PISGAH RESERVOIR AND DITCH COMPANY
P.O. BOX 352
ROCKY FORD, CO 81067

September 30, 2014

Colorado Water Conservation Board
Finance Section
Attn: Anna Mauss, P.E.
1580 Logan Street, Suite 600
Denver, CO 80203

Re: Application for Additional Loan Funding - Mount Pisgah Dam/Wrights Reservoir Outlet Works Rehabilitation

Dear Ms. Mauss,

On September 28, 2012, the CWCB Board approved loan and grant requests for this project, totaling $322,690. Included in the project were Final Design, Bidding and Procurement, Construction and Construction Management.

As Design tasks proceeded, the project's engineering firm, RJH Consultants, Inc., worked closely with the State Engineer's Office. Video inspections of the original outlet works pipes showed embankment seepage into the pipelines and boils at the pipeline daylight points, even at reduced reservoir stages. In July of 2013 the State Engineer's Office determined that these conditions present a dam safety risk, and the SEO now requires remedial abandonment measures consisting of full-length grouting of the pipes and construction of a diaphragm filter for the original outlet works (full explanation included in the Design Summary Report).

The Scope of Work of the project has changed dramatically as a result, and the cost estimate has risen from an estimated $362,690.00 to $684,565.00.

The Pisgah Reservoir and Ditch Company is asking to increase the CWCB loan amount to $483,220.00, an increase of $321,875.00. We expect to continue to seek additional grant funding as well, but want to ensure project funding at the outset with loan funds that will cover construction in full.

The Grant Contract was dated to expire September 30, 2014. Be advised that a request to extend that contract until September 30, 2015 has been submitted.

Transmitted herewith is a revised Budget and Timeline, a Design Summary Report, and Revised Drawings. Updated financial reports will follow shortly. Questions may be directed to myself, or to Elise Bergsten of Balanced Management Services Company, at (719) 963-1809.

Thank you for your consideration.

Sincerely,

Wayne W. Whittaker

Wayne Whittaker
Pisgah Reservoir and Ditch Company
(719) 254-3389

GEOTECHNICAL AND
WATER RESOURCES ENGINEERING

DESIGN SUMMARY REPORT

MT. PISGAH DAM/WRIGHTS RESERVOIR OUTLET WORKS REHABILITATION PROJECT

TELLER COUNTY, COLORADO

Submitted to

Pisgah Reservoir and Ditch Company
917 Elm Street
Rocky Ford, Colorado 81067

Submitted by

RJH Consultants, Inc.
9800 Mt. Pyramid Court, Suite 330
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303-225-4611
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April 2014
Project 12120

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Michael L. Graber, P.E.
Project Manager

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SECTION 1 - INTRODUCTION

1.1 Project Location and Objective

Mount Pisgah Dam impounds Wright's Reservoir approximately 6 miles northwest of the Town of Cripple Creek in Teller County Colorado. The dam is located in Section 31 of Township 14 South, Range 70 West. The location of the site is shown on Figure 1.1.

The project objective is to rehabilitate the current functional outlet works and to design measures for the proper and safe abandonment of the original outlet works pipelines previously abandoned in 1929. Recent video inspections of the original outlet works pipes have shown embankment seepage into the pipelines and boils at the pipeline daylight points even at reduced reservoir stages. These conditions have been determined to present a dam safety risk and the State Engineer's Office has required that remedial abandonment measures consisting of full-length grouting of the pipes and construction of a diaphragm filter be carried out for the original outlet works. The currently functional outlet works facilities were completed in 1929 and existing manual flow control gate valves are only partially functional. The rehabilitation work consists of replacing these valves, installing a new trash rack, adding a guard gate, repairing cracks in the concrete outlet works tunnel, lining existing steel outlet works pipes, providing a hydraulic actuation system for all gates and valves and constructing a new valve house.

1.2 Purpose

The purpose of this report is to provide documentation of engineering analyses and design carried out for rehabilitation of the currently functioning outlet works and abandonment measures for the original dam outlet works.

1.3 Background

Mount Pisgah Dam is a large, significant hazard, earth embankment dam located in Teller County, Colorado approximately 6 miles from the Town of Cripple Creek. The dam is located on Fourmile Creek and impounds Wrights Reservoir, with a capacity of approximately 2,192 acre-feet (ac-ft) supplied by direct inflow from Fourmile Creek. The embankment has an approximate upstream slope of 3H:1V, a crest width of about 10 feet, and a downstream slope of approximately 2H:1V.

The dam and reservoir were originally constructed in 1911 and are currently operated to store and release irrigation water. According to design documents provided by the SEO, the upstream slope of the embankment was originally 1.5H:1V with a reinforced concrete face when constructed around 1911. The original outlet works consisted of dual 16-inch diameter cast iron pipes and dual 16-inch gate valves located near the downstream toe of the embankment. In 1928, there was an upstream slope failure which plugged the entrance to the original outlet works. In 1929, the upstream slope was reconstructed at a reduced slope and a new outlet works was constructed through the right abutment. The original rock-cut spillway is located at the left abutment and was enlarged in 1988. The dam crest elevation provides more than 10 feet of freeboard above the spillway invert elevation based on the June 2011 Colorado Office of the State Engineer (SEO) Engineer's Inspection Report.

Limited drawings available from the SEO office did not include as-built conditions and were not in agreement with RJH observations of the existing functional outlet works completed in 1929. An SEO assessment of the condition of the outlet works required dewatering and inspection of the outlet works and preparation of as-constructed drawings of the outlet geometry. RJH prepared as-constructed drawings based on site visits and surveying performed on August 23 and 31, 2011. The as-constructed drawings and associated inspection memorandum have been previously submitted under separate cover to the SEO.

The current functional outlet works constructed in 1929 extends from Wrights Reservoir through Mount Pisgah Dam at the right abutment. A general plan and profile of the existing outlet works is shown on Figure 1.2. The outlet works consists of a concrete intake structure with trash rack connected to a rock-cut tunnel extending approximately 400 feet through the right abutment of the dam and discharging into Fourmile Creek. The initial 100 feet of the tunnel is concrete lined and the remainder is excavated through bedrock. Approximately 140 feet downstream of the inlet structure within the rockcut tunnel is a concrete bulkhead with two parallel 30-inch-diameter steel pipes penetrating it. The pipes are approximately 15 feet in length with 30-inch diameter gate valves fixed to the downstream side. The gate valves discharge to atmosphere in the rock-cut outlet tunnel. The gate valves are manually operated with valve stems extending up a vertical rock-cut shaft to a small valve house above.

The abandoned 1911 outlet works consisting of dual 16-inch pipes and valves was video-inspected on June 13, 2013. The inspection revealed broken cast iron pipe, debris and seepage. Subsequently, in a letter to the dam owners dated July 11, 2013, the SEO required action to properly and safely abandon the original pipes.

1.4 Existing Conditions

RJH carried out a hydraulic analysis of the existing outlet works to assess the ability of existing facilities to meet the SEO requirement for evacuating the top 5 feet of reservoir storage in 5 days. Based on the results of this analysis, the existing outlet works can evacuate the top 5 feet of reservoir storage in less than 2 days. RJH assumed the valves will not open more than 50 percent as observed in site visits. The capacity of the existing outlet works at the normal maximum pool elevation (El.) of 7984.35 is estimated to be 194 cubic feet per second (cfs).

The existing concrete intake structure for the outlet works includes a trash rack with 6-inch bar spacing. The rack is significantly corroded and the center portion was found to be removed. Currently there is no guard gate, or accommodation for a bulkhead or stoplogs at the intake and it is not possible to dewater the downstream outlet works between the intake structure and the downstream valves.

The existing outlet works valves and stems are intact but have more than 50 turns of slack in the gear driven operators. The valves will currently only open approximately 50 percent. The limited operating range is most likely due to a lack of fully opening the valves on a routine basis, which has resulted in corrosion and gauling of the operators in the infrequently used range. The owner reports that the two 30-inch-diameter valves have become increasingly difficult to operate and suffer from icing problems in the winter. Ice builds up on the valve stems and the owner reports having to use a heater to thaw them out when winter valve operation is needed.

The existing 30-inch steel pipes are significantly corroded on both the interior and exterior surfaces. Sounding of the pipes indicates that the wall thickness is significantly diminished. There do not appear to be any pipe joints. All concrete appeared in good condition and rock-cut surfaces appeared sound with cuts being smooth but irregular in section and shape.

Stream channel erosion issues have been noted in Fourmile Creek downstream of the dam when significant flows have been released through the outlet works; however, this evaluation is limited in scope to the outlet works structures and RJH did not evaluate the need for energy dissipation structures or downstream channel improvements.

The existing valve house is a wood structure with metal siding and is in very poor condition. It is not heated or insulated and is open to the elements and rodents in many

places. The existing concrete foundation and steel access ramp are in reasonable condition and will be incorporated into a new valve house.

1.5 Major Project Components

Major components of the outlet works rehabilitation are listed below and shown on Figure 1.3.

- Replacement of the existing intake structure trash rack and supports.
- Construction of a concrete and steel gate attachment structure within the existing intake for attachment of a new guard gate.
- Installation of a new heavy-duty, 30-inch by 30-inch sluice gate, hydraulic actuator and associated piping. New sluice gate will function as a guard gate.
- Removal of existing dual 30-inch diameter gate valves and associated valve stems and supports.
- Installation of 24-inch-diameter steel pipe liners within the existing dual, 30-inch diameter steel pipes.
- Installation of new, dual 24-inch diameter knife gate valves, hydraulic actuators and associated piping.
- Demolition and removal of the existing valve house structure located near the dam crest.
- Construction of a new valve house on the existing concrete foundation and installation of a hydraulic power unit and associated controls to operate the new sluice and knife gate valves.
- Full-length grouting of the dual 16-inch diameter abandoned outlet works pipes and installation of a diaphragm filter at the location where the pipes daylight.

1.6 Scope of Work

RJH Consultants, Inc. (RJH) performed the following work for design of the project:

- Performed an inspection of the outlet works including intake structure, concrete-lined tunnel section, rockcut tunnels, concrete bulkhead and 30-inch diameter piping and gate valves.
- Performed a topographic survey of the dam cross section near the outlet works and surveyed key points of the outlet works structures.
- Obtained copies of the existing design drawings.

- Prepared an inspection memorandum and record drawings for existing dam facilities:
  - *Mt. Pisgah Dam and Reservoir Outlet Inspection* (RJH memorandum, November 2011)
  - *Mount Pisgah Dam Existing Outlet Works Record Drawings* (RJH, 11-09-11)
- Prepared an alternatives evaluation memorandum including preliminary engineering analysis and sizing for alternatives, concept-level drawings and quantity and cost estimates for the non-similar components of each alternative. We did not develop an opinion of total project costs.
  - *Alternatives Evaluation Mount Pisgah Dam/Wrights Reservoir Outlet Works Rehabilitation* (RJH, November 2011).
- Participated in meetings with the SEO and the dam owner including a 90 percent design meeting at which drawings and specifications were presented and reviewed.
- Prepared an inspection memorandum documenting video inspection of the abandoned outlet works pipes (Mt. Pisgah Dam and Reservoir Outlet Inspection, RJH, November 9, 2011).
- Performed hydraulic analyses of proposed new outlet works facilities to assure compliance with SEO requirements and to select gates, valves and piping.
- Worked with valve manufacturers to evaluate various types of valves, valve options and associated costs.
- Prepared design drawings and specifications for review and approval by the SEO and the Owner and for bidding and constructing the project.
- Developed an Engineer's Opinion of Probable Construction Cost for the project.
- Prepared this Design Summary Report to document the results of our evaluation and design for review and approval by the SEO.

1.8 Authorization

RJH performed the work described in this report under the terms and conditions of the June 27, 2012 Agreement for Professional Consulting Services between RJH and the Catlin Canal Company.

1.9 Project Personnel

The following RJH personnel are responsible for the work described in this report:

Project Manager	Michael L. Graber, P.E.
Project Hydraulic Engineer	Gustav George Slovensky, P.E.
Project Structural Engineer	Jennifer D. Forbes, P.E.
Technical Review	J. Douglas Neighbors, P.E.

SECTION 2 - DESIGN REQUIREMENTS

2.1 General

The design requirements governing the outlet works rehabilitation of Mt. Pisgah Dam are set forth by the SEO in the Rules and Regulations for Dam Safety and Dam Construction (Rules) (SEO, 2007) and in the Dam Safety Review Guide (SEO, 2000).

2.2 Hydraulic Design Requirements

Hydraulic design criteria for outlet works are described in Section 5.9.6.2 of the Rules. Relevant hydraulic design criteria for the outlet works set forth in this section are as follows:

- The outlet works must be capable of releasing the top 5 feet of reservoir capacity within 5 days.
- Minimum outlet size for conduits of 12 inches.
- Outlet shall be capable of releasing the entire reservoir in a reasonable amount of time.
- Outlet shall be capable of passing inflow to the reservoir with a minimum of ten feet of head to meet the demands of downstream senior water rights.
- Outlet conduits shall have guard gates.
- Intake structures shall have trash racks.

Further hydraulic design criteria for outlet works are presented in the *Rules and the Dam Safety Review Guide* (SEO, 2000). Relevant hydraulic design criteria for outlet works set forth in this document are as follows:

- Maximum velocity through trash racks that are inaccessible for cleaning is to be limited to 2 feet per second (fps).
- Trash racks shall be designed for a loading condition of 25 percent of the maximum reservoir head.
- All outlets shall have energy dissipaters to prevent erosion of surrounding structures.
- Air venting of the outlet should be provided to prevent surging and cavitation.
- Outlet systems using hydraulic controls shall have multiple lines or backup systems to ensure they will be operable.

- Hydraulic lines should be installed in buried or encased conduits to prevent damage and allow for easy replacement.

2.3 Structural

2.3.1 Structural Steel and Concrete

Section 5.9.6.2 of the Rules presents the structural design criteria for outlet works. This section stipulates that outlet conduits have a gate guard installed at the upstream end of the conduit. It also requires that the intake structures for the outlet works include a trash rack.

Concrete design was performed based on the American Concrete Institute (ACI) Building Code Requirements for Structural Concrete (ACI 318-11). Trash rack and other steel design was performed based on the 2011 American Institute of Steel Construction (AISC) Steel Construction Manual, 14th Edition.

2.4 Owner Operations

The reservoir outlet works will not be operable during a portion of the construction but irrigation deliveries must be maintained. The construction contractor will be required to provide a minimum continuous pumping capacity of 1,200 gallons per minute (gpm) at any reservoir head. Pumping will be from the reservoir to the spillway for delivery to Fourmile Creek below the dam.

SECTION 3 - ANALYSES

3.1 Key Issues Impacting Design

Based on RJH's understanding of project objectives, constraints, and site conditions, RJH identified the following key considerations that influenced design:

- The reservoir water level cannot be lowered for construction because of the loss of water to downstream water rights owners that would occur and concern about the potential environmental and property impacts of the discharge of sediment-laden flows.
- The corroded condition of the existing 30-inch-diameter intake pipes requires that they be lined. Lining will involve inserting a smaller diameter pipe into both of the 30-inch-diameter outlet pipes and grouting the resulting annular space.
- Given the location and elevation of the intake structure in the reservoir bottom, the outlet works will be required to pass some amount of sediment and debris.
- The modified outlet works should maintain as much of the existing outlet works capacity as possible.
- The outlet works will typically be operated at or near 30 to 40 cfs. Releases greater than 40 cfs are not typical and are generally short-term to minimize impacts to the downstream channel.
- Flow control will be provided by new hydraulically-operated valves at the current valve location near the mid-section of the dam.
- Flow measurement within the outlet works will not be required. The existing Parshall flume located downstream of the outlet works will continue to be used for this purpose.
- The existing concrete intake structure will only be modified to the extent necessary to install the required new guard gate and a new trash rack.
- The Colorado Office of the State Engineer has required that the existing 16-inch diameter cast iron outlet conduits be properly and safely abandoned.

3.2 Rehabilitation Concept

Based on the above considerations, our analyses and experience and design criteria established by the SEO, RJH developed the following rehabilitation concept for the outlet works:

- Remove and replace the existing intake structure trash rack and supports.

- Install a new 30-inch square sluice gate, hydraulic actuator and associated piping in the existing intake to act as a guard gate.
- Install 24-inch diameter steel pipe liners within the existing 30-inch diameter steel pipes and grout in place.
- Replace the existing dual, 30-inch diameter gate valves and associated manual operators with new 24-inch diameter knife gate valves and hydraulic actuators.
- Remove the existing valve house structure and construct a new valve house on the existing concrete foundation.
- Install a hydraulic power unit and associated controls within the new valve house to operate the new sluice gate and knife gate valves.
- Grout the full length of the existing abandoned 16-inch outlet works pipes.
- Construct a filter diaphragm at the outlet of the abandoned 16-inch pipes.

