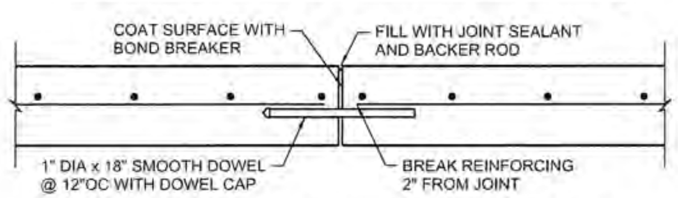
NOTES:

1. SAW-CUT SAME DAY AS POUR AS SOON AS SPALLING WILL NOT OCCUR.
2. CONTRACTOR SHALL USE STRING LINE OR OTHER POSITIVE MEANS TO PLACE REINFORCING AND LOCATE SAWCUT.
3. BREAK REINF AND ADD SPLICE BARS SIMILAR AT DOUBLE MAT.
4. 3/8" TOOLED JOINT MAY BE USED IN PLACE OF SAWN JOINT.

SLAB ON GRADE SAWN JOINT, TYPE A



SLAB ON GRADE CONSTRUCTION JOINT, TYPE B



SLAB ON GRADE CONSTRUCTION JOINT, TYPE C

CONC SLAB ON GRADE JOINTS

NTS

3160

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN	JK
DRAWN	VP
CHECKED	JK
APPROVED	CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DETAILS

STANDARD DETAILS

DATE FEB 2015

PROJECT NUMBER 10-011

DRAWING NUMBER 00-SD-302

SHEET 58 OF 70

SCALE: 1:0.166667

NOTES:

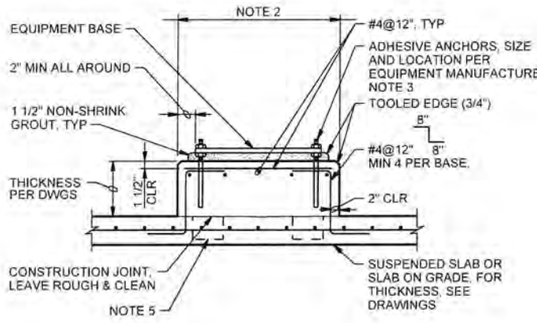
1. PAD SIZE SHALL BE MINIMUM INDICATED OR AS SHOWN ON THE DRAWINGS OR AS INDICATED BY THE MANUFACTURER AND APPROVED BY THE ENGINEER.
2. THE SIZE, NUMBER, TYPE, LOCATION, AND THREAD PROJECTION OF THE ANCHOR BOLTS SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER, AND SHALL BE AS APPROVED BY THE ENGINEER. ANCHOR BOLTS SHALL BE HELD IN POSITION WITH A ONE PIECE TEMPLATE, MATCHING THE BASE PLATE, WHILE PAD IS BEING POURED.
3. ANCHOR BOLT SLEEVES SHALL BE USED TO PROVIDE THE ANCHOR BOLT A MINIMUM MOVEMENT OF 1/2" IN ALL DIRECTIONS. THE MINIMUM SLEEVE LENGTH SHALL BE 8 TIMES THE BOLT DIAMETER. SLEEVES SHALL BE FILLED WITH NON-SHRINK GROUT.
4. ANCHOR BOLT SLEEVES SHALL HAVE A MINIMUM INTERNAL DIAMETER 1" GREATER THAN BOLT DIAMETER AND A MAXIMUM INTERNAL DIAMETER 3" GREATER THAN ANCHOR BOLT DIAMETER. SLEEVES SHALL BE FILLED WITH NON-SHRINK GROUT.
5. EQUIPMENT BASES SHALL BE INSTALLED LEVEL UNLESS SPECIFIED OTHERWISE.
6. TYPE "D" DETAIL SHALL BE USED ONLY FOR SLABS ON GRADE AND AT GRADE. THE SURROUNDING FLOOR SLAB SHALL NOT BE PLACED UNTIL THE EXACT SIZE AND LOCATION OF THE PAD IS KNOWN.
7. WEDGES OR SHIMS SHALL BE USED TO SUPPORT THE BASE WHILE THE NON-SHRINK GROUT IS PLACED. TEMPORARY LEVELING NUTS SHALL BE BACKED OFF. IF LEFT IN, THE WEDGES OR SHIMS SHALL NOT BE EXPOSED TO VIEW.
8. HEIGHT OF PADS SHALL BE MINIMUM REQUIRED FOR ANCHOR BOLT CLEARANCE TO KEEP ANCHOR BOLT OUT OF SLAB (SEE TABLE BELOW). WHERE EQUIPMENT OR PIPING ELEVATION REQUIRE A PAD HEIGHT LESS THAN THE MINIMUM SHOWN, USE TYPE B WITH BLOCKOUT.

AB DIA (IN.)	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2	1 3/4	2
MIN PAD HT (IN.)	7	8 1/2	10	11	12 1/2	15	16 1/2	18	21	24

9. TYPE "F" PADS MAY BE SUBSTITUTED FOR TYPE "A" PADS FOR LOCATIONS APPROVED IN WRITING BY THE ENGINEER.
10. SEE ANCHOR BOLT AND BLOCKOUT DETAILS (3210)

EQUIPMENT PAD NOTES
NTS

3200

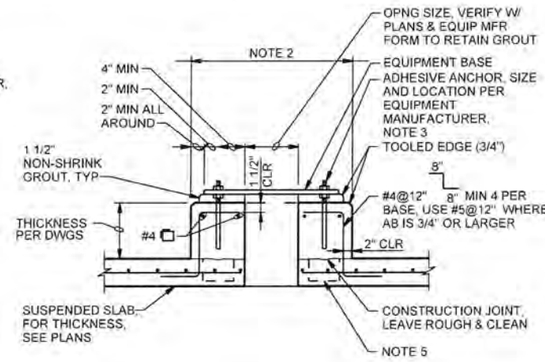


NOTES:

1. SEE (3200) FOR GENERAL EQUIPMENT PAD NOTES.
2. EQUIPMENT PAD SIZE PER DRAWINGS. WHERE PAD SIZE IS NOT SHOWN, SIZE TO FIT EQUIPMENT.
3. IF ANCHOR BOLTS ARE CALLED OUT FOR ON DRAWINGS, PROVIDE ANCHOR BOLTS PER (3210) IN LIEU OF ADHESIVE ANCHORS.
4. ANCHOR BOLT LOCATION SHALL BE WITHIN 4-INCH OF THE FINAL LOCATION REQUIRED FOR EQUIPMENT MOUNTING OR EQUIPMENT PAD SHALL BE DEMOLISHED AND RE-CONSTRUCTED.
5. IF REQUIRED TO ACCOMODATE ANCHOR BOLT LENGTH, PROVIDE BLOCK-OUT OR CORE DRILL IN SLABS AT ALL ANCHOR BOLT LOCATIONS PER (3210).

EQUIPMENT PAD-TYPE A
NTS

3200A

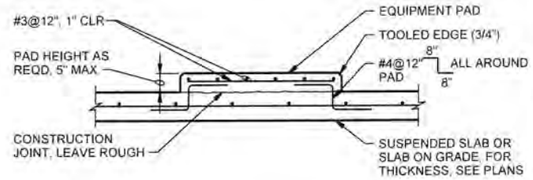


NOTES:

1. SEE (3200) FOR GENERAL EQUIPMENT PAD NOTES.
2. EQUIPMENT PAD SIZE PER DRAWINGS. WHERE PAD SIZE IS NOT SHOWN, SIZE TO FIT EQUIPMENT.
3. IF ANCHOR BOLTS ARE CALLED OUT FOR ON DRAWINGS, PROVIDE ANCHOR BOLTS PER (3210) IN LIEU OF ADHESIVE ANCHORS.
4. ANCHOR BOLT LOCATION SHALL BE WITH IN 4-INCH OF THE FINAL LOCATION REQUIRED FOR EQUIPMENT MOUNTING OR EQUIPMENT PAD SHALL BE DEMOLISHED AND RE-CONSTRUCTED.
5. IF REQUIRED TO ACCOMODATE ANCHOR BOLT LENGTH, PROVIDE BLOCK-OUT OR CORE DRILL IN SLABS AT ALL ANCHOR BOLT LOCATIONS PER (3210).

EQUIPMENT PAD-TYPE C
NTS

3200C

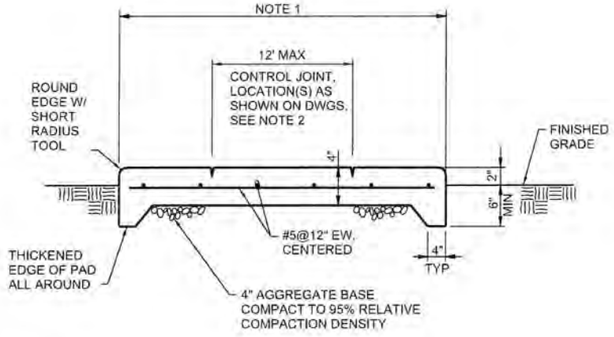


NOTES:

1. SEE (3200) FOR GENERAL EQUIPMENT PAD NOTES.
2. WHEN ANCHORAGE OF EQUIPMENT TO SLAB IS REQUIRED, USE CAST-IN-PLACE ANCHOR BOLTS IN ACCORDANCE WITH (3210) UNLESS OTHERWISE APPROVED BY THE ENGINEER.

EQUIPMENT PAD-TYPE F
NTS

3200F

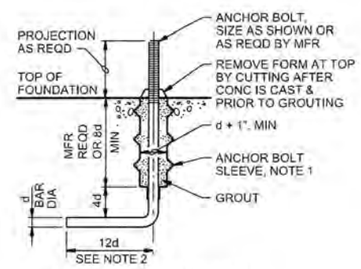


NOTE:

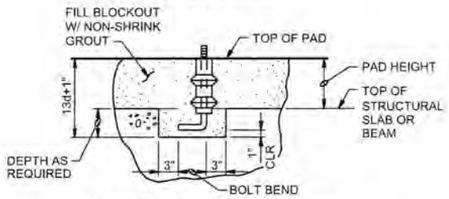
1. CONCRETE PAD, SIZED PER DRAWINGS.
2. CONTROL JOINT SHALL BE FORMED IN FRESH CONCRETE BY HAND TOOLING OR SAW CUTTING. CONTROL JOINTS SHALL BE FORMED TO A DEPTH OF 1 1/2"

CONCRETE HOUSEKEEPING PAD
NTS

3201



MACHINERY ANCHOR BOLT DETAIL



ANCHOR BOLT BLOCKOUT

NOTES:

1. ANCHOR BOLT SLEEVE BY THE ANCHOR BOLT SLEEVE COMPANY, SHELTON, CT, OR EQUAL.
2. 3d WHERE MANUFACTURER VERIFIES NO BOLT PULLOUT RESISTANCE REQUIRED.

