



INNOVATIVE DESIGN. **CLASSIC RESULTS.**

**FLYING HORSE NORTH  
IRRIGATION RESERVOIR EMBANKMENT  
DESIGN REPORT**

**DAMID: 080459  
Construction File No.: C-2085**

**AUGUST 2018**

Prepared for:  
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Job no. 1096.11  
PCD File No. SF-18-001

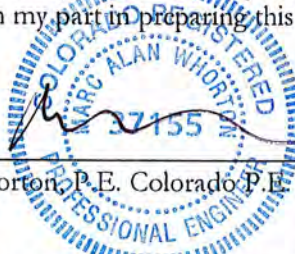


# FLYING HORSE NORTH IRRIGATION RESERVOIR EMBANKMENT DESIGN REPORT

## DRAINAGE REPORT STATEMENT

### ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

  
\_\_\_\_\_  
Marc A. Whorton, P.E. Colorado P.E. #37155

8/20/18

\_\_\_\_\_  
Date

### OWNER/DEVELOPER'S STATEMENT:

I, the owner/developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: PRI #2 LLC

By: 

Title: V. President

Address: 6385 Corporate Drive, Suite 200

Colorado Springs, CO 80919

### EL PASO COUNTY:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

\_\_\_\_\_  
Jennifer Irvine, P.E.  
County Engineer / ECM Administrator

\_\_\_\_\_  
Date

Conditions:



# **FLYING HORSE NORTH IRRIGATION RESERVOIR EMBANKMENT DESIGN REPORT**

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## ACRONYMS AND ABBREVIATIONS

|         |  |
|---------|--|
| BMP     | Best Management Practice                                   |
| CDOT    | Colorado Department of Transportation                      |
| CDPHE   | Colorado Department of Public Health and Environment       |
| CCES    | Classic Consulting Engineers and Surveyors                 |
| EDB     | Extended Detention Basin                                   |
| EURV    | Excess Urban Runoff Volume                                 |
| GIS     | Global Information System                                  |
| HEC-HMS | Hydrologic Engineering Center – Hydrologic Modeling System |
| NGVD    | National Geodetic Vertical Datum                           |
| NOAA    | National Oceanic and Atmospheric Administration            |
| NRCS    | Natural Resources Conservation Service                     |
| PUD     | Planned Unit Development                                   |
| SCS     | Soil Conservation Service                                  |
| SWQ     | Storm Water Quality  |
| USACE   | U.S. Army Corps of Engineers                               |
| USGS    | U.S. Geological Survey                                     |
| WQCV    | Water Quality Capture Volume                               |



## SECTION 1: INTRODUCTION

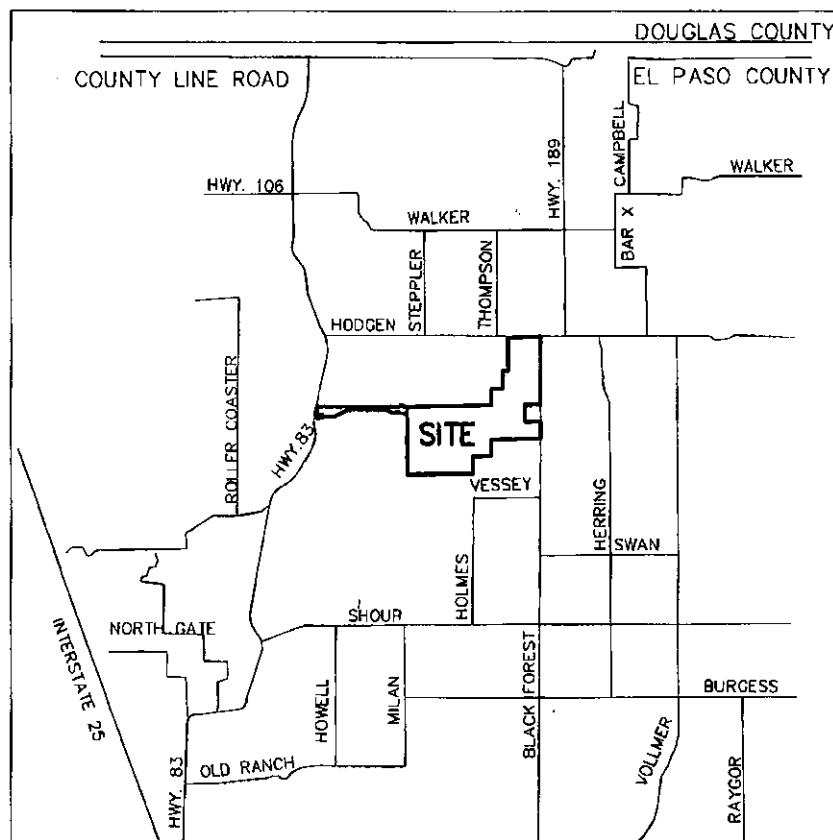
### 1.1 PROJECT BACKGROUND

PRI #2 LLC is the property owner and developer of the Flying Horse North (FHN) development in northern El Paso County, Colorado. The overall site contains 1,418 acres located in all of section 36, township 11 south, range 66 west of the sixth principal meridian, and a portion of sections 30 and 31 township 11 south, range 65 west of the sixth principal meridian. The site is bounded on the north by Hodgen Road and the High Forest Ranch Community, to the south by the Cathedral Pines Subdivision and unplatted county land, to the east by Black Forest Road, and to the west by the State Highway 83 and unplatted county land. **(See Figure 1.1)** A Planned Unit Development (PUD) Plan for this property was approved and recorded by El Paso County in February 2017. The development includes large lot single family residential, open space/park land and a private golf course with club house amenities. **(See Figure 1.2)** A phase 1 Final Plat to include the golf course, clubhouse and 80 residential lots was submitted to El Paso County December 2017. As a part of the private golf course, a lake is planned to serve as a golf course feature, irrigation reservoir for the golf course as well as provide for detention and SWQ. The specific location of this reservoir is within a portion of Section 36, township 11 south, range 66 west of the sixth principal meridian, and a portion of Section 31 township 11 south, range 65 west of the sixth principal meridian. **(See Figure 1.3)** A well, also located in Section 36, is designed to pump directly into the irrigation reservoir with a surface area at normal pool depth of 6.8 acres. A minor jurisdictional dam with low hazard classification will then provide the operational storage for the associated irrigation pump station located adjacent to the reservoir. The pump station is designed to meet the daily peak irrigation demand for the private golf course. The system is planned to be operational in late Summer 2018. Also, per the El Paso County Drainage Criteria Manual and the requirement to provide both stormwater detention and SWQ, this reservoir will also be designed with a separate outlet structure to facilitate the specific release for the various stormwater events.

### 1.2 TOPOGRAPHIC MAPPING

The topographic base mapping was produced from aerial photography provided by North American Mapping in 2009. The horizontal control is based on a local calibration and the vertical control is based on NGVD 1929 datum.





VICINITY MAP

NTS

Figure 1.1



## PLANNED UNIT DEVELOPMENT

\_\_\_\_\_

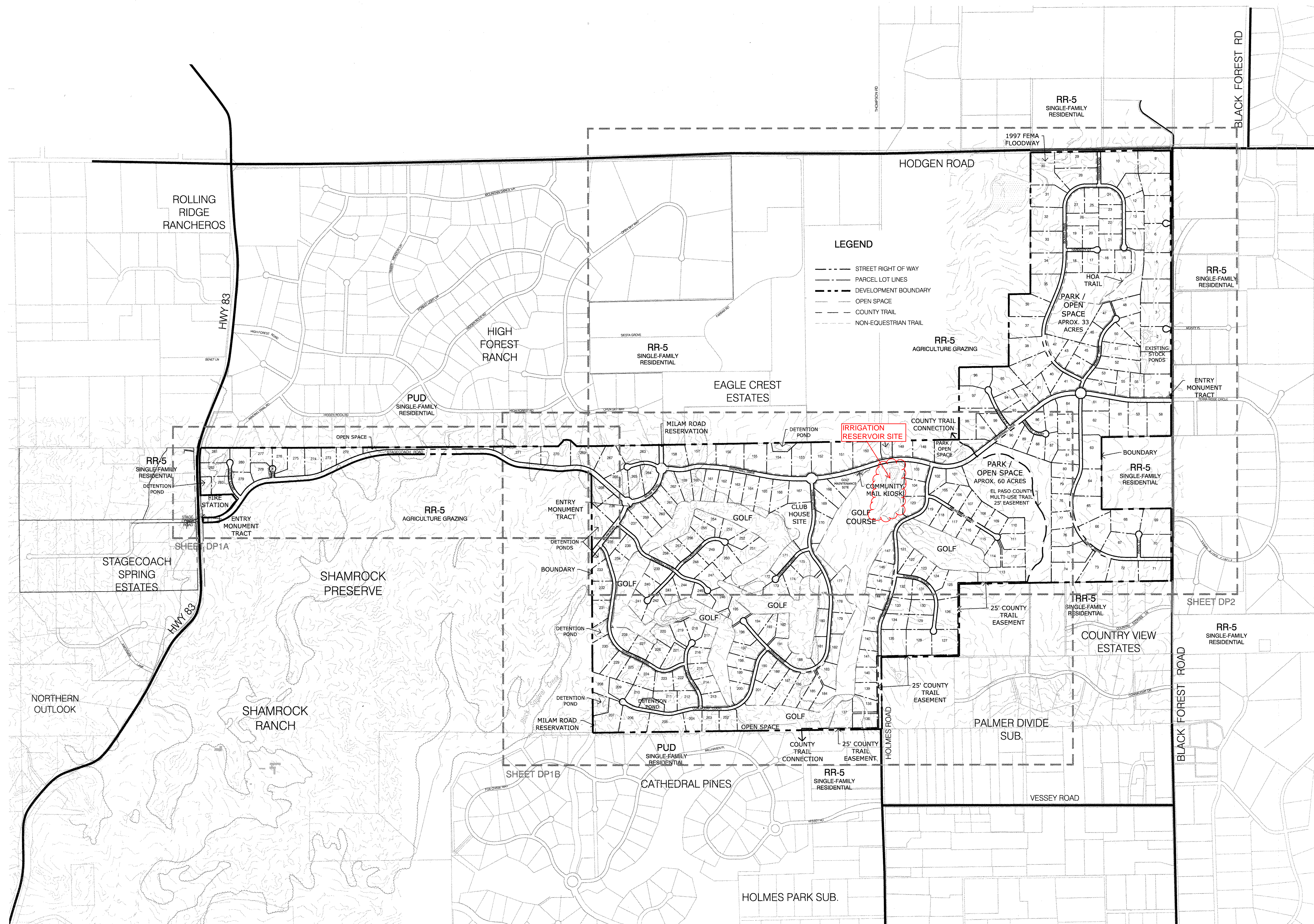
DATE:  
PROJECT MGR:  
PREPARED BY:

04-18-201  
J. MAYNARD  
K. MARSHALL

| DATE:    | BY: | DESCRIPTION:           |
|----------|-----|------------------------|
| 07-25-16 | KMM | Per review comments    |
| 09-07-16 | KMM | Per 2nd review comment |
| 11-28-16 | KMM | Milam Revisions        |

DP

FIGURE 1.2







## **SECTION 2: IRRIGATION WELL**

### **2.1 LOCATION / WELL DRILLING**

The Flying Horse North Well A-1 is located in the NE  $\frac{1}{4}$  of the NE  $\frac{1}{4}$  of Section 36, Township 11 South, Range 66 West of the Principal Meridian. This location is approximately 1,650 LF SW of the Flying Horse North irrigation reservoir embankment and within the Golf Course Clubhouse site. Construction and testing of the well, permit number 81145-F, was completed in November 2017 by Layne-Western and TZA Water Engineers. The well is completed into the Arapahoe Aquifer at a depth of 2,540 feet. The well was drilled using the reverse air method at a diameter of 17.5 inches to total depth.

### **2.2 HYDRAULIC TESTING**

On December 1, 2017, a step test was performed to evaluate the specific capacity of the well over a 24-hr. test period. The well produced an average flow rate of 450 GPM. The static water level was shown at 1,534 feet. (See Appendix A for test report documents)

### **2.3 PUMP DESIGN AND EQUIPMENT**

The well downhole equipment will consist of a submersible pump, pressure transducer and airline piping. A 350 HP 3-phase submersible pump setting at a depth of 1,830 feet will provide the necessary pumping ability to achieve the 450 GPM flow rate. A six inch diameter flow meter will also be provided. The well location is approximately 75 feet higher than the irrigation reservoir permanent WSE. A 6" PVC water line will be installed to convey the pumped well water towards the irrigation reservoir.

### **2.4 WELL HOUSING**

There are currently no plans for a Well House. Any pertinent well facilities will be contained within a vault located adjacent to the well head, along with all above ground electrical facilities installed near the well head.



## SECTION 3: PUMP STATION

### 3.1 LOCATION / IRRIGATION DEMAND

The proposed irrigation pump station will be located directly adjacent to the Flying Horse North reservoir as shown on the conceptual plan in **Figure 1.3**. The pump station pumps stored groundwater from the reservoir to the irrigation system that serves the entire golf course that anticipates using an average of 200 AF per year.

### 3.3 MECHANICAL EQUIPMENT

The pump station will include the following components: intake, wet well, pumping equipment, filters and metering equipment and controls.

#### Lake Intake

The intake for the pump station is located in the Flying Horse North reservoir towards the north end. (See **Figure 1.3**) The 4'x4' intake with 48" stainless steel inlet screens will sit on a 12" thick concrete slab near the base of the lake. A 30" SDR 35 pipe will convey the water from the intake structure to the wet well located beneath the pump station.

#### Wet Well

The pump station wet well consists of a 96" diameter precast concrete structure with a height of 25'. The base elevation equals 7511. The invert of the 30" SDR 35 intake pipe is 1.0' above the wet well base. This connection is made with a KOR-N-SEAL Boot36. In the wet well there are high and low level water probes that turn on and off the lake fill pump and will shut down the station if the water level gets down to elevation 7515.67. The wet well has access through a 24"x26" hatch located in the floor of the pump station.

#### Pumping Equipment / Filtering

The pump station is designed as a Variable Frequency Drive (VFD) station with pumping equipment consisting of three 75 hp. pumps and one 5 hp. sustain pump. The VFD system turns on and off the pumps on a pressure / GPM demand allowing each of the 75 hp. pumps to facilitate 150 – 750 GPM rated for a total performance of 2250 GPM @ 110 psi. The construction will also include a blind flange for a



fourth 75 hp. pump which may be installed in the future for a total rating of 3000 GPM @ 110 psi. The pumps are designed to deliver the required flow for the golf course irrigation system via a flanged 16" mainline from the pump station. Internal to the pump station, two 8" VAF 1500 filters with 300 micron screens will provide filtration of the system to eliminate system blockage.

### **3.4 PUMP HOUSE STRUCTURE**

The pump station will be located adjacent to the reservoir along the western edge and have a FF elevation of 7536. (Three feet above spillway) The footprint of the structure is approximately 30'x20'. The access to this facility will be via a paved driveway directly off of Old Stagecoach Road. The pump station power requirements are 480 V, 60 Hz, 3 PZ, 386 FLA with a 600 AMP disconnect. The power supply will be provided by Mountain View Electric Association (MVEA) via a 3-phase circuit. The underground electric infrastructure serving the entire Flying Horse North development will be designed by MVEA and installed by the property owner/developer. Based on the location of the pump station (directly adjacent to Old Stagecoach Road and the 3-phase loop) and design provided by the MVEA, this facility will have redundant service built into the system as it will be fed from two directions (both east and west buried within Old Stagecoach Road). Thus, the reliability of power is nearly 100% given the buried looped system design. However, in this extreme unlikely event of complete power failure, a generator will be rented to keep the pump station on-line. In the unlikely event of a pump failure simultaneous with the need to drain the reservoir, the 3 pump system will still have the ability to drain the reservoir using the other two pumps.





## **SECTION 4: RESERVOIR AND DAM**

### **4.1 DESIGN CRITERIA**

The proposed dam for the Flying Horse North Irrigation Reservoir was designed in accordance with Rule 5 of the State of Colorado Rules and Regulations for Dam Safety and Dam Construction, dated January 2007.

### **4.2 RESERVOIR**

This watershed will contain development of a private golf course (currently under construction) including an outdoor golf maintenance facility, along with 2.5 ac. rural residential lot development accessed by rural County paved roadways. As such, the irrigation reservoir will also be designed with a separate stormwater detention and SWQ component per El Paso County criteria. This separate structure will be in the form of a concrete outlet box with an orifice plate and 30" RCP outlet allowing the release of the smaller storm events to meet the standards as specified per this criteria and the County's MS4 permit with the State. This SWQ release through the 30" RCP will be constructed outside of the reservoir embankment. The specific location of this reservoir is within a portion of Section 36, township 11 south, range 66 west of the sixth principal meridian, and a portion of Section 31 township 11 south, range 65 west of the sixth principal meridian, El Paso County Colorado. **(See Figure 1.3)**

The reservoir has a surface area at its permanent WSE (Elev. 7531.0) of 7.0 acres with a storage volume of 94.9 acre feet. The maximum depth at this elevation is 21 feet with the lake bed at 7510. The reservoir will have a liner constructed of a flexible membrane. This liner will be laid up to a maximum elevation of 7534. The reservoir is supplied by water from a well located on the Clubhouse site within the development approximately 1/4 mile west of the reservoir. The level in the reservoir is controlled by the two outlet structures. The Detention/SWQ structure will facilitate the State required 72 hr. drain time for the smaller stormwater events and help maintain the permanent water level while the twin box culvert spillway will allow for the County required 100 yr. detention release of the major stormwater events. The total storage capacity table is found in Section 5, Table 5.4.

### **4.3 DAM EMBANKMENT**

The dam embankment for this reservoir will be constructed within the County owned and maintained Old Stagecoach Road (80' ROW - Collector). The subdivision Improvement Agreement (SIA) as required by El



Paso County for this subdivision, will be recorded along with the Final Plat and specify ownership and maintenance responsibilities related to the embankment and associated drainage structures. The crest of the embankment, which will be the finished grade of asphalt for the roadway is at elevation 7539.0 at the lowest point. The regulatory height from the twin box culvert emergency spillway invert to the native channel grade equals 23.0'. The length of the embankment measured from the toe of slopes on each side is approximately 450'. Both the upstream and downstream slopes of the embankment will be constructed at no greater than a 4:1 slope. The roadway will have a typical 2% crown with an asphalt width of 32.0' with El Paso County Type A concrete curb and gutter on both sides and then 6:1 maximum to edge of ROW with a County required clear zone of 14.0'. The twin box culvert emergency spillway structure is outside this clear zone. El Paso County will also require CDOT Type 3 W-Beam guardrail along both sides of the embankment. The embankment itself will be constructed of local material found on-site and tested by the Geotech. According to the State of Colorado Rules and Regulations for Dam Safety and Dam Construction, Rule 4.2.5.4, this facility is considered a “**Small Jurisdictional Dam**” given the jurisdictional height greater than 20 feet but less than 50 feet and a capacity greater than 100 acre-feet.

#### **4.4 SPILLWAY AND OUTLET WORKS**

This facility will be designed with two separate outlet structures. One will facilitate the State/County required detention/SWQ component of the facility while the other will allow for the 100 yr. stormwater event and emergency flow situations. A low level outlet will be built into the pump station design allowing for an emergency drawdown of the reservoir to be with connection to the SWQ outlet piping.

##### **Detention / SWQ Outlet**

Per the County's MS4 permit with the State, this development is required to provide detention and stormwater quality within this reservoir facility. The design for this is being handled by a separate concrete outlet box constructed outside the formal dam embankment. This structure is a 4'x8' concrete box with a steel flow control plate and protective well screen located on the front. The control plate is designed with three rectangular holes to facilitate the State required drain times. The first hole is located at elevation 7531.0 with the top of box at elevation 7533.0. The top of box will be constructed with a grate to allow flows to enter the box as well. A 30" RCP outlet pipe will allow for the release of all the flows entering the box structure. The design of this structure meets all State and County requirements for both EURV and



WQCV. The 30" RCP outlet piping will be routed around the dam embankment and into the rock chute and plunge pool at the base of the emergency spillway.

### **Spillway Outlet**

Given that the embankment for this reservoir will be a County roadway, the conventional emergency spillway channel design at the crest of the embankment was not appropriate. But rather a concrete box culvert spillway design under the roadway to allow for both the major stormwater events and emergency release has been employed. Twin 4'x10' concrete box culverts (CBC) will facilitate the required releases. The crest of the spillway will be constructed at elevation 7533.0 where the release will then travel under the roadway and into a 20' wide rock chute. The rock chute will have a 4:1 slope with 3:1 side slopes and a total drop of 18.0' into a 2.0' deep plunge pool. The following roughness coefficients were used: CBCs 0.013 and Rock Chute 0.035. The rip-rap thickness will be 56" with a gradation specified by the Geotech. (See Design Plans) The spillway CBCs and Rock Chute have been designed to accommodate both the 100 yr. release of 182 cfs with a headwater depth ratio (Hw/D) of 0.54 and the total basin inflow of 609 cfs with a (Hw/D) of 1.31. This design is within the maximum County criteria of (Hw/D) of 1.40. The freeboard design is as follows: 100 Yr. = 4.39' and 500 Yr. = 3.03'. The velocity at inlet of chute = 15.6 fps and velocity at outlet of chute = 6.99 fps, both at normal depth. 1.76' of Freeboard is included in chute design.

### **Low Level Outlet**

This reservoir will not be designed with a formal low level outlet given the nature of the facility and the ability for the pump station to facilitate the draining of the reservoir for embankment inspection or emergency purposes. Thus, directly off of the 16" irrigation main just outside the pump station, a 16"x8" tee with gate valves and a 8" drain line will be installed to allow for the pumped release and draining of the reservoir. This 8" drain line will then connect directly to the 30" RCP storm system via a Type II concrete storm manhole constructed as a part of the release of the Detention/SWQ component as required by El Paso County. This 30" storm system then daylights into the base of the rock chute and plunge pool on the backside of the embankment. The 8" drain line @ 110 psi is expected to release 800-1200 GPM. However, using the maximum pump station capacity of 2,250 GPM while opening system drain valves and irrigation heads, the drain time is as follows: As mentioned earlier, the pumps will allow for release down to an elevation of 7515.67. Based on the permanent WSE of 7531, this equates to a total of approximately 26 million gallons (MG) to be drained. The total drain time is estimated at approximately 8 days.