Engineering analysis of individual project components is described in the following sections.

3.3 Trash Rack

The intake structure will be fitted with a new trash rack. The new trash rack is configured such that flow velocity through the rack is approximately 1.1 feet per second (fps) at the maximum typical discharge of 40 cfs. Obstruction of the trash rack must exceed 40 percent before velocities through the rack exceed 2 fps. Bar spacing for the trash rack was selected to be 6 inches matching the existing rack and allowing the passage of small debris to limit rack plugging potential while not passing debris large enough to damage or plug downstream pipes and valves. To limit construction costs, the existing concrete intake structure, trash rack size and trash rack orientation have not been modified from existing.

The potential for plugging of the new intake structure rack does exist and maintenance may be required on occasion to clear it of debris. A burn event in the watershed resulting in heavy debris loads in Fourmile Creek could dramatically increase the potential for plugging.

The reservoir head used in structural design of the trash rack was 25 percent of maximum normal water surface in the reservoir minus the lowest point on the trash rack. The resulting design head was 13 feet. The reservoir head condition and self-weight of the rack members were used to develop the moments and shear for design. The trash racks

were designed to be removable and to be as light as possible for the underwater placement and for future access to the gate within the intake structure.

The design included analysis of four supporting members, which will be bolted to the existing structure and four racks that will be connected to the supporting members. The width of the intake structure opening tapers, therefore the design was performed for two large (or wider) trash racks and for two small (more narrow) trash racks. All members were designed to resist shear and bending based on the governing condition to simplify fabrication and construction. The results of the calculations are provided in Appendix B.1.

3.4 Sluice Gate Attachment Structure

The sluice gate attachment structure will incorporate a 6-inch diameter galvanized steel vent pipe to prevent the development of low pressure conditions in the downstream tunnel. The vent pipe will extend from the submerged intake structure to the valve house above. Vent sizing computations are provided in Appendix A.4.

In order to add the sluice gate at the opening of the intake structure, a steel plate must be attached to cover the existing arched opening. The plate will be anchored to the concrete with adhesive bolts and a neoprene seal will be adhered to the downstream face to seal the plate against the existing concrete face. The gate will be attached to the steel plate by a thimble bolted connection to the steel plate. The thimble and steel plate will be encased in concrete to support the thimble and to provide a seal for the steel plate connection. The results of the calculations are provided in Appendix B.1.

3.5 Sluice Gate

A 30-inch by 30-inch square, self-contained, sluice gate will be installed within the existing inlet structure using the new gate attachment structure. The sluice gate will act as a guard gate as required by the SEO for all new or rehabilitated outlet works. It will typically either be fully open or fully closed and not used for flow control. Functioning in this manner, a sluice gate is an appropriate choice. The sluice gate will be a cast iron, heavy duty gate designed for a minimum 60 feet of seating head and 10 feet unseating. The specified seating head corresponds to the emergency spillway crest elevation plus an approximate 5 feet of additional overtopping head. There is essentially no potential for the development of any significant unseating head condition.

Several sizes of sluice gate were evaluated to assess their impact on system capacity. The parallel 24-inch-diameter pipe lengths downstream though are the most significant limit on system capacity and increasing the sluice gate to greater than the selected size provides only a small increase in capacity.

3.6 Pipe

The inlet structure discharges to a tunnel, which ends at a head wall and a short reach of parallel existing 30-inch diameter pipes. The length of these pipes is approximately 15 feet and they are significantly corroded. Lining of these pipes is required. A steel liner pipe was selected because large, heavy valves will be mounted to the pipe for outlet works flow control. A pipe diameter of 24-inches was selected balancing system capacity, pipe and valve cost and flow control. This pipe and valve sizing allows evacuation of the top 5 feet of reservoir storage in less than 2 days and will provide improved control of low flow rates over the existing 30-inch valves. A pipe wall thickness of 0.25-inch was selected considering handling, static head, transient pressure potential and allowance for corrosion. The selected thickness significantly exceeds the AWWA M-11 handling minimum but access to the valve chamber will be difficult, the work area will be tight and the additional thickness may be a benefit. The selected thickness is also greater than required to meet AWWA M-11 maximum induced stresses as a percentage of yield strength for both static and likely transient pressure conditions. Finally, the additional wall thickness will provide a longer design life with respect to corrosion.

3.7 Knife Gate Valves

Knife gate valves, 24-inches in diameter, were selected for flow control on the outlet works. Sizing of the valves was discussed in the previous section. Knife gate valves offer the advantages of small size, relatively low weight and cost and the best ability to close in the presence of sediment and debris. The valves will be mounted to flanges on the downstream ends of the parallel 24-inch steel liner pipes. Because of their smaller diameter, it is expected the new valves will provide improved flow control over the existing 30-inch valves. The valves have been specified to be cast stainless steel for longevity and reduction in maintenance in the wet tunnel environment. Since the valves will be used for throttling, several features to improve their durability and reduce maintenance have been included. UHMW inserts in the metal seal and packing are specified to reduce and absorb vibration and a spring-loaded packing gland will extend the time between packing adjustments.

The knife gate valves will discharge to the existing irregular rockcut tunnel downstream. The tunnel extends approximately 225 feet to daylight at Fourmile Creek at a slope of approximately 1.5 percent. Valves will typically discharge above the tunnel floor to a combination of air at atmospheric pressure and shallow water depths from backwater conditions in the tunnel. Energy dissipation will be accomplished by jet travel, backwater submergence and impact against the rock tunnel floor and walls. Inspection of the outlet works in 2011 did not reveal any concerns over downstream rock integrity or identify any existing significant rock erosion. The combined flow capacity of the two knife gates have the capability to lower the top 5 feet of the reservoir in 1.2 days and completely drain the reservoir in approximately 4.5 days (see Appendix A.2).

A steel plate with anchors will be constructed to resist the maximum thrust force acting on the knife gates. The maximum force anticipated to act on the new knife gates is about 13.0 kips based on a fully closed condition. The gates will be connected to the 24-inch steel liner pipes, which will be set on a new concrete support partial encasement. The plate will be connected to the bottom half of the gate by flange connection, and therefore the plate will resist the loading to avoid applying a torsional moment on the gate from the loads. The plate will have three mechanical wedge anchors. A 28-day compressive strength (f'c) of 2,000 psi was used for design. This value was used because the new concrete will be placed, bonded or dowelled onto the existing pipe support concrete, and the existing concrete is anticipated to have an f'c of 2000 psi. The results of the calculations are provided in Appendix B.2.

3.8 Gate and Valve Actuation and Controls

The new sluice gate and knife gates will be actuated by hydraulic cylinders and a single hydraulic power unit (HPU). Hydraulic actuation was selected for all valves because the sluice gate will be submerged in a vertical orientation 160 feet from the valve control house. The HPU will limit valve travel to approximately 12 inches per minute and be equipped with a hand pump for backup operation. Hydraulic piping will consist of stainless steel tubing within schedule 80 galvanized steel pipe. All gate cylinders will have position feedback that will be displayed as percent open in the valve house.

3.9 Valve Control House

The existing 10-foot by 10-foot wood and metal valve house will be demolished and a new valve house constructed on-site utilizing the existing foundation and steel access ramp. This new valve house will be designed to be removable to facilitate future

infrequent major maintenance. The existing power supply and reservoir level instrumentation will be temporarily removed and re-established in the new building. The HPU will also be housed in the new building. A 32-inch square opening will be cut into the existing concrete foundation to provide air venting for the outlet works tunnel below. Air vent opening computations are provided in Appendix A.4.

The existing building provides access to the valve chamber 50 feet below through the floor and a metal ladder down a vertical rockcut shaft. The vertical shaft currently has horizontal steel members extending across the shaft that either have a gate stem or have a gate stem and an access ladder attached. The size, locations and anchorage of the existing horizontal steel supports are unknown.

The existing ladder and supports in the vertical shaft will have to be removed to allow for removal of the existing control valves and installation of new valves. The existing ladder has significant safety concerns and will not be reinstalled. A new ladder with fall protection system will be installed as part of the rehabilitation work. New members will be installed into the rock walls of the shaft to support the gate hydraulic control lines and new access ladder. Based on engineering judgment, the new horizontal steel supports will be spaced vertically at a maximum of 5.0-foot intervals, unless more stringent spacing is required by either the gate or ladder manufacturers. The gate hydraulic control lines are not anticipated to apply significant loading to the supports, therefore both supports were designed for the minimum ladder loading.

The results of the calculations are provided in Appendix B.2.

3.10 Filter Diaphragm

A filter diaphragm is required at the daylight point of the existing abandoned outlet works pipes near the downstream toe of the dam embankment. The filter will intercept seepage through the embankment around the outlet works pipes.

Gradation data for a soil sample taken near the daylight point for the outlet works was evaluated for filter compatibility and a filter sand material based on ASTM C 33 fine concrete aggregate was selected. The filter material was also evaluated for compatibility with perforated pipe slot size and a standard slot opening width selected. Drainage pipe was sized to accommodate a flow rate of 25 gallons per minute. Seepage flows at the site have not been measured. Visual estimates from limited site visits carried out for this

project at lower reservoir levels are a few gallons per minute. Flows are expected to increase with higher reservoir levels but remain less than the pipe capacity.

Computations for selection of the filter material and the design of the drainage pipe are contained in Appendix C.

SECTION 4 - PROJECT COMPONENTS

4.1 Removal and Abandonment of Existing Facilities

The existing outlet works intake structure trash rack and supports will be completely removed. Miscellaneous bolt anchors and any sediment in the intake will be removed. Existing concrete surfaces will be cleaned and prepared.

Existing 30-inch diameter gate valves, valve stems and stem supports located in the rockcut valve chamber will be removed after upstream guard gate installation and dewatering of the outlet works. Existing 30-inch diameter steel pipes will remain in place to be lined with new pipe.

The existing 10-foot by 10-foot valve control house will be demolished and replaced by a new structure constructed on-site utilizing the existing concrete foundation and steel access ramp. Power supply and existing reservoir level instrumentation will be temporarily removed and subsequently re-established in the new building.

The existing dual, 16-inch diameter outlet works pipes will be filled with grout for the entire length to the point of upstream blockage.

4.2 Inlet

Modifications to the existing inlet structure will consist of a new trash rack and the addition of a 30-inch by 30-inch sluice gate, gate attachment structure and associated hydraulic control and vent piping. This work will be performed without lowering the reservoir level, and will require divers.

Following removal of the existing trash rack and trash rack supports, cleaning of the intake and surfaces will be carried out and construction of the sluice gate attachment structure will begin. Structural steel components and the cast iron wall thimble for the new gate attachment structure will be installed. Neoprene j-bulb seals will be placed between structural steel members and concrete mounting surfaces. A 6-inch-diameter vent pipe will be installed with a merchant coupling to the top of the wall thimble. The sluice gate attachment structure will be completed by forming and pouring a vertical concrete wall flush with the face of the wall thimble.

Upon curing of the concrete, the new sluice gate will be installed along with the hydraulic actuator and associated piping to the valve house. Once installed and adjusted, the sluice gate will be closed, the new trash rack installed and the downstream outlet works dewatered. The remainder of the outlet works rehabilitation work will be carried out in the dry.

4.3 Tunnel Inspection and Repairs

Once dewatered, the approximate 100-foot length of concrete-lined tunnel immediately downstream of the inlet structure will be inspected. Any leaks or cracks in the tunnel lining will be repaired by pressurized injection of hydrophobic, polyurethane grout.

4.4 Pipe

The existing, parallel 30-inch diameter steel pipes extending from the headwall to the location of the removed 30-inch gate valves will be lined with new 24-inch steel pipes. Temporary end plates will be fabricated with vents for grouting and the annulus between the new and old pipes will be filled with grout. The existing partial concrete pipe encasement for the 30-inch pipes will be extended to support to new liner pipes.

4.5 Knife Gate Valves

Two new 24-inch diameter knife gate valves will be installed on flanges on the new parallel 24-inch diameter liner pipes. A short pipe length on a pipe support will be installed on the downstream side of each of the valves and will provide additional support for the valves.

4.6 Controls and Valve Control House

Flow measurement for the reservoir outlet works is currently provided by a Parshall flume and recorder on Fourmile Creek downstream of the dam. No additional flowmeters will be installed. The reservoir water surface elevation measurement is also already provided onsite and no additional water surface elevation gaging will be installed.

Discharge through the outlet works will be controlled by the two new 24-inch diameter knife gates installed in the valve chamber. The upstream 30-inch by 30-inch sluice gate will function as a guard gate and typically be fully open or fully closed.

All three gates will be hydraulically actuated using a single hydraulic power unit (HPU) to be located in the reconstructed valve control house near the dam crest. The HPU will be equipped with a hand pump for backup operation. Each hydraulic cylinder will be equipped with a transducer to provide continuous position feedback and valve percent open will be displayed on the control panel for the HPU. The operator will adjust valve position using momentary switches on the control panel.

The new valve control house will be constructed on the existing 10-foot by 10-foot concrete foundation. The new structure will be built on site with a wood-frame and metal siding and roof. The existing steel access ramp will be integrated into the new structure and continue to provide the only access to the building. An access panel will be provided in the floor to provide access to the vertical shaft and piping below for maintenance. Secondary access to the valve chamber will be through the rock cut tunnel outlet to Fourmile Creek.

A 32-inch square opening to act as an air vent will be saw-cut into the existing concrete foundation. The opening will be located about 1.0-ft from the top of the foundation wall and is not expected to experience significant loading. The opening will be protected with a welded steel plate frame grouted into the wall, and an outside face steel frame with stainless steel screen will be attached on the outside face of the concrete foundation wall to keep out wildlife. The outside steel frame will be anchored into the concrete with epoxy anchors to hold the stainless steel wire mesh in place.

4.7 Grouting Abandoned Outlet Works Conduits

Two existing 16-inch diameter outlet works pipes that were previously improperly abandoned will be filled with concrete grout for their entire length up to the point of upstream blockage. The grouting will prevent future collapse of the pipes and prevent seepage flows and possible piping of embankment materials through the pipes. In addition to grouting of the pipes, a filter diaphragm will be installed at the discharge point of the pipes and is discussed in the next section.

4.8 Filter Diaphragm

A filter diaphragm has been designed for the abandoned outlet works pipes. The area around the outlet works discharge point will be excavated to a minimum depth of 2 feet below the pipes and 5 feet on each side. The area will be backfilled to a minimum depth of 2 feet above the pipes with a filter sand. Slotted drain pipe 6 inches in diameter will be

installed in the filter sand and non-perforated pipe used to drain collected flow to Fourmile Creek approximately 50 feet away.

SECTION 5 - CONSTRUCTION CONSIDERATIONS

5.1 Construction Sequence

The construction sequencing of the outlet works for this project is critical because the reservoir will not be lowered for construction. An initial set of tasks will be carried out underwater and require divers. A general sequence of construction activities is provided below beginning with underwater construction activities.

Underwater construction tasks:

1. Remove the existing intake structure trash rack and supports.
2. Construct a concrete and structural steel attachment structure within the existing intake that will allow attachment of a new sluice gate.
3. Install a new heavy-duty, 30-inch by 30-inch sluice gate to act as a guard gate. Also, install a hydraulic actuator and associated piping.
4. Close the new guard gate and dewater the downstream outlet works.
5. Install a new trash rack.

The following rehabilitation work will be carried out in the dry after closure of the new outlet works guard gate:

6. Remove the existing dual, 30-inch diameter gate valves and associated valve stems and supports.
7. Install 24-inch diameter steel pipe liners within the existing 30-inch diameter pipes and grout in place.
8. Install new, dual 24-inch diameter knife gate valves, hydraulic actuators and associated piping.
9. Demolish and remove the existing valve house structure located near the dam crest.
10. Construct a new valve house structure on the existing concrete foundation and install a hydraulic power unit and associated controls to operate the new sluice gate and knife gate valves.

Grouting of the existing abandoned 16-inch diameter outlet works pipes and installation of the associated sand filter is not dependent on flow control at the existing outlet works. This task is an independent activity and its timing will be determined by the contractor.

5.2 Reservoir Operations

It is expected that construction of the outlet works improvements will require approximately 8 weeks. The reservoir level will not be lowered for construction because of concerns over sediment management. During construction, the reservoir outlet works will not be functional. The contractor will be required to provide a minimum 1,200 gallon-per-minute pump for the duration of construction in order to meet downstream water rights. Pumped water will be discharged to the rockcut spillway and from there flow into Fourmile Creek.

5.3 Construction Materials

5.3.1 Trash Rack

The replacement trash rack components will be fabricated out of carbon steel and galvanized.