ANCHOR BOLT DETAILS
NTS

3210

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

WATERWORKS ENGINEERS
215 South State Street, Suite 200 • Salt Lake City, Utah 84111 • (801) 746-0455

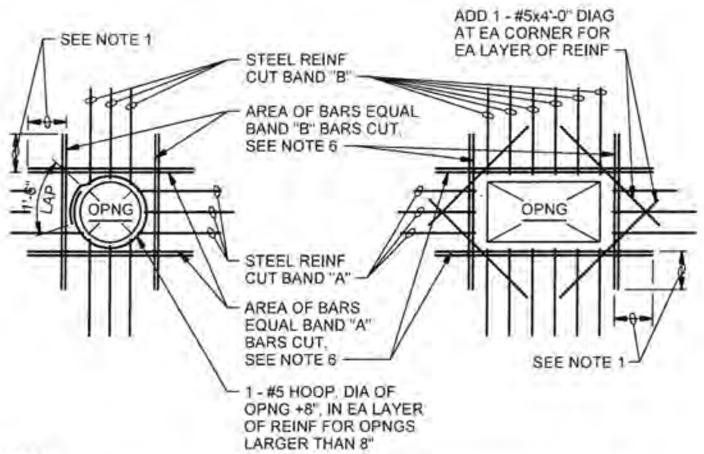
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DETAILS
STANDARD DETAILS

LICENSED PROFESSIONAL ENGINEER
JEREMY A. KELLOGG
NO.8464725
STATE OF UTAH
2/5/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-SD-303
SHEET 59 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD303.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:54:32 AM SCALE: 1:0.166667



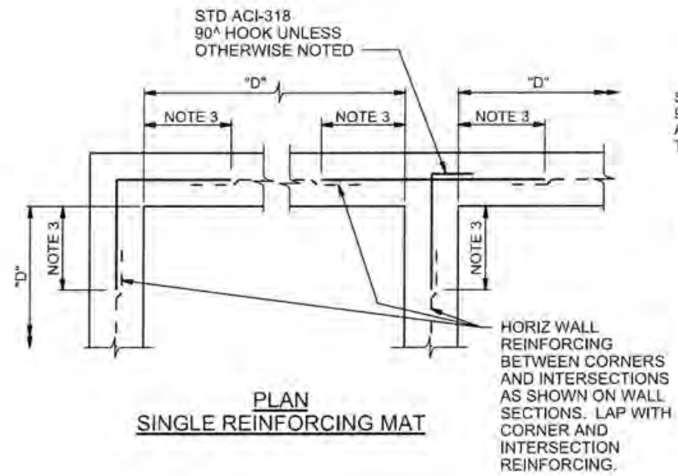
NOTES:

1. PROVIDE MINIMUM LAP, SEE GENERAL STRUCTURAL NOTES. WHERE FULL LAP LENGTH CANNOT BE ACHIEVED DUE TO SLAB OR WALL EDGE, TERMINATE BARS WITH A STANDARD 90 DEGREE BEND 2 INCHES CLEAR OF SLAB OR WALL EDGE. ROTATE HOOKS AS REQUIRED TO MAINTAIN CONCRETE COVER.
2. TYPICAL FOR ALL OPENINGS IN CONCRETE WALLS OF BELOW GRADE AND HYDRAULIC STRUCTURES AND ALL STRUCTURAL CONCRETE SLABS UNLESS INDICATED OTHERWISE ON PLANS.
3. DO NOT WELD REINFORCEMENT TO PIPE SLEEVES AND INSERTS.
4. PROVIDE A MINIMUM OF 2 "A" BARS AND 2 "B" BARS EACH SIDE OF OPENING (1 EACH FACE).
5. FOR OPENINGS LARGER THAN 8'-0", REINFORCE SAME AS FOR 8'-0" OPENINGS.
6. SPACE AT 3 BAR DIAMETERS (OR 3" MINIMUM) ON CENTER.

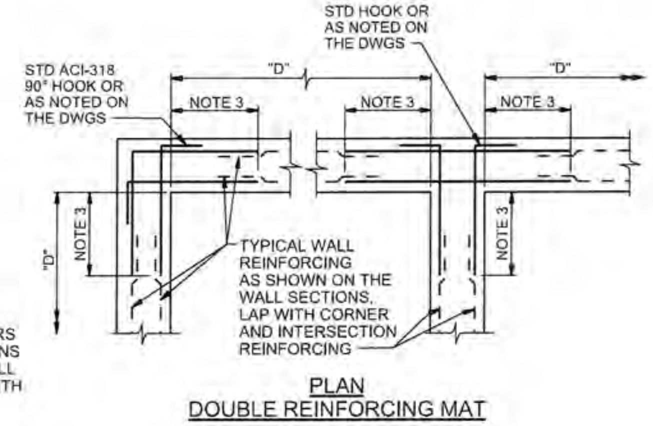
OPENING REINFORCING

NTS

3301



PLAN
SINGLE REINFORCING MAT



PLAN
DOUBLE REINFORCING MAT

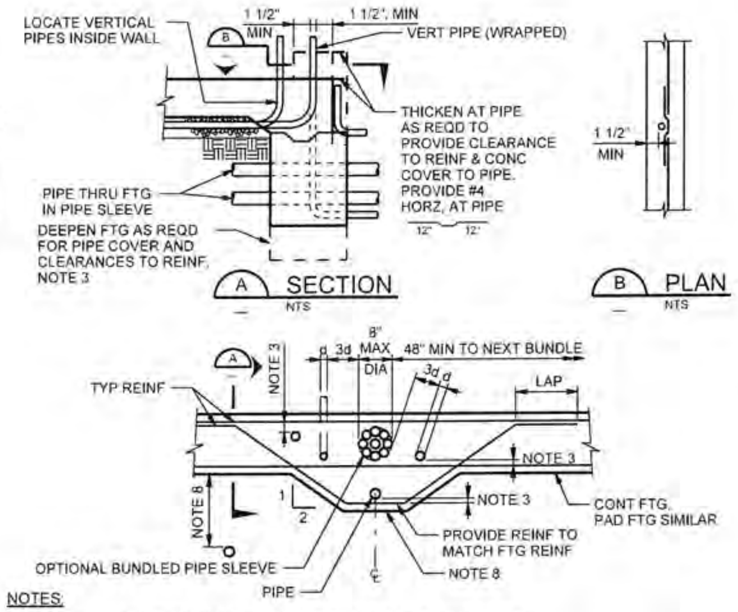
NOTES:

1. TYPICAL HORIZONTAL WALL CORNER AND INTERSECTION REINFORCING LAYOUT IS SHOWN. FOR SIZE AND SPACING, SEE PLANS.
2. WHERE THE CORNER OR INTERSECTION REINFORCING SIZE AND SPACING IS NOT SHOWN, NOTED OR TABULATED ON THE PLANS, THE SIZE AND SPACING SHALL BE THE SAME AS THE WALL HORIZONTAL REINFORCING SHOWN ON THE WALL SECTIONS OR AS NOTED FOR THE REINFORCING BETWEEN THE CORNERS OR INTERSECTIONS.
3. EXCEPT WHERE OTHERWISE SHOWN ON THE DRAWINGS, THE LENGTH INDICATED AS "NOTE 3" SHALL BE THE LESSER OF D/4, 8 FEET, OR 1.0 TIMES THE HEIGHT OF THE WALL, EXCEPT THAT IN NO CASE SHALL IT BE LESS THAN 2.0 FEET.
4. D = LENGTH OF WALL PARALLEL TO THE BAR LENGTH IN QUESTION.
5. USE THE LAP LENGTH AS REQUIRED FOR THE SMALLER OF THE TWO REINFORCING BARS BEING SPLICED, SEE CONCRETE REINFORCING NOTES.

TYPICAL WALL CORNER AND INTERSECTION REINFORCING

NTS

3303



NOTES:

1. PIPE = ANY PENETRATION THRU OR EMBEDDED IN FOUNDATION.
2. ALL PIPES THROUGH FOOTINGS TO BE WRAPPED OR SLEEVED AS FOLLOWS:
   a. SLEEVES: PROVIDE 1" MIN CLR ALL AROUND O.D. PIPE TO I.D. SLEEVE. UNO.
   b. WRAPPED VERTICAL PIPES: PROVIDE 1/8" NOMINAL SHEET FOAM WITH (3) WRAPS MINIMUM UNO.
   c. WRAPPED HORIZONTAL PIPES: PROVIDE 1/8" NOMINAL SHEET FOAM WITH (8) WRAPS MINIMUM UNO.
   d. UNDERGROUND FIRE LINES 4" AND LARGER:
      a. SLEEVES: PROVIDE 2" MIN CLEAR ALL AROUND O.D. PIPE TO I.D. SLEEVE
      b. WRAPPED: PROVIDE 1/8" NOMINAL SHEET FOAM WITH (16) WRAPS MIN.
3. WRAPPED & SLEEVED PIPES SHALL HAVE 1 1/2" MIN CLEAR TO REINF STEEL. MIN CONC COVER AT PIPES TO BE 3".
4. CLEARANCE BETWEEN PIPES TO BE 3d MIN TYP. WITH A MAXIMUM OF (8) PIPES PER 48". GROUPS OF PIPES MAY BE BUNDLED AS SHOWN, EXEPT IN PAD FOOTINGS.
5. NO PIPE TO RUN PARALLEL IN FOOTINGS, STEM OR CURB.
6. PVC CONDUIT (PIPE) EMBEDDED IN CURB/STEM MAY BE WIRED TIED TO HORIZ REINF.
7. NO HORIZONTAL PIPES ALLOWED THROUGH FOOTING WITH 2'-0" EACH SIDE OF HOLD-DOWNS OR STEEL COLUMNS. NO VERTICAL PIPES ALLOWED IN FOOTINGS AT BRACED FRAMES.
8. PROVIDE 18" MIN OF COMPACTED FILL ABOVE PIPES UP TO 12" DIA. FOR LARGER PIPES INCREASE COMPACTED FILL DEPTH 1'-0" FOR EACH 6" INCREASE IN PIPE DIAMETER. OTHERWISE DEEPIN THE FOOTING AS SHOWN.

PIPES THRU FOOTINGS

NTS

3305

VERIFY SCALE — BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK | DRAWN VP | CHECKED JK | APPROVED CC

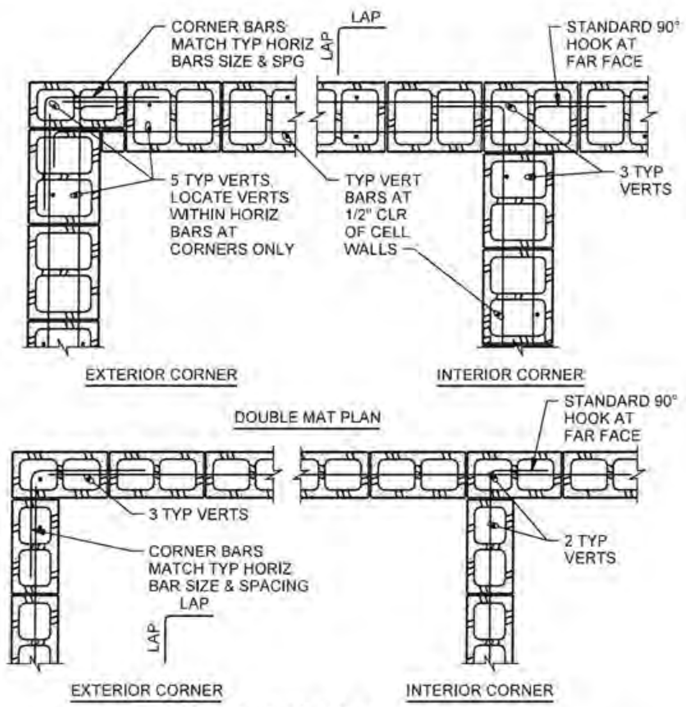
WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DETAILS — STANDARD DETAILS

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-SD-304
SHEET 60 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD304.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:58:09 AM SCALE: 1:0.166667



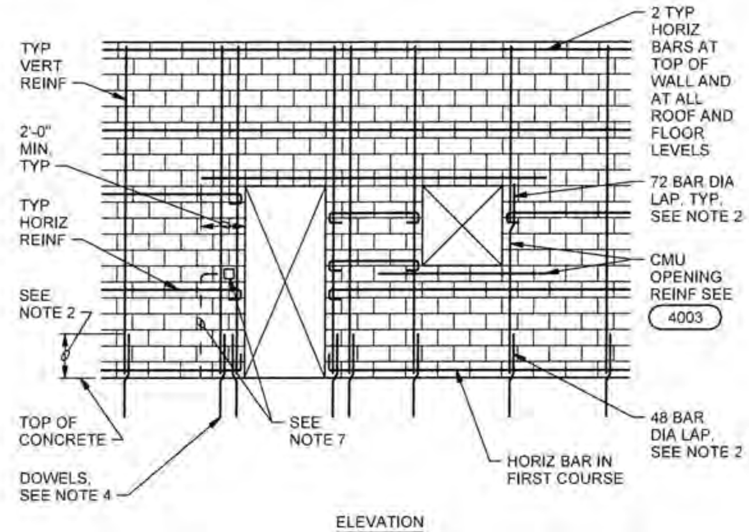
NOTES:

1. LAP=48 BAR DIAMETERS OR 2'-0" MINIMUM UNLESS OTHERWISE NOTED.
2. PROVIDE A STANDARD 90° HOOK EACH END ON ANY HORIZONTAL BAR BETWEEN OPENINGS, CONTROL JOINTS, OR CORNERS LESS THAN 6'-0" IN LENGTH.