## 4.6 COST ESTIMATE

The construction costs have been estimated for the dam and reservoir construction for budgetary planning purposes. See Table 4.1 below for the major construction activities:

Table 4.1: Estimated Construction Costs

| Description  | Estimated Cost    |
|--|-------------------|
| Irrigation Pump Station and Intake (Under separate contract) | \$ N/A            |
| Reservoir Lining and installation (Face of Embankment)       | \$ 50,000         |
| Embankment earthwork / Revegetation                          | \$ 85,000         |
| SWQ Outlet box and piping                                    | \$ 50,000         |
| Twin 4'x10' CBC Spillway Outlet and wingwalls                | \$ 180,000        |
| 20' wide rock chute and plunge pool                          | \$ 80,000         |
| Two 6" slotted pipe toe drains / 3' rip-rap swale            | \$ 8,000          |
| 8" Irrigation drain piping / 12" HDPE pipe                   | \$ 4,000          |
| <b>Subtotal</b>  | <b>\$ 457,000</b> |
| Contingency (10%)  | \$ 45,700         |
| Engineering / Construction staking / Materials testing       | \$ 40,000         |
| <b>Total Project Cost</b>                                    | <b>\$ 542,700</b> |

## 4.7 PERMITTING / SCHEDULE

The dam application package will be submitted to The Dam Safety Branch (DSB) for review and comment in January 2018. No dam related construction will take place on-site until a notice to proceed from DSB is received. A separate submittal package will also be provided to El Paso County for review. Owner/developer to provide DSB approval and notice to proceed to El Paso County prior to their final approval of the facility. Construction is anticipated to begin in the late Summer 2018.



## SECTION 5: HYDROLOGY AND HYDRAULICS

### 5.1 DESIGN CRITERIA

The Flying Horse North irrigation reservoir will function as both a water source for the golf course irrigation and a detention/stormwater quality (SWQ) pond for stormwater flows within the basin. As such, CCES has applied hydrology criteria from the following sources:

**“State of Colorado Rules and Regulations for Dam Safety and Dam Construction”,**  
dated January 2007 (Inflow Design Flood – IDF requirements)

**“City of Colorado Springs/El Paso County Drainage Criteria Manual, Vol. 1 & 2”,**  
dated May 2014 (Stormwater detention and SWQ requirements)

**“Urban Drainage and Flood Control District Vol. 1, 2 & 3”,** dated 2017  
(Detention and SWQ design requirements)

**“NOAA Atlas 14 Point Precipitation Frequency Estimate”,** dated October 2017  
(Precipitation Frequency – 24hr duration)

A Bentley Systems PondPack V8i NRCS unit hydrograph model was utilized to estimate the peak discharge for the 2-, 5-, 50- and 100-year, 24-hour duration storms. NOAA Atlas 14 point precipitation frequency estimates were obtained from the NOAA’s National Weather Service Hydro-Meteorological Design Studies Center Precipitation Frequency Data Server (PFDS). This data was taken near the centroid of the basin. (See Appendix B) The NRCS 24-Hour Type II design storm distribution was used within the model.

According to the State of Colorado Rules and Regulations for Dam Safety and Dam Construction, Rule 4.2.5.4, this facility is considered a **“Small Jurisdictional Dam”** given the jurisdictional height greater than 20 feet but less than 50 feet and a capacity greater than 100 acre-feet. Dead storage of approximately 5.67’ (Elev. 7510 – 7515.67) is assumed based on the low-level outlet design facilitated by the pump station intake pipe located at elev. 7511 and suction head of 4.0’ min. required above pipe. Based on the **“Low**



**Hazard Classification**” as described in section 5.6 of this report the Inflow Design Flood Requirements (IDF) as found in Rule 5.9.1, Table 5.1 utilize the (NOAA 14 – 24 Hr. duration) 100 Yr. storm event. The UD-Detention v3.07 spreadsheet (Per Urban Drainage Vol. 3) will also be utilized in the final design of the Detention and SWQ aspects of this facility. This spreadsheet uses 1 Hr. precipitation depths. See Table 5.1 for precipitation depth comparison. Please note that the higher precipitation amounts have been used for each return period.

Table 5.1: Precipitation Depth Comparison

| Return Period | 1-Hr. Depth (City/County) | 1-Hr. Depth (NOAA 14) | 24-Hr. Depth (City/County) | 24-Hr. Depth (NOAA 14) |
|---------------|---------------------------|-----------------------|----------------------------|------------------------|
| 2             | 1.19                      | 0.92                  | 2.10                       | 1.93                   |
| 5             | 1.50                      | 1.20                  | 2.70                       | 2.44                   |
| 50            | 2.25                      | 2.15                  | 4.20                       | <b>4.33</b>            |
| 100           | 2.52                      | 2.49                  | <b>4.60</b>                | <b>5.04</b>            |

## 5.2 WATER RIGHTS

Based on the water decree filed October 6, 2017 (See Appendix), PRI #2, LLC has the water rights to pump and store in the on-site Flying Horse North reservoir. PRI #2, LLC has a lease from the State Land Board for the following water rights: 515 AF in the Dawson, 577 AF in the Denver, 239 AF in the Arapahoe and 182 AF in the Laramie Fox Hills. The Arapahoe and Laramie Fox Hills are both deemed non-tributary reservoirs. The Flying Horse North Golf Course will take an average of 200 AF per year from their Arapahoe well that will be pumped into the reservoir. Evaporative loss is not an issue when pumping from a non-tributary source. Upon termination of the State Land Board Lease in 2048, all water rights revert automatically back to PRI #2, LLC who will own them in perpetuity.

### 5.3 WATERSHED CHARACTERISTICS

The watershed of the irrigation reservoir includes a total area of 366.8 acres within the East Cherry Creek drainage basin and just north of the Palmer Divide. A portion of this area is outside the Flying Horse North development as shown in basins OS-12, OS-13 and OS-14. These basins are both currently undeveloped and developed as County zoned RR-5 (5 ac. rural residential). All the on-site basins are zoned PUD for either 2.5 ac. rural residential or golf course/open space. (See Tables 5.2 and 5.3 for sub-basin CN values and associated Tc times) Nearly the entire watershed is outside of the black forest tree line and mainly consists of prairie grasses with grades ranging from 2%-20% with three major natural ravines that drain in a northwesterly direction directly towards the planned irrigation reservoir. The golf course layout aides in the natural conveyance of the majority of the stormwater flows to the reservoir. The storage capacity table for the reservoir is listed in Table 5.4.

**Table 5.2: Sub-basin CN Values**

| ALL LAND ASSUMED 2 ACRE RESIDENTIAL LOTS OR<br>GOOD CONDITION OPEN SPACE (LAWNS, PARKS GOLF COURSES, CEMETARIES ETC.) |                                |                        |                       |                              |                       |                                    |
|---|--------------------------------|------------------------|-----------------------|------------------------------|-----------------------|------------------------------------|
| <b>C<sub>N</sub> VALUES - DEVELOPED CONDITIONS</b>  |                                |                        |                       |                              |                       |                                    |
| <b>BASIN<br/>(label)</b>  | <b>BASIN<br/>AREA<br/>(Ac)</b> | <b>GOLF COURSE (B)</b> |                       | <b>2 AC. RESIDENTIAL (B)</b> |                       | <b>COMPOSITE<br/>C<sub>N</sub></b> |
|   |                                | <b>CN</b>              | <b>AREA<br/>(Ac.)</b> | <b>CN</b>                    | <b>AREA<br/>(Ac.)</b> |                                    |
| CC-1  | 22.3                           | 61                     | 0.0                   | 65                           | 22.3                  | <b>65.0</b>                        |
| CC-2  | 36.4                           | 61                     | 0.0                   | 65                           | 36.4                  | <b>65.0</b>                        |
| CC-3  | 51.9                           | 61                     | 19.1                  | 65                           | 32.8                  | <b>63.5</b>                        |
| CC-4A   | 108.2                          | 61                     | 63.2                  | 65                           | 45.0                  | <b>62.7</b>                        |
| CC-4B   | 17.0                           | 61                     | 5.5                   | 65                           | 11.5                  | <b>63.7</b>                        |
| OS-12   | 67.7                           | 61                     | 0.0                   | 65                           | 67.7                  | <b>65.0</b>                        |
| OS-13   | 36.9                           | 61                     | 0.0                   | 65                           | 36.9                  | <b>65.0</b>                        |
| OS-14   | 26.4                           | 61                     | 0.0                   | 65                           | 26.4                  | <b>65.0</b>                        |



**Table 5.3: Sub-basin Time of Concentration**

| TIME OF CONCENTRATION DEVELOPED |                 |                |                            |            |   |              |                   |            |                     |                           |
|---------------------------------|-----------------|----------------|----------------------------|------------|---|--------------|-------------------|------------|---------------------|---------------------------|
| BASIN                           | COMPOSITE<br>Cn | Length<br>(ft) | OVERLAND<br>Height<br>(ft) | Tc<br>(hr) | STREET / CHANNEL FLOW(DCM Vol. 1 Fig. 6-25) |              |                   | Tc<br>(hr) | Tc<br>TOTAL<br>(hr) | Tc<br>LAG (0.6tc)<br>(hr) |
|                                 |                 |                |                            |            | Length<br>(ft)                              | Slope<br>(%) | Velocity<br>(fps) |            |                     |                           |
| CC-1                            | 65.0            | 300            | 10                         | 0.40       | 900   | 2.0%         | 1.8               | 0.14       | 0.53                | 0.32                      |
| CC-2                            | 65.0            | 300            | 10                         | 0.40       | 1700  | 2.0%         | 1.8               | 0.26       | 0.66                | 0.39                      |
| CC-3                            | 63.5            | 300            | 14                         | 0.35       | 900   | 2.5%         | 2.4               | 0.10       | 0.45                | 0.27                      |
| CC-4A                           | 62.7            | 300            | 14                         | 0.35       | 2900  | 2.0%         | 2.1               | 0.38       | 0.73                | 0.44                      |
| CC-4B                           | 63.7            | 300            | 12                         | 0.37       | 900   | 3.0%         | 2.5               | 0.10       | 0.47                | 0.28                      |
|                                 |                 |                |                            |            |   |              |                   |            |                     |                           |
| OS-12                           | 65.0            | 300            | 14                         | 0.35       | 1500  | 3.0%         | 2.5               | 0.17       | 0.51                | 0.31                      |
| OS-13                           | 65.0            | 300            | 16                         | 0.33       | 900   | 3.0%         | 2.5               | 0.10       | 0.43                | 0.26                      |
| OS-14                           | 65.0            | 300            | 14                         | 0.35       | 600   | 3.5%         | 2.7               | 0.06       | 0.41                | 0.24                      |

**Table 5.4: Storage Capacity Table**

| Elevation<br>NGVD 1929 | Area<br>(Acres) | Storage Volume<br>(Ac. Ft.) |
|------------------------|-----------------|-----------------------------|
| *7510.0                | 1.51            | 0.00                        |
| *7511.0                | 1.99            | 1.74                        |
| *7512.0                | 2.52            | 3.99                        |
| *7513.0                | 2.85            | 6.68                        |
| *7514.0                | 3.05            | 9.63                        |
| *7515.0                | 3.26            | 12.78                       |
| 7516.0                 | 3.48            | 16.15                       |
| 7517.0                 | 3.70            | 19.74                       |
| 7518.0                 | 3.93            | 23.56                       |
| 7519.0                 | 4.16            | 27.60                       |
| 7520.0                 | 4.40            | 31.88                       |
| 7521.0                 | 4.64            | 36.40                       |
| 7522.0                 | 4.88            | 41.16                       |

|        |      |        |
|--------|------|--------|
| 7523.0 | 5.14 | 46.17  |
| 7524.0 | 5.36 | 51.42  |
| 7525.0 | 5.59 | 56.89  |
| 7526.0 | 5.84 | 62.61  |
| 7527.0 | 6.08 | 68.57  |
| 7528.0 | 6.33 | 74.77  |
| 7529.0 | 6.57 | 81.22  |
| 7530.0 | 6.81 | 87.91  |
| 7531.0 | 7.15 | 94.89  |
| 7532.0 | 7.52 | 102.22 |
| 7533.0 | 7.83 | 109.90 |
| 7534.0 | 8.37 | 118.00 |
| 7535.0 | 8.77 | 126.57 |
| 7536.0 | 9.17 | 135.53 |

\*Indicates dead storage below pumping ability

#### 5.4 HYDROLOGIC MODEL

The PondPack model produced peak discharges for the 2-yr, 5-yr, 50-yr and 100-yr storm events assuming a permanent pool elevation of 7531.0. Reference Appendix B for specific hydrologic model results. Table 5.5 below shows the results of these storm events upon the irrigation reservoir.

**Table 5.5: Inflow Design Flood (IDF) Summary Table**

| <b>Storm Event</b> | <b>Peak Inflow<br/>(cfs)</b> | <b>Max. WSE<br/>(ft.)</b> | <b>Total<br/>Discharge<br/>(cfs)</b> |
|--------------------|------------------------------|---------------------------|--------------------------------------|
| 2-yr (City/County) | 48                           | 7531.40                   | 6                                    |
| 5-yr (City/County) | 119                          | 7531.87                   | 12                                   |
| 50-yr (NOAA 14)    | 431                          | 7533.58                   | 64                                   |
| 100-yr (NOAA 14)   | 609                          | 7534.23                   | 124                                  |



## 5.5 HYDRAULIC MODEL

Both the SWQ Outlet and the CBC Spillway were modeled using both PondPack (24-hr. precipitation) and the Urban Drainage UD Detention Spreadsheet (1-hr precipitation) as required by County design criteria. Table 5.6 below shows the results of the PondPack model. Reference Appendix B for the UD Detention – Retention Pond Spreadsheet results. As this facility is required to meet both detention and SWQ criteria, the following is applicable to these design components:

|                    |              |                   |              |
|--------------------|--------------|-------------------|--------------|
| Required WQCV =    | 1.36 ac-ft.  | Provided WQCV =   | 15.01 ac-ft. |
| Required EURV =    | 2.83 ac-ft.  | Provided EURV =   | 15.01 ac-ft. |
| Required 100-yr. = | 12.42 ac-ft. | Provided 100-yr = | 27.35 ac-ft. |

**Table 5.6: Reservoir Discharge Table**

| <b>Elevation</b> | <b>Discharge (cfs)<br/>(SWQ Outlet Box)</b> | <b>Discharge (cfs)<br/>(Twin CBC Spillway)</b> | <b>Discharge (cfs)<br/>(Total)</b> |
|------------------|---|--|------------------------------------|
| 7531.0           | 0.0   | 0.0  | 0.0                                |
| 7532.0           | 13.89                                       | 0.0  | 13.89                              |
| 7533.0           | 27.77                                       | 0.0  | 27.77                              |
| 7534.0           | 51.31                                       | 49.05  | 100.36                             |
| 7535.0           | 69.52                                       | 138.56   | 208.08                             |
| 7536.0           | 74.61                                       | 254.72   | 329.33                             |

Permanent WSE = 7531.0

Top of SWQ Outlet box = 7533.0

Spillway elevation = 7533.0

The twin 4'x10' CBC Spillway design has the following results:

|  |             |
|--|-------------|
| 100-yr storm release = 182 cfs               | Hw/D = 0.54 |
| Emergency release – Max. basin IDF = 609 cfs | Hw/D = 1.31 |
| County Criteria (max.)                       | Hw/D = 1.40 |



## 5.6 HAZARD CLASSIFICATION

As discussed earlier based on the State of Colorado Rules and Regulations for Dam Safety and Dam Construction, dated January 2007, defined by Rules 4.2.5.4, this proposed irrigation reservoir is considered a “Small Jurisdictional Dam”. This facility will be lined and has also been designed based on County criteria for detention and SWQ that also meets the 100-yr event. The location of the facility is in a rural environment with downstream characteristics being a single property ownership (362 acres) within El Paso County, zoned RR-5 with a single family home and multiple out-buildings. Based on topography, the home seems to be well outside of the possible floodway with no loss of human life expected. Thus, based on the rural nature, location and size of this proposed irrigation reservoir, it is considered a “Low Hazard Dam” as described in the State of Colorado Rules and Regulations for Dam Safety and Dam Construction, dated January 2007, defined by Rule 4.2.14.3. However, attached are the Dam Breach Estimations found in Figures 1.4 & 1.5.

In regards to the future development potential on the large property located due north of Flying Horse North: If development is indeed proposed on this property, PRI#2 LLC intends to coordinate with both the County Staff and the property owner in providing the dam breach floodplain to allow for responsible planning through this corridor.



**ESTIMATION OF DAM BREACH PARAMETERS  
USING THE FROEHLICH 2008 METHOD**

**PROJECT:** Flying Horse North Dam, DAMID: 080459

**BREACH INPUT PARAMETERS:**

Select Failure Mode From Drop-Down Menu: **OVERTOPPING**

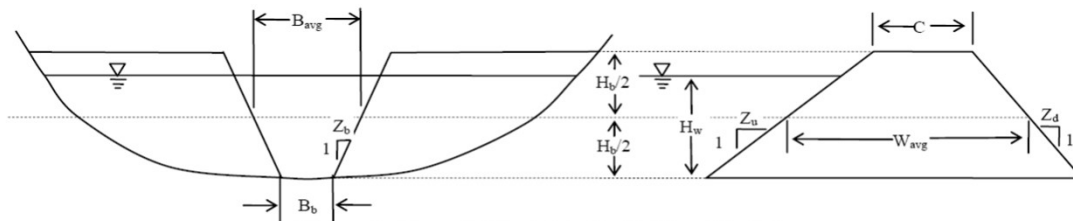
|   |       |   |
|---|-------|---|
| Height of water over base elevation of breach ( $H_w$ ) =           | 23.0  | Feet                                      |
| Volume of water in the reservoir at the time of failure ( $V_w$ ) = | 109.9 | Acre-Feet                                 |
| Reservoir Surface Area at $H_w$ ( $A_s$ ) =                         | 7.8   | Acres                                     |
| Height of breach ( $H_b$ ) =  | 29.0  | Feet                                      |
| Failure Mode Factor ( $K_o$ ) =                                     | 1.3   |   |
| Breach Side-Slope Ratio ( $Z_b$ ) =                                 | 1     | Z(H):1(V)                                 |
| Dam Size Class:   | Small | Assumes Full Reservoir At Time of Breach. |

**CALCULATED BREACH CHARACTERISTICS:**

|  |      |                       |
|--|------|-----------------------|
| Average Breach Width ( $B_{avg}$ ) =     | 55.1 | Feet                  |
| Bottom Width of Breach ( $B_b$ ) =       | 26.1 | Feet                  |
| Breach Formation Time ( $T_f$ ) =        | 0.23 | Hours                 |
| Storage Intensity (SI) =                 | 4.8  | Acre Feet/Foot        |
| SMPDBK Peak Breach Discharge ( $Q_p$ ) = | 7868 | Cubic Feet per Second |

**RESULTS CHECK:**

|  |       |  |
|--|-------|--|
| Average Breach Width Divided by Height of Breach ( $B_{avg}/H_b$ ) =       | 1.90  | If ( $B_{avg}/H_b$ ) > 0.6, Full Breach Development is Anticipated |
| Erosion Rate (ER), Calculated as ( $B_{avg}/T_f$ ) =                       | 236.2 |  |
| Erosion Rate Divided by Height of Water Over Base of Breach ( $ER/H_w$ ) = | 10.3  | If $1.6 < (ER/H_w) < 21$ , Erosion Rate is Assumed Reasonable      |



**Figure 1- Breach Variable Definition Sketch**

**FIGURE 1.4**

**ESTIMATION OF DAM BREACH PARAMETERS  
USING THE FROEHLICH 2008 METHOD**

**PROJECT:** Flying Horse North Dam, DAMID: 080459

**BREACH INPUT PARAMETERS:**

Select Failure Mode From Drop-Down Menu: **PIPING**

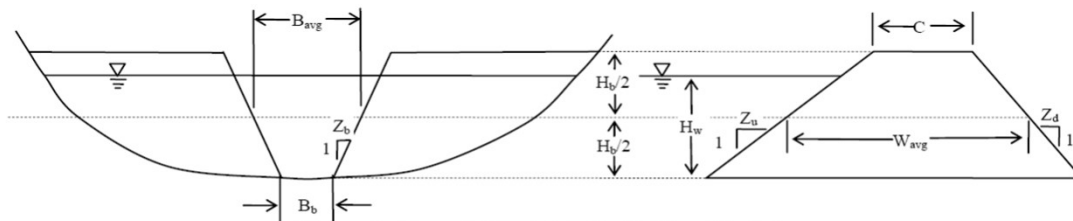
|   |       |   |
|---|-------|---|
| Height of water over base elevation of breach ( $H_w$ ) =           | 23.0  | Feet                                      |
| Volume of water in the reservoir at the time of failure ( $V_w$ ) = | 109.9 | Acre-Feet                                 |
| Reservoir Surface Area at $H_w$ ( $A_s$ ) =                         | 7.8   | Acres                                     |
| Height of breach ( $H_b$ ) =  | 29.0  | Feet                                      |
| Failure Mode Factor ( $K_o$ ) =                                     | 1     |   |
| Breach Side-Slope Ratio ( $Z_b$ ) =                                 | 0.7   | Z(H):1(V)                                 |
| Dam Size Class:   | Small | Assumes Full Reservoir At Time of Breach. |

**CALCULATED BREACH CHARACTERISTICS:**

|  |      |                       |
|--|------|-----------------------|
| Average Breach Width ( $B_{avg}$ ) =     | 42.4 | Feet                  |
| Bottom Width of Breach ( $B_b$ ) =       | 22.1 | Feet                  |
| Breach Formation Time ( $T_f$ ) =        | 0.23 | Hours                 |
| Storage Intensity (SI) =                 | 4.8  | Acre Feet/Foot        |
| SMPDBK Peak Breach Discharge ( $Q_p$ ) = | 7248 | Cubic Feet per Second |

**RESULTS CHECK:**

|  |       |  |
|--|-------|--|
| Average Breach Width Divided by Height of Breach ( $B_{avg}/H_b$ ) =       | 1.46  | If ( $B_{avg}/H_b$ ) > 0.6, Full Breach Development is Anticipated |
| Erosion Rate (ER), Calculated as ( $B_{avg}/T_f$ ) =                       | 181.7 |  |
| Erosion Rate Divided by Height of Water Over Base of Breach ( $ER/H_w$ ) = | 7.9   | If $1.6 < (ER/H_w) < 21$ , Erosion Rate is Assumed Reasonable      |



**Figure 1- Breach Variable Definition Sketch**

**FIGURE 1.5**

## **SECTION 6: GEOLOGICAL INVESTIGATION**

### **6.1 FIELD INVESTIGATIONS**

Subsurface conditions within the dam footprint and soil borrow areas were explored by drilling thirteen test borings. The locations of the soil borings were determined based on access points on the property. Six test borings were drilled in the proposed dam footprint, two test borings were drilled in the proposed west borrow area, and five test borings were drilled in the proposed east borrow area to obtain soils information for use within the new dam embankment. The borings were typically advanced to depths of approximately 10 to 40 feet below ground surface (bgs) with one tested area, Test Boring No. 13, that was excavated with a small backhoe by an onsite contractor, prepared to 3 feet (bgs) in the proposed east borrow area. The soils in all but Test Boring No. 13 were obtained using a truck mounted, drilling rig with continuous flight auger supplied and operated by Entech.