5.3.2 Sluice Gate Attachment Structure

The sluice gate attachment structure will be constructed out of structural steel, a cast-iron wall thimble provided by the gate manufacturer and concrete poured in place. Structural steel elements will be fabricated out of carbon steel and then galvanized. A neoprene, hollow j-bulb seal will be used between steel members and existing concrete to minimize leakage. Concrete will be appropriate for underwater placement by tremie methods. It will have a maximum aggregate size of ¾-inch and a minimum 28-day compressive strength of 4,000 pounds-per-square inch (psi).

5.3.3 Tunnel Grouting Repairs

Cracks and leaks in the existing concrete tunnel wall downstream of the inlet structure will be repaired using a flexible, hydrophobic, polyurethane grout.

5.3.4 Pipe, Conduit and Tubing

The existing parallel 30-inch steel outlet conduits are to be lined with 24-inch diameter steel pipes having a wall thickness of 0.25 inches. The annulus between the existing and new pipes will be filled with pumpable cement grout.

Stainless steel tubing will be used to convey hydraulic fluid for control of the gates. Tubing and transducer cable for gate operation will be carried in 3-inch nominal diameter, schedule 80 galvanized steel conduit.

Vent pipe for the outlet works will be 6-inch nominal diameter schedule 80 galvanized steel pipe.

5.3.5 Gates

The new 30-inch by 30-inch sluice gate will be the heavy-duty type constructed of cast iron. The hydraulic actuation cylinder for the gate, including all fasteners and fittings will be constructed of stainless steel and will be heavy duty and appropriate for submerged duty.

The two new 24-inch diameter knife gate valves will be constructed of cast stainless steel. Actuators including all fasteners and fittings will be constructed of stainless steel.

5.3.6 Valve House

The new valve house will be an insulated, wood-frame structure with painted galvanized metal siding and roof. The valve house will be designed to allow for lifting and removal by crane if necessary for valve maintenance and otherwise designed in accordance with Teller County building code.

5.3.7 Grout for Abandoned Outlet Works Pipes

The abandoned 16-inch outlet works pipes will be filled with a flowable concrete grout. The grout mix will include additives for set retarding, anti-washout and minimization of shrinkage.

5.3.8 Diaphragm Filter

Construction of the diaphragm filter for the abandoned outlet works will utilize a select sand material for the filter, perforated and non-perforated PVC drain pipe and a concrete outlet structure to Fourmile Creek.

SECTION 6 - OPERATIONS AND MAINTENANCE

6.1 Operations

Primary control of releases through the rehabilitated outlet works will be accomplished using the 24-inch diameter knife gate valves. The upstream 30-inch square sluice gate will be used as a guard gate and typically positioned fully open or fully closed. The hydraulic power unit, controls and position indication for all gates will be located in the reconstructed valve control house located near the dam crest. Training and operating instructions for all equipment will be provided by equipment manufacturers through the construction contractor.

6.2 Routine Maintenance

6.2.1 Gates Actuators and Control Equipment

Water control gates, actuators, and control equipment will require regular maintenance. Some general recommendations for maintenance and inspections are provided below:

- All of the water control gates should be tested over their full range of operation at least once every 6 months. Any problems should be addressed immediately.
- Inspect the submerged sluice gate, gate attachment structure, gate actuator, submerged piping and connections at 5-year intervals.
- Inspect the knife gates, actuators and associated piping at least annually and after any significant flood releases or events resulting in significant inflows of debris to the reservoir.
- The packing of the knife gates will require adjustment over time to minimize leakage. Follow the gate manufacturer's instructions for tightening of the packing bolts.

Detailed maintenance requirements and instructions for all new equipment will be provided by equipment manufacturers through the construction contractor. All manufacturer's instructions should be followed and their specific instructions should govern if more stringent than any of the general recommendations given above.

6.2.1 Outlet Works Structures

Outlet works structures should also be carefully inspected on a regular basis. The frequency of inspections will depend on whether a particular facility is located above or below the water surface and if any significant flow events have occurred:

- Facilities located above the water surface should be inspected at least annually and additionally after any large discharge event.
- Facilities located below the water surface should be inspected at 5-year intervals.

In general, minimum inspection items are as follows:

- Any cracking or movement observed in concrete structures should be documented and monitored.
- Any cracks or leaks within the concrete outlet works tunnel should be documented and monitored.
- Corrosion of steel pipe, pipe appurtenances, steel structures, attachments and fasteners should be monitored.

Any identified maintenance or repair needs should be addressed as soon as possible.

The preceding recommendations apply only to the rehabilitated outlet works. Additional inspections related to seepage, the abandoned outlet works and other elements of the dam may be required by the SEO.

SECTION 7 - REFERENCES

American Concrete Institute (ACI) (2011). *Building Code Requirements for Structural Concrete* (ACI 318-11).

American Institute of Steel Construction (AISC) (2011). *Steel Construction Manual, 14th Edition*.

American Water Works Association (AWWA) (1989). *AWWA M11, Steel Pipe – A Guide For Design and Installation*, 3rd edition.

Colorado Office of the State Engineer (SEO) (2000). *Dam Safety Review Guide*, June.

Colorado Office of the State Engineer (SEO) (2007). *Rules and Regulations for Dam Safety and Dam Construction*, January.

Parmakian, John (1963), *Waterhammer Analysis*.

RJH Consultants (2011), Memorandum - *Mt. Pisgah Dam and Reservoir Outlet Inspection*

RJH Consultants (2011), Alternatives Evaluation, *Mount Pisgah Dam/Wrights Reservoir Outlet Works Rehabilitation*, November.

United States Department of the Interior, Bureau of Reclamation (USBR) (1987). *Design of Small Dams*.

APPENDIX A

_____

A.1 _____

PISGAH RESERVOIR AND DITCH COMPANY

MT. PISGAH DAM

OUTLET WORKS REHABILITATION

WATER DIVISION 2, WATER DISTRICT 12; DAMID: 120129
TELLER COUNTY, COLORADO

PROJECT VICINITY MAP
(NOT TO SCALE)

SITE LOCATION MAP
(NOT TO SCALE)

DRAWING NUMBER	TITLE
1	COVER SHEET
2	GENERAL AND STRUCTURAL NOTES
3	SITE ACCESS AND SURVEY CONTROL
4	EXISTING OUTLET WORKS - PLAN AND PROFILE
5	EXISTING OUTLET WORKS DEMOLITION - SECTIONS AND DETAILS 1
6	EXISTING OUTLET WORKS DEMOLITION - SECTIONS AND DETAILS 2
7	OUTLET WORKS MODIFICATIONS - PLAN AND PROFILE
8	INLET STRUCTURE MODIFICATIONS
9	VALVE CHAMBER MODIFICATIONS
10	VALVE HOUSE RECONSTRUCTION
11	ABANDONED OUTLET WORKS MODIFICATIONS
12	MISCELLANEOUS DETAILS

NOT FOR CONSTRUCTION

I HEREBY CERTIFY THAT THESE PLANS FOR THE MT. PISGAH DAM OUTLET WORKS REHABILITATION PROJECT WERE PREPARED BY ME (OR UNDER MY DIRECT SUPERVISION) FOR THE OWNERS THEREOF.

_____
MICHAEL L. GRABER, P.E. COLORADO P.E. #19963
REGISTERED ENGINEER
RJH CONSULTANTS, INC.

APPROVED ON THE _____ DAY OF _____ 20___.

_____
STATE ENGINEER

BY: _____
WILLIAM T. McCORMICK, P.E. COLORADO #29127
CHIEF, DAM SAFETY BRANCH

THESE PLANS REPRESENT THE AS-CONSTRUCTED CONDITIONS OF THE MT. PISGAH DAM OUTLET WORKS REHABILITATION TO THE BEST OF MY KNOWLEDGE AND JUDGMENT, BASED IN PART ON INFORMATION FURNISHED BY OTHERS, AS OF THE _____ DAY OF _____, _____.

_____ _____
(ENGINEER'S PRINTED NAME) (SIGNATURE)

PREPARED FOR

Pisgah Reservoir and Ditch Company

PREPARED BY

RJH CONSULTANTS, INC.
ENGLEWOOD • COLORADO
www.rjh-consultants.com

DWG. NO. 1

SHEET NO. 1 of 12

C-

P:\2120 - MT PISGAH OUTLET WORKS\CAD\TASK 1001 - DESIGN\90 PERCENT SUBMITTAL\2120 SHEET 1 COVER.DWG 4/2/2014

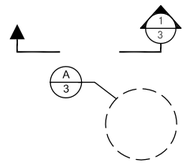
GENERAL NOTES

1. CONSTRUCTION IS SUBJECT TO THE RULES AND REGULATIONS OF THE COLORADO STATE ENGINEERS OFFICE (SEO). SUBSTANTIVE CHANGES TO THE APPROVED DRAWINGS AND SPECIFICATIONS REQUIRE APPROVAL OF THE SEO.
2. THE DATUM FOR THE PROJECT IS THE WORLD GEODETIC SYSTEMS (WGS) OF 1984.
3. LOCATION AND NATURE OF EXISTING UTILITIES SHOWN ON THE DRAWINGS ARE APPROXIMATE. CONTRACTOR SHALL FIELD LOCATE ALL UTILITIES, WHETHER SHOWN ON THE DRAWINGS OR NOT, PRIOR TO EXCAVATION. CONTRACTOR SHALL PROTECT ALL UTILITIES IN PLACE UNLESS DESIGNATED FOR REMOVAL OR REPLACEMENT.
4. UNLESS SHOWN OR SPECIFIED OTHERWISE, PAYLINES FOR UNIT PRICE PAY ITEMS ARE BASED ON THE DESIGN LINES (NEAT LINES) SHOWN ON THE DRAWINGS.
5. WHERE THE TERM "PROJECT LIMITS" IS USED, IT IS UNDERSTOOD TO MEAN THE LIMITS OF SITE DISTURBANCE SHOWN ON THE DRAWINGS OR OTHERWISE DESIGNATED BY THE ENGINEER.

LEGEND

DETAIL A / 3 — DETAIL TITLE. THE LETTER "A" REFERS TO THE DETAIL DESIGNATION. THE NUMBER "3" REFERS TO THE DRAWING NUMBER WHERE THE DETAIL IS CALLED OUT.

SECTION 1 / 3 **STA 0+00** — SECTION TITLE. THE NUMBER "1" REFERS TO THE SECTION DESIGNATION. THE NUMBER "3" REFERS TO THE DRAWING NUMBER WHERE THE SECTION IS CALLED OUT.



SECTION LOCATION. THE NUMBER "1" REFERS TO THE SECTION DESIGNATION. THE NUMBER "3" REFERS TO THE DRAWING NUMBER WHERE THE SECTION IS SHOWN.

DETAIL LOCATION. THE LETTER "A" REFERS TO THE DETAIL DESIGNATION. THE NUMBER "3" REFERS TO THE DRAWING NUMBER WHERE THE DETAIL IS SHOWN.

3630 — EXISTING INDEX TOPOGRAPHIC CONTOUR WITH ELEVATION IN FEET

EXISTING INTERMEDIATE TOPOGRAPHIC CONTOUR

EARTH SLOPE

CENTERLINE

SURFACE WATERWAY

APPROXIMATE WATER LEVEL

LIMIT OF DISTURBANCE

ABBREVIATIONS

APPROX	= APPROXIMATE	MIN	= MINIMUM
BO	= BLOCKOUT	MH	= MANHOLE
CL, ℄	= CENTERLINE	MFR	= MANUFACTURER
CMU	= CONCRETE MASONRY UNIT	MSE	= MECHANICALLY STABILIZED EARTH
CONC	= CONCRETE	NTS	= NOT TO SCALE
DIA	= DIAMETER	NWS	= NORMAL WATER SURFACE
DWG, DWGS	= DRAWING OR DRAWINGS	OD	= OUTSIDE DIAMETER
EA	= EACH	PEN.	= PENETRATION
EF	= EACH FACE	PVC	= POLYVINYL CHLORIDE
EL, ELEV	= ELEVATION	REINF	= REINFORCEMENT
EW	= EACH WAY	SCH	= SCHEDULE
FLG	= FLANGE	SS	= STAINLESS STEEL
HDPE	= HIGH DENSITY POLYETHYLENE	STA	= STATION
ID	= INSIDE DIAMETER	STL	= STEEL
IE	= INVERT ELEVATION	T&B	= TOP & BOTTOM
I.F.	= INSIDE FACE	T.O.	= TOP OF
MAX	= MAXIMUM	TYP	= TYPICAL
		WS	= WATER SURFACE

STRUCTURAL NOTES:

1) REINFORCEMENT SYMBOLS

BARS SHOWN THUS —— #8 @ 1'-0" OR —— # 8 @ 1'-0"

INDICATE A GROUP OF IDENTICAL #8 BARS SPACED AT 1'-0" (12") CENTERS.

o—— AN OPEN CIRCLE AT THE END OF A BAR INDICATES A BEND WITH THE BAR TURNED AWAY FROM THE OBSERVER.

●—— A CLOSED CIRCLE AT THE END OF A BAR INDICATES A BEND WITH THE BAR TURNED TOWARDS THE OBSERVER.

o INDICATES A DOWEL

SPLICES SHOWN THUS ——═—— INDICATES A LAPPED SPLICE, NOT A BEND IN THE BAR.

2) DIMENSIONS

DIMENSIONS ARE TO THE CENTERLINES OF THE BARS UNLESS OTHERWISE SHOWN. CLEAR COVER DIMENSIONS ARE MARKED "CLR." ALL DIMENSIONS TO A JOINT ARE TO THE CENTERLINE OF THE JOINT. BEAMS, COLUMNS, AND WALLS ARE CENTERED ON REFERENCED LINES.

THICKNESS SHOWN FOR WALLS AND SLABS ADJACENT TO UNDISTURBED SOIL OR ROCK ARE MINIMUM DIMENSIONS.

3) COVER

UNLESS OTHERWISE INDICATED ON THE DRAWING, PLACE THE REINFORCEMENT SO THAT THE CLEAR DISTANCE BETWEEN THE FACE OF CONCRETE AND NEAREST REINFORCEMENT IS 3 INCHES FOR #5 BARS OR LARGER. FOR CONCRETE PLACED DIRECTLY AGAINST EARTH OR ROCK, MINIMUM CLEAR CONCRETE COVER OVER REINFORCEMENT SHALL BE 3 INCHES.

4) REINFORCEMENT DOWELS

DOWELS INDICATED ON THE DRAWING SUCH AS #8(D), SHALL HAVE A MINIMUM STRAIGHT EMBEDMENT AND PROJECTION EQUAL TO THAT REQUIRED FOR LAP SPLICING A BAR OF THE SAME DIAMETER.

5) PLAIN DOWELS

PLAIN DOWELS, INDICATED ON THE DRAWINGS SUCH AS 3/4" (PD), ACROSS CONTRACTION JOINTS SHALL BE PLAIN REINFORCING BARS OF THE BAR DIAMETER INDICATED. PLAIN DOWELS SHALL BE A MINIMUM OF 36 INCHES LONG, WITH EQUAL LENGTH EXTENDING ON EITHER SIDE OF THE CONTRACTION JOINT. IMMEDIATELY BEFORE THE SECOND CONCRETE PLACEMENT, THE PROJECTING HALF LENGTH OF DOWEL SHALL BE GREASED TO PREVENT BOND TO THE CONCRETE.

6) STANDARD HOOKS AND BENDS

HOOKS AND BENDS SHALL CONFORM TO ACI 318, SECTIONS 7.1, 7.2. AND 7.3.

7) PLACING REINFORCEMENT

PLACE REINFORCEMENT IN ACCORDANCE WITH APPROVED REINFORCEMENT SHOP DRAWINGS. IN THE EVENT OF A CONFLICT BETWEEN THESE DRAWINGS AND THE APPROVED SHOP DRAWINGS, THE APPROVED SHOP DRAWINGS SHALL GOVERN.

SEE ACI 318, SECTION 7.5 AND ACI 301, SECTION 5.3 FOR PLACING TOLERANCES.

REINFORCEMENT MAY BE ADJUSTED IN THE FIELD TO CLEAR FORM TIES AND ANCHOR BARS. IN SUCH CASES, RELOCATION OF THE EMBEDDED MATERIALS MUST BE CONSIDERED. IN NO CASE SHALL BARS BE BENT IN THE FIELD.

REINFORCEMENT SHALL BE PLACED TO MAINTAIN A CLEAR DISTANCE OF AT LEAST 1 INCH BETWEEN OTHER REINFORCEMENT, ANCHOR BOLTS, FORM TIES, OR OTHER EMBEDDED METALWORK.

REINFORCEMENT PARALLEL TO ANCHOR BOLTS OR OTHER EMBEDDED METALWORK SHALL BE PLACED TO MAINTAIN A CLEAR DISTANCE OF AT LEAST 1-1/3 TIMES THE MAXIMUM SIZE AGGREGATE TO BE USED.