CMU WALL CORNERS

NTS

4001



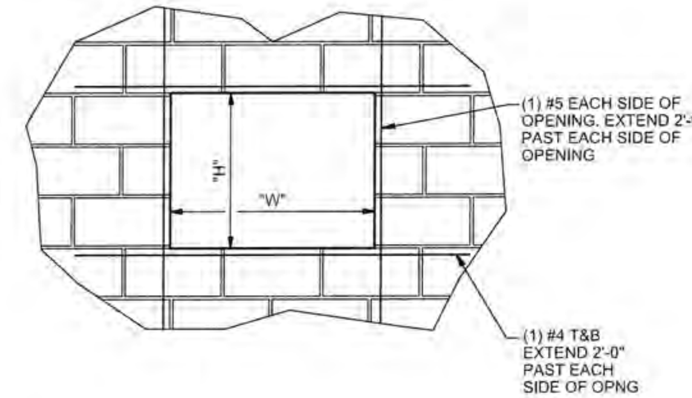
NOTES:

1. FOR TYPICAL WALL REINFORCING, SEE WALL SECTIONS AND DETAILS FOR EACH FACILITY.
2. LAP VERTICAL REINFORCING WITH WALL DOWELS 48 BAR DIAMETERS (2'-0" MIN). LAP ALL OTHER VERTICAL BARS 72 BAR DIAMETERS.
3. STAGGER SPLICES IN ADJACENT HORIZONTAL BARS IN THE SAME COURSE BY 2'-0".
4. PROVIDE DOWEL BARS IN FOUNDATION TO MATCH ALL VERTICAL REINFORCING.
5. FOR ADDED REINFORCING AT WALL INTERSECTIONS AND CORNERS, SEE 4001
6. SOLID GROUT ALL CMU WALLS UNLESS NOTED OTHERWISE.
7. DO NOT PLACE VERTICAL CONDUIT IN THE SAME CELL AS VERTICAL REINFORCING.

REINFORCED CMU WALL

NTS

4002



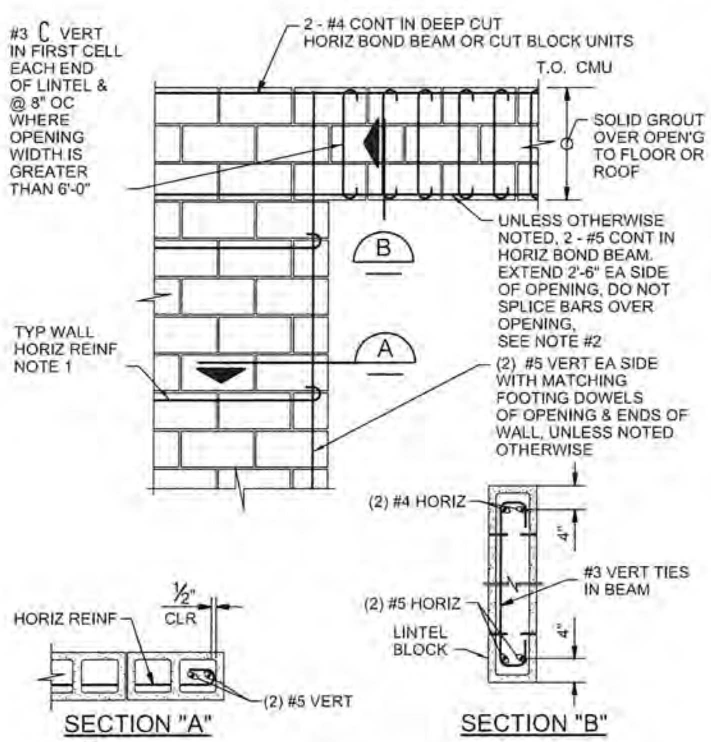
NOTES:

1. THIS DETAIL APPLICABLE WHERE OPNG LESS THEN 3'-0" IN ANY DIMENSION. SEE DETAIL 4004 FOR LARGER OPENINGS.
2. TERMINATE HORZ REINF WITH 180° HOOK AT WALL ENDS AND CMU CONTROL JOINTS PER DETAIL.

CMU OPENINGS LESS THAN 3'-0"

NTS

4003



NOTES:

1. TERMINATE HORIZ REINF WITH 180° HOOK AT WALL ENDS, JAMB OPENINGS AND CMU CONTROL JOINTS.
2. PLACE (2) #5 HORIZ AT WINDOW SILLS, SIM TO TOP OF OPENING.

CMU OPENINGS GREATER THAN 3'-0"

NTS

4004

JEREMY A. KELLOGG NO.8464725 LICENSED PROFESSIONAL ENGINEER STATE OF UTAH 2/5/15

VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK | DRAWN VP | CHECKED JK | APPROVED CC

WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DETAILS

STANDARD DETAILS

DATE FEB 2015

PROJECT NUMBER 10-011

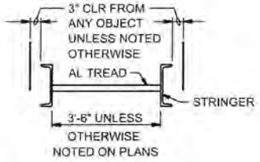
DRAWING NUMBER 00-SD-305

SHEET 61 OF 70

SCALE: 1:0.166667

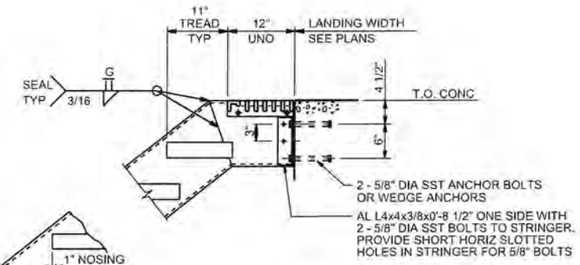
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD305.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:56:47 AM

STAIRWAY WIDTH	BEARING BARS ALUMINUM TREAD
2'-3" OR LESS	1"x3/16"
2'-9" OR LESS	1 1/4"x3/16"
3'-5" OR LESS	1 1/2"x3/16"
4'-2" OR LESS	1 3/4"x3/16"

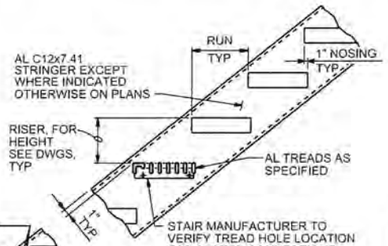


STAIR TREADS

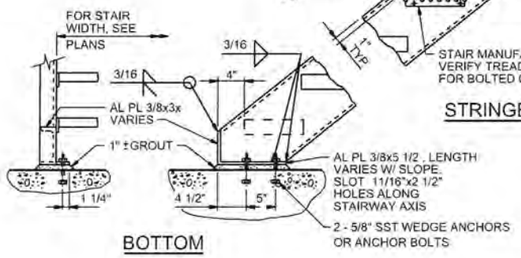
NOTES:
1. PROVIDE PROTECTION FOR DISSIMILAR METALS AND CONCRETE AS SPECIFIED.
2. GRIND EXPOSED FACES ONLY.
3. STAIR HANDRAIL NOT SHOWN FOR CLARITY. PROVIDE STAIR HANDRAIL BOTH SIDES.



TOP

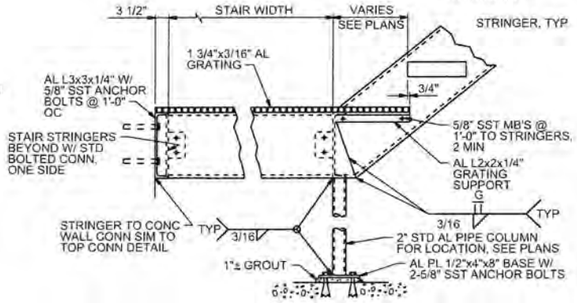


STRINGERS



BOTTOM

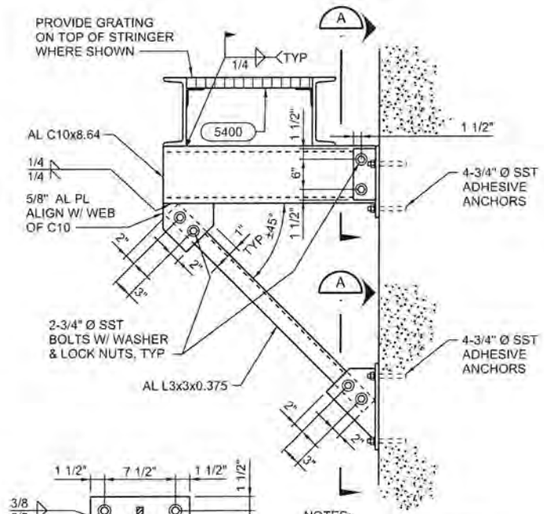
NOTE:
STAIR HANDRAIL NOT SHOWN.

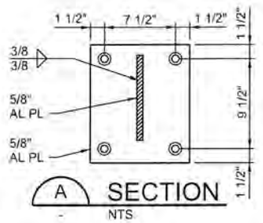


STRINGERS

ALUMINUM STAIRS
NTS

5100



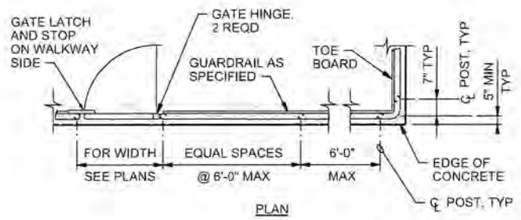


A SECTION
NTS

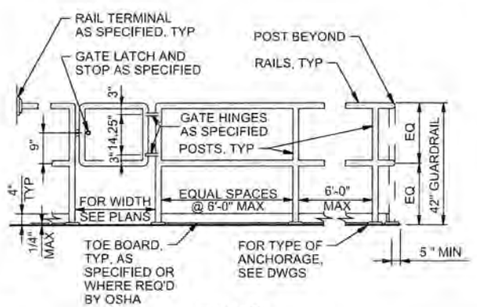
NOTES:
1. PROVIDE PROTECTION FOR DISSIMILAR METALS AND CONCRETE AS SPECIFIED.
2. SEE PLANS FOR LOCATION.
3. ADHESIVE ANCHORS SHALL BE INSTALLED BY PERSONNEL CERTIFIED BY THE ACI/CRSI ADHESIVE ANCHOR INSTALLER CERTIFICATION PROGRAM.

ALUMINUM STAIR SUPPORT
NTS

5105



PLAN

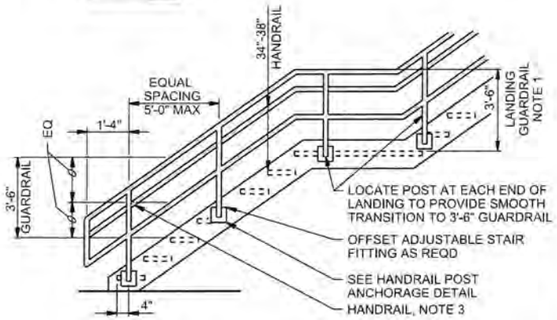


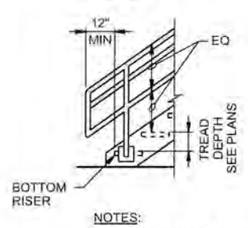
ELEVATION

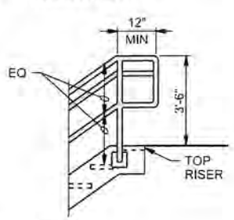
NOTE:
1. FOR GUARDRAIL MATERIAL REFERENCE DRAWINGS AND/OR JOB SPECIFICATIONS

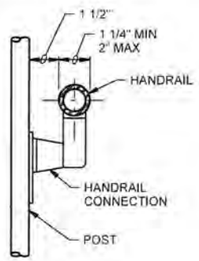
TWO-RAIL GUARDRAIL
NTS

5200A









NOTES:
1. SEE TYPICAL GUARDRAIL DETAIL (5200A).
2. SEE SPECIFICATIONS FOR MATERIALS.
3. HANDRAIL SHALL BE ATTATCHED TO POSTS AND PROVIDE A CONTINUOS GRIPPING SURFACE. HANDRAIL EXTENSIONS SHALL RETURN TO A WALL, GUARD, OR THE WALKING SURFACE.