Representative soil samples were recovered from each of the borings at approximate 5-foot intervals using 2-inch O.D. split barrel and California samplers and following Standard Penetration Test (ASTM D-1586) procedures. The locations and soil descriptions of the soils field investigation are presented in the appendices of the Subsurface Soil Investigation which is included in this report, Appendix C.

### **6.2 TEST BORINGS / LABORATORY TESTING**

Boring logs describing the subsurface conditions encountered in each of the borings and excavated area are included in the above-referenced Subsurface Soil Investigation. Laboratory classification testing was completed on selected soil samples recovered from the borings and soil borrow area for purposes of determining water content, evaluating engineering properties, classification and for grouping the materials by soil type. The water content testing results and soil types (by number) are included on the boring logs with respect to the sample depth measured from the existing ground surface. In addition to the classification testing sulfate, pH, resistivity, permeability, and direct shear testing was completed. A summary of the laboratory testing and the Unified Soil Classification System (USCS) designations for each of the soils encountered in the borings and the soil borrow areas are included in the appendices of the geotechnical report included in Appendix C.





### 6.3 RECOMMENDATIONS FOR CONSTRUCTION

The test borings were located to provide general geotechnical information and subsurface profiles at the new embankment location and soil borrow areas. Variations in subsurface conditions may be encountered across the site. Pockets of low soil densities determined from the standard penetration testing conducted during drilling indicated isolated zones within the surficial native soil exist in the existing drainageway. The loose zones were encountered in Test Boring Nos. 2 and 3. Surficial clays and silts with low bearing capacities were encountered in Test Boring Nos. 2, 4, and 6 were also encountered in the existing drainageway within the location of the proposed dam embankment. During excavations for the dam foundation, the loose and potentially low bearing soils will be excavated to the underlying medium dense to dense soil strata below. It is likely the granular soils removed from the foundation areas will be reused in the embankment foundation or reused in the new dam embankment. Spoils removed will likely be used elsewhere on the golf course property in softscape areas.

Additional soils drilling and testing is recommended after the dam foundation is exposed to verify the condition of the underlying geology for support and construction of the dam foundation and outlet structures. Based on our Sulfate, pH, and Resistivity Testing conducted on the soils proposed to construct the new dam, the soils exhibit a negligible potential for attack on concrete structures and Type II concrete is recommended. The soils are slightly to moderately acidic and corrosive to highly corrosive; therefore, all steel materials in contact with the new dam embankment soils should be cathodically protected.

The property in the vicinity of the new dam would provide a close staging area for construction equipment and storage of usable soils removed from the dam. The east borrow area was determined to provide an ample and close soil source for the dam embankment. Laboratory testing performed on the soils located at the east borrow area determined the soil suitable for the construction of a new earthen embankment. Initial slope stability analysis' indicates the embankment stability with elevated groundwater seepage through the embankment would meet acceptable factors of safety based on the soils tested for this investigation. Notably, it is likely that the groundwater within the embankment will never reach this elevated state with the proposed manmade pond liner and active toe drains proposed with this project. Additional dam testing is recommended prior to and during construction of the new earthen embankment. It is likely that a toe drain

will be required consisting of manmade and earthen materials during construction of the new dam embankment.

After the dam embankment foundation soils are exposed, potentially mitigated, and approved by the Dam Safety Branch and Geotechnical Engineers, the new embankment shall be constructed and periodically observed and tested. The foundation granular materials (site sands) as approved by the geotechnical engineer shall be compacted to a minimum of 100% of its maximum Standard Proctor Dry Density, ASTM D-698 at 0 to +3 percent of optimum moisture content. The embankment shell materials (site sands and very sandy clays) as approved by the geotechnical engineer shall be compacted to a minimum of 98% of its maximum Standard Proctor Dry Density, ASTM D-698 at 0 to +3 percent of optimum moisture content. The filter materials shall be tamped and observed by a construction materials testing agency prior to covering the filters with embankment materials to verify thicknesses and compaction efforts. The soils testing requirements and frequencies of testing will be noted on the construction drawings and technical specifications.

PREPARED BY:

**Classic Consulting Engineers & Surveyors, LLC**



Marc A. Whorton, P.E.  
Project Manager

maw/109611/PHN JD Design Report revised.doc



## REFERENCES

1. State of Colorado Rules and Regulations for Dam Safety and Dam Construction, January 2007
2. State of Colorado Hydrologic Basin Response Parameter Estimation Guidelines, May 2008
3. City of Colorado Springs/County of El Paso Drainage Criteria Manual Volumes I and II, dated May 2014.
4. “Black Squirrel Creek Drainage Basin Planning Study,” URS Corporation, dated August 1987.
5. “Flying Horse North Master Development Drainage Plan MDDP” Classic Consulting Engineers and Surveyors, dated October 2016.
6. “Urban Storm Drainage Criteria Manual Volume 1, 2 & 3” Urban Drainage and Flood Control District, dated January 2016.



**APPENDIX A**  
**WELL CONSTRUCTION AND TEST REPORT**

COLORADO DIVISION OF WATER RESOURCES  
DEPARTMENT OF NATURAL RESOURCES  
1313 SHERMAN ST, RM 821, DENVER, CO 80203  
Main: (303) 868-3581 dwrpermitsonline@state.co.us

Office Use Only

Form GWS-45 (07/2013)

## GENERAL PURPOSE

### Water Well Permit Application

Review instructions on reverse side prior to completing form.  
The form must be computer generated, typed or in black or blue ink.

#### 1. Applicant Information

Name of applicant

PRI#2

Mailing address

6385 Corporate Drive

City

Colorado Springs

State

C

Zip code

80919

Telephone # (area code & number)

E-mail (online filing required)

#### 6. Use Of Well (check applicable boxes)

Attach a detailed description of uses applied for:

☒ Industrial

☐ Dewatering System

☐ Municipal

☐ Geothermal (production or reinjection)

☐ Irrigation

☐ Other (describe): See 04-CW-098

☐ Commercial

#### 7. Well Data (proposed)

Maximum pumping rate

500

gpm

Annual amount to be withdrawn

239

acre-feet

Total depth

2400

feet

Aquifer

Arapahoe

#### 8. Land On Which Ground Water Will Be Used

Legal Description of Land (may be provided as an attachment):

Section 36, T 11 South, R 66 West

(If used for crop irrigation, attach a scaled map that shows irrigated area.)

A. # Acres

640

B. Owner

Applicant

C. List any other wells or water rights used on this land:

#### 9. Proposed Well Driller License #(optional):

#### 10. Sign or Entered Name Of Applicant(s) Or Authorized Agent

The making of false statements herein constitutes perjury in the second degree, which is punishable as a class 1 misdemeanor pursuant to C.R.S. 24-4-104 (13)(a). I have read the statements herein, know the contents thereof and state that they are true to my knowledge.

Sign or enter name(s) of person(s) submitting application

Date (mm/dd/yyyy)

TBD

If signing print name and title:

#### Office Use Only

USGS map name

DWR map no.

Surface elev.

Receipt area only

AQUAMAP

WE

WR

GWCB

TOPO

MYLAR

SB5

DIV \_\_\_\_ WD \_\_\_\_ BA \_\_\_\_ MD \_\_\_\_

#### 2. Type Of Application (check applicable boxes)

☒ Construct new well

☐ Use existing well

☐ Replace existing well

☐ Change or increase use

☐ Change source (aquifer)

☐ Reapplication (expired permit)

☐ COGCC Well

☐ Other:

#### 3. Refer To (if applicable)

Well permit #

Water Court case #

04-CW-098

Designated Basin Determination #

Well name or #

Flying Horse North A-1

#### 4. Location Of Proposed Well

County

El Paso

NE

1/4 of the

NE

1/4

Section

36

Township

11

N or S

☒ N

☒ S

Range

66

E or W

☒ E

☒ W

Principal Meridian

6th

Distance of well from section lines (section lines are typically not property lines)

1130

Feet from ☒ N ☐ S 1296

Feet from ☒ E ☐ W

For replacement wells only--distance and direction from old well to new well

feet

direction

Well location address (include City, State, Zip)

☐ Check if well address is same as in Item 1.

Optional: GPS well location information in UTM format. You must check GPS unit for required settings as follows:

Format must be UTM

☐ Zone 12 or ☒ Zone 13

Units must be Meters

Datum must be NAD83

Unit must be set to true north

Was GPS unit checked for above? ☐ YES

Easting

Northing

Remember to set Datum to NAD83

#### 5. Parcel On Which Well Will Be Located

(PLEASE ATTACH A CURRENT DEED FOR THE SUBJECT PARCEL)

A. Legal Description (may be provided as an attachment):

See legal description attached to 04-CW-098

B. # of acres in parcel

640

C. Owner

Applicant

D. Will this be the only well on this parcel? ☐ YES ☒ NO (If no list other wells)

Other wells may be applied for at a later date

E. State Parcel ID# (optional):





**ORIGINAL PERMIT APPLICANT(S)**

PRI#2

**APPROVED WELL LOCATION**

Water Division: 1      Water District: 8  
Designated Basin: N/A  
Management District: N/A  
County: EL PASO  
Parcel Name: N/A

NE 1/4 NE 1/4 Section 36 Township 11.0 S Range 66.0 W Sixth P.M.

**UTM COORDINATES (Meters, Zone:13, NAD83)**

Easting: 523876.9      Northing: 4322742.4

**PERMIT TO CONSTRUCT A NEW WELL**

**ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT**  
**CONDITIONS OF APPROVAL**

- 1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of this permit does not ensure that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.
- 2) The construction of this well shall be in compliance with the Water Well Construction Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 18.
- 3) Approved pursuant to CRS 37-90-137(4) and the decree granted in case no. 2004CW098 Division 2 Water Court. The operation of this well is subject to the terms and conditions of said decree.
- 4) The use of ground water from this well is limited to municipal, industrial, domestic, commercial, irrigation, stock watering, recreational, fish and wildlife, fire protection, and augmentation purposes.
- 5) The pumping rate of this well shall not exceed 500 GPM (as requested).
- 6) The allowed average annual amount of ground water to be withdrawn is 239 acre-feet.
- 7) Production is limited to the Arapahoe aquifer which is located 1,995 feet below land surface and extends to a depth of 2,495 feet. Plain casing must be installed and grouted to prevent the withdrawal of ground water from other aquifers and the movement of ground water between aquifers.
- 8) The entire length of the hole shall be geophysically logged as required by Rule 9 of the Statewide Nontributary Ground Water Rules prior to installing casing.
- 9) The owner shall mark the well in a conspicuous place with well permit number(s), name of the aquifer, and court case number (s) as appropriate. The owner shall take necessary means and precautions to preserve these markings.
- 10) A totalizing flow meter must be installed on this well and maintained in good working order. Permanent records of all diversions must be maintained by the well owner (recorded at least annually) and submitted to the Division Engineer upon request.
- 11) This well shall be constructed more than 600 feet from any existing well, completed in the same aquifer, that is not owned by the applicant.
- 12) This well shall be constructed not more than 200 feet from the location specified on this permit.
- 13) Pursuant to CRS 37-90-137(9)(b) and the Denver Basin Rules, no more than 98% of the nontributary ground water withdrawn annually shall be consumed and the well owner shall demonstrate to the reasonable satisfaction of the State Engineer that no more than 98% of the water withdrawn will be consumed.
- 14) This well is subject to administration by the Division Engineer in accordance with applicable decrees, statutes, rules, and regulations.

NOTE: The ability of this well to withdraw its authorized amount of water from this non-renewable aquifer may be less than the 100 years upon which the amount of water in the aquifer is allocated, due to anticipated water level declines.

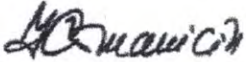
NOTE: To ensure a maximum productive life of this well, perforated casing should be set through the entire producing interval of the approved zone or aquifer indicated above.

WELL PERMIT NUMBER 81145-F

RECEIPT NUMBER 3680462

NOTE: This permit will expire on the expiration date unless the well is constructed and a pump is installed by that date. A Well Construction and Yield Estimate Report (GWS-31) and Pump Installation and Production Equipment Test Report (GWS-32) must be submitted to the Division of Water Resources to verify the well has been constructed and the pump has been installed. A one-time extension of the expiration date may be available. Contact the DWR for additional information or refer to the extension request form (GWS-64) available at: <http://www.water.state.co.us>

NOTICE: This permit has been approved subject to the following changes: The UTM coordinate values were calculated from the distances from section lines provided with the permit application. You are hereby notified that you have the right to appeal the issuance of this permit, by filing a written request with this office within sixty (60) days of the date of issuance, pursuant to the State Administrative Procedures Act. (See Section 24-4-104 through 106, C.R.S.)



Issued By IOANA COMANICIU

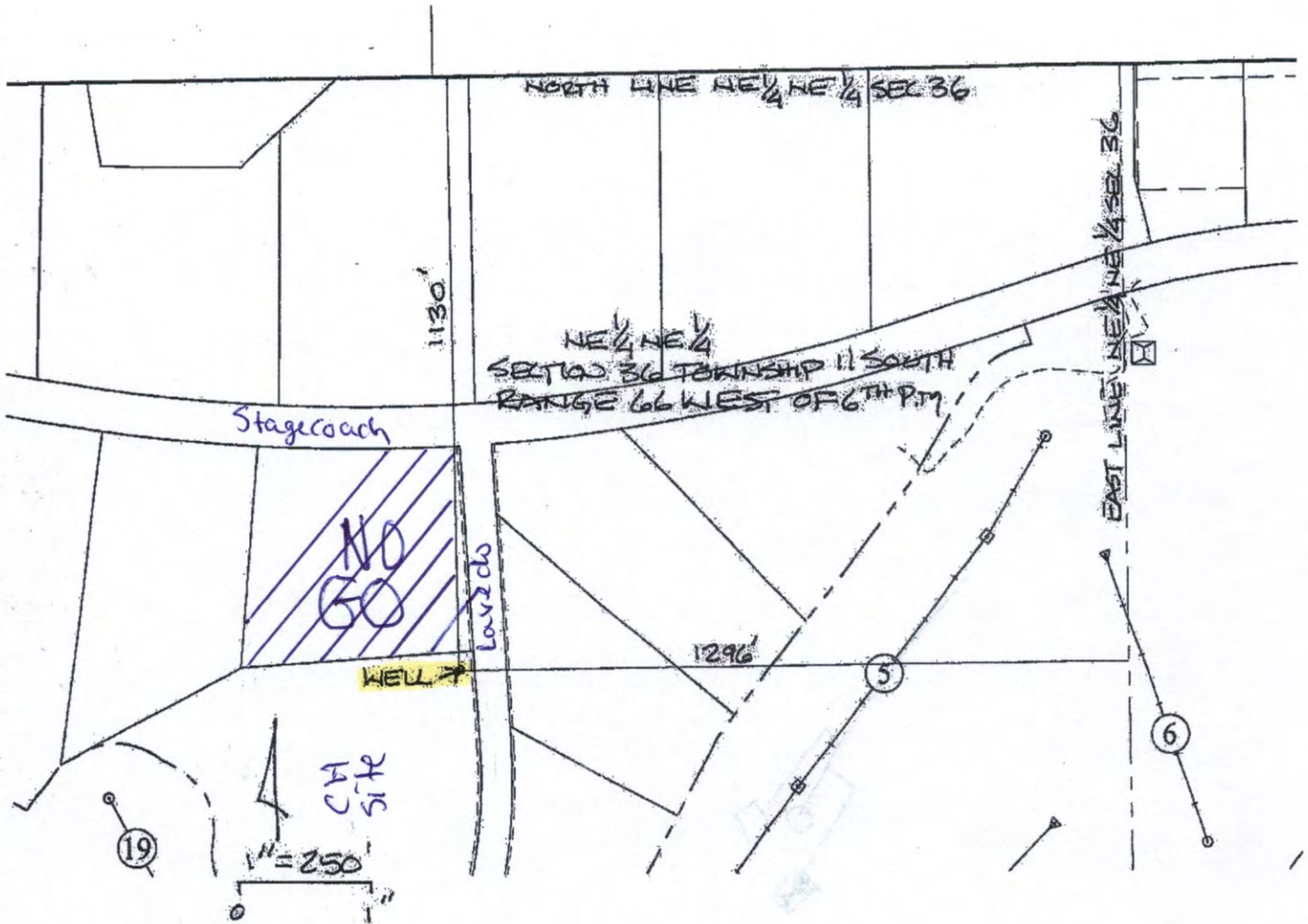
Date Issued: 7/24/2017

Expiration Date: 7/24/2018



From Dong Reinkelt  
@ CCEs

N:\109610\DRAWINGS\SURVEY\EXHIBITS\109610 PROPOSED WELL LOCATIONS 6-14-17.dwg, 6/14/2017 3:02:34 PM, 1:250



| Form No.<br>GWS-31<br><br>02/2017   |      | <b>WELL CONSTRUCTION AND YIELD ESTIMATE REPORT</b><br>State of Colorado, Office of the State Engineer<br>1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581<br><a href="http://www.water.state.co.us">www.water.state.co.us</a> and <a href="mailto:dwrpermitsonline@state.co.us">dwrpermitsonline@state.co.us</a> |                      |                    | For Office Use Only  |                 |
|---|------|---|----------------------|--------------------|--|-----------------|
| <b>1. Well Permit Number:</b>   |      | <b>Receipt Number:</b>  |                      |                    |  |                 |
| <b>2. Owner's Well Designation:</b>   |      |   |                      |                    |  |                 |
| <b>3. Well Owner Name:</b>  |      |   |                      |                    |  |                 |
| <b>4. Well Location Street Address:</b>   |      |   |                      |                    |  |                 |
| <b>5. GPS Well Location</b> <input type="checkbox"/> Zone 12 <input type="checkbox"/> Zone 13 Easting: _____ Northing: _____  |      |   |                      |                    |  |                 |
| <b>6. Legal Well Location:</b> ____ 1/4, ____ 1/4, Sec., ____ Twp., ____ N or S ____, Range ____, ____ E or W ____, ____ P.M.   |      |   |                      |                    |  |                 |
| County: _____<br>Subdivision: _____, Lot ____, Block ____, Filing (Unit) _____  |      |   |                      |                    |  |                 |
| <b>7. Ground Surface Elevation:</b> _____ feet <b>Date Completed:</b> _____ <b>Drilling Method:</b> _____   |      |   |                      |                    |  |                 |
| <b>8. Completed Aquifer Name :</b> _____ <b>Total Depth:</b> _____ feet <b>Depth Completed:</b> _____ feet  |      |   |                      |                    |  |                 |
| <b>9. Advance Notification:</b> Was Notification Required Prior to Construction? <input type="checkbox"/> Yes <input type="checkbox"/> No, Date Notification Given: _____   |      |   |                      |                    |  |                 |
| <b>10. Aquifer Type:</b> <input type="checkbox"/> Type I (One Confining Layer) <input type="checkbox"/> Type I (Multiple Confining Layers) <input type="checkbox"/> Laramie-Fox Hills<br>(Check one) <input type="checkbox"/> Type II (Not overlain by Type III) <input type="checkbox"/> Type II (Overlain by Type III) <input type="checkbox"/> Type III (alluvial/colluvial)   |      |   |                      |                    |  |                 |
| <b>11. Geologic Log:</b>  |      |   |                      |                    | <b>12. Hole Diameter (in.)</b> From (ft) To (ft)   |                 |
| Depth   | Type | Grain Size  | Color                | Water Loc.         |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
|   |      |   |                      |                    |  |                 |
| <b>Remarks:</b>   |      |   |                      |                    | <b>13. Plain Casing</b><br>OD (in) Kind Wall Size (in) From (ft) To (ft)<br>_____<br>_____                               |                 |
|   |      |   |                      |                    | <b>Perforated Casing</b> Screen Slot Size (in): _____<br>OD (in) Kind Wall Size (in) From (ft) To (ft)<br>_____<br>_____ |                 |
|   |      |   |                      |                    | <b>14. Filter Pack:</b><br>Material _____<br>Size _____<br>Interval _____  |                 |
|   |      |   |                      |                    | <b>15. Packer Placement:</b><br>Type _____<br>Depth _____  |                 |
|   |      |   |                      |                    | <b>16. Grouting Record</b><br>Material Amount Density Interval Method<br>_____<br>_____<br>_____                         |                 |
|   |      |   |                      |                    |  |                 |
| <b>17. Disinfection:</b> Type _____ Amt. Used _____   |      |   |                      |                    |  |                 |
| <b>18. Well Yield Estimate Data:</b> <input type="checkbox"/> Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report<br>Well Yield Estimate Method: _____<br>Static Level: _____ Estimated Yield (gpm) _____<br>Date/Time measured: _____ Estimate Length (hrs) _____  |      |   |                      |                    |  |                 |
| <b>Remarks:</b>   |      |   |                      |                    |  |                 |
| <b>19.</b> I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402.2. The filing of a document that contains false statements is a violation of section 37-91-108(1)(e), C.R.S., and is punishable by fines up to \$1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4. |      |   |                      |                    |  |                 |
| Company Name:   |      | Email:  |                      | Phone w/area code: |  | License Number: |
| Mailing Address:  |      |   |                      |                    |  |                 |
| Sign (or enter name if filing online)   |      |   | Print Name and Title |                    |  | Date:           |