8) SPACING

THE FIRST AND LAST BARS IN SLABS AND WALLS, STIRRUPS IN BEAMS, AND TIES IN COLUMNS ARE TO START AND END AT A MAXIMUM OF ONE HALF OF THE ADJACENT BAR SPACING. ALL REINFORCING TO BE EQUALLY SPACED UNLESS OTHERWISE SHOWN ON THE DRAWINGS.

9) ACCESSORIES

BAR SUPPORTS, SPACERS, AND OTHER ACCESSORIES ARE NOT SHOWN ON THE DRAWINGS. THE RECOMMENDATIONS OF ACI 315 (DETAILING MANUAL) SHALL BE USED IN SELECTING ACCESSORIES.

10) DETAILING

UNLESS OTHERWISE SHOWN, FOLLOW THE RECOMMENDATIONS OF ACI 315. NO CHANGES SHALL BE MADE WITHOUT PRIOR APPROVAL.

11) CONCRETE PLACEMENT

BEFORE PLACING CONCRETE, CHECK ALL APPLICABLE DRAWINGS RELEASED AS SUITABLE FOR CONSTRUCTION INCLUDING MANUFACTURER'S DRAWINGS TO VERIFY THE PRESENCE OF ALL EMBEDDED MATERIAL REQUIRED IN THE PLACEMENT.

12) EMBEDMENT AND LAP SPLICE LENGTH REQUIREMENTS

EMBEDMENT LENGTHS AND LAP SPLICE LENGTHS ARE SHOWN IN THE TABLES BELOW.

BASIC EMBEDMENT LENGTHS ARE BASED ON ACI 318, SECTION 12.2. AND THE REQUIRED fc'.

ALL LAP SPLICE LENGTHS SHOWN ARE CLASS B SPLICES BASED ON ACI 318, SECTION 12.15.

UNLESS OTHERWISE SHOWN ON THE DRAWINGS, THE MINIMUM LENGTHS FOR EMBEDMENT AND LAP SPLICES FOR PARALLEL BARS SHALL BE AS GIVEN IN THE TABLE BELOW.

WHEN REINFORCING BARS OF DIFFERENT SIZE ARE TO BE SPLICED, THE LENGTH OF THE LAP SHALL BE GOVERNED BY THE SMALLER DIAMETER BAR.

SPLICES ARE TO BE MADE SO THAT THE GIVEN CLEAR DISTANCES TO THE FACE OF CONCRETE WILL BE MAINTAINED.

TABLE OF BASIC EMBEDMENT AND LAP SPLICE LENGTHS ACCORDING TO ACI 318
fc' = 4000 PSI

BAR SIZE NO.	EMBEDMENT (INCHES)		LAP SPLICE (INCHES)	
	ALL BARS EXCEPT TOP BARS	TOP BARS *	ALL BARS EXCEPT TOP BARS	TOP BARS *
3	1'-3"	1'-7"	1'-7"	2'-1"
4	1'-7"	2'-1"	2'-1"	2'-9"
5	2'-0"	2'-7"	2'-7"	3'-5"
6	2'-5"	3'-1"	3'-1"	4'-1"
7	3'-6"	4'-6"	4'-6"	5'-10"
8	4'-0"	5'-2"	5'-2"	6'-10"

* TOP BARS ARE HORIZONTAL BARS IN BEAMS AND SLABS PLACED SO THAT MORE THAN 12 INCHES OF CONCRETE IS CAST IN THE MEMBER BELOW THE BAR.

13) EMBEDDED ITEMS AND OPENINGS

BEFORE PLACING CONCRETE, CARE SHALL BE TAKEN THAT ALL EMBEDDED ITEMS ARE IN POSITION AND SECURELY FASTENED IN PLACE. ADD ADDITIONAL REINFORCING AROUND OPENINGS AS SHOWN ON DRAWINGS.

14) FINISHING SYMBOLS AND CONCRETE TOLERANCES

THE FOLLOWING FINISHING SYMBOLS HAVE BEEN USED ON THESE DRAWINGS. REFER TO THE CONSTRUCTION SPECIFICATIONS FOR DETAILED REQUIREMENTS AND CONSTRUCTION TOLERANCES FOR HYDRAULIC STRUCTURES.

F4 U3 SPECIAL FINISH WITH SPECIAL TOLERANCES FOR HIGH VELOCITY WATER FLOW.

FINISH SURFACES FOR ALL CONSTRUCTION AND CONTRACTION JOINTS SHALL BE PROVIDED IN ACCORDANCE WITH THE SPECIFICATIONS. ALL SURFACES REQUIRING AN F4 OR U3 FINISH ARE SHOWN ON THE DRAWINGS.

15) CHAMFER

UNLESS OTHERWISE INDICATED, CHAMFER EDGES OF ALL PERMANENTLY EXPOSED CONCRETE SURFACES WITH A 45 DEGREE BEVEL, 3/4 INCH X 3/4 INCH. CHAMFER STRIP MAY NOT BE SHOWN ON THE DESIGN DRAWINGS.

16) JOINTS

ALL CONSTRUCTION JOINTS, CONTRACTION JOINTS AND EXPANSION JOINTS SHALL BE PROVIDED WHERE SHOWN ON THE APPROVED SHOP DRAWINGS. NO OTHER JOINTS SHALL BE INTRODUCED UNLESS APPROVED BY THE ENGINEER.

17) STRUCTURAL STEEL

17a) GENERAL

FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL CONFORM TO CURRENT AISC STEEL CONSTRUCTION MANUAL.

17b) BOLTED CONNECTIONS

ANCHOR AND NON-STRUCTURAL BOLTS AND NUTS SHALL BE ASTM A 307, STRUCTURAL BOLTS AND NUTS SHALL BE ASTM A 325. ALL BOLTED STRUCTURAL CONNECTIONS SHALL CONFORM TO THE AISC SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A 325 OR A 490 BOLTS. ALL BOLTS, NUTS AND WASHERS SHALL BE HOT-DIP GALVANIZED. ALL STRUCTURAL BOLTED CONNECTIONS SHALL BE BEARING-TYPE CONNECTIONS.

17c) WELDING

CONFORM TO AWS D1.1. WELDING ELECTRODES FOR PLAIN STRUCTURAL STEEL SHALL BE AWS SERIES E-70. WELDING ELECTRODES FOR GALVANIZED STEEL SHALL BE AWS SERIES E6010 OR E6011.

RIPRAP OR COBBLES

EARTH

AGGREGATE BASE COURSE

STRUCTURAL CONCRETE

STEEL

FILTER/DRAIN SAND

NOT FOR CONSTRUCTION

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NO.	DATE	ISSUE/REVISION	DES	DRN	CHK	APP
–	4/14	90-PERCENT DESIGN	GGS	RJA	JDN	MLG

RJH CONSULTANTS, INC.

PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

MT. PISGAH DAM OUTLET WORKS REHABILITATION

TELLER COUNTY, COLORADO

GENERAL AND STRUCTURAL NOTES

DWG. NO. 02

SHEET NO. 2 of 12

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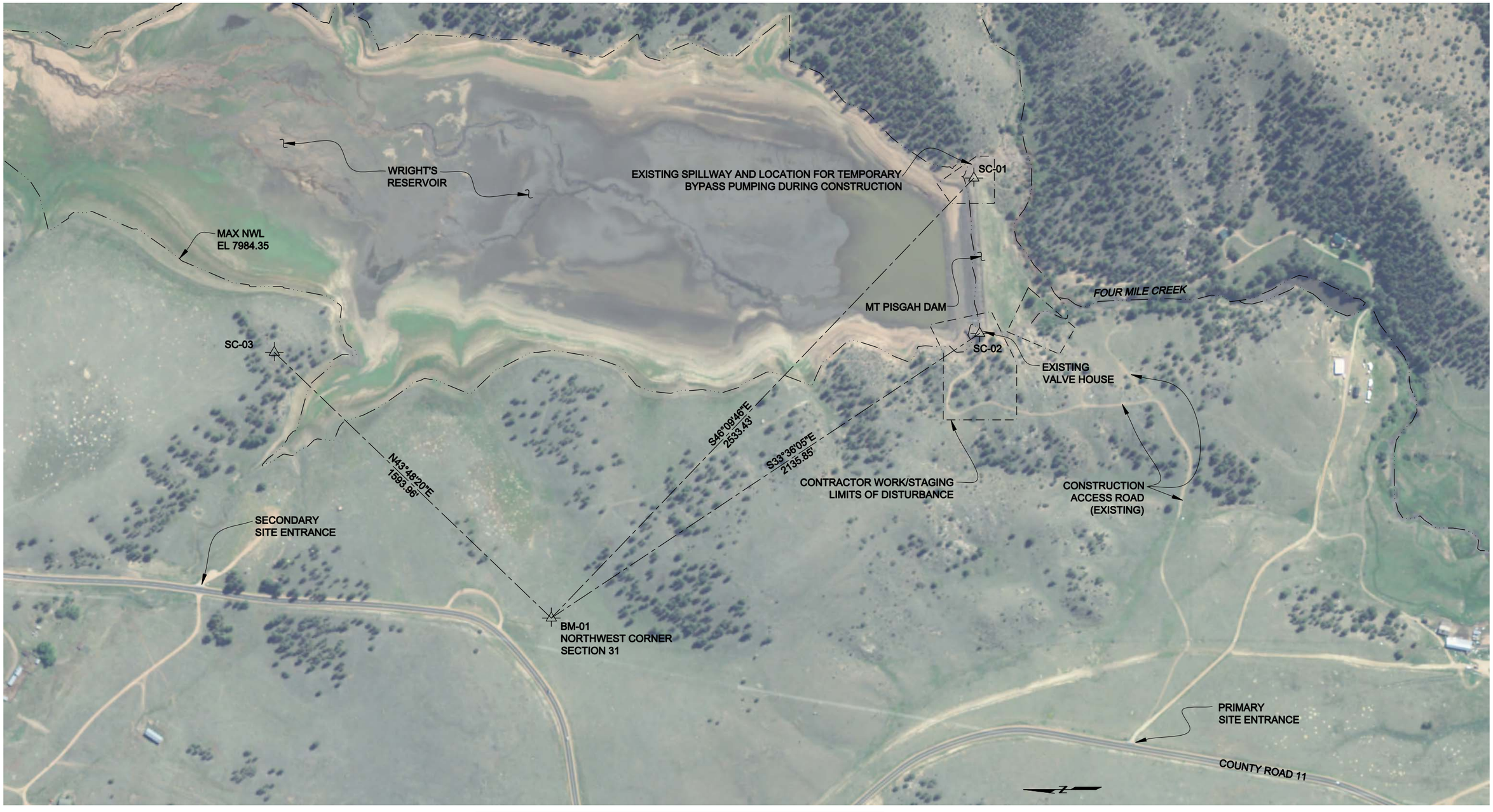

NOTES:

1. AERIAL PHOTOGRAPH FROM NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP), TELLER COUNTY, COLORADO (2011).
2. SURVEY CONTROL POINT INFORMATION FROM WACHOB AND WACHOB, INC. 2008 SURVEY.

SURVEY CONTROL TABLE

CONTROL POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
BM-01	8849.65	8896.64	8041.30	GLO BRASS CAP
SC-01	7094.97	10724.03	7994.40	CHISELED IN CONCRETE
SC-02	7070.68	10078.64	8000.14	CAP IN ROCK
SC-03	10000.00	10000.00	8026.45	1/2" REBAR WITH CAP

0 100 200 400 600
SCALE IN FEET

NOT FOR CONSTRUCTION

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NO.	DATE	ISSUE/REVISION	DES	DRN	CHK	APP
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RJH CONSULTANTS, INC.

PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

MT. PISGAH DAM OUTLET WORKS REHABILITATION

TELLER COUNTY, COLORADO

SITE ACCESS AND SURVEY CONTROL

DWG. NO. 03

SHEET NO. 3 of 12

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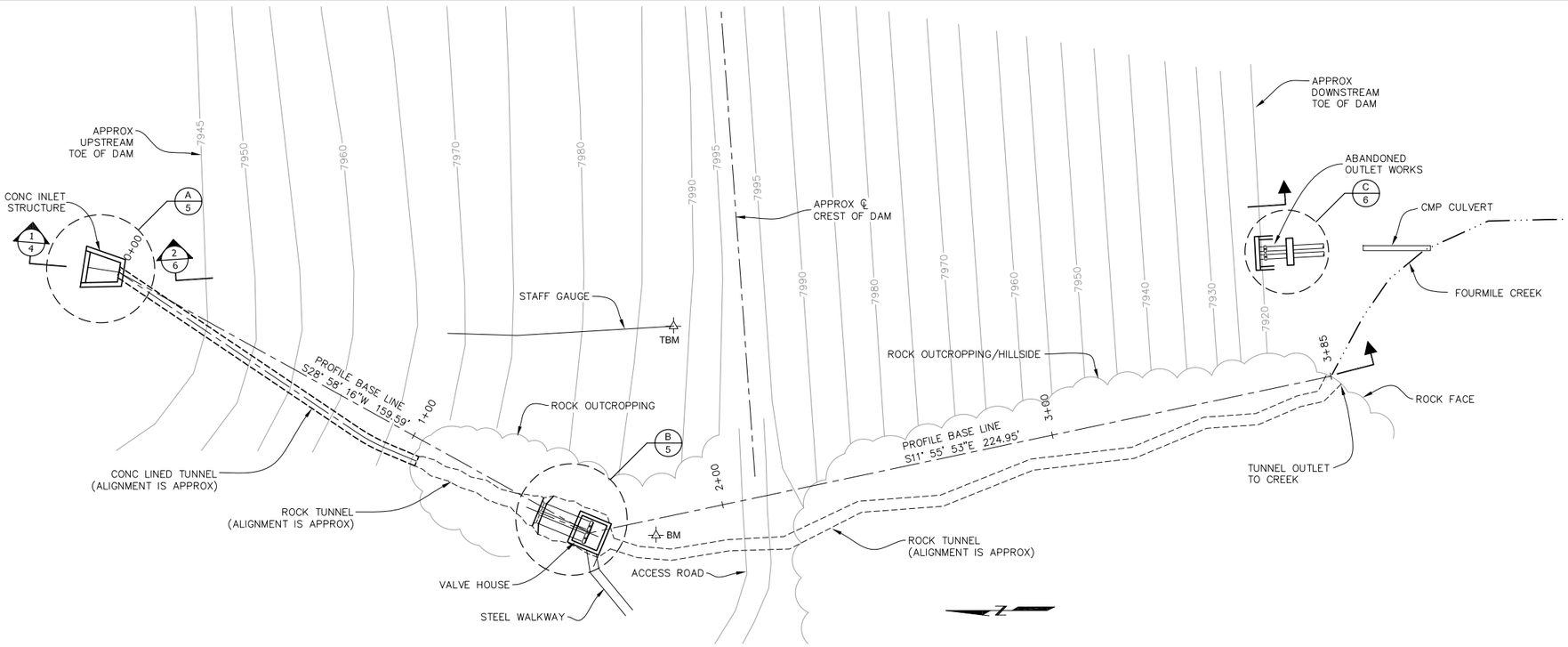
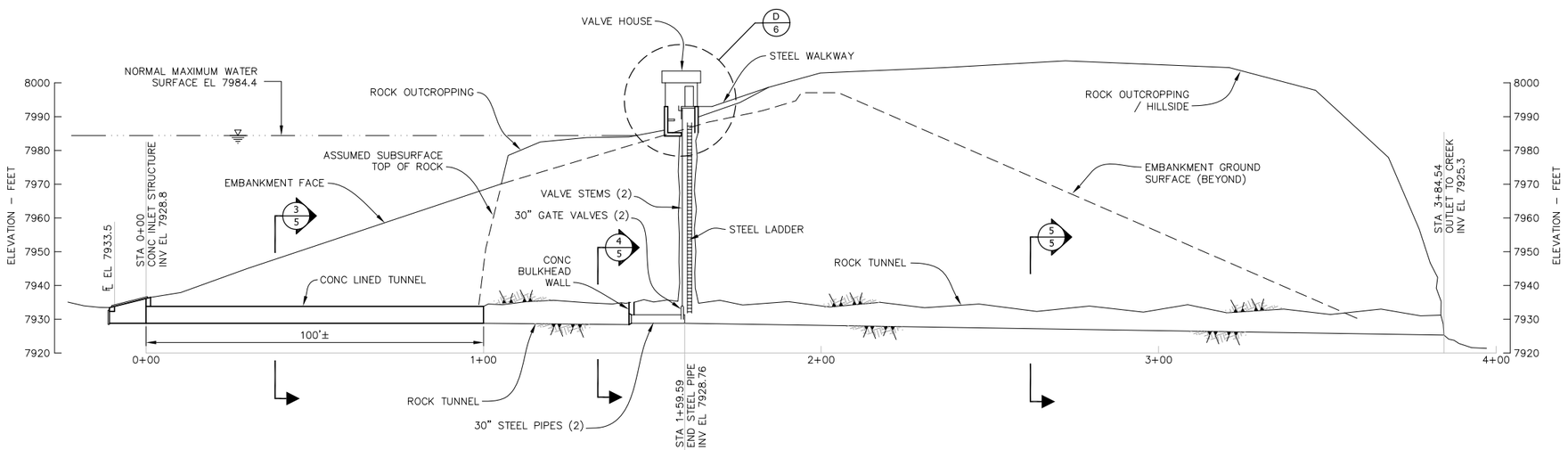


PLAN
OUTLET WORKS

0 10 20 40 60
SCALE IN FEET

BENCHMARKS FOR OUTLET WORKS				
CONTROL POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
BM	7070.68	10078.64	8000.14	X IN ROCK
TBM	7065.48	10140.66	7988.91	TOP OF STAFF GAUGE



SECTION 1/4
OUTLET WORKS

0 10 20 40 60
SCALE IN FEET

NOTES:

1. SURVEY DATA (POINT LOCATIONS INCLUDING ELEVATIONS) PROVIDED BY WACHOB AND WACHOB, INC., PROFESSIONAL LAND SURVEYORS, P.O. BOX 19376, COLORADO CITY, CO 81019, 719-676-3665. THE DATUM IS WGS 1984.
2. THE SIZE, SHAPE, AND CONFIGURATION OF THE OUTLET WORKS AND APPURTENANT FACILITIES WERE ESTIMATED BASED ON RJH SITE VISITS ON AUGUST 23 AND AUGUST 31, 2011. DURING THE SITE VISITS, SURVEY POINTS WERE RECORDED AT THE INLET STRUCTURE, THE VALVE HOUSE, AND THE TUNNEL OUTLET. THE OUTLET CONDUIT CONFIGURATION, MATERIALS, AND CONDITION WERE OBSERVED AND PHOTOGRAPHED. MEASUREMENTS WERE TAPED, PACED, OR VISUALLY ESTIMATED AND DIMENSIONS ARE APPROXIMATE.