TWO-RAIL GUARDRAIL AT STAIRS
NTS

5201B

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

WATERWORKS ENGINEERS

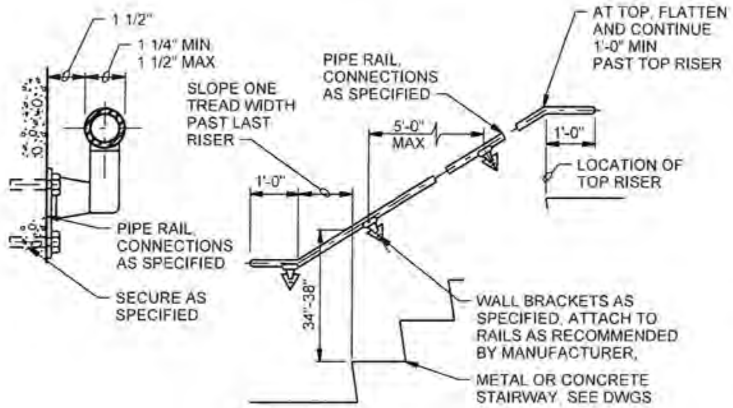
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DETAILS
STANDARD DETAILS

JEREMY A. KELLOGG NO.8464725 LICENSED PROFESSIONAL ENGINEER STATE OF UTAH
2/5/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-SD-306
SHEET 62 OF 70

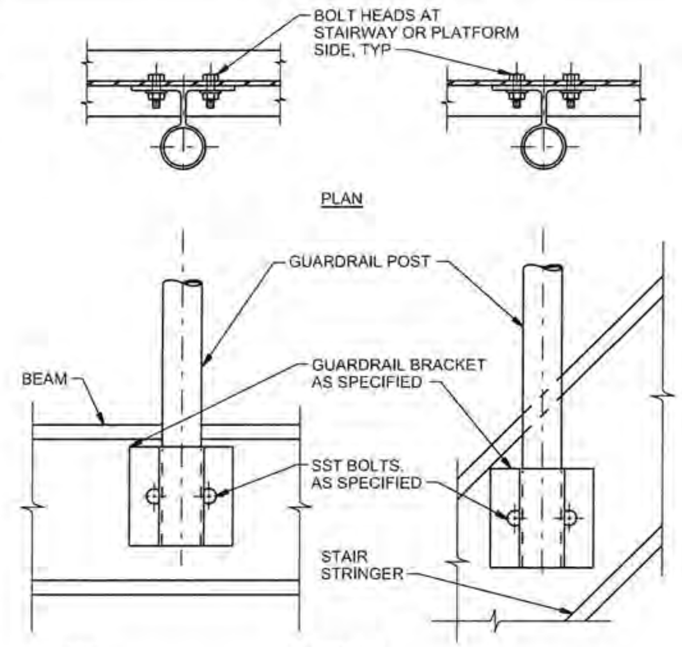
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD306.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:49:22 AM SCALE: 1:0.166667



WALL HANDRAIL AT STAIRS

NTS

5202



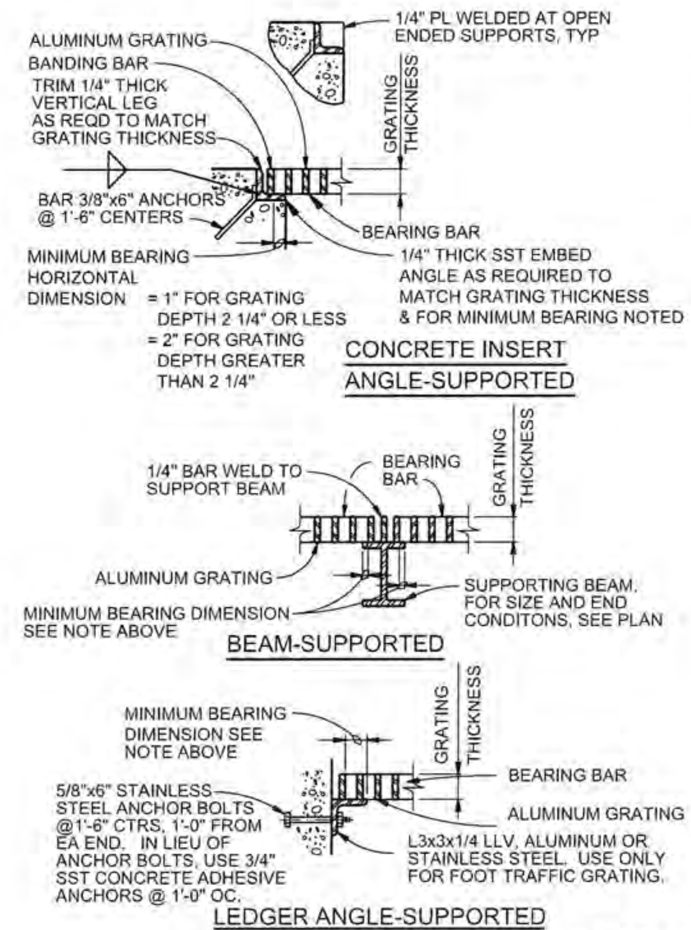
NOTES:

1. PROVIDE PROTECTION FOR DISSIMILAR METALS AND CONCRETE PER SPECIFICATIONS.
2. HANDRAIL POST ANCHORAGE TO ALSO BE USED FOR GUARDRAIL POST ANCHORAGE.
3. REFERENCE DRAWINGS AND OR SPECIFICATIONS FOR MATERIALS.

HANDRAIL POST ANCHORAGE-TYPE D

NTS

5250D



ALUMINUM GRATING

NTS

5400

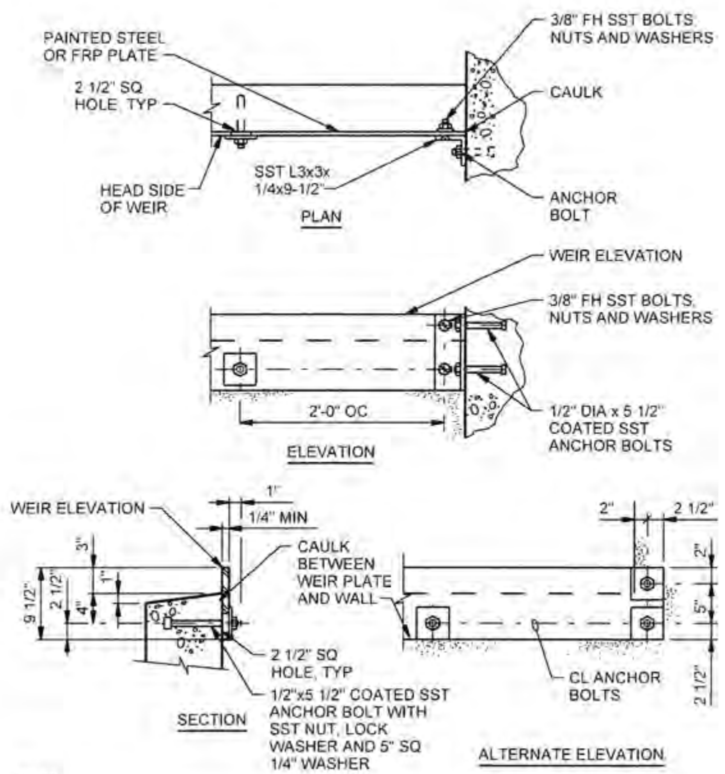
GRATING NOTES

1. EXTEND GRATING CONTINUOUSLY OVER GATE GUIDES AND GATES.
2. NOTCH GRATING SUPPORTS AT GATES AS REQUIRED.
3. GRATING SPAN ⟶ SEE PLAN.
4. WIDTH OF GRATING SECTIONS SHALL NOT EXCEED 3'-0" AND INDIVIDUAL SECTION WEIGHT SHALL NOT EXCEED 150 POUNDS.
5. SHOP DRAWINGS BASED ON FIELD DIMENSIONS SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO FABRICATION.
6. MATERIAL FOR SUPPORTS OF ALUMINUM GRATING TO BE SAME AS GRATING, EXCEPT METAL SUPPORTS THAT ARE TO BE EMBEDED IN CONCRETE SHALL BE TYPE 316 STAINLESS STEEL.
7. UNLESS NOTED OTHERWISE ON PLANS, GRATING THICKNESS SHALL BE AS TABULATED IN "GRATING THICKNESS TABLE" FOR APPLICABLE TRAFFIC.
8. BEARING BAR THICKNESS FOR GRATING TO BE 3/16" MINIMUM.
9. BAND ALL EDGES WITH 3/16 x DEPTH OF BEARING BAR.
10. PROVIDE MISCELLANEOUS GRATING FASTENERS AS REQUIRED.
11. THE HORIZONTAL CLEARANCE BETWEEN THE GRATING AND GRATING SUPPORTS SHALL NOT BE LESS THAN 1/4" NOR GREATER THAN 1/2" AND AS SPECIFIED.
12. ALL GRATING SECTIONS, WHEN IN PLACE, SHALL ALWAYS BE FIRMLY ANCHORED TO THEIR SUPPORTS AS SPECIFIED.
13. PROVIDE SUPPORT TYPE SHOWN IN DRAWINGS OR MOST APPLICABLE FOR THE INSTALLATION CONDITIONS.

FOOT TRAFFIC

GRATING THICKNESS TABLE

MAXIMUM SPAN	ALUMINUM (IN.)
3'-6"	1 1/4"
4'-0"	1 1/2"
4'-6"	1 3/4"
5'-0"	1 3/4"
5'-6"	2"
6'-0"	2 1/4"
6'-6"	2 1/4"
7'-0"	2 1/2"



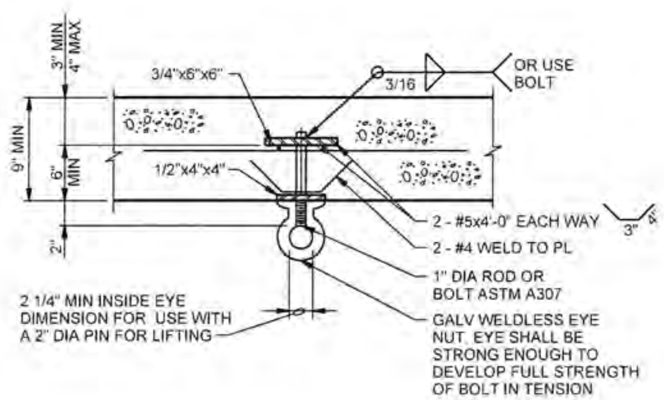
NOTE:

STEEL TROWEL TOP OF CONCRETE TO OBTAIN SMOOTH DENSE FINISH.

STRAIGHT EDGE WEIR

NTS

5500



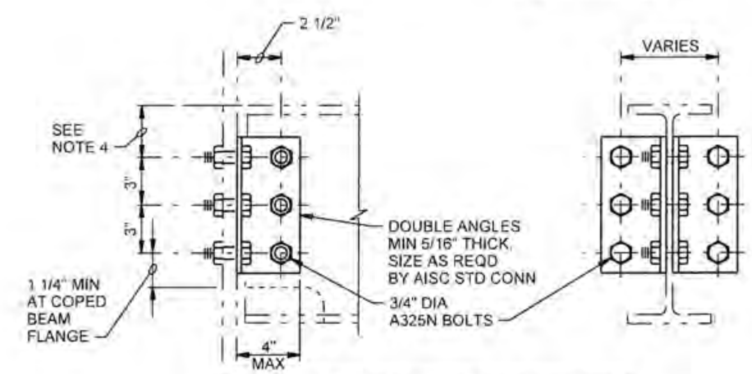
NOTES:

1. MAXIMUM LOAD RATING FOR LIFTING EYE 4000 LBS.
2. SUBMIT DATA ON EYE BOLT WITH SHOP DRAWINGS.

LIFTING EYE

NTS

5610



NOMINAL BEAM DEPTH, INCHES	ROWS OF BOLTS	LENGTH (3) OF ANGLE
36	7	1'-8 1/2"
30-33	6	1'-5 1/2"
24-27	5	1'-2 1/2"
16-21	4	11 1/2"
12-15	3	8 1/2"
8-10	2	5 1/2"
6	1	3"
4	1	2 1/2"

NOTES:

1. NUMBER OF ROWS IS EQUAL TO NUMBER OF BOLTS TO ENCLOSED WEB.
2. ALL FRAMING CONNECTIONS SHALL CONFORM TO SCHEDULE UNLESS DETAILED OTHERWISE ON FRAMING PLANS.
3. ADD 1 1/2 " TO ANGLE LENGTH FOR STAGGERED BOLT CONNECTIONS.
4. 3" DIMENSION TYP EXCEPT AS RECOMMENDED BY AISC FOR LARGER MEMBERS.