Layne-Western, a Division of Layne Christensen Company  
17800 East 22nd Avenue  
Aurora, CO 80011  
Phone: 303-755-1281, FAX: 303-755-1236, E-Mail: 1031@laynechristensen.com

**WELL TEST  
TEST ENGINE**

Well # A-1 Customer FLYING HORSE City BLACK FOREST State COLORADO  
Job # 47170 Date 12/1/2017 Test Type (Step, Continuous, Duration) CONT Tested By SNYDER  
Pump Setting Depth (ft) 1830 Shroud Info. (ft) 42X7 Airline Length (ft) 1812.28 Transducer setting depth 1812.28  
Static Water Level (ft) 1534 Airline Reading @ Start (psi) 125 Transducer reading @ Start 277FT  
(manual correct gl)  
Flow Meter Totalizer-Start 0 Flow Meter Totalizer-End 591333 Flow Meter Size (dia) 6  
MOTOR 350HP @ 2034V Test Pump Make & Model GE TJ2000 # Pump Stages 31 Probe Model 900PSI DYNOTEC

Ground Level Correction \_\_\_\_\_ Pumping water levels (column F) are from ground level. M-Scope readings (Column D) are actual from top of sounder tube.

| Time of Day<br>(am/pm) | Elapsed Time<br>(min) | GPM | AIR | Transducer<br>FT | Pumping<br>Level (ft) | Drawdown (ft) | Amps | Volts | Hertz | Discharge<br>Pressure | Sand Test<br>(ml/min) | Flow Meter<br>Totalizer | Remarks (adjustments,<br>conditions, etc.) |
|------------------------|-----------------------|-----|-----|------------------|-----------------------|---------------|------|-------|-------|-----------------------|-----------------------|-------------------------|--|
| 908A                   | 0                     | 0   | 125 | 277              | 0                     | 0             | 0    | 0     | 0     | 0                     | 0                     | 0                       | ROUGH PUMP                                 |
| 925A                   | 17                    | 196 | 109 | 234.13           | 1578.15               | 44.15         | X    | X     | 47    | 14                    | 0.7                   | 1266                    | ORANGE WATER                               |
| 927A                   | 19                    | 194 | 107 | 231              | 1581.28               | 47.28         | X    | X     | X     | 14                    | 0.8                   | 1652                    |  |
| 929A                   | 21                    | 188 | 105 | 229              | 1583.28               | 49.28         | X    | X     | 46.7  | 12                    | 0.7                   | 2034                    |  |
| 931A                   | 23                    | 188 | 105 | 225              | 1587.28               | 53.28         | X    | X     | X     | 12                    | -                     | 2492                    |  |
| 933A                   | 25                    | 183 | 105 | 223.91           | 1588.37               | 54.37         | X    | X     | X     | 12                    | 0.7                   | 2882                    | ORANGE WATER                               |
| 935A                   | 27                    | 186 | 104 | 221              | 1591.28               | 57.28         | 355  | 317   | 47    | -                     | 0.7                   | 3137                    |  |
| 937A                   | 29                    | 193 | 101 | 223.5            | 1588.78               | 54.78         | X    | X     | X     | 14                    | 0.7                   | 3602                    |  |
| 939A                   | 31                    | 197 | 101 | 221.2            | 1591.08               | 57.08         | X    | X     | X     | 14                    | 0.7                   | 3931                    |  |
| 943A                   | 35                    | 202 | 100 | 219.63           | 1592.65               | 58.65         | X    | X     | X     | 12                    | 0.7                   | 4654                    |  |
| 945A                   | 37                    | 196 | 101 | 215.8            | 1596.48               | 62.48         | X    | X     | X     | 10                    | 0.7                   | 4992                    |  |
| 950A                   | 42                    | 203 | 100 | 215.03           | 1597.25               | 63.25         | X    | X     | X     | 10                    | 0.7                   | 6008                    |  |
| 955A                   | 47                    | 196 | 99  | 212.02           | 1600.26               | 66.26         | X    | X     | X     | 10                    | 0.7                   | 6990                    |  |
| 1000A                  | 52                    | 200 | 99  | 209              | 1603.28               | 69.28         | X    | X     | X     | 10                    | 0.7                   | 7983                    |  |
| 1008A                  | 60                    | 194 | 98  | 209.94           | 1602.34               | 68.34         | X    | X     | X     | 10                    | 0.7                   | 9521                    |  |
| 1018A                  | 70                    | 202 | 96  | 211.69           | 1600.59               | 66.59         | X    | X     | X     | 10                    | 0.7                   | 11468                   | SCALE FROM 4.5                             |
| 1028A                  | 80                    | 195 | 95  | 207.46           | 1604.82               | 70.82         | X    | X     | X     | 10                    | 0.7                   | 13384                   | CLEAN OUT TUBE                             |
| 1038A                  | 90                    | 203 | 95  | 207.29           | 1604.99               | 70.99         | X    | X     | X     | 10                    | 0                     | 15413                   |  |
| 1048A                  | 100                   | 191 | 94  | 206.28           | 1606                  | 72            | X    | X     | X     | 10                    | 0                     | 17321                   |  |
| 1058A                  | 110                   | 192 | 94  | 204.36           | 1607.92               | 73.92         | 356  | 318   | 47    | 10                    | 0                     | 19135                   |  |
| 1108A                  | 120                   | 195 | 94  | 202.2            | 1610.08               | 76.08         | X    | X     | X     | 10                    | 0                     | 20961                   |  |
| 1110A                  | 122                   | 299 | 90  | 186.28           | 1626                  | 92            | 415  | 412   | 51.9  | 15                    | 0                     | 21629                   |  |
| 1112A                  | 124                   | 300 | 86  | 180.9            | 1631.38               | 97.38         | X    | X     | 51.9  | 15                    | 0                     | 22145                   |  |
| 1114A                  | 126                   | 302 | 84  | 177.36           | 1634.88               | 100.88        | X    | X     | 51.9  | 15                    | 0                     | 22737                   |  |
| 1116                   | 128                   | 302 | 84  | 175.04           | 1637.24               | 103.24        | X    | X     | 51.9  | 15                    | 0                     | 23444                   |  |
| 1118                   | 130                   | 299 | 82  | 173.74           | 1638.54               | 104.54        | X    | X     | 51.9  | 15                    | 0                     | 23947                   |  |
| 1120A                  | 132                   | 300 | 82  | 172.39           | 1639.89               | 105.89        | X    | X     | 51.9  | 15                    | 0                     | 24562                   |  |
| 1122A                  | 134                   | 299 | 81  | 171.25           | 1641.03               | 107.03        | X    | X     | 51.9  | 15                    | 0                     | 25163                   |  |
| 1124A                  | 136                   | 300 | 81  | 170.27           | 1642.01               | 108.01        | X    | X     | 51.9  | 15                    | 0                     | 25874                   |  |
| 1126A                  | 138                   | 298 | 81  | 170.03           | 1642.25               | 108.25        | X    | X     | 51.9  | 15                    | 0                     | 26372                   |  |
| 1128A                  | 140                   | 299 | 80  | 169.54           | 1642.74               | 108.74        | X    | X     | 51.9  | 15                    | 0                     | 27024                   |  |
| 1130A                  | 142                   | 300 | 80  | 168.2            | 1644.08               | 110.08        | X    | X     | 51.9  | 15                    | TRACE                 | 27689                   | ADJUST VALVE                               |
| 1135A                  | 147                   | 297 | 80  | 166.77           | 1645.51               | 111.51        | X    | X     | 51.9  | 15                    | TRACE                 | 29033                   | ADJUST VALVE                               |
| Time of Day<br>(am/pm) | Elapsed Time<br>(min) | GPM | AIR | Transducer<br>FT | Pumping<br>Level (ft) | Drawdown (ft) | Amps | Volts | Hertz | Discharge<br>Pressure | Sand Test<br>(ml/min) | Flow Meter<br>Totalizer | Remarks (adjustments,<br>conditions, etc.) |



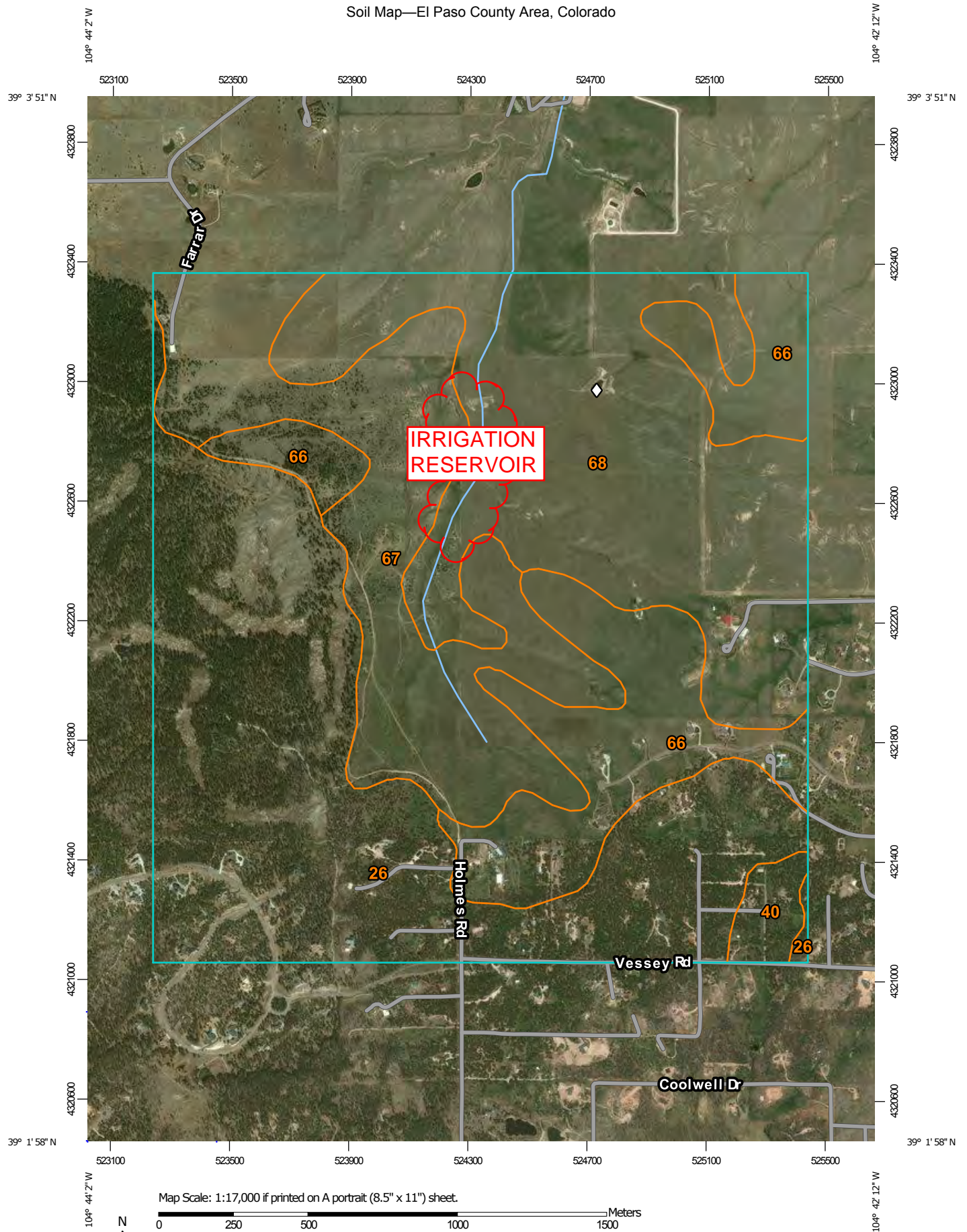
|                     |                    |     |     |               |                    |               |      |       |       |                    |                    |                      |   |
|---------------------|--------------------|-----|-----|---------------|--------------------|---------------|------|-------|-------|--------------------|--------------------|----------------------|---|
| 1140A               | 152                | 299 | 80  | 165.22        | 1647.06            | 113.06        | X    | X     | 51.9  | 15                 | TRACE              | 30553                |   |
| 1145A               | 157                | -   | X   | X             | X                  | X             | X    | X     | X     | X                  | X                  | X                    |   |
| 1150A               | 162                | 297 | 79  | 163.68        | 1648.6             | 114.6         | X    | X     | X     | 15                 | TRACE              | 33487                |   |
| 1155A               | 167                | 296 | 79  | 163.02        | 1649.26            | 115.26        | 415  | 414   | 52    | 15                 | TRACE              | 34988                |   |
| 1200P               | 172                | 299 | 77  | 161.8         | 1650.48            | 116.48        | X    | X     | 52    | 15                 | TRACE              | 36472                |   |
| 1205P               | 177                | 300 | 77  | 160.58        | 1651.7             | 117.7         | 415  | 414   | 52    | 15                 | TRACE              | 37972                |   |
| 1210P               | 182                | 300 | 76  | 160.01        | 1652.27            | 118.27        | X    | X     | 52    | 15                 | TRACE              | 39457                |   |
| 1220P               | 192                | 297 | 76  | 159.2         | 1653.08            | 119.08        | 415  | 414   | 52    | 15                 | TRACE              | 42457                |   |
| 1230P               | 202                | 300 | 76  | 157.77        | 1654.31            | 120.31        | 415  | 414   | 52    | 15                 | TRACE              | 45459                |   |
| 1240P               | 212                | 299 | 75  | 157.36        | 1654.92            | 120.92        | X    | X     | 52    | 15                 | TRACE              | 48414                |   |
| 1250P               | 222                | 299 | 75  | 156.06        | 1656.22            | 122.22        | 415  | 414   | 52    | 15                 | TRACE              | 51383                |   |
| 1300                | 232                | 299 | 75  | 155.29        | 1656.99            | 122.99        | 415  | 414   | 52    | 14                 | TRACE              | 54372                |   |
| 1308                | 240                | 298 | 75  | 153.86        | 1658.42            | 124.42        | 415  | 414   | 52    | 14                 | TRACE              | 56570                |   |
| 1310                | 242                | 438 | X   | X             | X                  | X             | X    | X     | 58.9  | X                  | X                  | 57983                |   |
| 1312                | 244                | 450 | 62  | 123.93        | 1688.35            | 154.35        | X    | X     | 58.9  | 10                 | TRACE              | 58543                |   |
| 1314                | 246                | 448 | 59  | 118.27        | 1694.01            | 160.01        | X    | X     | 58.9  | 10                 | TRACE              | 59500                |   |
| 1316                | 248                | 448 | 59  | 116.03        | 1696.25            | 162.25        | X    | X     | 58.9  | 10                 | TRACE              | 60231                |   |
| 1318                | 250                | 449 | 57  | 114.48        | 1697.8             | 163.8         | X    | X     | 58.9  | 10                 | 0.1                | 60989                |   |
| 1320                | 252                | 446 | 56  | 112.97        | 1699.31            | 165.31        | 509  | 461   | 59    | 10                 | 0.1                | 61886                |   |
| 1322                | 254                | 447 | 55  | 110.73        | 1701.55            | 167.55        | X    | X     | 59    | 10                 | 0.1                | 63136                |   |
| 1324                | 256                | 448 | 55  | 110           | 1702.28            | 168.28        | X    | X     | 59    | 10                 | 0.1                | 63696                |   |
| 1326                | 258                | 446 | 55  | 109.19        | 1703.09            | 169.09        | X    | X     | 59    | 10                 | 0.1                | 64572                |   |
| 1328                | 260                | 447 | 54  | 107.76        | 1704.52            | 170.52        | X    | X     | 59    | 9                  | 0.2                | 65659                |   |
| 1330                | 262                | 445 | 54  | 107.31        | 1704.97            | 170.97        | X    | X     | 59    | 9                  | 0.2                | 66345                |   |
| 1335                | 267                | 450 | 52  | 104.58        | 1707.7             | 173.7         | X    | X     | 59.2  | 9                  | 0.2                | 68606                |   |
| 1340                | 272                | 453 | 52  | 102.79        | 1709.49            | 175.49        | X    | X     | 59.2  | 9                  | 2.2                | 70873                |   |
| 1345                | 277                | 449 | 51  | 101.9         | 1710.38            | 176.38        | X    | X     | 59.2  | 9                  | 0.2                | 73126                |   |
| 1350                | 282                | 449 | 51  | 100.51        | 1711.77            | 177.77        | X    | X     | 59.2  | 9                  | 0.25               | 75371                |   |
| 1355                | 287                | 450 | 50  | 99.45         | 1712.83            | 178.83        | 509  | 461   | 59.2  | 9                  | 0.3                | 77566                |   |
| 1400                | 292                | 449 | 50  | 98.67         | 1713.61            | 179.61        | X    | X     | 59.2  | 9                  | 0.3                | 79816                |   |
| 1410                | 302                | 450 | 50  | 97.57         | 1714.71            | 180.71        | X    | X     | 59.2  | 9                  | 0.3                | 84235                |   |
| 1420                | 312                | 449 | 50  | 95.5          | 1716.78            | 182.78        | X    | X     | 59.2  | 9                  | 0.3                | 88769                |   |
| 1430                | 322                | 448 | 49  | 94.64         | 1717.64            | 183.64        | X    | X     | 59.2  | 9                  | 0.3                | 93288                |   |
| 1440                | 332                | 447 | 48  | 92.52         | 1719.76            | 185.76        | X    | X     | 59.2  | 9                  | 0.3                | 98695                |   |
| 1450                | 342                | 450 | 47  | 91.71         | 1720.57            | 186.57        | X    | X     | 59.2  | 9                  | 0.3                | 102268               |   |
| 1500                | 352                | 450 | 46  | 90.41         | 1721.87            | 187.87        | X    | X     | 59.2  | 9                  | 0.35               | 106744               |   |
| 1515                | 367                | 449 | 45  | 89.49         | 1722.81            | 188.31        | X    | X     | 59.2  | 9                  | 0.4                | 113988               |   |
| 1530                | 382                | 447 | 45  | 88.17         | 1724.11            | 190.11        | X    | X     | 59.2  | 10                 | 0.4                | 120007               |   |
| 1545                | 397                | 449 | 45  | 96.66         | 1725.62            | 191.62        | 512  | 472   | 59.4  | 9.5                | 0.4                | 126730               | SURGE IN PUMP                           |
| 1600                | 412                | 449 | 45  | 86.01         | 1726.27            | 192.27        | X    | X     | 59.4  | 9.5                | 0.4                | 133398               |   |
| 1615                | 427                | 448 | 42  | 84.54         | 1727.74            | 193.74        | X    | X     | 59.4  | 9.5                | 0.4                | 140493               |   |
| 1630                | 442                | 448 | 42  | 84.79         | 1727.49            | 193.49        | X    | X     | 59.4  | 9.5                | 0.4                | 146691               |   |
| Time of Day (am/pm) | Elapsed Time (min) | GPM | AIR | Transducer FT | Pumping Level (ft) | Drawdown (ft) | Amps | Volts | Hertz | Discharge Pressure | Sand Test (ml/min) | Flow Meter Totalizer | Remarks (adjustments, conditions, etc.) |
| 1645                | 457                | 446 | 42  | 82.79         | 1729.49            | 195.49        | X    | X     | 59.4  | 9.5                | 0.4                | 153478               |   |
| 1700                | 472                | 449 | 42  | 81.53         | 1730.45            | 196.45        | X    | X     | 59.4  | 9.5                | 0.4                | 160184               |   |
| 1730                | 502                | 449 | 41  | 80.39         | 1731.89            | 197.89        | 512  | 475   | 59.4  | 9.5                | 0.45               | 173506               |   |

[illegible]

**APPENDIX B**  
**HYDROLOGIC / HYDRAULIC DATA & MODELS**



# Soil Map—El Paso County Area, Colorado



Natural Resources  
Conservation Service


Web Soil Survey  
National Cooperative Soil Survey

10/31/2017  
Page 1 of 3





## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2016—Mar 9, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

| Map Unit Symbol                    | Map Unit Name                                     | Acres in AOI   | Percent of AOI |
|------------------------------------|---|----------------|----------------|
| 26                                 | Elbeth sandy loam, 8 to 15 percent slopes         | 433.1          | 34.4%          |
| 40                                 | Kettle gravelly loamy sand, 3 to 8 percent slopes | 17.8           | 1.4%           |
| 66                                 | Peyton sandy loam, 1 to 5 percent slopes          | 200.4          | 15.9%          |
| 67                                 | Peyton sandy loam, 5 to 9 percent slopes          | 253.2          | 20.1%          |
| 68                                 | Peyton-Pring complex, 3 to 8 percent slopes       | 353.2          | 28.1%          |
| <b>Totals for Area of Interest</b> |   | <b>1,257.7</b> | <b>100.0%</b>  |

## El Paso County Area, Colorado

### 66—Peyton sandy loam, 1 to 5 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369c

*Elevation:* 6,800 to 7,600 feet

*Farmland classification:* Prime farmland if irrigated and the product of  
I (soil erodibility) x C (climate factor) does not exceed 60

#### Map Unit Composition

*Peyton and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of  
the mapunit.*

#### Description of Peyton

##### Setting

*Landform:* Flats, hills

*Landform position (three-dimensional):* Side slope, talf

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock  
and/or arkosic residuum weathered from sedimentary rock

##### Typical profile

*A - 0 to 12 inches:* sandy loam

*Bt - 12 to 25 inches:* sandy clay loam

*BC - 25 to 35 inches:* sandy loam

*C - 35 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 1 to 5 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water (Ksat):*

Moderately high (0.20 to 0.60 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Moderate (about 7.3 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4c

*Hydrologic Soil Group:* B

*Ecological site:* Sandy Divide (R049BY216CO)

*Hydric soil rating:* No

### **Minor Components**

#### **Other soils**

*Percent of map unit:*

*Hydric soil rating:* No

#### **Pleasant**

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

## **Data Source Information**

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 14, Sep 23, 2016

## El Paso County Area, Colorado

### 67—Peyton sandy loam, 5 to 9 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369d

*Elevation:* 6,800 to 7,600 feet

*Mean annual air temperature:* 43 to 45 degrees F

*Frost-free period:* 115 to 125 days

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Peyton and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Peyton

##### Setting

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

##### Typical profile

*A - 0 to 12 inches:* sandy loam

*Bt - 12 to 25 inches:* sandy clay loam

*BC - 25 to 35 inches:* sandy loam

*C - 35 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 5 to 9 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):*

Moderately high (0.20 to 0.60 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Moderate (about 7.3 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B

*Ecological site:* Sandy Divide (R049BY216CO)

*Hydric soil rating:* No

### **Minor Components**

#### **Other soils**

*Percent of map unit:*

*Hydric soil rating:* No

#### **Pleasant**

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

## **Data Source Information**

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 14, Sep 23, 2016

## El Paso County Area, Colorado

### 68—Peyton-Pring complex, 3 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369f

*Elevation:* 6,800 to 7,600 feet

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Peyton and similar soils:* 40 percent

*Pring and similar soils:* 30 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Peyton

##### Setting

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

##### Typical profile

*A - 0 to 12 inches:* sandy loam

*Bt - 12 to 25 inches:* sandy clay loam

*BC - 25 to 35 inches:* sandy loam

*C - 35 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 3 to 5 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water (Ksat):*

Moderately high (0.20 to 0.60 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Moderate (about 7.3 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4c

*Hydrologic Soil Group:* B

*Ecological site:* Sandy Divide (R049BY216CO)

*Hydric soil rating:* No

## Description of Pring

### Setting

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock

### Typical profile

*A - 0 to 14 inches:* coarse sandy loam

*C - 14 to 60 inches:* gravelly sandy loam

### Properties and qualities

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water (Ksat):* High  
(2.00 to 6.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Low (about 6.0 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3e

*Hydrologic Soil Group:* B

*Ecological site:* Loamy Park (R048AY222CO)

*Hydric soil rating:* No

## Minor Components

### Other soils

*Percent of map unit:*

*Hydric soil rating:* No

### Pleasant

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

## Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 14, Sep 23, 2016



ALL LAND ASSUMED 2 ACRE RESIDENTIAL LOTS OR  
GOOD CONDITION OPEN SPACE (LAWNS, PARKS GOLF COURSES, CEMETARIES ETC.)