NOT FOR CONSTRUCTION

C-

NO.	DATE	ISSUE/REVISION	DES	DRN	CHK	APP
–	4/14	90–PERCENT DESIGN	GGS	RJA	JDN	MLG

RJH CONSULTANTS, INC.

PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

MT. PISGAH DAM OUTLET WORKS REHABILITATION

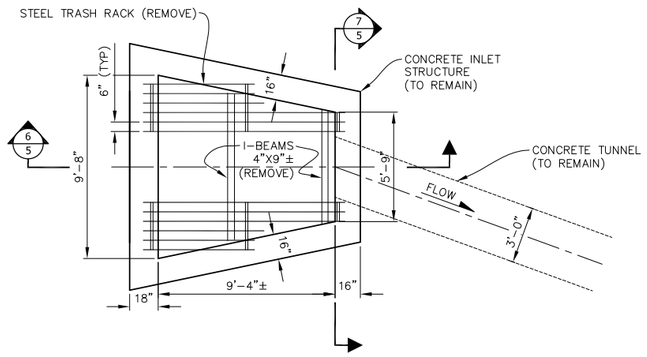
TELLER COUNTY, COLORADO

EXISTING OUTLET WORKS - PLAN AND PROFILE

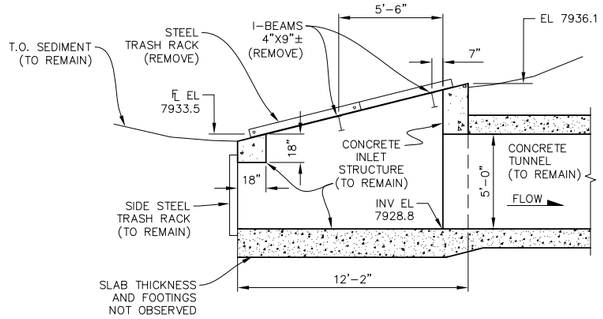
DWG. NO. 04

SHEET NO. 4 of 12

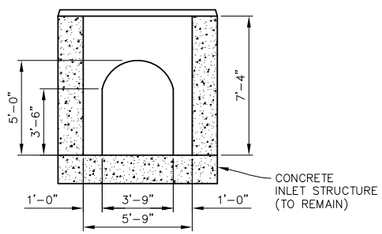
P:\12120 – MT PISGAH OUTLET WORKS\CAD\TASK 1001 – DESIGN\90 PERCENT SUBMITTAL\12120 SHEET 4 EXISTING PLAN–PROFILE.DWG 4/2/2014 10:11 AM



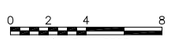
DETAIL A — INLET STRUCTURE (4)

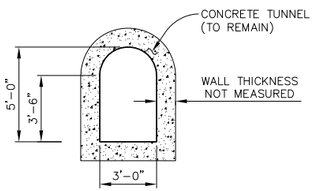


SECTION 6/5

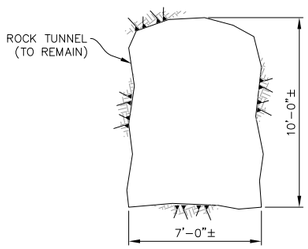


SECTION 7/5

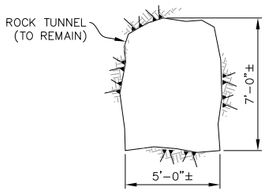




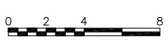
SECTION 3/4

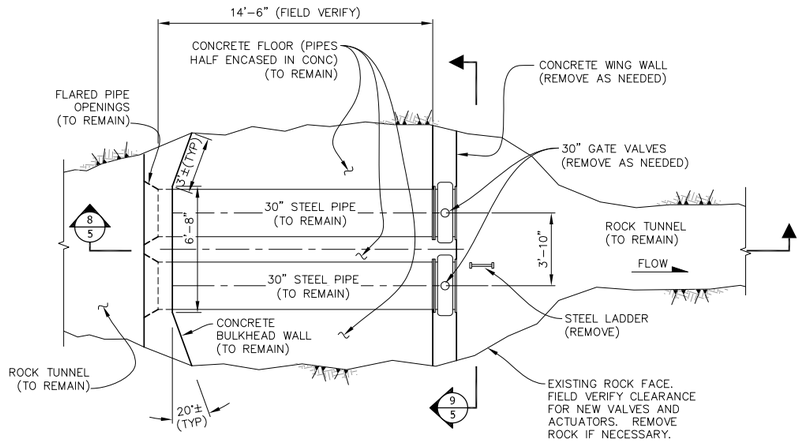


SECTION 4/4

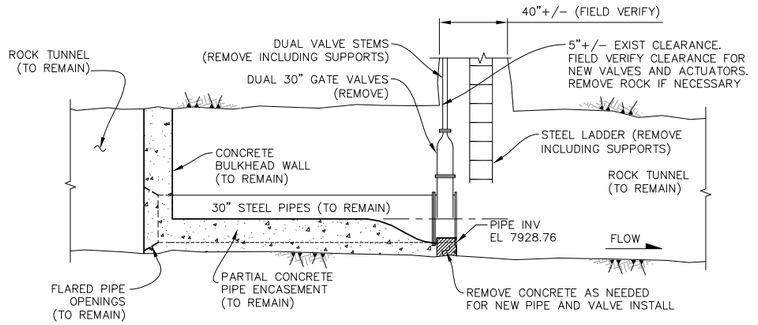


SECTION 5/4

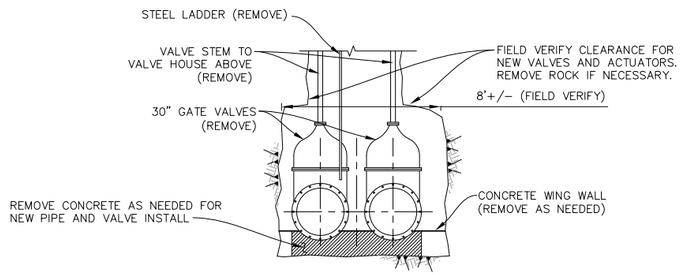




DETAIL B — VALVE ROOM (4)



SECTION 8/5



SECTION 9/5

NOT FOR CONSTRUCTION

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NO.	DATE	ISSUE/REVISION	DES	DRN	CHK	APP
–	4/14	90–PERCENT DESIGN	GGS	RJA	JDN	MLG

RJH CONSULTANTS, INC.

PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

MT. PISGAH DAM OUTLET WORKS REHABILITATION

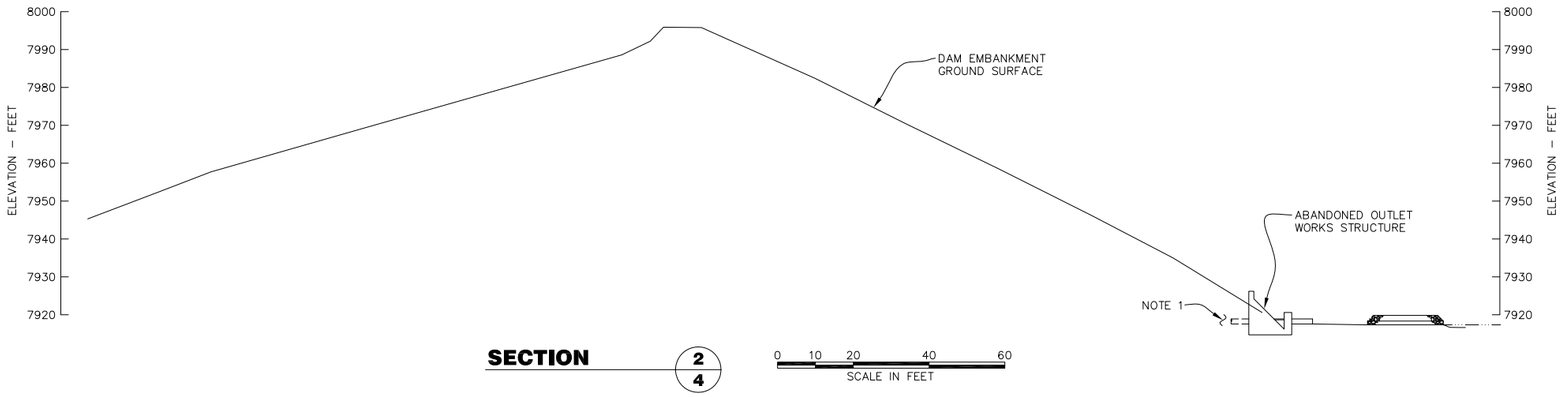
TELLER COUNTY, COLORADO

EXISTING OUTLET WORKS DEMOLITION - SECTIONS AND DETAILS 1

DWG. NO. 05

SHEET NO. 5 of 12

P:\12120 – MT PISGAH OUTLET WORKS\CAD\TASK 1001 – DESIGN\90 PERCENT SUBMITTAL\12120_SHEET 5 EXISTING SECTIONS AND DETAILS 1.DWG 4/22/2014 10:12 AM



SECTION 2/4

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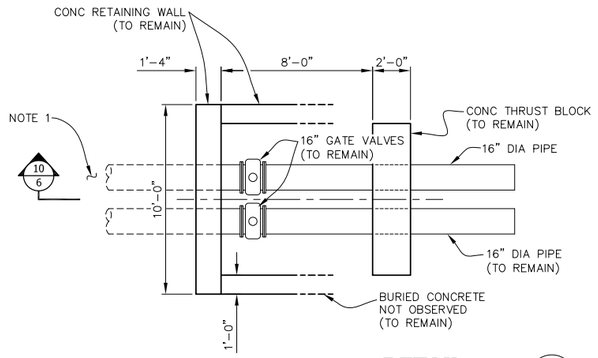
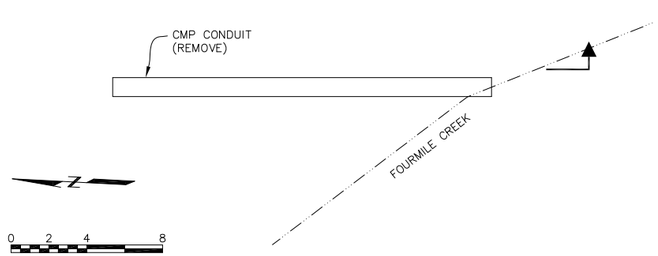
SCALE IN FEET



DETAIL C/4



0 2 4 8
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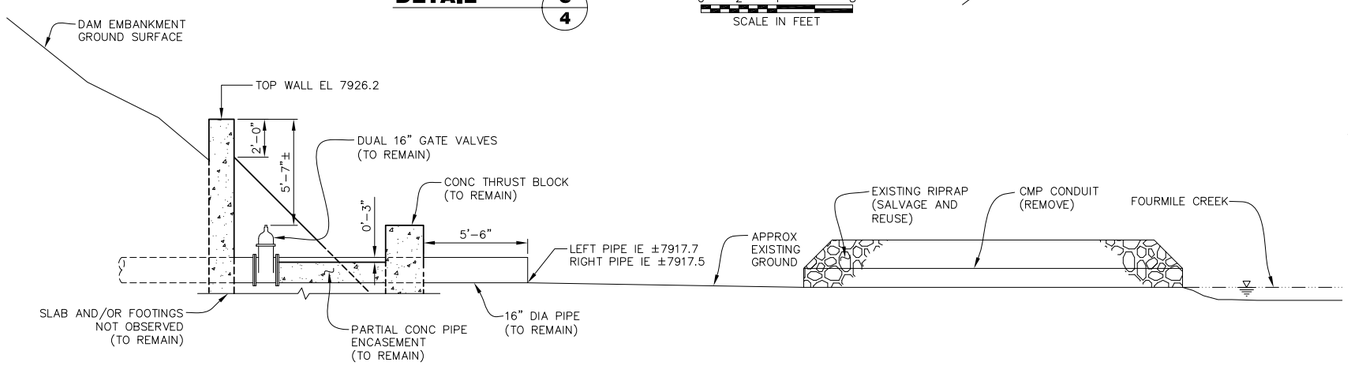

SECTION 10/6

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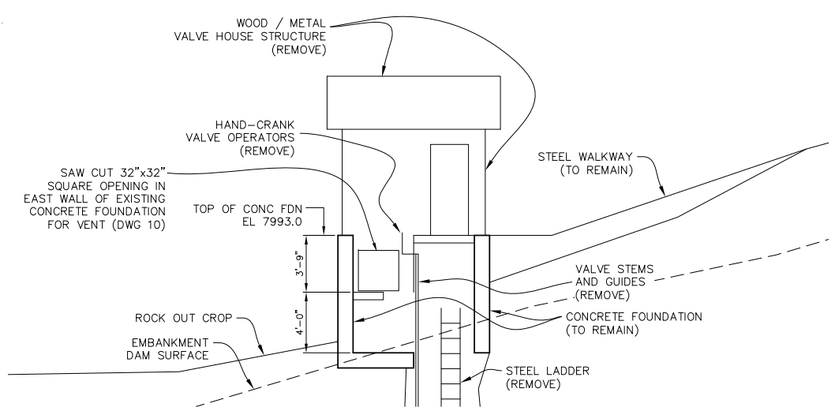

DETAIL
VALVE HOUSE D/4

0 2.5 5 10 15
SCALE IN FEET

NOTES:

1. THE UPSTREAM ENDS OF THE PIPES ARE PLUGGED AND TERMINATE WITHIN THE EMBANKMENT. THE PIPE ALIGNMENT IS UNKNOWN.

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PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