TYPICAL BEAM FRAMING CONNECTION-STEEL

NTS

5825

LICENSED PROFESSIONAL ENGINEER JEREMY A. KELLOGG NO.8464725 STATE OF UTAH 2/5/15

VERIFY SCALE — BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK | DRAWN VP | CHECKED JK | APPROVED CC

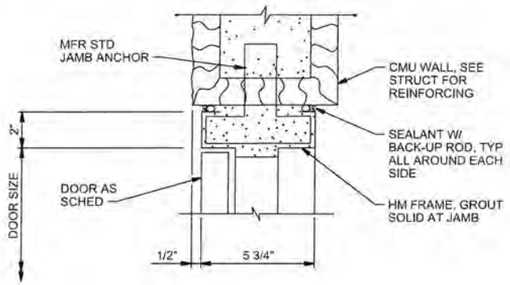
WATERWORKS ENGINEERS

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DETAILS — STANDARD DETAILS

DATE FEB 2015 | PROJECT NUMBER 10-011 | DRAWING NUMBER 00-SD-307 | SHEET 63 OF 70 | SCALE: 1:0.166667

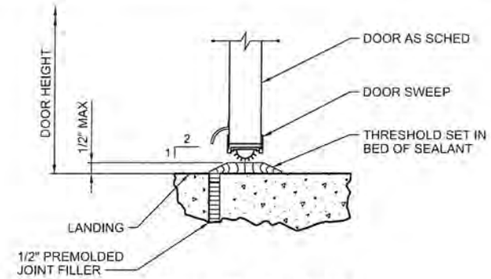
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD307.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:56:09 AM



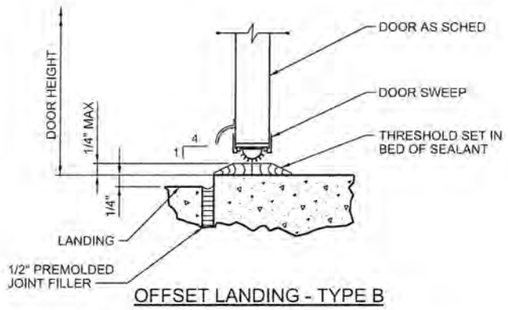
NOTE:
HEAD SIMILAR

DOOR JAMB - 8" CMU
NTS

8100



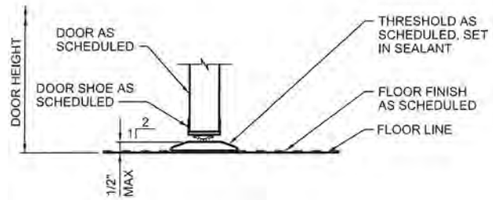
FLUSH LANDING - TYPE A



OFFSET LANDING - TYPE B

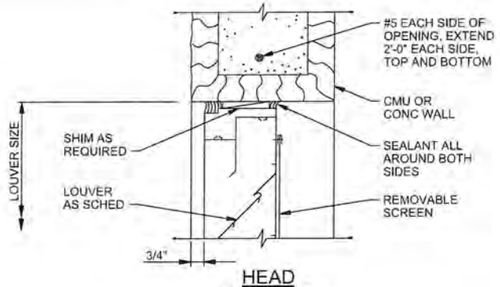
DOOR THRESHOLD
NTS

8110

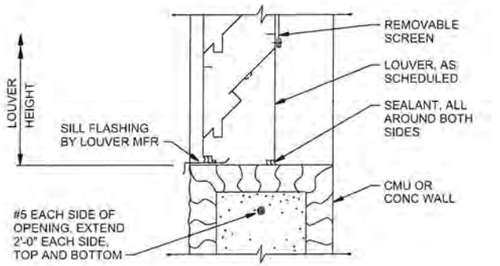


DOOR THRESHOLD
NTS

8111



HEAD
(JAMB SIMILAR)



SILL

LOUVER
NTS

8115

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

WATERWORKS ENGINEERS

PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

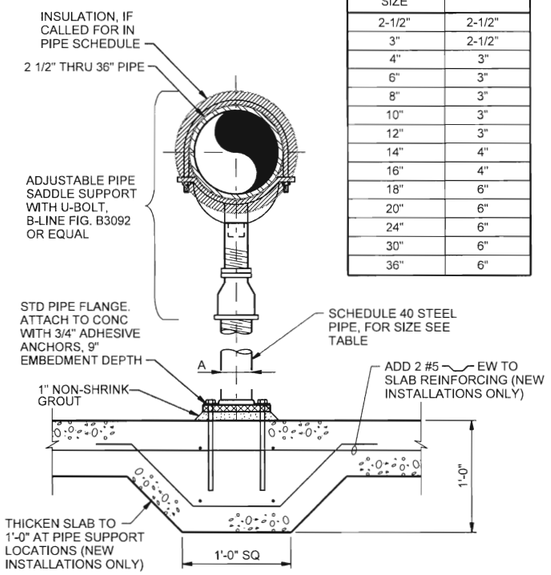
DETAILS
STANDARD DETAILS

LICENSED PROFESSIONAL ENGINEER
JEREMY A. KELLOGG
NO.8464725
STATE OF UTAH
2/5/15

DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
00-SD-308
SHEET 64 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD308.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:53:43 AM SCALE: 1:0.166667

DIMENSION TABLE	
PIPE SIZE	A
2-1/2"	2-1/2"
3"	2-1/2"
4"	3"
6"	3"
8"	3"
10"	3"
12"	3"
14"	4"
16"	4"
18"	6"
20"	6"
24"	6"
30"	6"
36"	6"

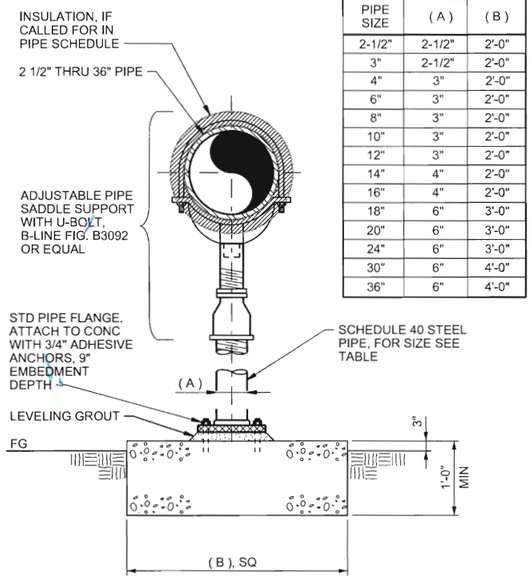


ADJUSTABLE-HEIGHT SADDLE PIPE SUPPORT

NTS

15000

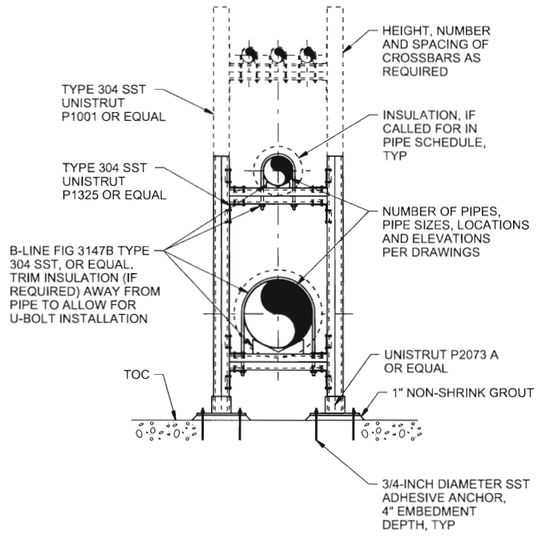
DIMENSION TABLE		
PIPE SIZE	(A)	(B)
2-1/2"	2-1/2"	2'-0"
3"	2-1/2"	2'-0"
4"	3"	2'-0"
6"	3"	2'-0"
8"	3"	2'-0"
10"	3"	2'-0"
12"	3"	2'-0"
14"	4"	2'-0"
16"	4"	2'-0"
18"	6"	3'-0"
20"	6"	3'-0"
24"	6"	3'-0"
30"	6"	4'-0"
36"	6"	4'-0"



ADJUSTABLE-HEIGHT SADDLE PIPE SUPPORT WITH CONCRETE PAD

NTS

15000A

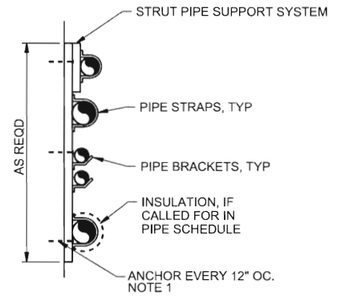


FIXED PIPE SUPPORT RACK

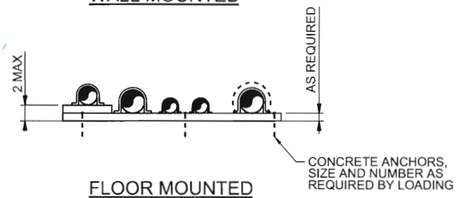
NTS

15006

NOTE:
USE NEOPRENE SLEEVE ON COPPER AND PVC PIPING AT STRAPS AND BRACKETS.



WALL MOUNTED



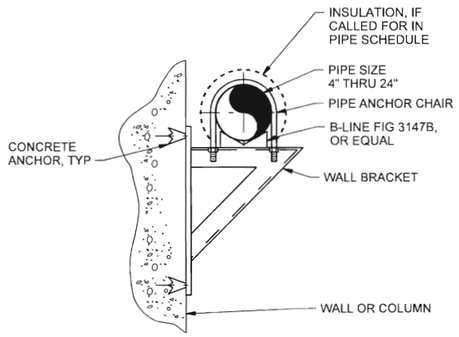
FLOOR MOUNTED

NOTE :
1. ATTACH TO WALL WITH SST ANCHORS, 3/8" DIAMETER MIN, COORDINATED WITH WALL CONSTRUCTION

PIPE SUPPORTS

NTS

15010



NOTES:
1. HOT DIP GALVANIZE AFTER FABRICATION.
2. WALL BRACKET TYPE AND SPACING DEPENDS ON PIPE SIZE. REFER TO SPEC SECTION 15010.

PIPE SUPPORT-WALL BRACKET

NTS

15011

LICENSED PROFESSIONAL ENGINEER
CORY L. CHRISTIANSEN
NO. 5102948
2/4/15
STATE OF UTAH

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

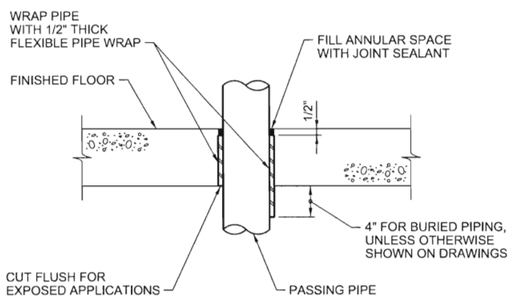
WATERWORKS ENGINEERS
2235 S Pleasant Grove Blvd, Suite 100 • Pleasant Grove UT • 801-763-4105

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DETAILS
STANDARD DETAILS

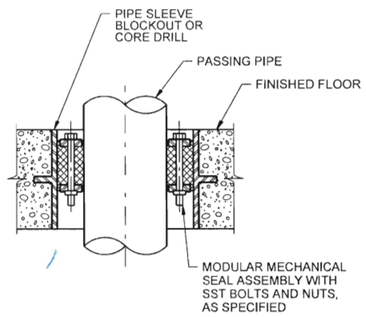
DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-SD-309
SHEET 65 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD309.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:52:56 AM SCALE: 1:0.166667



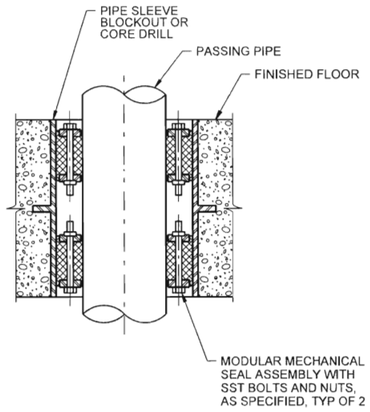
PIPE FLOOR PENETRATION
NTS

15102



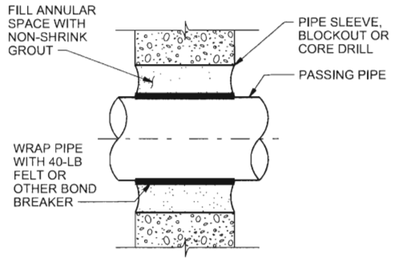
FLOOR SLEEVE WITH MODULAR MECHANICAL SEAL
NTS