### C<sub>N</sub> VALUES - DEVELOPED CONDITIONS

| BASIN<br>(label) | BASIN<br>AREA<br>(Ac) | GOLF COURSE (B) |               | 2 AC. RESIDENTIAL (B) |               | COMPOSITE<br>C <sub>N</sub> |
|------------------|-----------------------|-----------------|---------------|-----------------------|---------------|-----------------------------|
|                  |                       | CN              | AREA<br>(Ac.) | CN                    | AREA<br>(Ac.) |                             |
| CC-1             | 22.3                  | 61              | 0.0           | 65                    | 22.3          | 65.0                        |
| CC-2             | 36.4                  | 61              | 0.0           | 65                    | 36.4          | 65.0                        |
| CC-3             | 51.9                  | 61              | 19.1          | 65                    | 32.8          | 63.5                        |
| CC-4A            | 108.2                 | 61              | 63.2          | 65                    | 45.0          | 62.7                        |
| CC-4B            | 17.0                  | 61              | 5.5           | 65                    | 11.5          | 63.7                        |
|                  |                       |                 |               |                       |               |                             |
| OS-12            | 67.7                  | 61              | 0.0           | 65                    | 67.7          | 65.0                        |
| OS-13            | 36.9                  | 61              | 0.0           | 65                    | 36.9          | 65.0                        |
| OS-14            | 26.4                  | 61              | 0.0           | 65                    | 26.4          | 65.0                        |

### TIME OF CONCENTRATION DEVELOPED

| BASIN | COMPOSITE<br>Cn | OVERLAND       |                |            | STREET / CHANNEL FLOW (DCM Vol. 1 Fig. 6-25) |              |                   |            | Tc            | Tc                  |
|-------|-----------------|----------------|----------------|------------|--|--------------|-------------------|------------|---------------|---------------------|
|       |                 | Length<br>(ft) | Height<br>(ft) | Tc<br>(hr) | Length<br>(ft)                               | Slope<br>(%) | Velocity<br>(fps) | Tc<br>(hr) | TOTAL<br>(hr) | LAG (0.6tc)<br>(hr) |
| CC-1  | 65.0            | 300            | 10             | 0.40       | 900  | 2.0%         | 1.8               | 0.14       | 0.53          | 0.32                |
| CC-2  | 65.0            | 300            | 10             | 0.40       | 1700   | 2.0%         | 1.8               | 0.26       | 0.66          | 0.39                |
| CC-3  | 63.5            | 300            | 14             | 0.35       | 900  | 2.5%         | 2.4               | 0.10       | 0.45          | 0.27                |
| CC-4A | 62.7            | 300            | 14             | 0.35       | 2900   | 2.0%         | 2.1               | 0.38       | 0.73          | 0.44                |
| CC-4B | 63.7            | 300            | 12             | 0.37       | 900  | 3.0%         | 2.5               | 0.10       | 0.47          | 0.28                |
|       |                 |                |                |            |  |              |                   |            |               |                     |
| OS-12 | 65.0            | 300            | 14             | 0.35       | 1500   | 3.0%         | 2.5               | 0.17       | 0.51          | 0.31                |
| OS-13 | 65.0            | 300            | 16             | 0.33       | 900  | 3.0%         | 2.5               | 0.10       | 0.43          | 0.26                |
| OS-14 | 65.0            | 300            | 14             | 0.35       | 600  | 3.5%         | 2.7               | 0.06       | 0.41          | 0.24                |



NOAA Atlas 14, Volume 8, Version 2  
Location name: Colorado Springs, Colorado,  
USA\*  
Latitude: 39.051°, Longitude: -104.7161°  
Elevation: 7569.65 ft\*\*

\* source: ESRI Maps  
\*\* source: USGS



### POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

### PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup> |                                     |                        |                        |                        |                        |                        |                       |                       |                      |                      |
|--|-------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|-----------------------|----------------------|----------------------|
| Duration   | Average recurrence interval (years) |                        |                        |                        |                        |                        |                       |                       |                      |                      |
|  | 1                                   | 2                      | 5                      | 10                     | 25                     | 50                     | 100                   | 200                   | 500                  | 1000                 |
| 5-min  | 0.237<br>(0.194–0.290)              | 0.288<br>(0.236–0.353) | 0.376<br>(0.308–0.463) | 0.455<br>(0.370–0.562) | 0.570<br>(0.450–0.736) | 0.665<br>(0.510–0.867) | 0.765<br>(0.566–1.02) | 0.871<br>(0.616–1.19) | 1.02<br>(0.692–1.43) | 1.14<br>(0.749–1.61) |
| 10-min   | 0.346<br>(0.284–0.425)              | 0.421<br>(0.345–0.517) | 0.551<br>(0.450–0.678) | 0.666<br>(0.541–0.823) | 0.835<br>(0.658–1.08)  | 0.974<br>(0.747–1.27)  | 1.12<br>(0.828–1.50)  | 1.27<br>(0.902–1.75)  | 1.49<br>(1.01–2.10)  | 1.67<br>(1.10–2.36)  |
| 15-min   | 0.422<br>(0.347–0.518)              | 0.514<br>(0.421–0.631) | 0.672<br>(0.549–0.827) | 0.812<br>(0.660–1.00)  | 1.02<br>(0.803–1.31)   | 1.19<br>(0.911–1.55)   | 1.37<br>(1.01–1.82)   | 1.56<br>(1.10–2.13)   | 1.82<br>(1.24–2.56)  | 2.03<br>(1.34–2.88)  |
| 30-min   | 0.603<br>(0.495–0.739)              | 0.732<br>(0.601–0.899) | 0.957<br>(0.782–1.18)  | 1.16<br>(0.939–1.43)   | 1.45<br>(1.14–1.87)    | 1.69<br>(1.30–2.20)    | 1.94<br>(1.44–2.59)   | 2.21<br>(1.56–3.03)   | 2.59<br>(1.76–3.64)  | 2.89<br>(1.90–4.10)  |
| 60-min   | 0.768<br>(0.631–0.942)              | 0.921<br>(0.755–1.13)  | 1.20<br>(0.977–1.47)   | 1.45<br>(1.17–1.79)    | 1.83<br>(1.45–2.37)    | 2.15<br>(1.65–2.81)    | 2.49<br>(1.84–3.33)   | 2.86<br>(2.03–3.93)   | 3.39<br>(2.30–4.78)  | 3.82<br>(2.51–5.42)  |
| 2-hr   | 0.934<br>(0.771–1.14)               | 1.11<br>(0.915–1.35)   | 1.43<br>(1.18–1.75)    | 1.74<br>(1.42–2.13)    | 2.20<br>(1.76–2.85)    | 2.60<br>(2.02–3.39)    | 3.03<br>(2.27–4.05)   | 3.51<br>(2.51–4.80)   | 4.19<br>(2.87–5.88)  | 4.75<br>(3.15–6.69)  |
| 3-hr   | 1.02<br>(0.849–1.24)                | 1.20<br>(0.996–1.46)   | 1.54<br>(1.27–1.88)    | 1.87<br>(1.53–2.29)    | 2.39<br>(1.92–3.09)    | 2.84<br>(2.21–3.70)    | 3.33<br>(2.50–4.44)   | 3.88<br>(2.79–5.30)   | 4.68<br>(3.22–6.55)  | 5.34<br>(3.55–7.49)  |
| 6-hr   | 1.20<br>(0.999–1.44)                | 1.39<br>(1.16–1.67)    | 1.76<br>(1.46–2.13)    | 2.13<br>(1.76–2.59)    | 2.73<br>(2.22–3.52)    | 3.26<br>(2.56–4.23)    | 3.85<br>(2.92–5.11)   | 4.51<br>(3.27–6.14)   | 5.49<br>(3.81–7.65)  | 6.29<br>(4.22–8.78)  |
| 12-hr  | 1.41<br>(1.18–1.69)                 | 1.63<br>(1.36–1.95)    | 2.05<br>(1.71–2.46)    | 2.47<br>(2.05–2.98)    | 3.15<br>(2.57–4.03)    | 3.74<br>(2.96–4.82)    | 4.41<br>(3.36–5.81)   | 5.15<br>(3.76–6.96)   | 6.24<br>(4.36–8.63)  | 7.14<br>(4.82–9.90)  |
| 24-hr  | 1.65<br>(1.39–1.96)                 | 1.93<br>(1.62–2.29)    | 2.44<br>(2.05–2.91)    | 2.93<br>(2.44–3.50)    | 3.68<br>(3.01–4.65)    | 4.33<br>(3.44–5.51)    | 5.04<br>(3.86–6.57)   | 5.82<br>(4.26–7.78)   | 6.95<br>(4.88–9.52)  | 7.87<br>(5.35–10.8)  |
| 2-day  | 1.93<br>(1.63–2.27)                 | 2.28<br>(1.93–2.69)    | 2.91<br>(2.46–3.45)    | 3.48<br>(2.92–4.13)    | 4.32<br>(3.53–5.36)    | 5.01<br>(3.99–6.30)    | 5.75<br>(4.41–7.40)   | 6.54<br>(4.81–8.64)   | 7.66<br>(5.41–10.4)  | 8.56<br>(5.86–11.7)  |
| 3-day  | 2.12<br>(1.80–2.49)                 | 2.51<br>(2.13–2.94)    | 3.18<br>(2.69–3.74)    | 3.78<br>(3.18–4.47)    | 4.66<br>(3.82–5.76)    | 5.39<br>(4.30–6.73)    | 6.16<br>(4.74–7.88)   | 6.98<br>(5.15–9.17)   | 8.13<br>(5.76–11.0)  | 9.05<br>(6.23–12.3)  |
| 4-day  | 2.28<br>(1.95–2.67)                 | 2.68<br>(2.28–3.14)    | 3.37<br>(2.86–3.96)    | 3.99<br>(3.37–4.70)    | 4.90<br>(4.02–6.03)    | 5.65<br>(4.52–7.04)    | 6.45<br>(4.98–8.23)   | 7.30<br>(5.40–9.56)   | 8.49<br>(6.03–11.4)  | 9.44<br>(6.51–12.8)  |
| 7-day  | 2.68<br>(2.30–3.12)                 | 3.10<br>(2.65–3.61)    | 3.84<br>(3.27–4.48)    | 4.49<br>(3.81–5.26)    | 5.46<br>(4.50–6.68)    | 6.26<br>(5.03–7.74)    | 7.10<br>(5.51–9.01)   | 8.01<br>(5.96–10.4)   | 9.28<br>(6.63–12.4)  | 10.3<br>(7.14–13.9)  |
| 10-day   | 3.03<br>(2.61–3.51)                 | 3.48<br>(2.99–4.04)    | 4.27<br>(3.65–4.96)    | 4.96<br>(4.22–5.80)    | 5.99<br>(4.95–7.29)    | 6.83<br>(5.51–8.41)    | 7.71<br>(6.01–9.74)   | 8.66<br>(6.46–11.2)   | 9.98<br>(7.16–13.3)  | 11.0<br>(7.69–14.9)  |
| 20-day   | 4.03<br>(3.48–4.63)                 | 4.61<br>(3.98–5.31)    | 5.60<br>(4.82–6.47)    | 6.45<br>(5.52–7.48)    | 7.66<br>(6.36–9.21)    | 8.63<br>(6.99–10.5)    | 9.63<br>(7.53–12.0)   | 10.7<br>(8.01–13.7)   | 12.1<br>(8.73–16.0)  | 13.2<br>(9.27–17.7)  |
| 30-day   | 4.85<br>(4.21–5.55)                 | 5.56<br>(4.82–6.37)    | 6.73<br>(5.81–7.74)    | 7.72<br>(6.62–8.91)    | 9.08<br>(7.54–10.8)    | 10.1<br>(8.23–12.3)    | 11.2<br>(8.80–13.9)   | 12.3<br>(9.27–15.7)   | 13.8<br>(9.98–18.1)  | 14.9<br>(10.5–19.9)  |
| 45-day   | 5.88<br>(5.12–6.71)                 | 6.75<br>(5.87–7.71)    | 8.15<br>(7.07–9.33)    | 9.30<br>(8.01–10.7)    | 10.8<br>(9.01–12.8)    | 12.0<br>(9.77–14.4)    | 13.2<br>(10.3–16.2)   | 14.3<br>(10.8–18.1)   | 15.8<br>(11.5–20.6)  | 16.9<br>(12.0–22.4)  |
| 60-day   | 6.76<br>(5.90–7.68)                 | 7.76<br>(6.76–8.83)    | 9.35<br>(8.12–10.7)    | 10.6<br>(9.18–12.2)    | 12.3<br>(10.2–14.5)    | 13.6<br>(11.0–16.2)    | 14.8<br>(11.6–18.1)   | 15.9<br>(12.0–20.0)   | 17.4<br>(12.6–22.5)  | 18.4<br>(13.1–24.4)  |

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

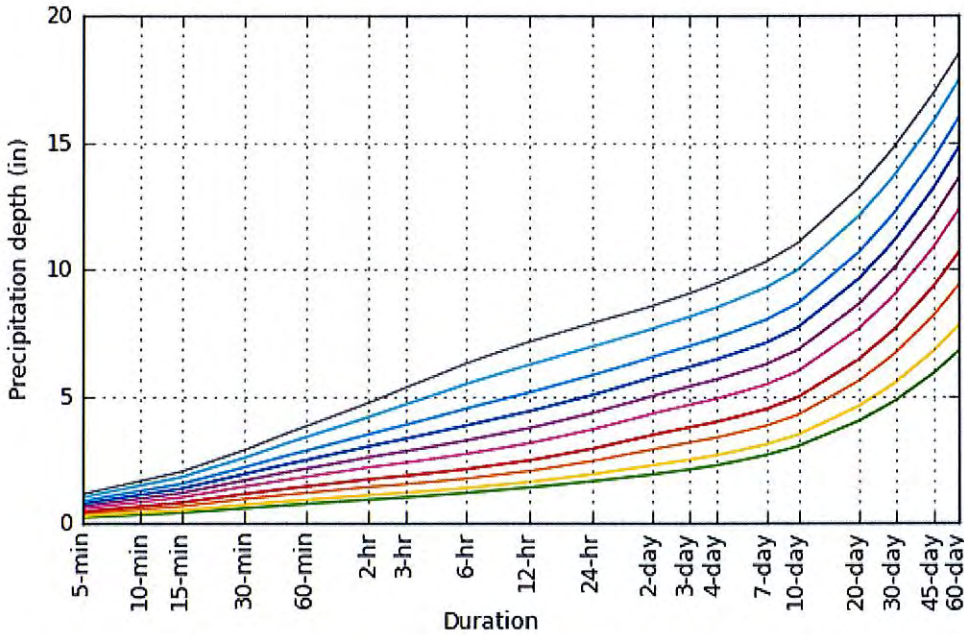
Please refer to NOAA Atlas 14 document for more information.

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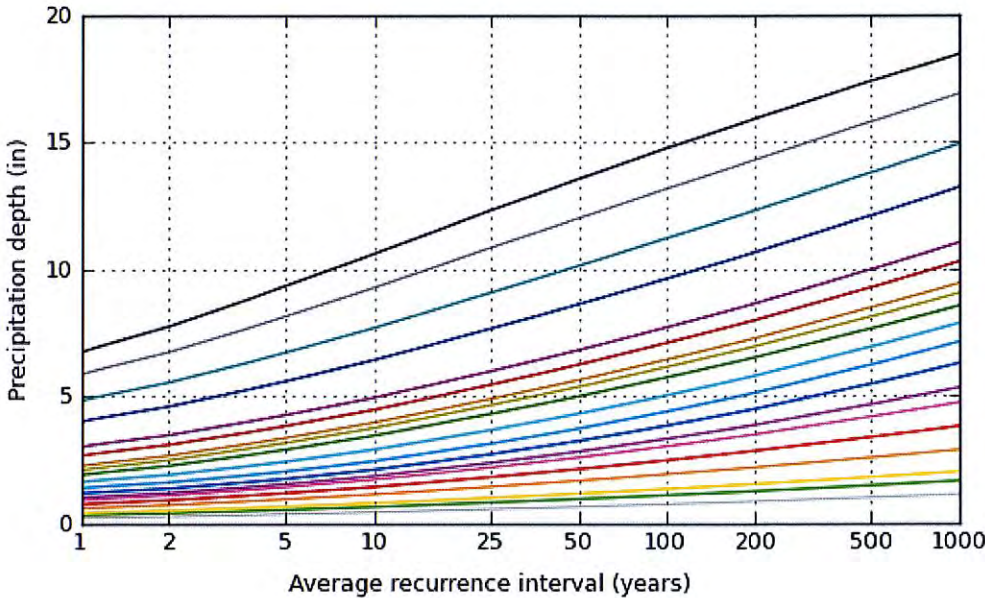


PF graphical

PDS-based depth-duration-frequency (DDF) curves  
Latitude: 39.0510°, Longitude: -104.7161°



| Average recurrence interval (years) |      |
|-------------------------------------|------|
| 1                                   | 2    |
| 5                                   | 10   |
| 25                                  | 50   |
| 100                                 | 200  |
| 500                                 | 1000 |

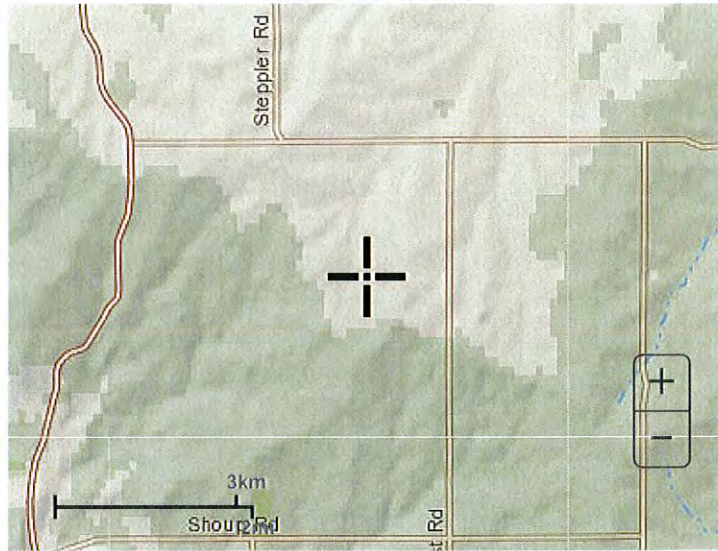


| Duration |        |
|----------|--------|
| 5-min    | 2-day  |
| 10-min   | 3-day  |
| 15-min   | 4-day  |
| 30-min   | 7-day  |
| 60-min   | 10-day |
| 2-hr     | 20-day |
| 3-hr     | 30-day |
| 6-hr     | 45-day |
| 12-hr    | 60-day |
| 24-hr    |        |



## Maps & aerals

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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[National Oceanic and Atmospheric Administration](#)  
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1325 East West Highway  
Silver Spring, MD 20910  
Questions? [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

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**Table 6-4. NRCS 24-Hour Type II Design Storm Distribution, <10 mi<sup>2</sup>**  
(Fraction of 24-Hour Rainfall Depth)

| Hour | Minutes |        |        |        |
|------|---------|--------|--------|--------|
|      | 0       | 15     | 30     | 45     |
| 0    | 0.000   | 0.0020 | 0.0050 | 0.0080 |
| 1    | 0.0110  | 0.0140 | 0.0170 | 0.0200 |
| 2    | 0.0230  | 0.0260 | 0.0290 | 0.0320 |
| 3    | 0.0350  | 0.0380 | 0.0410 | 0.0440 |
| 4    | 0.0480  | 0.0520 | 0.0560 | 0.0600 |
| 5    | 0.0604  | 0.0680 | 0.0720 | 0.0760 |
| 6    | 0.0800  | 0.0850 | 0.0900 | 0.0950 |
| 7    | 0.1000  | 0.1050 | 0.1100 | 0.1150 |
| 8    | 0.1200  | 0.1260 | 0.1330 | 0.1400 |
| 9    | 0.1470  | 0.1550 | 0.1630 | 0.1720 |
| 10   | 0.1810  | 0.1910 | 0.2030 | 0.2180 |
| 11   | 0.2360  | 0.2570 | 0.2830 | 0.3870 |
| 12   | 0.6630  | 0.7070 | 0.7350 | 0.7580 |
| 13   | 0.7760  | 0.7910 | 0.8040 | 0.8150 |
| 14   | 0.8250  | 0.8340 | 0.8420 | 0.8490 |
| 15   | 0.8560  | 0.8630 | 0.8690 | 0.8750 |
| 16   | 0.8810  | 0.8870 | 0.8930 | 0.8980 |
| 17   | 0.9030  | 0.9080 | 0.9130 | 0.9180 |
| 18   | 0.9220  | 0.9260 | 0.9300 | 0.9340 |
| 19   | 0.9380  | 0.9420 | 0.9460 | 0.9500 |
| 20   | 0.9530  | 0.9560 | 0.9590 | 0.9620 |
| 21   | 0.9650  | 0.9680 | 0.9710 | 0.9740 |
| 22   | 0.9770  | 0.9800 | 0.9830 | 0.9860 |
| 23   | 0.9890  | 0.9920 | 0.9950 | 0.9980 |

### 2.2.1 Depth-Area Reduction Factors (DARFs)

Depth Area Reduction Factors (DARFs) are used to adjust point rainfall depths to average depths as the size of drainage basins increase. As a part of the 2011 rainfall study, Carlton analyzed radar data to develop DARF curves applicable to the Fountain Creek watershed, El Paso County and eastern Colorado. However, these relationships were determined for short-duration thunderstorms and are not applicable to longer-duration frontal storms. Therefore, the DARFs provided in the NOAA Atlas will continue to be applied for the frontal-type storms.