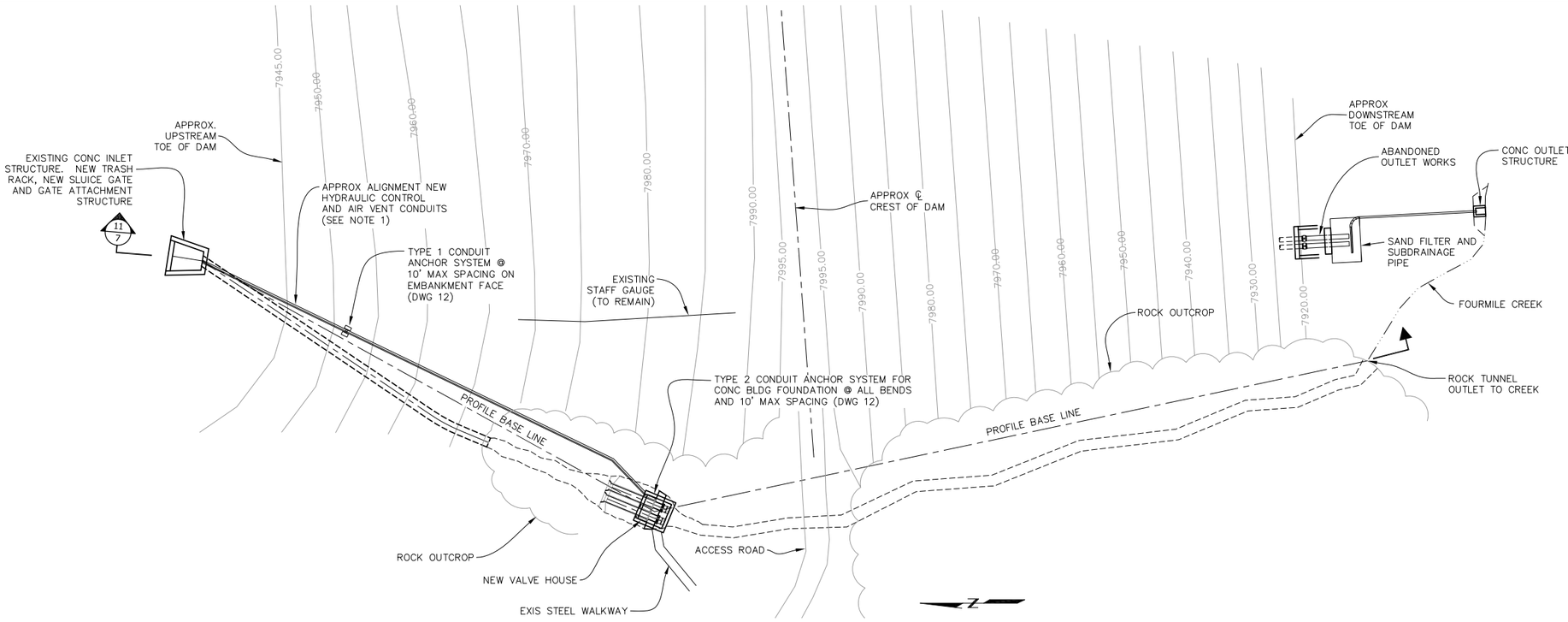
MT. PISGAH DAM
OUTLET WORKS
REHABILITATION

TELLER COUNTY, COLORADO

EXISTING OUTLET WORKS DEMOLITION - SECTIONS AND DETAILS 2

DWG. NO. 06

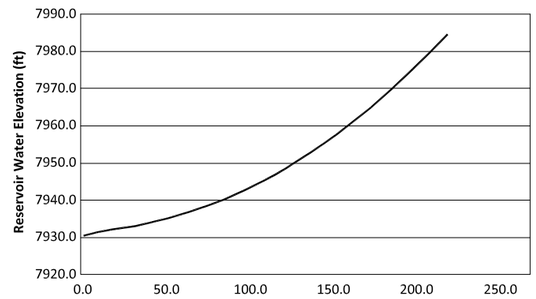
SHEET NO. 6 of 12

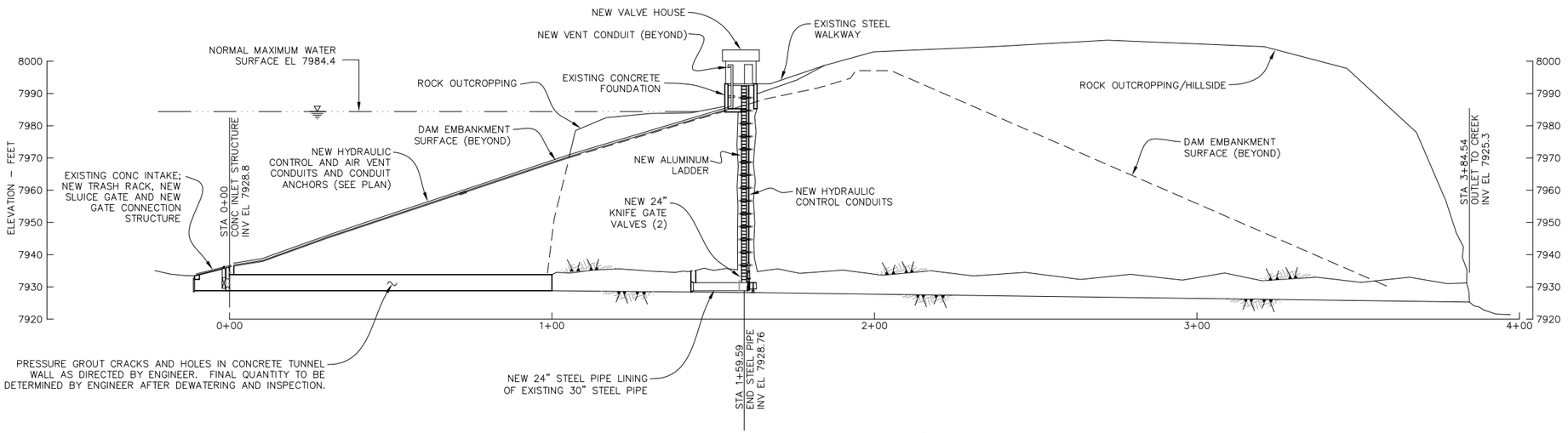


PLAN
OUTLET WORKS

0 10 20 40 60
SCALE IN FEET

WSE (ft)	Outlet Works Discharge (cfs)
7930.5	2.5
7931.0	6.5
7932.0	18.0
7933.0	33.0
7934.0	42.4
7935.0	52.2
7940.0	85.7
7945.0	109.4
7950.0	128.8
7955.0	145.4
7960.0	160.6
7965.0	174.4
7970.0	187.2
7975.0	199.2
7980.0	210.4
7984.35	219.8





SECTION
OUTLET WORKS

11
7

0 10 20 40 60
SCALE IN FEET

GENERAL SEQUENCE OF CONSTRUCTION:

1. UNDERWATER DEMOLITION OF INLET TRASH RACK AND SUPPORTS.
2. UNDERWATER CONSTRUCTION/INSTALL OF INTAKE STRUCTURE SLUICE GATE ATTACHMENT STRUCTURE, SLUICE GATE AND TRASH RACK.
3. SLUICE GATE CLOSURE AND TUNNEL DEWATERING.
4. CONCRETE TUNNEL INSPECTION AND GROUTING.
5. FIELD VERIFICATION BY CONTRACTOR OF VALVE CHAMBER DIMENSIONS, CLEARANCES FOR NEW FACILITIES AND 24" STEEL PIPE LENGTH.
6. VALVE CHAMBER DEMOLITION AND REHABILITATION.
7. VALVE HOUSE DEMOLITION AND RECONSTRUCTION.
8. UNDERWATER CONSTRUCTION/INTAKE STRUCTURE TRASH RACK INSTALLATION.

NOTES – AIR VENT AND HYDRAULIC CONTROL CONDUITS:

1. DETAILED ROUTING OF PIPE OVER EMBANKMENT FACE AND EXPOSED ROCK NOT SHOWN. ADDITIONAL BENDS AND PIPE LENGTH MAY BE REQUIRED. CONTRACTOR MAY FIELD ADJUST CONDUIT ALIGNMENT TO MINIMIZE PIPE LENGTH AND BENDS.
2. ALL GALV STEEL PIPE BENDS TO BE LONG RADIUS TYPE.

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RJH PROJECT 12120

MT. PISGAH DAM OUTLET WORKS REHABILITATION

TELLER COUNTY, COLORADO

OUTLET WORKS MODIFICATIONS - PLAN AND PROFILE

DWG. NO. 07

SHEET NO. 7 of 12

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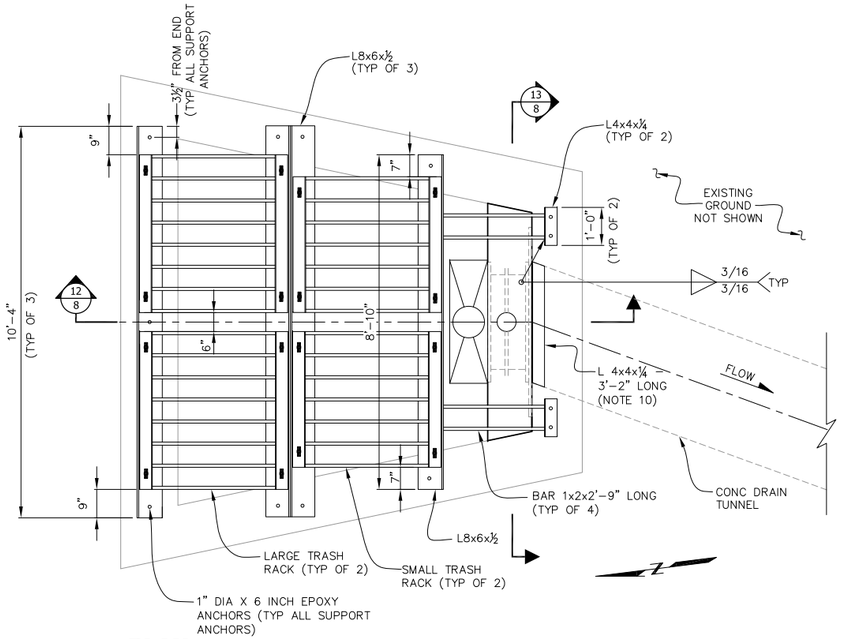
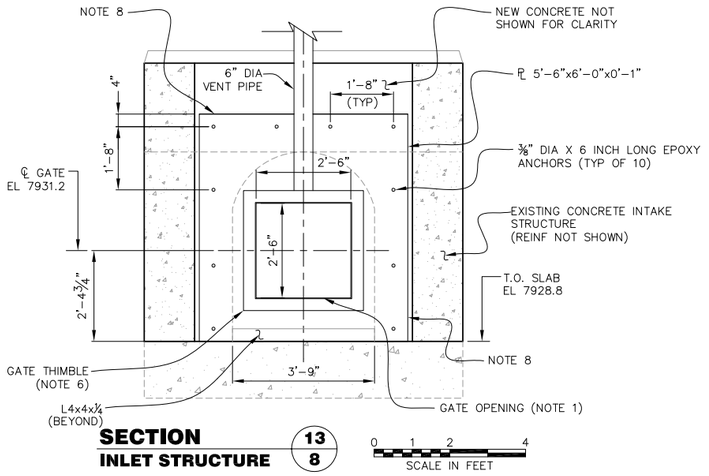
P:\12120 – MT PISGAH OUTLET WORKS\CAD\TASK 1001 – DESIGN\90 PERCENT SUBMITTAL\12120 SHEET 7 OW MODIFICATIONS PLAN AND PROFILE.DWG 4/2/2014 10:15 AM



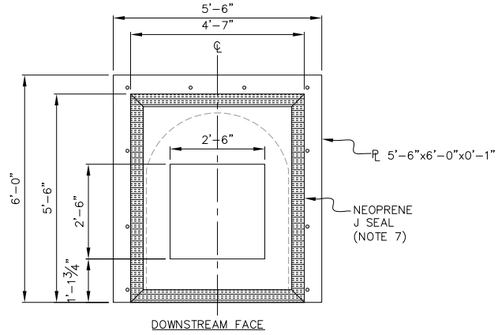
PLAN
INLET STRUCTURE (SKEWED)

0 1 2 4
SCALE IN FEET



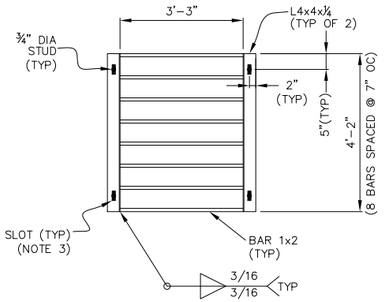
SECTION 13
INLET STRUCTURE 8

0 1 2 4
SCALE IN FEET



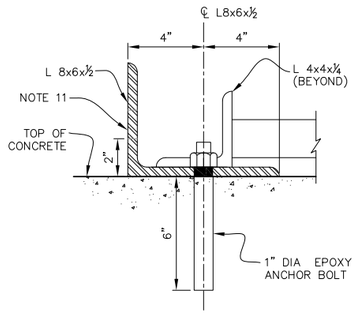
TYPICAL DETAIL
STEEL PLATE

0 1 2 4
SCALE IN FEET

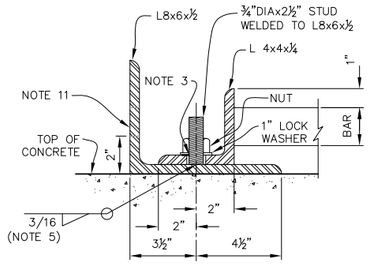


TRASH RACK DETAIL
LARGE RACK (TYP OF 2)

0 1 2 4
SCALE IN FEET



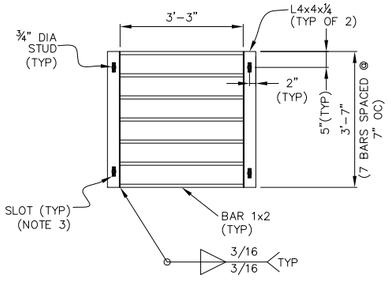
DETAIL E
NTS 8



DETAIL F
NTS 8

SECTION 12
INLET STRUCTURE 8

0 1 2 4
SCALE IN FEET



TRASH RACK DETAIL
SMALL RACK (TYP OF 2)

0 1 2 4
SCALE IN FEET

NOTES:

1. "E" TYPE WALL THIMBLE CONSISTS OF A SQUARE INTERIOR FLANGE TO MATE WITH SLIDE GATE AND SQUARE OPENING FOR A GASKETED BOLT CONNECTION TO PLATE. GATE MANUFACTURER TO PROVIDE GATE THIMBLE WITH STANDARD MERCHANT COUPLING FOR VENT PIPE WITH COUPLING I.D. EQUAL TO VENT PIPE O.D. + ⅛".
2. ENCASE THIMBLE IN CONCRETE. FORM TOP OF CONCRETE SECTION TO MATCH EXISTING SLOPE OF INTAKE STRUCTURE HEAD WALL.
3. PROVIDE 1"x3" SLOT CENTERED ON ANCHORS.
4. ALL TRASH RACKS SHALL BE GALVANIZED. NO PAINTED MATERIALS SHALL BE ACCEPTED.
5. GRIND WELD CONNECTING STUD AND L8x6x½ ANGLE SMOOTH.
6. DIMENSIONS OF THIMBLE UNKNOWN. THIMBLE TO BE PROVIDED BY GATE MANUFACTURER.
7. ATTACH WILLIAMS EVERLASTIC NEOPRENE 4–INCH HOLLOW BULB JSEAL TO DOWNSTREAM FACE OF PLATE WITH WILLIAMS NO. 37 HIGH STRENGTH, SYNTHETIC BASED ADHESIVE, OR APPROVED EQUAL.
8. PLACE POLYURETHANE SEALANT AROUND STEEL PLATE DOWNSTREAM FACE EDGE DURING PLATE ATTACHMENT AND ALONG EDGES OF NEW CONCRETE.
9. THE TRASH RACK SLOPE IS FLATTER THAN REQUIRED FOR A SELF–CLEANING CONDITION. ADDITIONAL ROUTINE MAINTENANCE MAY BE NECESSARY.
10. THE WIDTH AND ANGLE OF WALL FACE VARIES. THE ANGLE SHALL TO EXTEND TO FULL WIDTH OF BOTTOM OF OPENING. THE LENGTH SHOULD BE CONFIRMED IN THE FIELD BEFORE PROCUREMENT.
11. PROVIDE (2) 1–1/2 INCH DIAMETER LIFT HOLES IN VERTICAL EDGE OF ANGLES.