15105



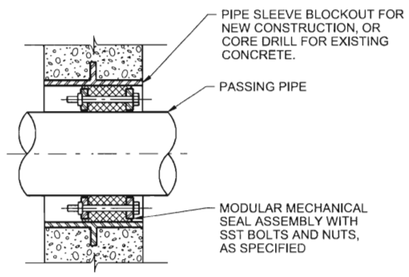
FLOOR SLEEVE WITH DOUBLE MODULAR MECHANICAL SEAL
NTS

15106



WALL SLEEVE WITH GROUT SEAL
NTS

15131



WALL SLEEVE WITH MODULAR MECHANICAL SEAL
NTS

15132

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd, Suite 102 • Pleasant Grove, UT • 801-763-4105

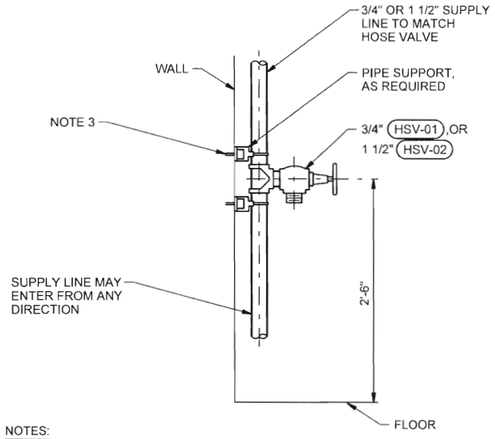
PLEASANT GROVE
MICRO-HYDRO POWER
GENERATOR PROJECT

DETAILS
STANDARD DETAILS

LICENSED PROFESSIONAL ENGINEER
CORY L. CHRISTIANSEN
NO. 702048
STATE OF UTAH
2/4/15

DATE
FEB 2015
PROJECT NUMBER
10-011
DRAWING NUMBER
00-SD-310
SHEET 66 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD310.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:48:14 AM SCALE: 1:0.166667



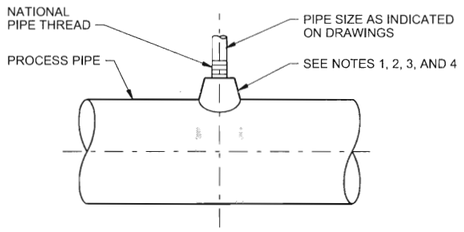
NOTES:

1. ROTATE HOSE VALVE 90° OFF WALL.
2. WHERE HOSE VALVE IS SUPPLIED WITH NON-POTABLE WATER, INSTALL SIGN S-101 IN A CONSPICUOUS PLACE NEXT TO EACH HOSE VALVE. SEE SPEC SECTION 10400 FOR SIGN REQUIREMENTS.
3. ATTACH TO WALL WITH SST ANCHORS, 3/8" DIAMETER MIN, COORDINATED WITH WALL CONSTRUCTION

SURFACE-MOUNTED HOSE VALVE

NTS

15200E



PIPE TAPS

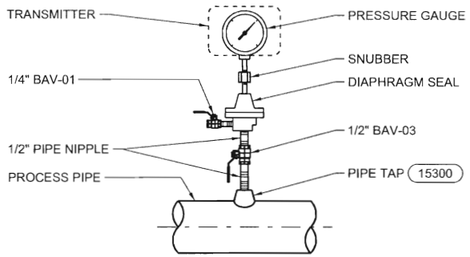
NOTES:

1. FOR STEEL, GALVANIZED STEEL, AND PVC 2 1/2" AND SMALLER USE A BUSHING IN A TEE.
2. FOR DUCTILE IRON, ALL SIZES, USE SERVICE SADDLE.
3. FOR NEW STEEL AND STAINLESS STEEL PIPES 3" AND LARGER, AND PRESSURE VESSELS, USE THRED-O-LET AS SHOWN.
4. FOR EXISTING PVC, STEEL AND STAINLESS STEEL PIPES 3" AND LARGER, USE SERVICE SADDLE.

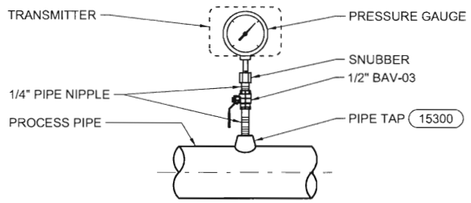
PIPE TAPS

NTS

15300



DIAPHRAGM SEAL INSTALLATION



DIRECT INSTALLATION

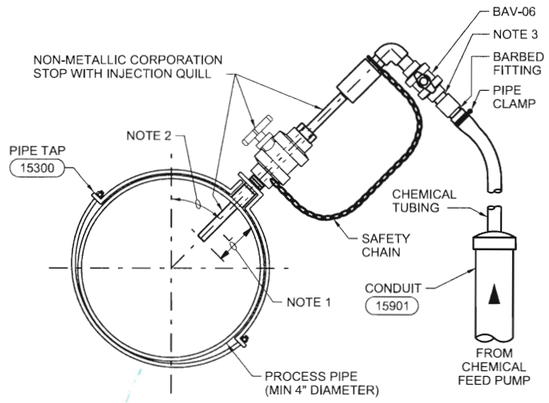
NOTES:

1. USE DIRECT INSTALLATION FOR POTABLE WATER, RAW WATER, RECLAIMED WATER AND AIR PROCESS PIPING.
2. USE DIAPHRAGM SEAL INSTALLATION FOR SEWAGE, SLUDGE, CHEMICAL AND ALL PROCESS PIPES THAT ARE NOT WATER OR AIR.
3. ALL PIPE NIPPLES TO BE TYPE 304 STAINLESS STEEL.
4. FOR MULTIPLE INSTRUMENTS, PROVIDE TEE, PIPE NIPPLES AND ELBOWS AS REQUIRED IN INSTRUMENT LOCATION.

PRESSURE GAUGE OR TRANSMITTER INSTALLATION

NTS

15310



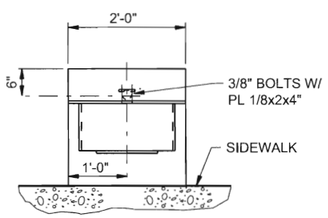
NOTES:

1. INJECTION QUILL SHALL EXTEND INTO PROCESS PIPE SUCH THAT "L" DIMENSION IS BETWEEN ONE-THIRD AND ONE-HALF OF PIPE DIAMETER. MINIMUM "L" DIMENSION SHALL BE 2-INCHES.
2. LOCATE PIPE TAP ABOVE THE HORIZONTAL PLANE. ORIENT PIPE TAP / INJECTION QUILL AND PROVIDE FITTINGS AS REQUIRED TO ALLOW FOR ACCESS TO INJECTION POINT AND A STRAIGHT RUN OF CHEMICAL TUBING TO CONDUIT.
3. CPVC PIPING, FITTINGS AND VALVES SHALL BE 1/2" UNLESS NOTED OTHERWISE. COORDINATE PIPE AND TUBING CONNECTION SIZES WITH INJECTION QUILL.

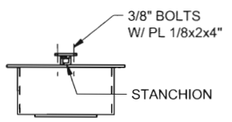
CHEMICAL INJECTION POINT

NTS

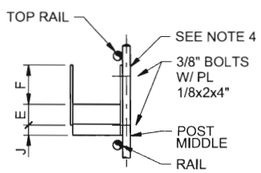
15350



PLAN-POST MOUNT



STANCHION MOUNTED

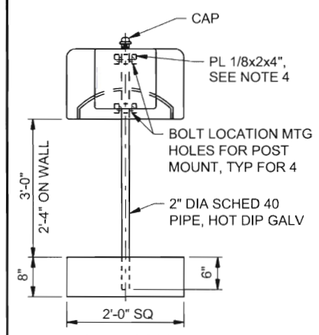


HANDRAIL POST MOUNTED

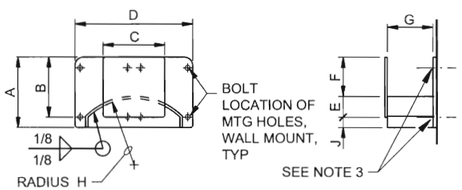
RACK TYPE	DIMENSION IN INCHES								
	A	B	C	D	E	F	G	H	J
TYPE A-3/4" & 1" HOSE	9	7-1/2	6	9	3	4	7-1/2	9-3/4	2
TYPE B-1 1/2" HOSE	12	10	9	12	4	6	10	13	2

NOTES:

1. INTERIOR UNITS SHALL BE FABRICATED FROM 1/8" A-36 STEEL PLATE AND ENTIRE UNIT SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
2. EXTERIOR UNITS SHALL BE FABRICATED FROM 3/16" 6061-T6 ALUMINUM ALLOY PLATE.
3. ATTACH TO WALL WITH SST ANCHORS, 3/8" DIAMETER MIN, COORDINATE WITH WALL CONSTRUCTION
4. ATTACH TO VERTICAL HANDRAIL OR INDIVIDUAL POST WITH PLATES AND (4) - 3/8" STAINLESS STEEL BOLTS.
5. ATTACH TO STEEL COLUMN WITH (4) - 3/8" ROUND HEAD BOLTS, ONE EACH CORNER. INSERT DOUBLE SPACER NUTS BETWEEN COLUMN AND HOSE RACK.



SECTION



WALL MOUNTED

HOSE RACK

NTS

15720

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN JK
DRAWN VP
CHECKED JK
APPROVED CC

WATERWORKS ENGINEERS
233 S. Pleasant Grove Blvd Suite 100 • Pleasant Grove, UT • 801-785-4185

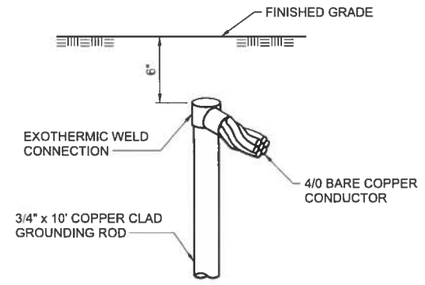
PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

DETAILS
STANDARD DETAILS

LICENSED PROFESSIONAL ENGINEER
CORY L. CHRISTIANSEN
NO. 5670948
STATE OF UTAH

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-SD-311
SHEET 67 OF 70

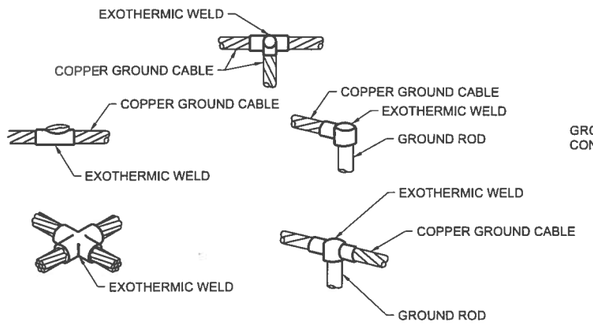
FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD311.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:51:19 AM SCALE: 1:0.166667