- **Thunderstorm DARFs:** The Carlton study provided DARF curves for various storm return periods for short-duration thunderstorm events; however, the difference between the sets of curves was determined to be insignificant. As described in the technical memorandum *Stormwater Management Assessment and Standards Development Project, Proposed Rainfall and Standard Design Storms* (City of Colorado Springs 2012), the 5-year set of DARF curves was selected for the development of thunderstorm type design storms. These DARF curves for short-duration events are shown in Figure 6-21 at the end of this chapter.

As described in the memorandum documenting the development of design storms, the HEC-HMS program provides guidance on the application of DARFs to define adjusted design storms as the



|                      |  |
|----------------------|--|
| Project Summary      |  |
| Title                | Flying Horse North<br>Irrigation<br>Reservoir (Pond<br>13) |
| Engineer             | MAW  |
| Company              | CCES   |
| Date                 | 8/8/2018   |
| Notes                |  |
| 2 Year (Colo. Spgs.) |  |

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|                              | Elevation-Volume-Flow Table (Pond), 2 years | 29 |
| JD Reservoir (Pond 13) (OUT) |   |    |
|                              | Pond Routed Hydrograph (total out), 2 years | 31 |

## Subsection: Master Network Summary

### Catchments Summary

| Label              | Scenario             | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) |
|--------------------|----------------------|----------------------|---------------------------|----------------------|--------------------------------|
| Basin CC-3         | Post-Development 2YR | 2                    | 0.855                     | 12.150               | 5.98                           |
| Basin CC-4A        | Post-Development 2YR | 2                    | 2.351                     | 12.200               | 15.53                          |
| Basin CC-4B        | Post-Development 2YR | 2                    | 0.693                     | 12.100               | 7.92                           |
| Basins OS-12, CC-1 | Post-Development 2YR | 2                    | 1.892                     | 12.150               | 14.75                          |
| Basins OS-13, CC-2 | Post-Development 2YR | 2                    | 1.616                     | 12.200               | 11.52                          |
| Basins OS-14       | Post-Development 2YR | 2                    | 0.397                     | 12.100               | 2.82                           |

### Node Summary

| Label              | Scenario             | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) |
|--------------------|----------------------|----------------------|---------------------------|----------------------|--------------------------------|
| DP-18 (MDDP DP 16) | Post-Development 2YR | 2                    | 4.628                     | 14.950               | 5.58                           |

### Pond Summary

| Label                        | Scenario             | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ac-ft) |
|------------------------------|----------------------|----------------------|---------------------------|----------------------|--------------------------------|--------------------------------------|------------------------------|
| Golf Course Pond 12 (IN)     | Post-Development 2YR | 2                    | 1.253                     | 12.100               | 8.75                           | (N/A)                                | (N/A)                        |
| Golf Course Pond 12 (OUT)    | Post-Development 2YR | 2                    | 0.135                     | 23.850               | 0.61                           | 7,544.04                             | 4.542                        |
| JD Reservoir (Pond 13) (IN)  | Post-Development 2YR | 2                    | 6.686                     | 12.150               | 47.71                          | (N/A)                                | (N/A)                        |
| JD Reservoir (Pond 13) (OUT) | Post-Development 2YR | 2                    | 4.628                     | 14.950               | 5.58                           | 7,531.40                             | 97.789                       |

Subsection: Time-Depth Curve  
Label: Colo Springs 2015

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

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Time-Depth Curve: TYPE II 24 HOUR (Colo. Spgs.)

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|              |                                  |
|--------------|----------------------------------|
| Label        | TYPE II 24 HOUR<br>(Colo. Spgs.) |
| Start Time   | 0.000 hours                      |
| Increment    | 0.250 hours                      |
| End Time     | 24.000 hours                     |
| Return Event | 2 years                          |

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**CUMULATIVE RAINFALL (in)**  
**Output Time Increment = 0.250 hours**  
**Time on left represents time for first value in each row.**

| Time<br>(hours) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) |
|-----------------|---------------|---------------|---------------|---------------|---------------|
| 0.000           | 0.00          | 0.00          | 0.01          | 0.02          | 0.02          |
| 1.250           | 0.03          | 0.04          | 0.04          | 0.05          | 0.05          |
| 2.500           | 0.06          | 0.07          | 0.07          | 0.08          | 0.09          |
| 3.750           | 0.09          | 0.10          | 0.11          | 0.12          | 0.13          |
| 5.000           | 0.13          | 0.14          | 0.15          | 0.16          | 0.17          |
| 6.250           | 0.18          | 0.19          | 0.20          | 0.21          | 0.22          |
| 7.500           | 0.23          | 0.24          | 0.25          | 0.26          | 0.28          |
| 8.750           | 0.29          | 0.31          | 0.33          | 0.34          | 0.36          |
| 10.000          | 0.38          | 0.40          | 0.43          | 0.46          | 0.50          |
| 11.250          | 0.54          | 0.59          | 0.81          | 1.39          | 1.48          |
| 12.500          | 1.54          | 1.59          | 1.63          | 1.66          | 1.69          |
| 13.750          | 1.71          | 1.73          | 1.77          | 1.78          | 1.80          |
| 15.000          | 1.81          | 1.82          | 1.84          | 1.85          | 1.86          |
| 16.250          | 1.88          | 1.89          | 1.90          | 1.91          | 1.92          |
| 17.500          | 1.93          | 1.94          | 1.94          | 1.94          | 1.95          |
| 18.750          | 1.96          | 1.97          | 1.98          | 1.99          | 2.00          |
| 20.000          | 2.00          | 2.01          | 2.01          | 2.02          | 2.03          |
| 21.250          | 2.03          | 2.04          | 2.05          | 2.05          | 2.06          |
| 22.500          | 2.06          | 2.07          | 2.08          | 2.08          | 2.09          |
| 23.750          | 2.10          | 2.10          | (N/A)         | (N/A)         | (N/A)         |

Subsection: Elevation-Area Volume Curve  
 Label: Golf Course Pond 12

Return Event: 2 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

| Elevation<br>(ft) | Planimeter<br>(ft <sup>2</sup> ) | Area<br>(acres) | A1+A2+sqr<br>(A1*A2)<br>(acres) | Volume<br>(ac-ft) | Volume (Total)<br>(ac-ft) |
|-------------------|----------------------------------|-----------------|---------------------------------|-------------------|---------------------------|
| 7,534.00          | 0.0                              | 0.043           | 0.000                           | 0.000             | 0.000                     |
| 7,536.00          | 0.0                              | 0.200           | 0.336                           | 0.224             | 0.224                     |
| 7,538.00          | 0.0                              | 0.330           | 0.787                           | 0.525             | 0.748                     |
| 7,540.00          | 0.0                              | 0.470           | 1.194                           | 0.796             | 1.544                     |
| 7,542.00          | 0.0                              | 0.640           | 1.658                           | 1.106             | 2.650                     |
| 7,544.00          | 0.0                              | 1.240           | 2.771                           | 1.847             | 4.497                     |
| 7,546.00          | 0.0                              | 1.400           | 3.958                           | 2.638             | 7.136                     |

Subsection: Elevation-Area Volume Curve  
Label: JD Reservoir (Pond 13)

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

| Elevation<br>(ft) | Planimeter<br>(ft <sup>2</sup> ) | Area<br>(acres) | A1+A2+sqr<br>(A1*A2)<br>(acres) | Volume<br>(ac-ft) | Volume (Total)<br>(ac-ft) |
|-------------------|----------------------------------|-----------------|---------------------------------|-------------------|---------------------------|
| 7,510.00          | 0.0                              | 1.510           | 0.000                           | 0.000             | 0.000                     |
| 7,511.00          | 0.0                              | 1.990           | 5.233                           | 1.744             | 1.744                     |
| 7,512.00          | 0.0                              | 2.520           | 6.749                           | 2.250             | 3.994                     |
| 7,513.00          | 0.0                              | 2.850           | 8.050                           | 2.683             | 6.678                     |
| 7,514.00          | 0.0                              | 3.050           | 8.848                           | 2.949             | 9.627                     |
| 7,515.00          | 0.0                              | 3.260           | 9.463                           | 3.154             | 12.781                    |
| 7,516.00          | 0.0                              | 3.480           | 10.108                          | 3.369             | 16.151                    |
| 7,517.00          | 0.0                              | 3.700           | 10.768                          | 3.589             | 19.740                    |
| 7,518.00          | 0.0                              | 3.930           | 11.443                          | 3.814             | 23.555                    |
| 7,519.00          | 0.0                              | 4.160           | 12.133                          | 4.044             | 27.599                    |
| 7,520.00          | 0.0                              | 4.400           | 12.838                          | 4.279             | 31.879                    |
| 7,521.00          | 0.0                              | 4.640           | 13.558                          | 4.519             | 36.398                    |
| 7,522.00          | 0.0                              | 4.880           | 14.278                          | 4.760             | 41.158                    |
| 7,523.00          | 0.0                              | 5.140           | 15.028                          | 5.009             | 46.167                    |
| 7,524.00          | 0.0                              | 5.360           | 15.749                          | 5.250             | 51.417                    |
| 7,525.00          | 0.0                              | 5.590           | 16.424                          | 5.475             | 56.891                    |
| 7,526.00          | 0.0                              | 5.840           | 17.144                          | 5.715             | 62.606                    |
| 7,527.00          | 0.0                              | 6.080           | 17.879                          | 5.960             | 68.565                    |
| 7,528.00          | 0.0                              | 6.330           | 18.614                          | 6.205             | 74.770                    |
| 7,529.00          | 0.0                              | 6.570           | 19.349                          | 6.450             | 81.220                    |
| 7,530.00          | 0.0                              | 6.810           | 20.069                          | 6.690             | 87.909                    |
| 7,531.00          | 0.0                              | 7.150           | 20.938                          | 6.979             | 94.889                    |
| 7,532.00          | 0.0                              | 7.520           | 22.003                          | 7.334             | 102.223                   |
| 7,533.00          | 0.0                              | 7.830           | 23.023                          | 7.674             | 109.897                   |
| 7,534.00          | 0.0                              | 8.370           | 24.295                          | 8.099             | 117.996                   |
| 7,535.00          | 0.0                              | 8.770           | 25.708                          | 8.569             | 126.565                   |
| 7,536.00          | 0.0                              | 9.170           | 26.908                          | 8.969             | 135.534                   |



Subsection: Outlet Input Data

Label: FH North Pond 13

Return Event: 2 years

Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

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Requested Pond Water Surface Elevations

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|                       |             |
|-----------------------|-------------|
| Minimum (Headwater)   | 7,510.00 ft |
| Increment (Headwater) | 0.50 ft     |
| Maximum (Headwater)   | 7,536.00 ft |

---

**Outlet Connectivity**

| Structure Type     | Outlet ID               | Direction | Outfall            | E1<br>(ft) | E2<br>(ft) |
|--------------------|-------------------------|-----------|--------------------|------------|------------|
| Inlet Box          | SWQ<br>Outlet Box       | Forward   | SWQ<br>Outlet Pipe | 7,533.00   | 7,536.00   |
| Orifice-Area       | SWQ<br>Orifice<br>Plate | Forward   | SWQ<br>Outlet Pipe | 7,531.00   | 7,536.00   |
| Culvert-Circular   | SWQ<br>Outlet Pipe      | Forward   | TW                 | 7,526.90   | 7,536.00   |
| Culvert-Box        | Twin CBC<br>Spillway    | Forward   | TW                 | 7,533.00   | 7,536.00   |
| Tailwater Settings | Tailwater               |           |                    | (N/A)      | (N/A)      |

## Subsection: Outlet Input Data

Label: FH North Pond 13

Return Event: 2 years

Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

---

Structure ID: SWQ Outlet Box  
Structure Type: Inlet Box

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|                     |                             |
|---------------------|-----------------------------|
| Number of Openings  | 1                           |
| Elevation           | 7,533.00 ft                 |
| Orifice Area        | 20.8 ft <sup>2</sup>        |
| Orifice Coefficient | 0.600                       |
| Weir Length         | 8.00 ft                     |
| Weir Coefficient    | 3.00 (ft <sup>0.5</sup> )/s |
| K Reverse           | 1.000                       |
| Manning's n         | 0.000                       |
| Kev, Charged Riser  | 0.000                       |
| Weir Submergence    | False                       |
| Orifice H to crest  | False                       |

---

---

Structure ID: SWQ Orifice Plate  
Structure Type: Orifice-Area

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|                     |                     |
|---------------------|---------------------|
| Number of Openings  | 3                   |
| Elevation           | 7,531.00 ft         |
| Orifice Area        | 1.4 ft <sup>2</sup> |
| Top Elevation       | 7,533.00 ft         |
| Datum Elevation     | 7,531.00 ft         |
| Orifice Coefficient | 0.600               |

---

Subsection: Outlet Input Data  
 Label: FH North Pond 13

Return Event: 2 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

|                                  |             |
|----------------------------------|-------------|
| Structure ID: SWQ Outlet Pipe    |             |
| Structure Type: Culvert-Circular |             |
| Number of Barrels                | 1           |
| Diameter                         | 30.0 in     |
| Length                           | 100.00 ft   |
| Length (Computed Barrel)         | 100.00 ft   |
| Slope (Computed)                 | 0.010 ft/ft |
| Outlet Control Data              |             |
| Manning's n                      | 0.013       |
| Ke                               | 0.200       |
| Kb                               | 0.009       |
| Kr                               | 0.000       |
| Convergence Tolerance            | 0.00 ft     |
| Inlet Control Data               |             |
| Equation Form                    | Form 1      |
| K                                | 0.0045      |
| M                                | 2.0000      |
| C                                | 0.0317      |
| Y                                | 0.6900      |
| T1 ratio (HW/D)                  | 1.090       |
| T2 ratio (HW/D)                  | 1.192       |
| Slope Correction Factor          | -0.500      |

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...

|              |             |         |                          |
|--------------|-------------|---------|--------------------------|
| T1 Elevation | 7,529.63 ft | T1 Flow | 27.16 ft <sup>3</sup> /s |
| T2 Elevation | 7,529.88 ft | T2 Flow | 31.05 ft <sup>3</sup> /s |

## Subsection: Outlet Input Data

Label: FH North Pond 13

Return Event: 2 years

Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

---

 Structure ID: Twin CBC Spillway  
 Structure Type: Culvert-Box
 

---

|                          |             |
|--------------------------|-------------|
| Number of Barrels        | 2           |
| Width                    | 10.00 ft    |
| Height                   | 4.00 ft     |
| Length                   | 65.00 ft    |
| Length (Computed Barrel) | 65.00 ft    |
| Slope (Computed)         | 0.010 ft/ft |

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 Outlet Control Data
 

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|                       |         |
|-----------------------|---------|
| Manning's n           | 0.013   |
| Ke                    | 0.500   |
| Kb                    | 0.003   |
| Kr                    | 0.000   |
| Convergence Tolerance | 0.00 ft |

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 Inlet Control Data
 

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|                         |        |
|-------------------------|--------|
| Equation Form           | Form 1 |
| K                       | 0.0260 |
| M                       | 1.0000 |
| C                       | 0.0347 |
| Y                       | 0.8100 |
| T1 ratio (HW/D)         | 1.173  |
| T2 ratio (HW/D)         | 1.360  |
| Slope Correction Factor | -0.500 |

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 Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

 In transition zone between unsubmerged and submerged inlet control,  
 interpolate between flows at T1 & T2...

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|              |             |         |                           |
|--------------|-------------|---------|---------------------------|
| T1 Elevation | 7,537.69 ft | T1 Flow | 280.00 ft <sup>3</sup> /s |
| T2 Elevation | 7,538.44 ft | T2 Flow | 320.00 ft <sup>3</sup> /s |

---

Subsection: Outlet Input Data

Label: FH North Pond 13

Return Event: 2 years

Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

|                                      |                           |
|--------------------------------------|---------------------------|
| Structure ID: TW                     |                           |
| Structure Type: TW Setup, DS Channel |                           |
| Tailwater Type                       | Free Outfall              |
| Convergence Tolerances               |                           |
| Maximum Iterations                   | 30                        |
| Tailwater Tolerance<br>(Minimum)     | 0.01 ft                   |
| Tailwater Tolerance<br>(Maximum)     | 0.50 ft                   |
| Headwater Tolerance<br>(Minimum)     | 0.01 ft                   |
| Headwater Tolerance<br>(Maximum)     | 0.50 ft                   |
| Flow Tolerance (Minimum)             | 0.001 ft <sup>3</sup> /s  |
| Flow Tolerance (Maximum)             | 10.000 ft <sup>3</sup> /s |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 2 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water<br>Surface<br>Elevation<br>(ft) | Device<br>Flow<br>(ft <sup>3</sup> /s) | (into)<br>Headwater<br>Hydraulic<br>Grade Line<br>(ft) | Converge<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Next<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Downstream<br>Hydraulic<br>Grade Line<br>Error<br>(ft) | Convergence<br>Error<br>(ft <sup>3</sup> /s) | Downstream<br>Channel<br>Tailwater<br>(ft) | Tailwater<br>Error<br>(ft) |
|---------------------------------------|--|--|---|---|--|--|--|----------------------------|
| 7,510.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,510.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.90                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |



Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)  
Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 0.00                             | 0.00                                       | 0.00  | 7,528.16                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 0.00                             | 0.00                                       | 0.00  | 7,528.75                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 0.00                             | 0.00                                       | 0.00  | 7,529.24                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 0.00                             | 0.00                                       | 0.00  | 7,529.71                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 8.49                             | 7,533.50                                   | Free Outfall                                  | 7,530.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 24.00                            | 7,534.00                                   | Free Outfall                                  | 7,532.08                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 44.09                            | 7,534.50                                   | 7,533.67                                      | 7,533.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 67.88                            | 7,535.00                                   | 7,534.99                                      | 7,534.99                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 94.87                            | 7,535.50                                   | 7,535.50                                      | 7,535.50                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,536.00                     | 124.71                           | 7,536.00                                   | 7,536.00                                      | 7,536.00                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)

Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Message                          |
|----------------------------------|
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| Weir: H =0.5ft                   |
| Weir: H =1ft                     |
| FULLY CHARGED RISER: ADJUSTED TO |
| WEIR: H =1.5ft                   |
| FULLY CHARGED RISER: ADJUSTED TO |
| WEIR: H =2ft                     |
| FULLY CHARGED RISER: ADJUSTED TO |
| WEIR: H =2.5ft                   |
| FULLY CHARGED RISER,             |
| DOWNSTREAM CONTROL: Kev=0.       |
| Hev=0.000                        |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 2 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,510.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,510.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.90                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,527.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,527.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 6.94                             | 7,531.50                                   | Free Outfall                                  | 7,528.16                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 13.89                            | 7,532.00                                   | Free Outfall                                  | 7,528.75                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 20.83                            | 7,532.50                                   | Free Outfall                                  | 7,529.24                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 27.77                            | 7,533.00                                   | Free Outfall                                  | 7,529.71                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 31.05                            | 7,533.50                                   | Free Outfall                                  | 7,530.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 27.25                            | 7,534.00                                   | 7,532.08                                      | 7,532.08                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 17.92                            | 7,534.50                                   | 7,533.67                                      | 7,533.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 1.59                             | 7,535.00                                   | 7,534.99                                      | 7,534.99                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 0.00                             | 7,535.50                                   | 7,535.50                                      | 7,535.50                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,536.00                     | 0.00                             | 7,536.00                                   | 7,536.00                                      | 7,536.00                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Message   |
|---|
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| Hi=.50; Ht=2.00; Qt=9.26                                      |
| Hi=1.00; Ht=2.00; Qt=9.26                                     |
| Hi=1.50; Ht=2.00; Qt=9.26                                     |
| H =2.00   |
| H =2.50   |
| H =1.92   |
| H =.83  |
| H =.01  |
| FLOW PRECEDENCE SET TO<br>DOWNSTREAM CONTROLLING<br>STRUCTURE |
| FLOW PRECEDENCE SET TO<br>DOWNSTREAM CONTROLLING<br>STRUCTURE |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 2 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,510.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,510.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.90                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,527.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,527.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 6.94                             | 7,528.16                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 13.89                            | 7,528.75                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 20.83                            | 7,529.24                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 27.77                            | 7,529.71                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.01                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 39.53                            | 7,530.67                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 51.31                            | 7,532.08                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.06                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 61.99                            | 7,533.67                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.02                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 69.52                            | 7,534.99                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.05                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 72.13                            | 7,535.50                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 22.74                                  | (N/A)                             | 0.00                 |
| 7,536.00                     | 74.61                            | 7,536.00                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 50.10                                  | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.



Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

### RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
CRIT.DEPTH CONTROL Vh= .321ft  
Dcr= .874ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .493ft  
Dcr= 1.255ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .659ft  
Dcr= 1.551ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .840ft  
Dcr= 1.797ft CRIT.DEPTH Hev= .00ft  
INLET CONTROL... Submerged: HW  
=3.77  
INLET CONTROL... Submerged: HW  
=5.18  
INLET CONTROL... Submerged: HW  
=6.77

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

-----  
Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Message   |
|---|
| FULL FLOW...Lfull=98.92ft Vh=3.117ft<br>HL=6.583ft Hev= .00ft |
| FULL FLOW...Lfull=99.10ft Vh=3.356ft<br>HL=7.092ft Hev= .00ft |
| FULL FLOW...Lfull=99.31ft Vh=3.590ft<br>HL=7.594ft Hev= .00ft |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 2 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = Twin CBC Spillway (Culvert-Box)

-----  
 Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s  
 Upstream ID = (Pond Water Surface)  
 Downstream ID = Tailwater (Pond Outfall)

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,510.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,510.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.90                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.00                           | 0.00                         | (N/A)                       | 0.00                      |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = Twin CBC Spillway (Culvert-Box)

Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s  
Upstream ID = (Pond Water Surface)  
Downstream ID = Tailwater (Pond Outfall)

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,528.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,532.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,532.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,533.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,533.50                           | 17.36                        | (N/A)                       | 0.00                      |
| 7,534.00                           | 49.05                        | (N/A)                       | 0.00                      |
| 7,534.50                           | 90.08                        | (N/A)                       | 0.00                      |
| 7,535.00                           | 138.56                       | (N/A)                       | 0.00                      |
| 7,535.50                           | 193.63                       | (N/A)                       | 0.00                      |
| 7,536.00                           | 254.72                       | (N/A)                       | 0.00                      |

Computation Messages

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

Structure ID = Twin CBC Spillway (Culvert-Box)

Computation Messages

WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 CRIT.DEPTH CONTROL Vh= .143ft  
 Dcr= .286ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .286ft  
 Dcr= .572ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .429ft  
 Dcr= .858ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .571ft  
 Dcr= 1.143ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .714ft  
 Dcr= 1.428ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .857ft  
 Dcr= 1.715ft CRIT.DEPTH Hev= .00ft

Subsection: Composite Rating Curve  
 Label: FH North Pond 13

Return Event: 2 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

Composite Outflow Summary

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,510.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,510.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.90                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.00                           | 0.00                         | (N/A)                       | 0.00                      |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

### Composite Outflow Summary

| Water Surface Elevation (ft) | Flow (ft <sup>3</sup> /s) | Tailwater Elevation (ft) | Convergence Error (ft) |
|------------------------------|---------------------------|--------------------------|------------------------|
| 7,531.50                     | 6.94                      | (N/A)                    | 0.00                   |
| 7,532.00                     | 13.89                     | (N/A)                    | 0.00                   |
| 7,532.50                     | 20.83                     | (N/A)                    | 0.00                   |
| 7,533.00                     | 27.77                     | (N/A)                    | 0.00                   |
| 7,533.50                     | 56.89                     | (N/A)                    | 0.00                   |
| 7,534.00                     | 100.36                    | (N/A)                    | 0.00                   |
| 7,534.50                     | 152.07                    | (N/A)                    | 0.00                   |
| 7,535.00                     | 208.08                    | (N/A)                    | 0.00                   |
| 7,535.50                     | 265.76                    | (N/A)                    | 0.00                   |
| 7,536.00                     | 329.33                    | (N/A)                    | 0.00                   |

### Contributing Structures

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)



Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
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| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
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| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Outlet Pipe,Twin<br>CBC Spillway (no Q: SWQ Orifice<br>Plate) |
| SWQ Outlet Box,SWQ Outlet Pipe,Twin<br>CBC Spillway (no Q: SWQ Orifice<br>Plate) |

Subsection: Elevation-Volume-Flow Table (Pond)  
Label: JD Reservoir (Pond 13)

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

| Infiltration                          |                         |
|---------------------------------------|-------------------------|
| Infiltration Method<br>(Computed)     | No Infiltration         |
| Initial Conditions                    |                         |
| Elevation (Water Surface,<br>Initial) | 7,531.00 ft             |
| Volume (Initial)                      | 94.889 ac-ft            |
| Flow (Initial Outlet)                 | 0.00 ft <sup>3</sup> /s |
| Flow (Initial Infiltration)           | 0.00 ft <sup>3</sup> /s |
| Flow (Initial, Total)                 | 0.00 ft <sup>3</sup> /s |
| Time Increment                        | 0.050 hours             |

| Elevation<br>(ft) | Outflow<br>(ft <sup>3</sup> /s) | Storage<br>(ac-ft) | Area<br>(acres) | Infiltration<br>(ft <sup>3</sup> /s) | Flow (Total)<br>(ft <sup>3</sup> /s) | 2S/t + O<br>(ft <sup>3</sup> /s) |
|-------------------|---------------------------------|--------------------|-----------------|--------------------------------------|--------------------------------------|----------------------------------|
| 7,510.00          | 0.00                            | 0.000              | 1.510           | 0.00                                 | 0.00                                 | 0.00                             |
| 7,510.50          | 0.00                            | 0.812              | 1.742           | 0.00                                 | 0.00                                 | 393.13                           |
| 7,511.00          | 0.00                            | 1.744              | 1.990           | 0.00                                 | 0.00                                 | 844.33                           |
| 7,511.50          | 0.00                            | 2.803              | 2.247           | 0.00                                 | 0.00                                 | 1,356.72                         |
| 7,512.00          | 0.00                            | 3.994              | 2.520           | 0.00                                 | 0.00                                 | 1,933.23                         |
| 7,512.50          | 0.00                            | 5.295              | 2.682           | 0.00                                 | 0.00                                 | 2,562.63                         |
| 7,513.00          | 0.00                            | 6.678              | 2.850           | 0.00                                 | 0.00                                 | 3,231.95                         |
| 7,513.50          | 0.00                            | 8.127              | 2.949           | 0.00                                 | 0.00                                 | 3,933.62                         |
| 7,514.00          | 0.00                            | 9.627              | 3.050           | 0.00                                 | 0.00                                 | 4,659.48                         |
| 7,514.50          | 0.00                            | 11.178             | 3.154           | 0.00                                 | 0.00                                 | 5,410.14                         |
| 7,515.00          | 0.00                            | 12.781             | 3.260           | 0.00                                 | 0.00                                 | 6,186.22                         |
| 7,515.50          | 0.00                            | 14.439             | 3.369           | 0.00                                 | 0.00                                 | 6,988.30                         |
| 7,516.00          | 0.00                            | 16.151             | 3.480           | 0.00                                 | 0.00                                 | 7,817.01                         |
| 7,516.50          | 0.00                            | 17.918             | 3.589           | 0.00                                 | 0.00                                 | 8,672.34                         |
| 7,517.00          | 0.00                            | 19.740             | 3.700           | 0.00                                 | 0.00                                 | 9,554.30                         |
| 7,517.50          | 0.00                            | 21.619             | 3.814           | 0.00                                 | 0.00                                 | 10,463.47                        |
| 7,518.00          | 0.00                            | 23.555             | 3.930           | 0.00                                 | 0.00                                 | 11,400.48                        |
| 7,518.50          | 0.00                            | 25.548             | 4.044           | 0.00                                 | 0.00                                 | 12,365.32                        |
| 7,519.00          | 0.00                            | 27.599             | 4.160           | 0.00                                 | 0.00                                 | 13,357.99                        |
| 7,519.50          | 0.00                            | 29.709             | 4.279           | 0.00                                 | 0.00                                 | 14,379.10                        |
| 7,520.00          | 0.00                            | 31.879             | 4.400           | 0.00                                 | 0.00                                 | 15,429.24                        |
| 7,520.50          | 0.00                            | 34.108             | 4.519           | 0.00                                 | 0.00                                 | 16,508.43                        |
| 7,521.00          | 0.00                            | 36.398             | 4.640           | 0.00                                 | 0.00                                 | 17,616.66                        |
| 7,521.50          | 0.00                            | 38.748             | 4.759           | 0.00                                 | 0.00                                 | 18,753.94                        |
| 7,522.00          | 0.00                            | 41.158             | 4.880           | 0.00                                 | 0.00                                 | 19,920.26                        |
| 7,522.50          | 0.00                            | 43.630             | 5.009           | 0.00                                 | 0.00                                 | 21,116.81                        |
| 7,523.00          | 0.00                            | 46.167             | 5.140           | 0.00                                 | 0.00                                 | 22,344.83                        |
| 7,523.50          | 0.00                            | 48.764             | 5.249           | 0.00                                 | 0.00                                 | 23,601.92                        |
| 7,524.00          | 0.00                            | 51.417             | 5.360           | 0.00                                 | 0.00                                 | 24,885.64                        |
| 7,524.50          | 0.00                            | 54.125             | 5.474           | 0.00                                 | 0.00                                 | 26,196.58                        |
| 7,525.00          | 0.00                            | 56.891             | 5.590           | 0.00                                 | 0.00                                 | 27,535.35                        |

Subsection: Elevation-Volume-Flow Table (Pond)  
Label: JD Reservoir (Pond 13)

Return Event: 2 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

| Elevation<br>(ft) | Outflow<br>(ft <sup>3</sup> /s) | Storage<br>(ac-ft) | Area<br>(acres) | Infiltration<br>(ft <sup>3</sup> /s) | Flow (Total)<br>(ft <sup>3</sup> /s) | 2S/t + O<br>(ft <sup>3</sup> /s) |
|-------------------|---------------------------------|--------------------|-----------------|--------------------------------------|--------------------------------------|----------------------------------|
| 7,525.50          | 0.00                            | 59.717             | 5.714           | 0.00                                 | 0.00                                 | 28,903.14                        |
| 7,526.00          | 0.00                            | 62.606             | 5.840           | 0.00                                 | 0.00                                 | 30,301.19                        |
| 7,526.50          | 0.00                            | 65.556             | 5.959           | 0.00                                 | 0.00                                 | 31,728.89                        |
| 7,526.90          | 0.00                            | 67.959             | 6.056           | 0.00                                 | 0.00                                 | 32,891.95                        |
| 7,527.00          | 0.00                            | 68.565             | 6.080           | 0.00                                 | 0.00                                 | 33,185.63                        |
| 7,527.50          | 0.00                            | 71.636             | 6.204           | 0.00                                 | 0.00                                 | 34,672.01                        |
| 7,528.00          | 0.00                            | 74.770             | 6.330           | 0.00                                 | 0.00                                 | 36,188.65                        |
| 7,528.50          | 0.00                            | 77.965             | 6.449           | 0.00                                 | 0.00                                 | 37,734.94                        |
| 7,529.00          | 0.00                            | 81.220             | 6.570           | 0.00                                 | 0.00                                 | 39,310.27                        |
| 7,529.50          | 0.00                            | 84.534             | 6.689           | 0.00                                 | 0.00                                 | 40,914.64                        |
| 7,530.00          | 0.00                            | 87.909             | 6.810           | 0.00                                 | 0.00                                 | 42,548.05                        |
| 7,530.50          | 0.00                            | 91.356             | 6.979           | 0.00                                 | 0.00                                 | 44,216.48                        |
| 7,531.00          | 0.00                            | 94.889             | 7.150           | 0.00                                 | 0.00                                 | 45,926.04                        |
| 7,531.50          | 6.94                            | 98.509             | 7.334           | 0.00                                 | 6.94                                 | 47,685.48                        |
| 7,532.00          | 13.89                           | 102.223            | 7.520           | 0.00                                 | 13.89                                | 49,489.69                        |
| 7,532.50          | 20.83                           | 106.021            | 7.674           | 0.00                                 | 20.83                                | 51,335.10                        |
| 7,533.00          | 27.77                           | 109.897            | 7.830           | 0.00                                 | 27.77                                | 53,218.02                        |
| 7,533.50          | 56.89                           | 113.879            | 8.098           | 0.00                                 | 56.89                                | 55,174.31                        |
| 7,534.00          | 100.36                          | 117.996            | 8.370           | 0.00                                 | 100.36                               | 57,210.28                        |
| 7,534.50          | 152.07                          | 122.230            | 8.569           | 0.00                                 | 152.07                               | 59,311.55                        |
| 7,535.00          | 208.08                          | 126.565            | 8.770           | 0.00                                 | 208.08                               | 61,465.51                        |
| 7,535.50          | 265.76                          | 131.000            | 8.969           | 0.00                                 | 265.76                               | 63,669.55                        |
| 7,536.00          | 329.33                          | 135.534            | 9.170           | 0.00                                 | 329.33                               | 65,927.87                        |

Subsection: Pond Routed Hydrograph (total out)  
 Label: JD Reservoir (Pond 13) (OUT)

Return Event: 2 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

|                   |                         |
|-------------------|-------------------------|
| Peak Discharge    | 5.58 ft <sup>3</sup> /s |
| Time to Peak      | 14.950 hours            |
| Hydrograph Volume | 4.628 ac-ft             |

### HYDROGRAPH ORDINATES (ft<sup>3</sup>/s)

Output Time Increment = 0.050 hours

Time on left represents time for first value in each row.

| Time<br>(hours) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 11.400          | 0.00                         | 0.00                         | 0.00                         | 0.01                         | 0.02                         |
| 11.650          | 0.03                         | 0.05                         | 0.07                         | 0.11                         | 0.16                         |
| 11.900          | 0.23                         | 0.34                         | 0.50                         | 0.74                         | 1.04                         |
| 12.150          | 1.40                         | 1.76                         | 2.10                         | 2.41                         | 2.69                         |
| 12.400          | 2.93                         | 3.13                         | 3.31                         | 3.47                         | 3.61                         |
| 12.650          | 3.74                         | 3.85                         | 3.96                         | 4.06                         | 4.15                         |
| 12.900          | 4.24                         | 4.32                         | 4.40                         | 4.47                         | 4.53                         |
| 13.150          | 4.59                         | 4.65                         | 4.70                         | 4.75                         | 4.80                         |
| 13.400          | 4.85                         | 4.89                         | 4.93                         | 4.97                         | 5.00                         |
| 13.650          | 5.03                         | 5.07                         | 5.09                         | 5.12                         | 5.15                         |
| 13.900          | 5.17                         | 5.19                         | 5.21                         | 5.23                         | 5.25                         |
| 14.150          | 5.27                         | 5.30                         | 5.33                         | 5.37                         | 5.41                         |
| 14.400          | 5.45                         | 5.48                         | 5.51                         | 5.53                         | 5.55                         |
| 14.650          | 5.56                         | 5.56                         | 5.57                         | 5.57                         | 5.57                         |
| 14.900          | 5.57                         | 5.58                         | 5.57                         | 5.57                         | 5.57                         |
| 15.150          | 5.57                         | 5.57                         | 5.57                         | 5.56                         | 5.56                         |
| 15.400          | 5.55                         | 5.55                         | 5.54                         | 5.54                         | 5.53                         |
| 15.650          | 5.52                         | 5.52                         | 5.51                         | 5.51                         | 5.50                         |
| 15.900          | 5.50                         | 5.49                         | 5.48                         | 5.48                         | 5.47                         |
| 16.150          | 5.47                         | 5.46                         | 5.46                         | 5.46                         | 5.45                         |
| 16.400          | 5.44                         | 5.44                         | 5.43                         | 5.42                         | 5.42                         |
| 16.650          | 5.41                         | 5.40                         | 5.39                         | 5.38                         | 5.37                         |
| 16.900          | 5.36                         | 5.35                         | 5.34                         | 5.33                         | 5.32                         |
| 17.150          | 5.32                         | 5.31                         | 5.30                         | 5.29                         | 5.28                         |
| 17.400          | 5.27                         | 5.26                         | 5.26                         | 5.25                         | 5.24                         |
| 17.650          | 5.23                         | 5.22                         | 5.21                         | 5.20                         | 5.19                         |
| 17.900          | 5.17                         | 5.15                         | 5.13                         | 5.10                         | 5.07                         |
| 18.150          | 5.04                         | 5.02                         | 4.99                         | 4.97                         | 4.95                         |
| 18.400          | 4.93                         | 4.92                         | 4.90                         | 4.89                         | 4.87                         |
| 18.650          | 4.86                         | 4.85                         | 4.84                         | 4.83                         | 4.82                         |
| 18.900          | 4.81                         | 4.79                         | 4.78                         | 4.77                         | 4.76                         |
| 19.150          | 4.75                         | 4.74                         | 4.73                         | 4.72                         | 4.71                         |
| 19.400          | 4.71                         | 4.70                         | 4.69                         | 4.68                         | 4.67                         |
| 19.650          | 4.66                         | 4.65                         | 4.64                         | 4.63                         | 4.62                         |
| 19.900          | 4.61                         | 4.60                         | 4.59                         | 4.58                         | 4.57                         |
| 20.150          | 4.56                         | 4.54                         | 4.53                         | 4.52                         | 4.50                         |
| 20.400          | 4.49                         | 4.47                         | 4.46                         | 4.45                         | 4.43                         |
| 20.650          | 4.42                         | 4.41                         | 4.40                         | 4.38                         | 4.37                         |
| 20.900          | 4.36                         | 4.35                         | 4.34                         | 4.33                         | 4.32                         |

Subsection: Pond Routed Hydrograph (total out)  
 Label: JD Reservoir (Pond 13) (OUT)

Return Event: 2 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

**HYDROGRAPH ORDINATES (ft<sup>3</sup>/s)**

**Output Time Increment = 0.050 hours**

**Time on left represents time for first value in each row.**

| Time<br>(hours) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 21.150          | 4.31                         | 4.30                         | 4.29                         | 4.28                         | 4.27                         |
| 21.400          | 4.26                         | 4.25                         | 4.24                         | 4.24                         | 4.23                         |
| 21.650          | 4.22                         | 4.21                         | 4.20                         | 4.20                         | 4.19                         |
| 21.900          | 4.18                         | 4.17                         | 4.17                         | 4.16                         | 4.15                         |
| 22.150          | 4.14                         | 4.14                         | 4.13                         | 4.12                         | 4.12                         |
| 22.400          | 4.11                         | 4.11                         | 4.10                         | 4.09                         | 4.09                         |
| 22.650          | 4.08                         | 4.08                         | 4.07                         | 4.06                         | 4.06                         |
| 22.900          | 4.05                         | 4.05                         | 4.04                         | 4.04                         | 4.03                         |
| 23.150          | 4.03                         | 4.02                         | 4.02                         | 4.01                         | 4.01                         |
| 23.400          | 4.00                         | 4.00                         | 3.99                         | 3.99                         | 3.99                         |
| 23.650          | 3.98                         | 3.98                         | 3.97                         | 3.97                         | 3.96                         |
| 23.900          | 3.96                         | 3.95                         | 3.95                         | (N/A)                        | (N/A)                        |



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### M

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|                      |  |
|----------------------|--|
| Project Summary      |  |
| Title                | Flying Horse North<br>Irrigation<br>Reservoir (Pond<br>13) |
| Engineer             | MAW  |
| Company              | CCES   |
| Date                 | 8/8/2018   |
| Notes                |  |
| 5 Year (Colo. Spgs.) |  |

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## Subsection: Master Network Summary

### Catchments Summary

| Label              | Scenario             | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) |
|--------------------|----------------------|----------------------|---------------------------|----------------------|--------------------------------|
| Basin CC-3         | Post-Development 5YR | 5                    | 1.849                     | 12.100               | 19.21                          |
| Basin CC-4A        | Post-Development 5YR | 5                    | 4.720                     | 12.200               | 39.18                          |
| Basin CC-4B        | Post-Development 5YR | 5                    | 1.229                     | 12.100               | 15.28                          |
| Basins OS-12, CC-1 | Post-Development 5YR | 5                    | 3.838                     | 12.150               | 38.36                          |
| Basins OS-13, CC-2 | Post-Development 5YR | 5                    | 3.239                     | 12.150               | 29.22                          |
| Basins OS-14       | Post-Development 5YR | 5                    | 0.886                     | 12.100               | 9.76                           |

### Node Summary

| Label              | Scenario             | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) |
|--------------------|----------------------|----------------------|---------------------------|----------------------|--------------------------------|
| DP-18 (MDDP DP 16) | Post-Development 5YR | 5                    | 10.285                    | 15.200               | 12.09                          |

### Pond Summary

| Label                        | Scenario             | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ac-ft) |
|------------------------------|----------------------|----------------------|---------------------------|----------------------|--------------------------------|--------------------------------------|------------------------------|
| Golf Course Pond 12 (IN)     | Post-Development 5YR | 5                    | 2.735                     | 12.100               | 28.97                          | (N/A)                                | (N/A)                        |
| Golf Course Pond 12 (OUT)    | Post-Development 5YR | 5                    | 1.581                     | 14.150               | 2.88                           | 7,544.17                             | 4.709                        |
| JD Reservoir (Pond 13) (IN)  | Post-Development 5YR | 5                    | 14.607                    | 12.150               | 118.81                         | (N/A)                                | (N/A)                        |
| JD Reservoir (Pond 13) (OUT) | Post-Development 5YR | 5                    | 10.285                    | 15.200               | 12.09                          | 7,531.87                             | 101.252                      |

Subsection: Time-Depth Curve  
Label: Colo Springs 2015

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

Time-Depth Curve: TYPE II 24 HOUR (Colo. Spgs.)

|              |                                  |
|--------------|----------------------------------|
| Label        | TYPE II 24 HOUR<br>(Colo. Spgs.) |
| Start Time   | 0.000 hours                      |
| Increment    | 0.250 hours                      |
| End Time     | 24.000 hours                     |
| Return Event | 5 years                          |

**CUMULATIVE RAINFALL (in)**

**Output Time Increment = 0.250 hours**

**Time on left represents time for first value in each row.**

| Time<br>(hours) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) |
|-----------------|---------------|---------------|---------------|---------------|---------------|
| 0.000           | 0.00          | 0.01          | 0.01          | 0.02          | 0.03          |
| 1.250           | 0.04          | 0.05          | 0.05          | 0.06          | 0.07          |
| 2.500           | 0.08          | 0.09          | 0.09          | 0.10          | 0.11          |
| 3.750           | 0.12          | 0.13          | 0.14          | 0.15          | 0.16          |
| 5.000           | 0.16          | 0.18          | 0.19          | 0.21          | 0.22          |
| 6.250           | 0.23          | 0.24          | 0.26          | 0.27          | 0.28          |
| 7.500           | 0.30          | 0.31          | 0.32          | 0.34          | 0.36          |
| 8.750           | 0.38          | 0.40          | 0.42          | 0.44          | 0.46          |
| 10.000          | 0.49          | 0.52          | 0.55          | 0.59          | 0.64          |
| 11.250          | 0.69          | 0.76          | 1.04          | 1.79          | 1.90          |
| 12.500          | 1.98          | 2.04          | 2.10          | 2.14          | 2.17          |
| 13.750          | 2.20          | 2.23          | 2.25          | 2.27          | 2.29          |
| 15.000          | 2.31          | 2.33          | 2.35          | 2.36          | 2.38          |
| 16.250          | 2.39          | 2.41          | 2.42          | 2.44          | 2.45          |
| 17.500          | 2.47          | 2.48          | 2.49          | 2.50          | 2.51          |
| 18.750          | 2.52          | 2.53          | 2.54          | 2.55          | 2.57          |
| 20.000          | 2.57          | 2.58          | 2.59          | 2.60          | 2.61          |
| 21.250          | 2.61          | 2.62          | 2.63          | 2.64          | 2.65          |
| 22.500          | 2.65          | 2.66          | 2.67          | 2.68          | 2.69          |
| 23.750          | 2.69          | 2.70          | (N/A)         | (N/A)         | (N/A)         |