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PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

MT. PISGAH DAM
OUTLET WORKS
REHABILITATION

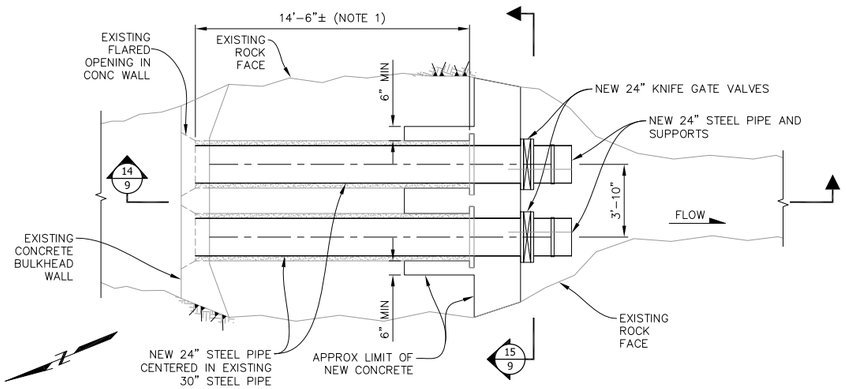
TELLER COUNTY, COLORADO

INLET STRUCTURE
MODIFICATIONS

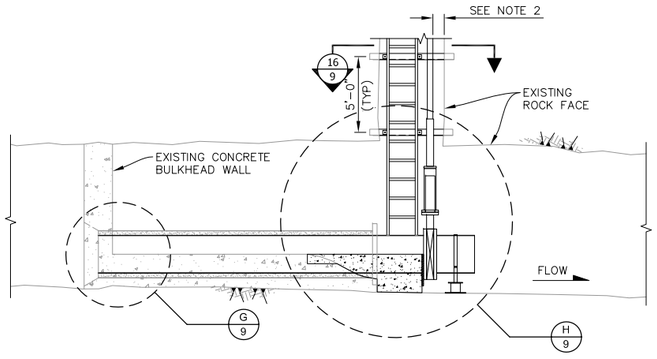
DWG. NO. 08

SHEET NO. 8 of 12

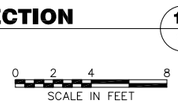
P:\12120 – MT PISGAH OUTLET WORKS\CAD\TASK 1001 – DESIGN\90 PERCENT SUBMITTAL\12120 SHEET 8 INLET STRUCTURE MOD.DWG 4/2/2014 10:16 AM

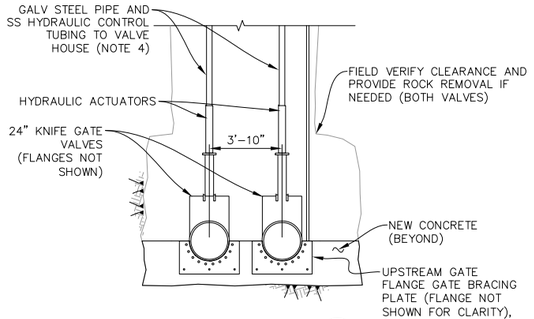


PLAN



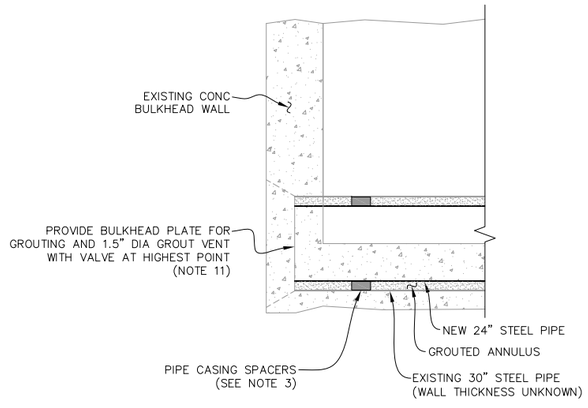
SECTION 14/9



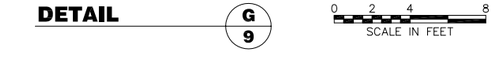


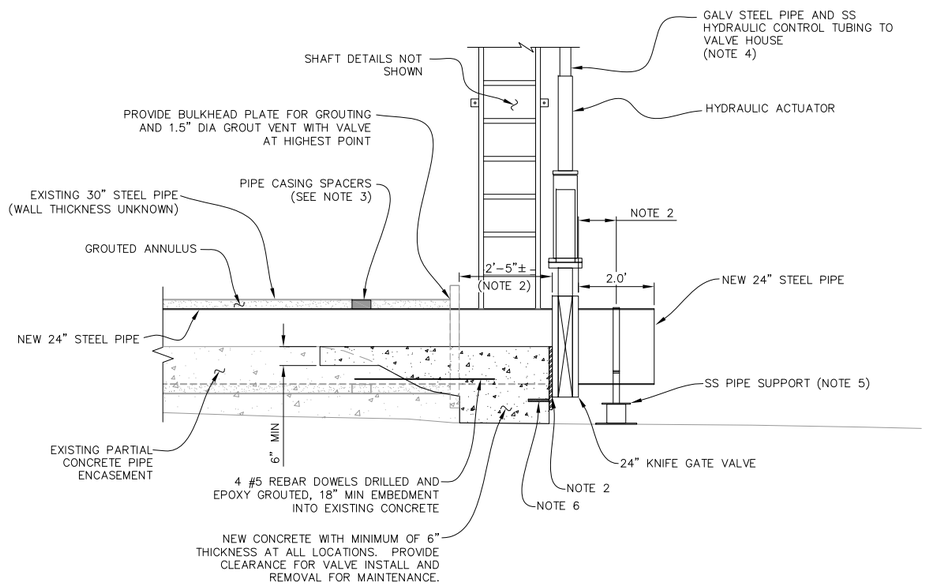
SECTION 15/9

NTS

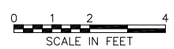


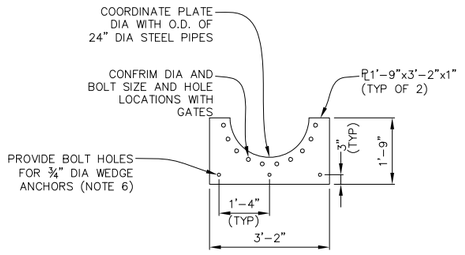
DETAIL G/9



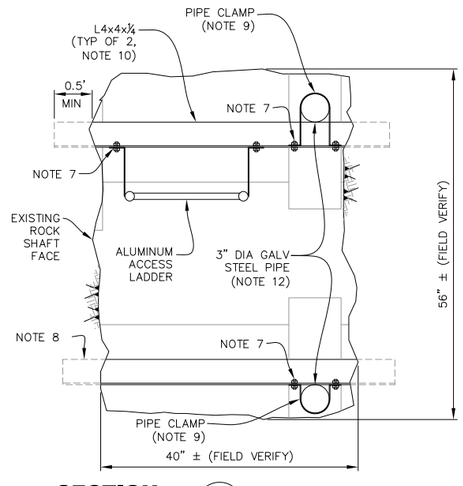


DETAIL H/9 — VALVE ROOM





GATE BRACING PLATE (TYP OF 2)



SECTION 16/9

PIPE INSTALLATION SEQUENCE:

1. REMOVE EXISTING VALVES AND CONCRETE AS NECESSARY FOR NEW PIPE AND VALVE INSTALLATION.
2. VERIFY OVERHEAD CLEARANCE FOR NEW VALVES AND ACTUATORS AND REMOVE ROCK IF REQUIRED.
3. INSTALL NEW 24-INCH DIA STEEL PIPE CENTERED IN EXISTING 30-INCH STEEL PIPE.
4. SEAL UPSTREAM AND DOWNSTREAM ENDS OF CONDUITS BETWEEN EXISTING AND NEW PIPES.
5. GROUT ANNULUS. OPEN 1½" VENT VALVES UNTIL GROUT FLOWS FROM VENT. CLOSE VENT.

NOTES:

1. EXISTING PIPE LENGTH IS APPROXIMATE. CONTRACTOR TO FIELD VERIFY LENGTH.
2. VERIFY MINIMUM REQUIRED CLEARANCE FOR VALVE, ACTUATOR AND LADDER.
3. PROVIDE CASING SPACERS WITHIN 2 FEET OF EACH PIPE END AND AT A MAXIMUM 8 FOOT SPACING OTHERWISE.
4. PROVIDE PIPE SUPPORTS AT 10-FOOT MAXIMUM SPACING IN ACCORDANCE WITH SECTION 16.
5. LEVEL PIPE SUPPORT AND ANCHOR WITH (4) 1/2-INCH DIAMETER EPOXY ANCHORS WITH MINIMUM EMBEDMENT OF 6 INCHES INTO BEDROCK.
6. PROVIDE (3) 3/4-INCH DIAMETER WEDGE ANCHORS, WITH MINIMUM 6-5/8-INCH EMBEDMENT LENGTH. PRODUCT SHALL BE HEDHEAD TRUBOLT OR APPROVED EQUAL.
7. PROVIDE GALVANIZED STEEL BOLT CONNECTIONS SIZED PER MANUFACTURER'S RECOMMENDATIONS.
8. PROVIDE A MINIMUM OF 6-INCH EMBEDMENT INTO ROCK SHAFT FACE. SECURE AND GROUT L4x4x¼ MEMBERS.
9. CONNECT PIPE CLAMP TO L4x4x¼ MEMBERS PER MANUFACTURER'S RECOMMENDATIONS.
10. PROVIDE BOLT HOLES IN L4x4x¼ MEMBERS AT CONNECTION LOCATIONS IN ACCORDANCE WITH AISC.
11. NO DRILLING, PENETRATION OR MODIFICATION OF ANY KIND TO THE EXISTING CONCRETE BULKHEAD WALL SHALL BE PERMITTED FOR ATTACHMENT OF THE TEMPORARY BULKHEAD PLATE FOR GROUTING.
12. VERIFY GALVANIZED STEEL CARRIER PIPE DIAMETER IS ADEQUATE FOR SELECTED HYDRAULIC TUBING DIAMETER.

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PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

MT. PISGAH DAM OUTLET WORKS REHABILITATION

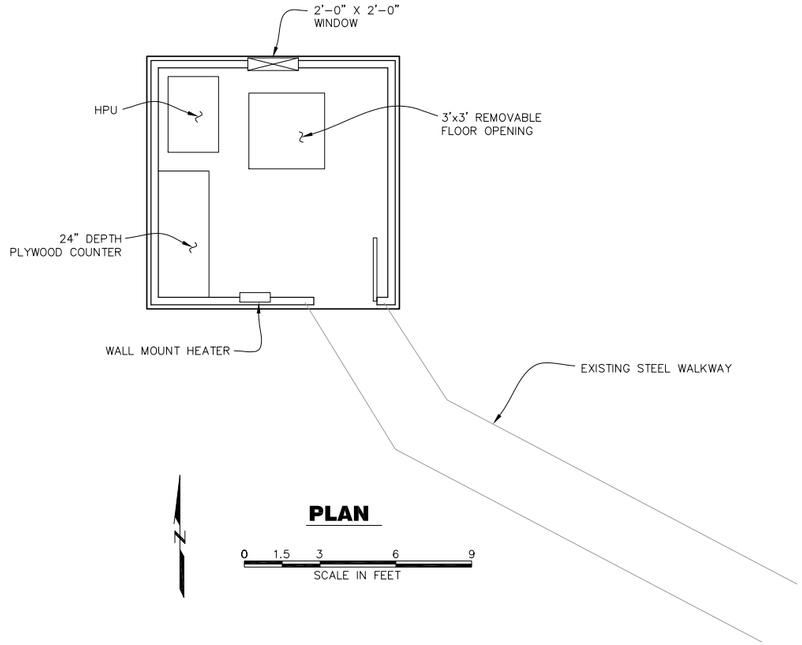
TELLER COUNTY, COLORADO

VALVE CHAMBER MODIFICATIONS

DWG. NO. 09

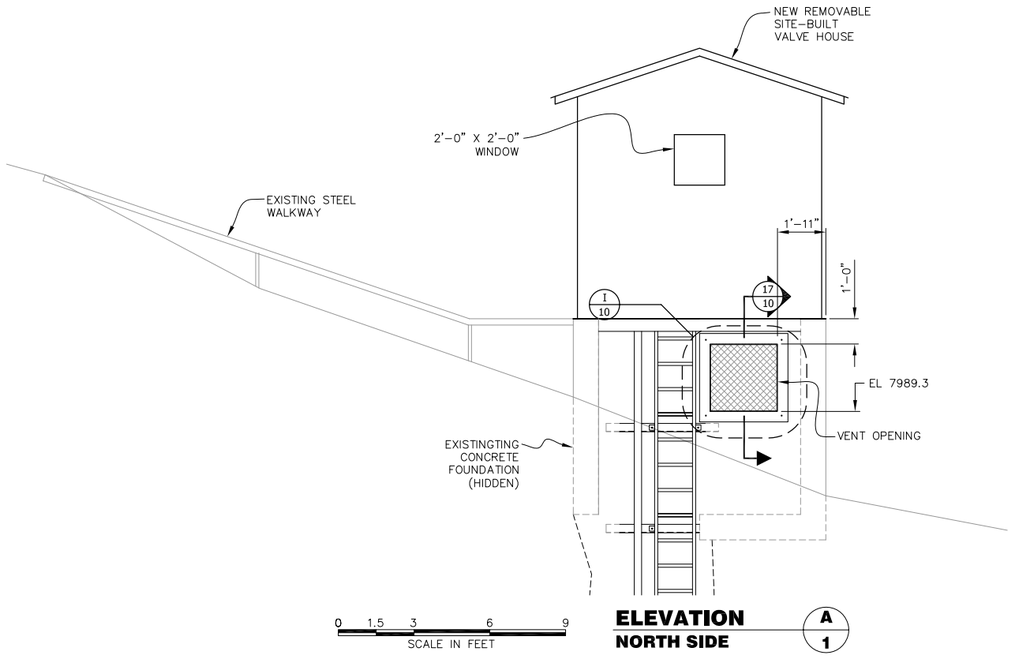
SHEET NO. 9 of 12

P:\12120 - MT PISGAH OUTLET WORKS\CAD\TASK 1001 - DESIGN\90 PERCENT SUBMITTAL\12120 SHEET 9 VALVE ROOM MOD.DWG 4/2/2014 10:17 AM



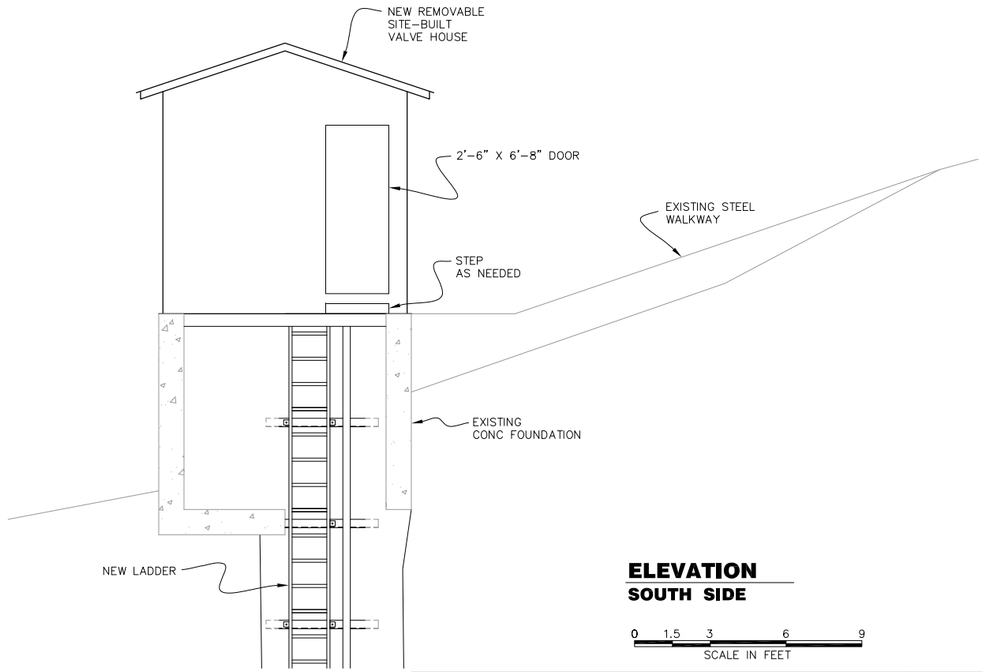
PLAN

0 1.5 3 6 9
SCALE IN FEET



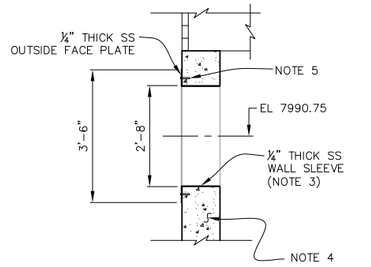
0 1.5 3 6 9
SCALE IN FEET

ELEVATION
NORTH SIDE A/1



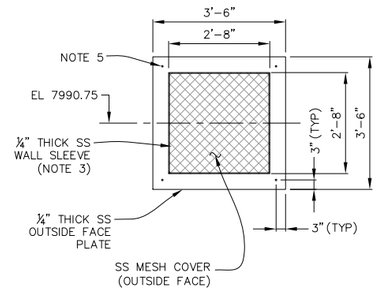
ELEVATION
SOUTH SIDE

0 1.5 3 6 9
SCALE IN FEET



DETAIL 17/10

0 1 2 4
SCALE IN FEET



DETAIL I/10

0 1 2 4
SCALE IN FEET

NOTES:

1. VERIFY CONCRETE FOUNDATION WALL THICKNESS IN FIELD.
2. PROVIDE STAINLESS STEEL WELDED WIRE MESH BARRIER TO BE ATTACHED BY FACE PLATE TO OUTSIDE FACE OF CONCRETE FOUNDATION WALL. PRODUCT BY NIXALITE OF AMERICA, INC, PRODUCT NO. WMS400 OR APPROVED EQUAL.
3. PROVIDE 1/4–INCH THICK GALVANIZED STEEL PLATES TO PROVIDE A 32–INCH BY 32–INCH OPENING. MINIMUM FILLET WELD SIZE = ⅛ INCH – FOR FULL WIDTH OF SLEEVE. WIDTH OF WALL SLEEVE TO BE EQUAL TO WIDTH WALL FOUNDATION WALL. ENCASE OR GROUT STEEL SLEEVE INTO WALL SECTION AT LOCATION SHOWN.
4. WALL REINFORCEMENT NOT SHOWN. TO BE VERIFIED IN THE FIELD.
5. ATTACH OUTSIDE FACE PLATE TO CONCRETE FOUNDATION WALL WITH MINIMUM (4) EPOXY ANCHOR BOLTS, WASHERS AND NUTS. PROVIDE 3/8–INCH DIA BOLTS AND HARDWARE SHOWN IN ACCORDANCE WITH THE SPECIFICATIONS. PROVIDE LENGTH OF ANCHORS PER MANUFACTURER'S RECOMMENDATIONS.