EXOTHERMIC GROUND ROD CONNECTION

NTS

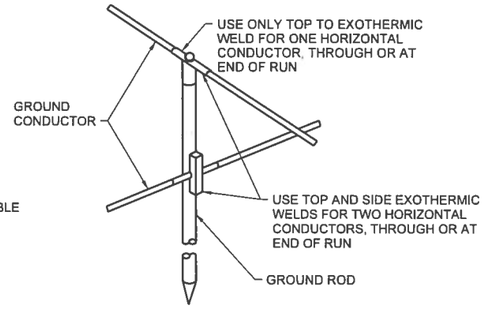
17001



TYPICAL EXOTHERMIC WELDS

NTS

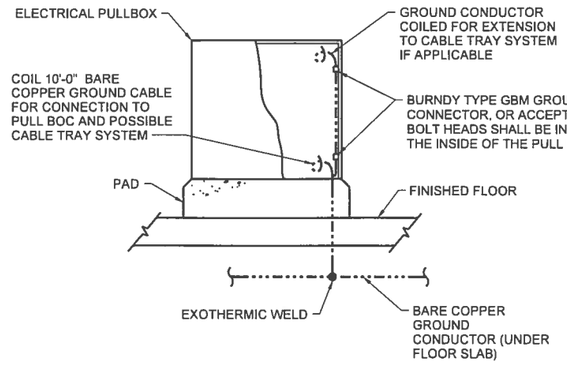
17002



TYPICAL GROUND GRID ROD CONNECTION

NTS

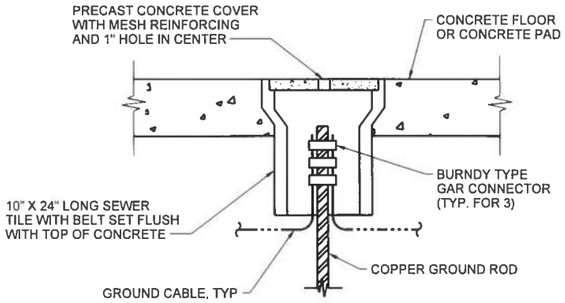
17003



TYPICAL ELECTRICAL PULLBOX GROUNDING

NTS

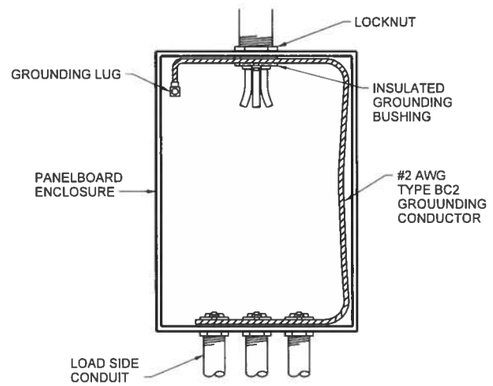
17004



TYPICAL GROUNDING TEST WELL

NTS

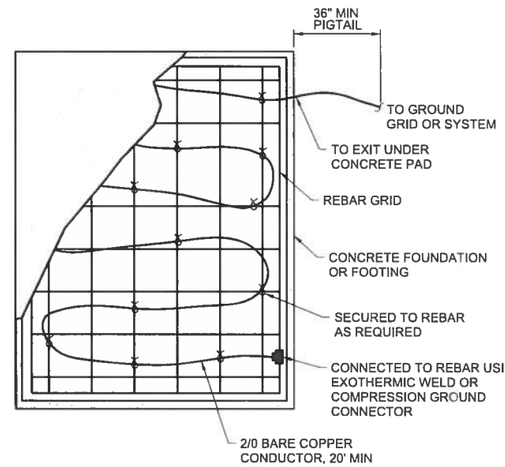
17005



TYPICAL PANELBOARD CONDUIT GROUNDING

NTS

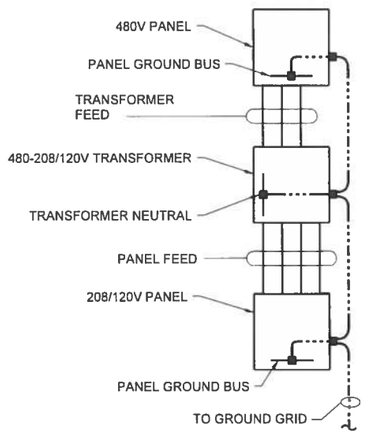
17006



UFER GROUNDING DETAIL

NTS

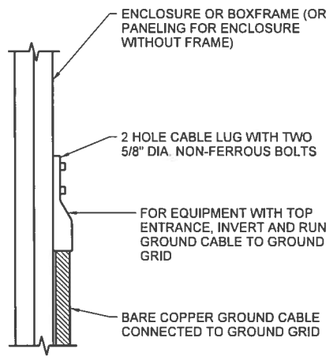
17007



NTS

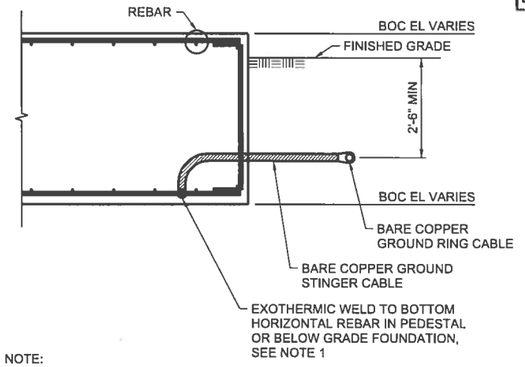
TYPICAL MULTIPLE PANEL AND SMALL TRANSFORMER GROUNDING

17008



TYPICAL EQUIPMENT ENCLOSURE OR BOX GROUNDING

17009



NOTE:

1. CONTRACTOR SHALL WELD TO #4 (.5") DIAMETER OR LARGER REBAR, EITHER 20' CONTINUOUS OR 20' OF WIRE TIED PIECES OR SUBSTITUTE A 20' LENGTH OF BARE COPPER CONDUCTOR NOT SMALLER THAN #4 AWG.

TYPICAL CONCRETE ENCASED ELECTRODE AT PEDESTAL OR BELOW GRADE FOUNDATION

NTS

17010

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO.9062312-2202
STATE OF UTAH
2/4/15

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

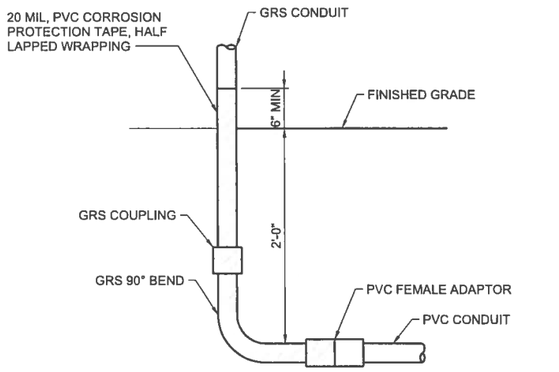
WATERWORKS ENGINEERS
2319 Pleasant Grove Blvd Suite 101 Pleasant Grove, UT 801-785-0170

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ELECTRICAL

STANDARD DETAILS

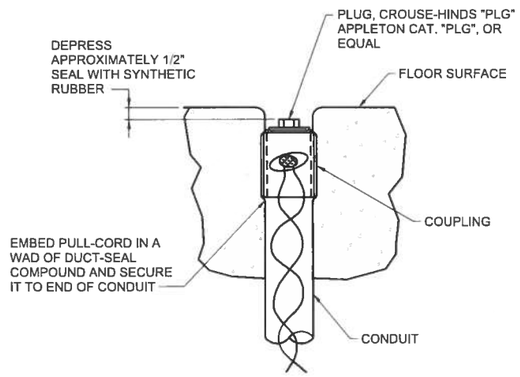
DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-SD-312
SHEET 68 OF 70



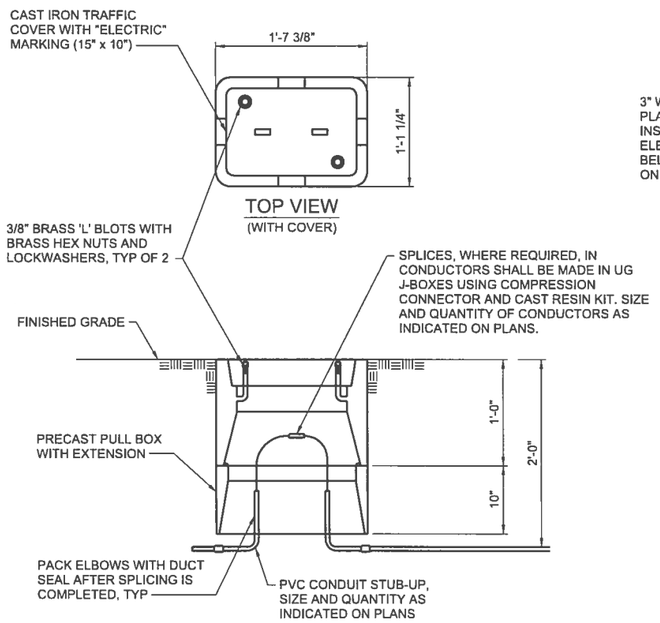
NOTE:

1. WHERE CONDUITS ARE INSTALLED INA CONCRETE SLAB, THE 2'-0" DIMENSION DOES NOT APPLY. CONDUITS SHALL BE INSTALLED BETWEEN REBAR MATS OR UNDER A SINGLE REBAR MAT.
2. IN CORROSIVE AREAS, PVC COATED GRS SHALL BE USED.

CONDUIT STUB-UP DETAIL 17011
NTS

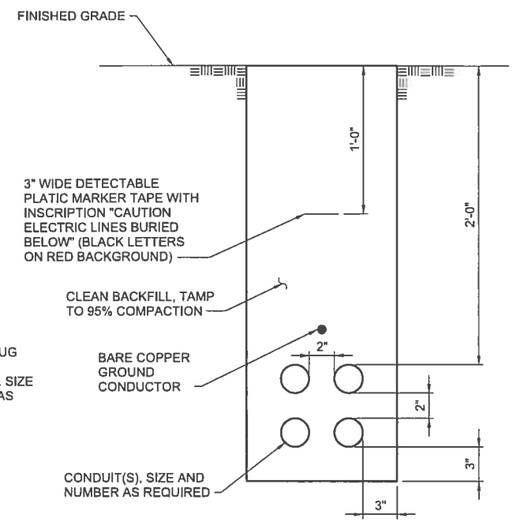


CONDUIT STUB-UP DETAIL 17012
NTS



NOTE: ALL DIMENSIONS ARE MINIMUM

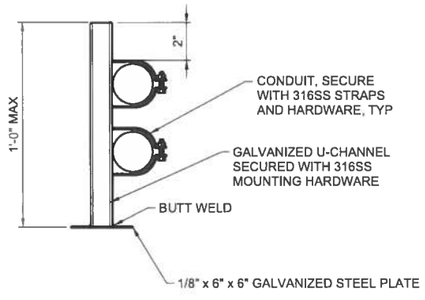
UNDERGROUND CONCRETE JUNCTION BOX 17013
NTS



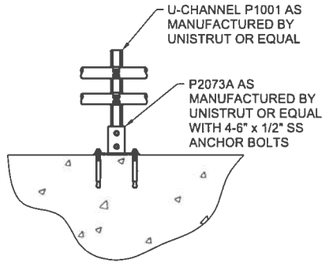
NOTES:

1. GROUND CONDUCTORS SHALL RUN CONTINUOUSLY THROUGH MANHOLES AND SHALL CONTINUE FROM DUCTBANK INTO SWITCHGEAR OR BUILDING GROUNDING SYSTEM AND SHALL BE BONDED TO EACH RIGID METAL CONDUIT. SIZE TO BE 4/0 UNLESS OTHERWISE INDICATED ON PLANS.
2. ALL DIMENSIONS ARE MINIMUM.

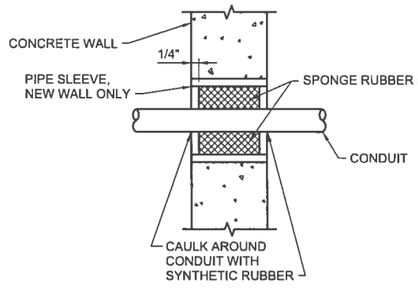
TRENCH/DUCTBANK DETAIL 17014
NTS



INTERMEDIATE CONDUIT SUPPORT NEAR GRADE 17015
NTS



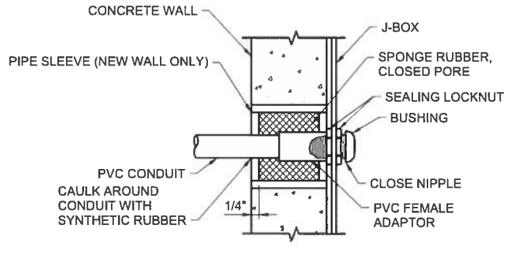
CONDUIT MOUNTING 17016
NTS



NOTE:

IN EXISTING WALL, CORE DRILL HOLE CONDUIT OD +1-1/2". IN NEW CONCRETE, WALL OR DRY WALL, INSTALL PVC SCHEDULE 40 SLEEVE, CONDUIT OD +1-1/2"

CONDUIT THROUGH BLOCK WALL 17017
NTS



NOTE:

IN EXISTING WALL, CORE DRILL HOLE CONDUIT OD +1-1/2". IN NEW CONCRETE, WALL OR DRY WALL, INSTALL PVC SCHEDULE 40 SLEEVE, CONDUIT OD +1-1/2"

CONDUIT THROUGH CEMENT WALL 17018
NTS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

WATERWORKS ENGINEERS
2315 Pleasant Grove Blvd S Ste 101 · Pleasant Grove, UT · 801-796-4125

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

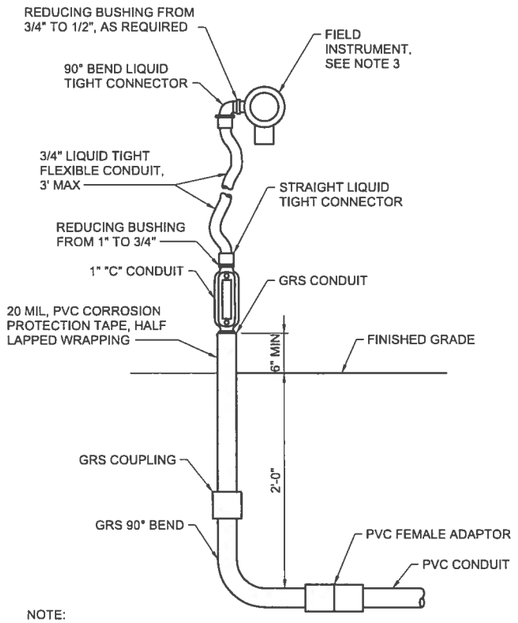
ELECTRICAL

STANDARD DETAILS

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO.9062312-2202
STATE OF UTAH
2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-SD-313
SHEET 69 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD313.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:50:41 AM SCALE: 1:0.166667



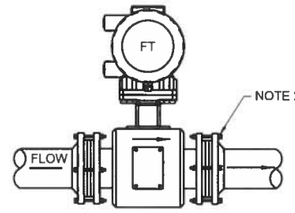
NOTE:

1. WHERE CONDUITS ARE INSTALLED IN A CONCRETE SLAB, THE 2'-0" DIMENSION DOES NOT APPLY. CONDUITS SHALL BE INSTALLED BETWEEN REBAR MATS OR UNDER A SINGLE REBAR MAT.
2. IN CORROSIVE AREAS, PVC COATED GRS SHALL BE USED.
3. MOUNT INSTRUMENT AS PER MANUFACTURER'S RECOMMENDATIONS.
4. INSULATE WATER LINES AND TRANSMITTER TO PREVENT FREEZING.
5. SUPPORT AS REQUIRED FOR DISTANCES GREATER THAN 3'-0".

INSTRUMENT FLEX CONDUIT DETAIL

NTS

17019



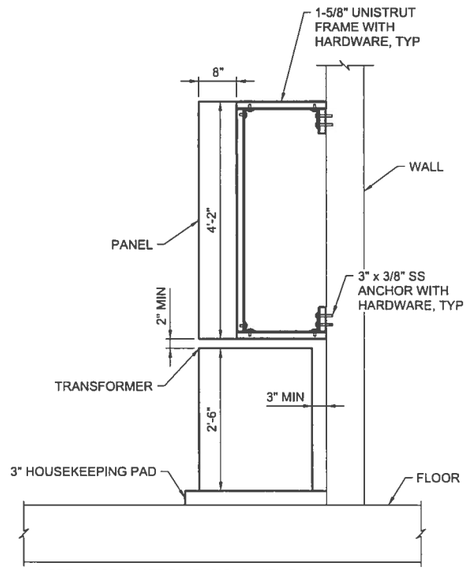
NOTES:

1. INSTALL WITH A MINIMUM OF FIVE (5) STRAIGHT PIPE DIAMETERS UPSTREAM AND TWO (2) STRAIGHT PIPE DIAMETERS DOWNSTREAM.
2. PROVIDE MATING FLANGES, GASKETS, AND BOLTING PER THE PDT OF THE PROCESS PIPE.

MAGNETIC FLOWMETER DETAIL

NTS

17020



NOTE: COORDINATE DIMENSIONS WITH EACH TRANSFORMER AND PANEL.

TRANSFORMER AND PANEL DETAIL

NTS

17021

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DESIGN GAF
DRAWN GAF
CHECKED GAF
APPROVED CC

WATERWORKS ENGINEERS
2319 Pleasant Grove Blvd Suite 130 • Pleasant Grove, UT • 801-796-4105

PLEASANT GROVE MICRO-HYDRO POWER GENERATOR PROJECT

ELECTRICAL

STANDARD DETAILS

LICENSED PROFESSIONAL ENGINEER
GREGORY A. FRON
NO. 9062312-2202
STATE OF UTAH
2/4/15

DATE FEB 2015
PROJECT NUMBER 10-011
DRAWING NUMBER 00-SD-314
SHEET 70 OF 70

FILENAME: S:\CAD\Projects\10-011 Pleasant Grove Microhydro\Drawings\Deliverables\10011D-00SD314.dgn PLOT DATE: 2/4/2015 PLOT TIME: 11:46:22 AM SCALE: 1:0.166667

APPENDIX E Battle Creek Power Generation Estimate Worksheet

BATTLE CREEK

Historical Flow Data

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total	Total MG	Total acre-ft	Average gpm	Average cfs
hours			744	672	744	720	744	720	744	720	720	744	720	744	744				
minutes			44640	40320	44640	43200	44640	43200	44640	43200	43200	44640	43200	44640	524160				
2012	Total Production	MG	20.183	8.735	4.509	5.072	4.508	20.679	33.602	34.000	25.240	10.716	4.363	4.509	176.116	176.1	540.5		
	Average Flow	gpm	452.1	216.6	101.0	117.4	101.0	478.7	752.7	787.0	584.3	240.1	101.0	101.0	336.0			336.1	0.75
2011	Total Production	MG	5.000	4.500	5.000	4.850	18.343	62.140	89.271	74.955	52.169	33.252	40.824	33.487	423.791	423.8	1300.7		
	Average Flow	gpm	112.0	111.6	112.0	112.3	410.9	1,438.4	1,999.8	1,735.1	1,207.6	744.9	945.0	750.2	808.5			806.6	1.80
2010	Total Production	MG	16.138	4.735	5.580	5.400	5.580	30.351	49.392	58.668	50.041	36.903	24.989	11.903	299.680	299.7	919.7		
	Average Flow	gpm	361.5	117.4	125.0	125.0	125.0	702.6	1,106.5	1,358.1	1,158.4	826.7	578.4	266.6	571.7			570.9	1.27
2009	Total Production	MG	5.000	5.000	5.000	5.000	29.966	62.240	75.024	52.579	59.766	49.204	35.182	27.522	411.483	411.5	1262.9		
	Average Flow	gpm	112.0	124.0	112.0	115.7	671.3	1,440.7	1,680.6	1,217.1	1,383.5	1,102.2	814.4	616.5	785.0			761.9	1.70
2008	Total Production	MG	5.000	5.000	5.000	5.000	5.000	13.500	31.829	51.582	44.145	33.257	20.186	6.586	226.085	226.1	693.9		
	Average Flow	gpm	112.0	124.0	112.0	115.7	112.0	312.5	713.0	1,194.0	1,021.9	745.0	467.3	147.5	431.3			431.4	0.96
2007	Total Production	MG	7.500	5.000	5.000	5.000	5.000	11.300	31.300	33.500	26.500	5.000	5.000	5.000	145.100	145.1	445.3		
	Average Flow	gpm	168.0	124.0	112.0	115.7	112.0	261.6	701.2	775.5	613.4	112.0	115.7	112.0	276.8			276.9	0.62
2006	Total Production	MG	23.600	6.020	0.500	0.604	46.000	66.000	81.000	76.458	59.508	46.483	34.387	25.043	465.603	465.6	1429.0		
	Average Flow	gpm	528.7	149.3	11.2	14.0	1,030.5	1,527.8	1,814.5	1,769.9	1,377.5	1,041.3	796.0	561.0	888.3			885.1	1.97
2005	Total Production	MG	3.128	1.113	0.901	2.300	47.000	84.000	100.000	90.000	71.000	64.480	48.000	35.000	546.922	546.9	1678.6		
	Average Flow	gpm	70.1	27.6	20.2	53.2	1,052.9	1,944.4	2,240.1	2,083.3	1,643.5	1,444.4	1,111.1	784.1	1,043.4			1039.6	2.32

Estimated Power Production

Available Head	
psi	ft
200	462.0

Estimated Power Cost 2008		
$	0.0880	/kW Hr
Avoided Cost 2009		
$	0.0515	/kW Hr

Turbine Efficiency	Generator Efficiency
70%	95%

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total	
Average Flow	gpm	239.6	124.3	88.2	96.1	451.9	1,013.3	1,376.1	1,365.0	1,123.8	782.1	616.1	417.4		
Power Production	kW	19	10	7	7	35	79	107	106	87	61	48	32	598	
	kW Hr	13,841	6,488	5,095	5,376	26,113	56,662	79,509	76,326	62,836	45,189	34,451	24,116	436003	
Power Usage	kW	65	65	90	108	120	120	120	120	120	120	117	120		
	kW Hr	48,360	43,680	66,960	77,760	89,280	86,400	89,280	86,400	86,400	89,280	84,240	89,280		
Power Cost	08/09 Data	0.0634	0.0681	0.0810	0.0907	0.1036	0.1007	0.0914	0.0889	0.0985	0.0971	0.0890	0.0885		
Estimated Revenue	2008 Monthly Data	$878	$442	$413	$488	$2,705	$5,706	$7,267	$6,785	$6,189	$4,388	$3,066	$2,134	$40,461	Nested if-then statement to take account for avoided cost. No avoided seen used.
Estimated Monthly Revenue	2008 Avg Data	$1,218	$571	$448	$473	$2,298	$4,986	$6,997	$6,717	$5,530	$3,977	$3,032	$2,122	$38,368	

Average Power Production (kW)	50
Estimated Annual Power Production (kW Hr)	436,003

Municipal Yield Curve Scales	Years	10	15	20
As of 10/26/09 @WSJ	A+	3.86%	4.76%	5.35%
	A	4.22%	5.14%	5.71%
	A-	4.60%	5.55%	6.09%

Price Increase/Percent			
	2008	8.80	2.56%
	2007	8.58	

Cash Flows

Year	Power Inflow	Tax Benefit	Inflation Cost	Maintenance	Total	
0					-$648,000	-$648,000
1	$40,461	$194,400	$2,177	$1,500	$231,184	-$416,816
2	$41,498	0	$2,232	$1,500	$37,766	-$379,050
3	$42,563	0	$2,290	$1,500	$38,773	-$340,277
4	$43,654	0	$2,348	$1,500	$39,806	-$300,471
5	$44,773	0	$2,409	$10,000	$32,365	-$268,106
6	$45,921	0	$2,470	$2,000	$41,451	-$226,656
7	$47,099	0	$2,534	$2,000	$42,565	-$184,090
8	$48,306	0	$2,599	$2,000	$43,708	-$140,383
9	$49,545	0	$2,665	$2,000	$44,880	-$95,503
10	$50,815	0	$2,734	$40,000	$8,082	-$87,421
11	$52,118	0	$2,804	$2,500	$46,815	-$40,607
12	$53,455	0	$2,876	$2,500	$48,079	$7,473
13	$54,825	0	$2,949	$2,500	$49,376	$56,849
14	$56,231	0	$3,025	$2,500	$50,706	$107,555
15	$57,673	0	$3,102	$10,000	$44,570	$152,125
16	$59,152	0	$3,182	$3,000	$52,970	$205,095
17	$60,668	0	$3,264	$3,000	$54,405	$259,500
18	$62,224	0	$3,347	$3,000	$55,877	$315,376
19	$63,820	0	$3,433	$3,000	$57,386	$372,763
20	$65,456	0	$3,521	$3,000	$58,935	$431,698

Estimated Capital Cost (2009 dollars)

Engineering and Admin		$55,000	
Mobilization		$25,000	
Building		$75,000	
Piping Modifications		$85,000	
Turbine		$50,000	
Electrical Equipment		$250,000	
	Subtotal		$540,000
Contingency	20%	$108,000	
	Total Estimated Cost		**$648,000**

Invstmnt Sensitivity Analysis	Years	NPV	IRR
	20	**$48,877**	6%
	15	**($42,454)**	3%
	10	**($159,386)**	-4%

Payback in Yrs	11