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NO.	DATE	ISSUE/REVISION	DES	DRN	CHK	APP
–	4/14	90–PERCENT DESIGN	GGS	RJA	JDN	MLG

RJH CONSULTANTS, INC.

PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

MT. PISGAH DAM
OUTLET WORKS
REHABILITATION

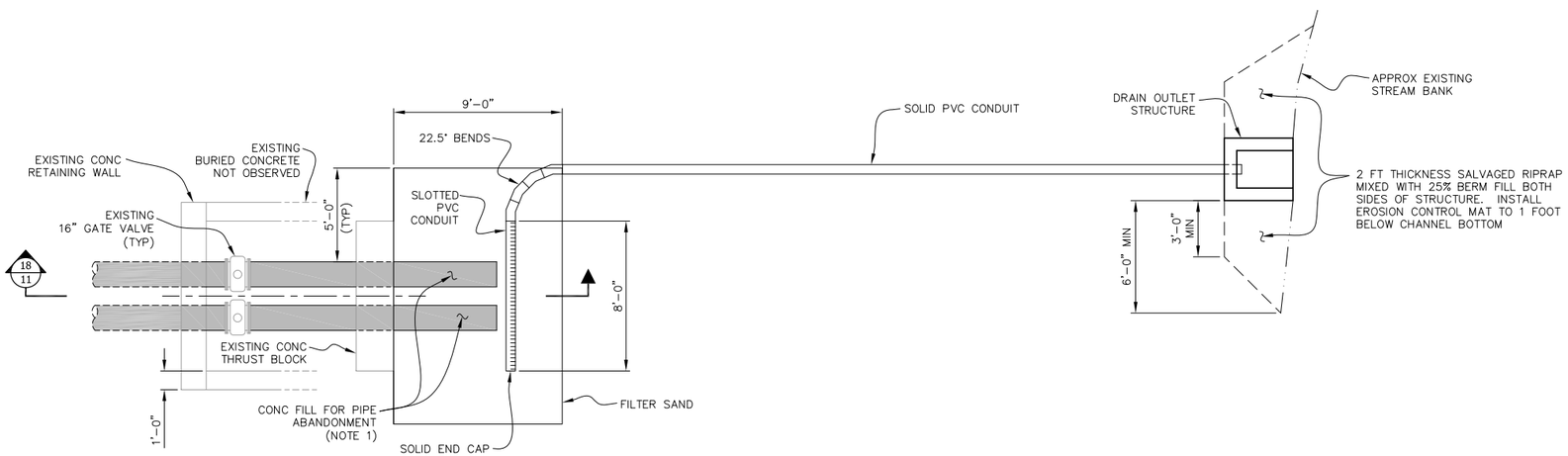
TELLER COUNTY, COLORADO

VALVE HOUSE
RECONSTRUCTION

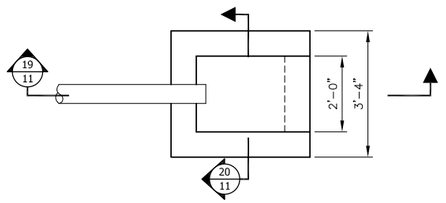
DWG. NO. 10

SHEET NO. 10 of 12

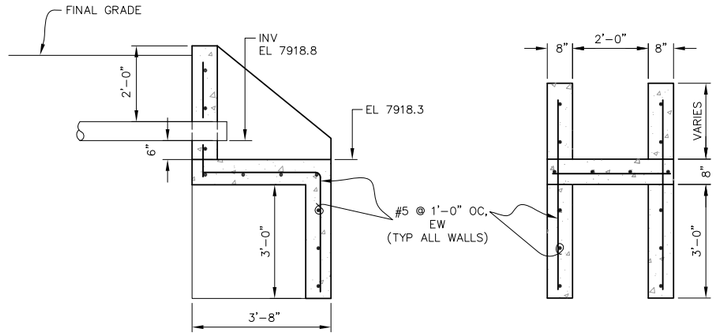
P:\12120 – MT PISGAH OUTLET WORKS\CAD\TASK 1001 – DESIGN\90 PERCENT SUBMITTAL\12120 SHEET 10 VALVE HOUSE RECONSTRUCTION.DWG 4/2/2014 10:18 AM



PLAN
OW MODIFICATIONS

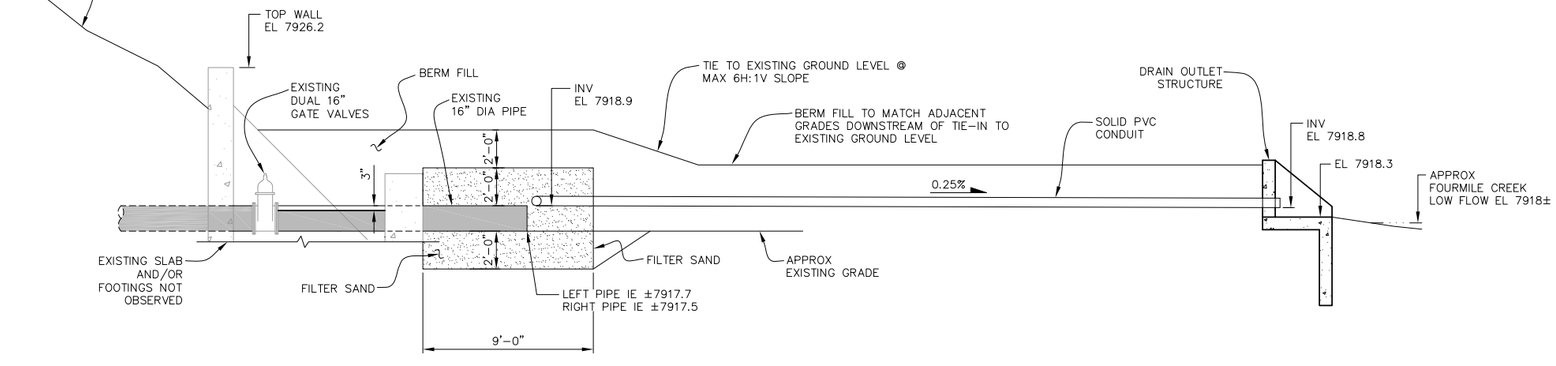


PLAN
DRAIN OUTLET STRUCTURE



SECTION 19 / 11

SECTION 20 / 11



SECTION 18 / 11

NOTES:

1. ABANDON BOTH 16 INCH PIPES WITH CLASS C CONCRETE PER PROJECT SPECIFICATIONS.
2. FIELD VERIFY CREEK LOW FLOW ELEVATION. RELATED DRAIN OUTLET STRUCTURE ELEVATIONS TO BE CONFIRMED IN FIELD BY ENGINEER.

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–	4/14	90–PERCENT DESIGN	GGS	RJA	JDN	MLG

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PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

MT. PISGAH DAM OUTLET WORKS REHABILITATION

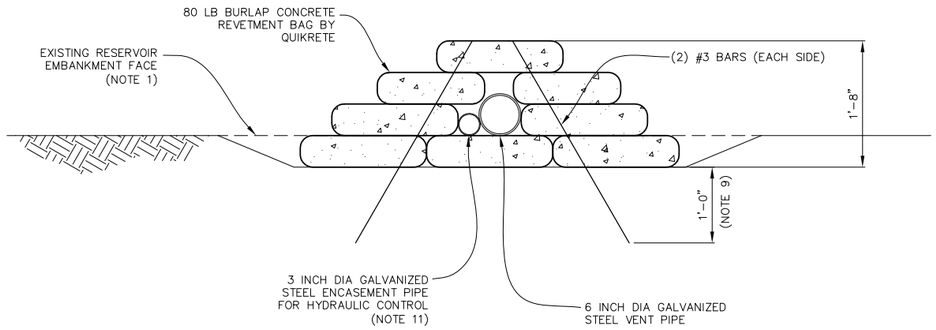
TELLER COUNTY, COLORADO

ABANDONED OUTLET WORKS MODIFICATIONS

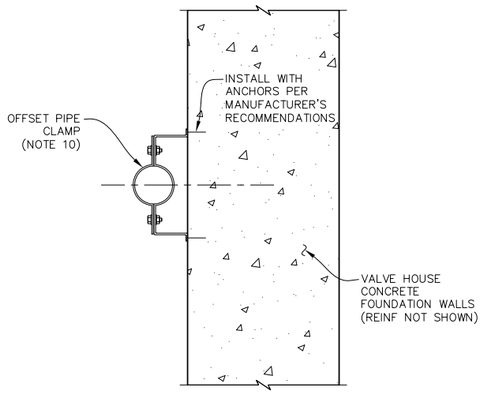
DWG. NO. 11

SHEET NO. 11 of 12

P:\12120 – MT PISGAH OUTLET WORKS\CAD\TASK 1001 – DESIGN\90 PERCENT SUBMITTAL\12120 SHEET 11 ABANDONED OUTLET WORKS MOD.DWG 4/2/2014 10:19 AM



TYPICAL SECTION
CONDUIT ANCHOR SYSTEM
TYPE 1



TYPICAL SECTION
CONDUIT ANCHOR SYSTEM
TYPE 2

NOTES:

1. PIPE SUPPORT DETAIL APPLIES TO SOIL, EXPOSED ROCK OR RIPRAP SURFACES. HAND REMOVE, ADJUST AND REPLACE EXISTING RIPRAP AS NEEDED.
2. CONTRACTOR MAY SUBSTITUTE MANUFACTURED PIPE SUPPORTS SUBJECT TO APPROVAL OF ENGINEER.
3. PROVIDE ONE SUPPORT AT BENDS AND AT 10–FOOT MAXIMUM SPACING OTHERWISE.
4. SINGLE ROW OF BAGS REQUIRED AT EACH PIPE SUPPORT LOCATION.
5. UTILIZE BAGGED CONCRETE PRODUCT MANUFACTURED FOR USE AS REVETMENT. MANUFACTURED BY QUIKRETE OR APPROVED EQUAL.
6. BAGGED CONCRETE MIX TO BE 3 PARTS AGGREGATE TO 1 PART CEMENT.
7. IF BAGS ARE NOT FACTORY PERFORATED, PERFORATE WITH A METAL RAKE OR PITCHFORK BEFORE WETTING.
8. THOROUGHLY SOAK BAGS WITH WATER IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS FOLLOWING INSTALLATION.
9. EMBED REBAR A MINIMUM OF 12–INCHES INTO SOIL SLOPES. EMBED REBAR MINIMUM 4–INCHES OR TO REFUSAL IN BEDROCK AND EPOXY GROUT.
10. INSTALL GALVANIZED STEEL OFFSET PIPE CLAMP FOR VERTICAL CONNECTION OF CONDUITS TO VALVE HOUSE CONCRETE FOUNDATION WALLS. PRODUCT BY ANVIL, FIG. 103 FOR 3–INCH AND 6–INCH DIAMETER CONDUITS.
11. VERIFY GALVANIZED STEEL CARRIER PIPE DIAMETER IS ADEQUATE FOR SELECTED HYDRAULIC TUBING DIAMETER.

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RJH CONSULTANTS, INC.

PISGAH RESERVOIR AND DITCH COMPANY

RJH PROJECT 12120

MT. PISGAH DAM OUTLET WORKS REHABILITATION

TELLER COUNTY, COLORADO

MISCELLANEOUS DETAILS

DWG. NO. 12

SHEET NO. 12 of 12

P:\12120 – MT PISGAH OUTLET WORKS\CAD\TASK 1001 – DESIGN\90 PERCENT SUBMITTAL\12120 SHEET 12 MISCELLANEOUS DETAILS.DWG 4/2/2014 10:20 AM

Pisgah
Balance Sheet Prev Year Comparison
As of September 30, 2014

	Sep 30, 14	Sep 30, 13	% Change
ASSETS			
Current Assets			
Checking/Savings			
1021 Community Bank	44,646.51	95,175.94	-53.1%
1022 Community Pledged	151,752.53	81,404.22	86.4%
Total Checking/Savings	196,399.04	176,580.16	11.2%
Other Current Assets			
3314 Prepaid Insurance	353.67	353.67	0.0%
Total Other Current Assets	353.67	353.67	0.0%
Total Current Assets	196,752.71	176,933.83	11.2%
Fixed Assets			
2410 Land	5,100.00	5,100.00	0.0%
2440 Structures - Dam	360,869.84	360,869.84	0.0%
2449 Dam Depreciation	-138,229.00	-135,497.00	-2.0%
Total Fixed Assets	227,740.84	230,472.84	-1.2%
TOTAL ASSETS	**424,493.55**	**407,406.67**	**4.2%**
LIABILITIES & EQUITY			
Liabilities			
Current Liabilities			
Other Current Liabilities			
4011 Acc'ts. Payable - Trade	12,528.91	12,528.91	0.0%
4014 Income Tax Payable	0.00	2,776.00	-100.0%
4050 CWCB Loan	36,802.57	24,050.96	53.0%
4310 Payroll Liabilities	183.60	348.84	-47.4%
4311 SS	-26.04	-26.04	0.0%
4312 MC	-6.09	-6.09	0.0%
Total Other Current Liabilities	49,482.95	39,672.58	24.7%
Total Current Liabilities	49,482.95	39,672.58	24.7%
Total Liabilities	49,482.95	39,672.58	24.7%
Equity			
5000 Capital Stock	155,614.16	155,614.16	0.0%
5010 Retained Earnings	34,253.44	34,253.44	0.0%
Retained Earnings	177,866.49	122,435.66	45.3%
Net Income	7,276.51	55,430.83	-86.9%
Total Equity	375,010.60	367,734.09	2.0%
TOTAL LIABILITIES & EQUITY	**424,493.55**	**407,406.67**	**4.2%**

Pisgah
Profit & Loss Prev Year Comparison
October 2013 through September 2014

	Oct '13 - Sep 14	Oct '12 - Sep 13	% Change
Ordinary Income/Expense			
Income			
4500 Grant Revenue	12,751.61	24,050.96	-47.0%
6011 Assessment Revenue	75,000.00	75,000.00	0.0%
6040 Transfer Fee	0.00	5.00	-100.0%
Total Income	87,751.61	99,055.96	-11.4%
Gross Profit	87,751.61	99,055.96	-11.4%
Expense			
5300 Depreciation	2,732.00	2,027.00	34.8%
605 Advertising Fee	0.00	-150.00	100.0%
7014 Dam Maintenance	0.00	63.00	-100.0%
7015 CWCB Exp.	0.00	0.00	0.0%
7081 Insurance Regular	4,213.00	4,429.41	-4.9%
7090 Lease Expense	0.00	5,000.00	-100.0%
7101 Legal Fees Regular	33,751.26	22,647.50	49.0%
7104 Accounting Fees	650.00	1,165.00	-44.2%
7106 Engineering Fees	30,154.91	0.00	100.0%
7110 Miscellaneous Expense	0.00	10.00	-100.0%
7121 Postage & Supplies	92.47	596.25	-84.5%
7122 Printing & Copies	400.00	446.49	-10.4%
7130 Power Electricity	163.88	285.97	-42.7%
7140 Meals & Travel	561.38	310.39	80.9%
7175 Caretaker Salary	1,200.00	0.00	100.0%
7180 Payroll Expenses	2,849.78	3,358.68	-15.2%
7181 Taxes FICA	266.18	0.00	100.0%
7184 Taxes - Income	2,276.00	0.00	100.0%
7185 Taxes Other	116.04	2,895.44	-96.0%
MC	-17.40	0.00	-100.0%
Satelite Monitor	1,200.00	600.00	100.0%
SS	-74.40	0.00	-100.0%
USWT	0.00	0.00	0.0%
Total Expense	80,535.10	43,685.13	84.4%
Net Ordinary Income	7,216.51	55,370.83	-87.0%
Other Income/Expense			
Other Income			
8140 Miscellaneous Income	60.00	60.00	0.0%
Total Other Income	60.00	60.00	0.0%
Net Other Income	60.00	60.00	0.0%
Net Income	**7,276.51**	**55,430.83**	**-86.9%**