Subsection: Elevation-Area Volume Curve  
 Label: Golf Course Pond 12

Return Event: 5 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

| Elevation<br>(ft) | Planimeter<br>(ft <sup>2</sup> ) | Area<br>(acres) | A1+A2+sqr<br>(A1*A2)<br>(acres) | Volume<br>(ac-ft) | Volume (Total)<br>(ac-ft) |
|-------------------|----------------------------------|-----------------|---------------------------------|-------------------|---------------------------|
| 7,534.00          | 0.0                              | 0.043           | 0.000                           | 0.000             | 0.000                     |
| 7,536.00          | 0.0                              | 0.200           | 0.336                           | 0.224             | 0.224                     |
| 7,538.00          | 0.0                              | 0.330           | 0.787                           | 0.525             | 0.748                     |
| 7,540.00          | 0.0                              | 0.470           | 1.194                           | 0.796             | 1.544                     |
| 7,542.00          | 0.0                              | 0.640           | 1.658                           | 1.106             | 2.650                     |
| 7,544.00          | 0.0                              | 1.240           | 2.771                           | 1.847             | 4.497                     |
| 7,546.00          | 0.0                              | 1.400           | 3.958                           | 2.638             | 7.136                     |

Subsection: Elevation-Area Volume Curve  
Label: JD Reservoir (Pond 13)

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

| Elevation<br>(ft) | Planimeter<br>(ft <sup>2</sup> ) | Area<br>(acres) | A1+A2+sqr<br>(A1*A2)<br>(acres) | Volume<br>(ac-ft) | Volume (Total)<br>(ac-ft) |
|-------------------|----------------------------------|-----------------|---------------------------------|-------------------|---------------------------|
| 7,510.00          | 0.0                              | 1.510           | 0.000                           | 0.000             | 0.000                     |
| 7,511.00          | 0.0                              | 1.990           | 5.233                           | 1.744             | 1.744                     |
| 7,512.00          | 0.0                              | 2.520           | 6.749                           | 2.250             | 3.994                     |
| 7,513.00          | 0.0                              | 2.850           | 8.050                           | 2.683             | 6.678                     |
| 7,514.00          | 0.0                              | 3.050           | 8.848                           | 2.949             | 9.627                     |
| 7,515.00          | 0.0                              | 3.260           | 9.463                           | 3.154             | 12.781                    |
| 7,516.00          | 0.0                              | 3.480           | 10.108                          | 3.369             | 16.151                    |
| 7,517.00          | 0.0                              | 3.700           | 10.768                          | 3.589             | 19.740                    |
| 7,518.00          | 0.0                              | 3.930           | 11.443                          | 3.814             | 23.555                    |
| 7,519.00          | 0.0                              | 4.160           | 12.133                          | 4.044             | 27.599                    |
| 7,520.00          | 0.0                              | 4.400           | 12.838                          | 4.279             | 31.879                    |
| 7,521.00          | 0.0                              | 4.640           | 13.558                          | 4.519             | 36.398                    |
| 7,522.00          | 0.0                              | 4.880           | 14.278                          | 4.760             | 41.158                    |
| 7,523.00          | 0.0                              | 5.140           | 15.028                          | 5.009             | 46.167                    |
| 7,524.00          | 0.0                              | 5.360           | 15.749                          | 5.250             | 51.417                    |
| 7,525.00          | 0.0                              | 5.590           | 16.424                          | 5.475             | 56.891                    |
| 7,526.00          | 0.0                              | 5.840           | 17.144                          | 5.715             | 62.606                    |
| 7,527.00          | 0.0                              | 6.080           | 17.879                          | 5.960             | 68.565                    |
| 7,528.00          | 0.0                              | 6.330           | 18.614                          | 6.205             | 74.770                    |
| 7,529.00          | 0.0                              | 6.570           | 19.349                          | 6.450             | 81.220                    |
| 7,530.00          | 0.0                              | 6.810           | 20.069                          | 6.690             | 87.909                    |
| 7,531.00          | 0.0                              | 7.150           | 20.938                          | 6.979             | 94.889                    |
| 7,532.00          | 0.0                              | 7.520           | 22.003                          | 7.334             | 102.223                   |
| 7,533.00          | 0.0                              | 7.830           | 23.023                          | 7.674             | 109.897                   |
| 7,534.00          | 0.0                              | 8.370           | 24.295                          | 8.099             | 117.996                   |
| 7,535.00          | 0.0                              | 8.770           | 25.708                          | 8.569             | 126.565                   |
| 7,536.00          | 0.0                              | 9.170           | 26.908                          | 8.969             | 135.534                   |



Subsection: Outlet Input Data

Label: FH North Pond 13

Return Event: 5 years

Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

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Requested Pond Water Surface Elevations

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|                       |             |
|-----------------------|-------------|
| Minimum (Headwater)   | 7,510.00 ft |
| Increment (Headwater) | 0.50 ft     |
| Maximum (Headwater)   | 7,536.00 ft |

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**Outlet Connectivity**

| Structure Type     | Outlet ID               | Direction | Outfall            | E1<br>(ft) | E2<br>(ft) |
|--------------------|-------------------------|-----------|--------------------|------------|------------|
| Inlet Box          | SWQ<br>Outlet Box       | Forward   | SWQ<br>Outlet Pipe | 7,533.00   | 7,536.00   |
| Orifice-Area       | SWQ<br>Orifice<br>Plate | Forward   | SWQ<br>Outlet Pipe | 7,531.00   | 7,536.00   |
| Culvert-Circular   | SWQ<br>Outlet Pipe      | Forward   | TW                 | 7,526.90   | 7,536.00   |
| Culvert-Box        | Twin CBC<br>Spillway    | Forward   | TW                 | 7,533.00   | 7,536.00   |
| Tailwater Settings | Tailwater               |           |                    | (N/A)      | (N/A)      |

## Subsection: Outlet Input Data

Label: FH North Pond 13

Return Event: 5 years

Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

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Structure ID: SWQ Outlet Box  
Structure Type: Inlet Box

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|                     |                             |
|---------------------|-----------------------------|
| Number of Openings  | 1                           |
| Elevation           | 7,533.00 ft                 |
| Orifice Area        | 20.8 ft <sup>2</sup>        |
| Orifice Coefficient | 0.600                       |
| Weir Length         | 8.00 ft                     |
| Weir Coefficient    | 3.00 (ft <sup>0.5</sup> )/s |
| K Reverse           | 1.000                       |
| Manning's n         | 0.000                       |
| Kev, Charged Riser  | 0.000                       |
| Weir Submergence    | False                       |
| Orifice H to crest  | False                       |

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Structure ID: SWQ Orifice Plate  
Structure Type: Orifice-Area

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|                     |                     |
|---------------------|---------------------|
| Number of Openings  | 3                   |
| Elevation           | 7,531.00 ft         |
| Orifice Area        | 1.4 ft <sup>2</sup> |
| Top Elevation       | 7,533.00 ft         |
| Datum Elevation     | 7,531.00 ft         |
| Orifice Coefficient | 0.600               |

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Subsection: Outlet Input Data  
 Label: FH North Pond 13

Return Event: 5 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

|                                  |             |
|----------------------------------|-------------|
| Structure ID: SWQ Outlet Pipe    |             |
| Structure Type: Culvert-Circular |             |
| Number of Barrels                | 1           |
| Diameter                         | 30.0 in     |
| Length                           | 100.00 ft   |
| Length (Computed Barrel)         | 100.00 ft   |
| Slope (Computed)                 | 0.010 ft/ft |
| Outlet Control Data              |             |
| Manning's n                      | 0.013       |
| Ke                               | 0.200       |
| Kb                               | 0.009       |
| Kr                               | 0.000       |
| Convergence Tolerance            | 0.00 ft     |
| Inlet Control Data               |             |
| Equation Form                    | Form 1      |
| K                                | 0.0045      |
| M                                | 2.0000      |
| C                                | 0.0317      |
| Y                                | 0.6900      |
| T1 ratio (HW/D)                  | 1.090       |
| T2 ratio (HW/D)                  | 1.192       |
| Slope Correction Factor          | -0.500      |

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...

|              |             |         |                          |
|--------------|-------------|---------|--------------------------|
| T1 Elevation | 7,529.63 ft | T1 Flow | 27.16 ft <sup>3</sup> /s |
| T2 Elevation | 7,529.88 ft | T2 Flow | 31.05 ft <sup>3</sup> /s |

Subsection: Outlet Input Data

Label: FH North Pond 13

Return Event: 5 years

Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

|                                 |             |
|---------------------------------|-------------|
| Structure ID: Twin CBC Spillway |             |
| Structure Type: Culvert-Box     |             |
| Number of Barrels               | 2           |
| Width                           | 10.00 ft    |
| Height                          | 4.00 ft     |
| Length                          | 65.00 ft    |
| Length (Computed Barrel)        | 65.00 ft    |
| Slope (Computed)                | 0.010 ft/ft |
| Outlet Control Data             |             |
| Manning's n                     | 0.013       |
| Ke                              | 0.500       |
| Kb                              | 0.003       |
| Kr                              | 0.000       |
| Convergence Tolerance           | 0.00 ft     |
| Inlet Control Data              |             |
| Equation Form                   | Form 1      |
| K                               | 0.0260      |
| M                               | 1.0000      |
| C                               | 0.0347      |
| Y                               | 0.8100      |
| T1 ratio (HW/D)                 | 1.173       |
| T2 ratio (HW/D)                 | 1.360       |
| Slope Correction Factor         | -0.500      |

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...

|              |             |         |                           |
|--------------|-------------|---------|---------------------------|
| T1 Elevation | 7,537.69 ft | T1 Flow | 280.00 ft <sup>3</sup> /s |
| T2 Elevation | 7,538.44 ft | T2 Flow | 320.00 ft <sup>3</sup> /s |

Subsection: Outlet Input Data

Label: FH North Pond 13

Return Event: 5 years

Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

|                                      |                           |
|--------------------------------------|---------------------------|
| Structure ID: TW                     |                           |
| Structure Type: TW Setup, DS Channel |                           |
| Tailwater Type                       | Free Outfall              |
| Convergence Tolerances               |                           |
| Maximum Iterations                   | 30                        |
| Tailwater Tolerance (Minimum)        | 0.01 ft                   |
| Tailwater Tolerance (Maximum)        | 0.50 ft                   |
| Headwater Tolerance (Minimum)        | 0.01 ft                   |
| Headwater Tolerance (Maximum)        | 0.50 ft                   |
| Flow Tolerance (Minimum)             | 0.001 ft <sup>3</sup> /s  |
| Flow Tolerance (Maximum)             | 10.000 ft <sup>3</sup> /s |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 5 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,510.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,510.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.90                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,527.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,527.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)  
Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 0.00                             | 0.00                                       | 0.00  | 7,528.16                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 0.00                             | 0.00                                       | 0.00  | 7,528.75                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 0.00                             | 0.00                                       | 0.00  | 7,529.24                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 0.00                             | 0.00                                       | 0.00  | 7,529.71                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 8.49                             | 7,533.50                                   | Free Outfall                                  | 7,530.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 24.00                            | 7,534.00                                   | Free Outfall                                  | 7,532.08                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 44.09                            | 7,534.50                                   | 7,533.67                                      | 7,533.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 67.88                            | 7,535.00                                   | 7,534.99                                      | 7,534.99                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 94.87                            | 7,535.50                                   | 7,535.50                                      | 7,535.50                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,536.00                     | 124.71                           | 7,536.00                                   | 7,536.00                                      | 7,536.00                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
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WS below an invert; no flow.  
WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)  
Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Message   |
|---|
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| WS below an invert; no flow.                                    |
| Weir: H =0.5ft  |
| Weir: H =1ft  |
| FULLY CHARGED RISER: ADJUSTED TO WEIR: H =1.5ft                 |
| FULLY CHARGED RISER: ADJUSTED TO WEIR: H =2ft                   |
| FULLY CHARGED RISER: ADJUSTED TO WEIR: H =2.5ft                 |
| FULLY CHARGED RISER,<br>DOWNSTREAM CONTROL: Kev=0.<br>Hev=0.000 |



Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 5 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water<br>Surface<br>Elevation<br>(ft) | Device<br>Flow<br>(ft <sup>3</sup> /s) | (into)<br>Headwater<br>Hydraulic<br>Grade Line<br>(ft) | Converge<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Next<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Downstream<br>Hydraulic<br>Grade Line<br>Error<br>(ft) | Convergence<br>Error<br>(ft <sup>3</sup> /s) | Downstream<br>Channel<br>Tailwater<br>(ft) | Tailwater<br>Error<br>(ft) |
|---------------------------------------|--|--|---|---|--|--|--|----------------------------|
| 7,510.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,510.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.90                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 5 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 6.94                             | 7,531.50                                   | Free Outfall                                  | 7,528.16                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 13.89                            | 7,532.00                                   | Free Outfall                                  | 7,528.75                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 20.83                            | 7,532.50                                   | Free Outfall                                  | 7,529.24                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 27.77                            | 7,533.00                                   | Free Outfall                                  | 7,529.71                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 31.05                            | 7,533.50                                   | Free Outfall                                  | 7,530.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 27.25                            | 7,534.00                                   | 7,532.08                                      | 7,532.08                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 17.92                            | 7,534.50                                   | 7,533.67                                      | 7,533.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 1.59                             | 7,535.00                                   | 7,534.99                                      | 7,534.99                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 0.00                             | 7,535.50                                   | 7,535.50                                      | 7,535.50                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,536.00                     | 0.00                             | 7,536.00                                   | 7,536.00                                      | 7,536.00                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Message   |
|---|
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| WS below an invert; no flow.                                  |
| Hi=.50; Ht=2.00; Qt=9.26                                      |
| Hi=1.00; Ht=2.00; Qt=9.26                                     |
| Hi=1.50; Ht=2.00; Qt=9.26                                     |
| H =2.00   |
| H =2.50   |
| H =1.92   |
| H =.83  |
| H =.01  |
| FLOW PRECEDENCE SET TO<br>DOWNSTREAM CONTROLLING<br>STRUCTURE |
| FLOW PRECEDENCE SET TO<br>DOWNSTREAM CONTROLLING<br>STRUCTURE |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 5 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,510.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,510.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.90                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,527.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,527.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 6.94                             | 7,528.16                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 13.89                            | 7,528.75                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 20.83                            | 7,529.24                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 27.77                            | 7,529.71                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.01                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 39.53                            | 7,530.67                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 51.31                            | 7,532.08                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.06                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 61.99                            | 7,533.67                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.02                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 69.52                            | 7,534.99                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.05                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 72.13                            | 7,535.50                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 22.74                                  | (N/A)                             | 0.00                 |
| 7,536.00                     | 74.61                            | 7,536.00                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 50.10                                  | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

### RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
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WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
CRIT.DEPTH CONTROL Vh= .321ft  
Dcr= .874ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .493ft  
Dcr= 1.255ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .659ft  
Dcr= 1.551ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .840ft  
Dcr= 1.797ft CRIT.DEPTH Hev= .00ft  
INLET CONTROL... Submerged: HW  
=3.77  
INLET CONTROL... Submerged: HW  
=5.18  
INLET CONTROL... Submerged: HW  
=6.77

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

-----  
Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Message   |
|---|
| FULL FLOW...Lfull=98.92ft Vh=3.117ft<br>HL=6.583ft Hev= .00ft |
| FULL FLOW...Lfull=99.10ft Vh=3.356ft<br>HL=7.092ft Hev= .00ft |
| FULL FLOW...Lfull=99.31ft Vh=3.590ft<br>HL=7.594ft Hev= .00ft |



Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 5 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Twin CBC Spillway (Culvert-Box)

Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s

Upstream ID = (Pond Water Surface)

Downstream ID = Tailwater (Pond Outfall)

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,510.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,510.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.90                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.00                           | 0.00                         | (N/A)                       | 0.00                      |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = Twin CBC Spillway (Culvert-Box)

Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s  
Upstream ID = (Pond Water Surface)  
Downstream ID = Tailwater (Pond Outfall)

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,528.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,532.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,532.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,533.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,533.50                           | 17.36                        | (N/A)                       | 0.00                      |
| 7,534.00                           | 49.05                        | (N/A)                       | 0.00                      |
| 7,534.50                           | 90.08                        | (N/A)                       | 0.00                      |
| 7,535.00                           | 138.56                       | (N/A)                       | 0.00                      |
| 7,535.50                           | 193.63                       | (N/A)                       | 0.00                      |
| 7,536.00                           | 254.72                       | (N/A)                       | 0.00                      |

Computation Messages

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
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WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

Structure ID = Twin CBC Spillway (Culvert-Box)

Computation Messages

WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
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 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 CRIT.DEPTH CONTROL Vh= .143ft  
 Dcr= .286ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .286ft  
 Dcr= .572ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .429ft  
 Dcr= .858ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .571ft  
 Dcr= 1.143ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .714ft  
 Dcr= 1.428ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .857ft  
 Dcr= 1.715ft CRIT.DEPTH Hev= .00ft

Subsection: Composite Rating Curve  
 Label: FH North Pond 13

Return Event: 5 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

Composite Outflow Summary

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,510.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,510.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.90                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.00                           | 0.00                         | (N/A)                       | 0.00                      |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

Composite Outflow Summary

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,531.50                           | 6.94                         | (N/A)                       | 0.00                      |
| 7,532.00                           | 13.89                        | (N/A)                       | 0.00                      |
| 7,532.50                           | 20.83                        | (N/A)                       | 0.00                      |
| 7,533.00                           | 27.77                        | (N/A)                       | 0.00                      |
| 7,533.50                           | 56.89                        | (N/A)                       | 0.00                      |
| 7,534.00                           | 100.36                       | (N/A)                       | 0.00                      |
| 7,534.50                           | 152.07                       | (N/A)                       | 0.00                      |
| 7,535.00                           | 208.08                       | (N/A)                       | 0.00                      |
| 7,535.50                           | 265.76                       | (N/A)                       | 0.00                      |
| 7,536.00                           | 329.33                       | (N/A)                       | 0.00                      |

Contributing Structures

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
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| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
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| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
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| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
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| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Outlet Pipe,Twin<br>CBC Spillway (no Q: SWQ Orifice<br>Plate) |
| SWQ Outlet Box,SWQ Outlet Pipe,Twin<br>CBC Spillway (no Q: SWQ Orifice<br>Plate) |



Subsection: Elevation-Volume-Flow Table (Pond)  
Label: JD Reservoir (Pond 13)

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

| Infiltration                          |                         |
|---------------------------------------|-------------------------|
| Infiltration Method<br>(Computed)     | No Infiltration         |
| Initial Conditions                    |                         |
| Elevation (Water Surface,<br>Initial) | 7,531.00 ft             |
| Volume (Initial)                      | 94.889 ac-ft            |
| Flow (Initial Outlet)                 | 0.00 ft <sup>3</sup> /s |
| Flow (Initial Infiltration)           | 0.00 ft <sup>3</sup> /s |
| Flow (Initial, Total)                 | 0.00 ft <sup>3</sup> /s |
| Time Increment                        | 0.050 hours             |

| Elevation<br>(ft) | Outflow<br>(ft <sup>3</sup> /s) | Storage<br>(ac-ft) | Area<br>(acres) | Infiltration<br>(ft <sup>3</sup> /s) | Flow (Total)<br>(ft <sup>3</sup> /s) | 2S/t + O<br>(ft <sup>3</sup> /s) |
|-------------------|---------------------------------|--------------------|-----------------|--------------------------------------|--------------------------------------|----------------------------------|
| 7,510.00          | 0.00                            | 0.000              | 1.510           | 0.00                                 | 0.00                                 | 0.00                             |
| 7,510.50          | 0.00                            | 0.812              | 1.742           | 0.00                                 | 0.00                                 | 393.13                           |
| 7,511.00          | 0.00                            | 1.744              | 1.990           | 0.00                                 | 0.00                                 | 844.33                           |
| 7,511.50          | 0.00                            | 2.803              | 2.247           | 0.00                                 | 0.00                                 | 1,356.72                         |
| 7,512.00          | 0.00                            | 3.994              | 2.520           | 0.00                                 | 0.00                                 | 1,933.23                         |
| 7,512.50          | 0.00                            | 5.295              | 2.682           | 0.00                                 | 0.00                                 | 2,562.63                         |
| 7,513.00          | 0.00                            | 6.678              | 2.850           | 0.00                                 | 0.00                                 | 3,231.95                         |
| 7,513.50          | 0.00                            | 8.127              | 2.949           | 0.00                                 | 0.00                                 | 3,933.62                         |
| 7,514.00          | 0.00                            | 9.627              | 3.050           | 0.00                                 | 0.00                                 | 4,659.48                         |
| 7,514.50          | 0.00                            | 11.178             | 3.154           | 0.00                                 | 0.00                                 | 5,410.14                         |
| 7,515.00          | 0.00                            | 12.781             | 3.260           | 0.00                                 | 0.00                                 | 6,186.22                         |
| 7,515.50          | 0.00                            | 14.439             | 3.369           | 0.00                                 | 0.00                                 | 6,988.30                         |
| 7,516.00          | 0.00                            | 16.151             | 3.480           | 0.00                                 | 0.00                                 | 7,817.01                         |
| 7,516.50          | 0.00                            | 17.918             | 3.589           | 0.00                                 | 0.00                                 | 8,672.34                         |
| 7,517.00          | 0.00                            | 19.740             | 3.700           | 0.00                                 | 0.00                                 | 9,554.30                         |
| 7,517.50          | 0.00                            | 21.619             | 3.814           | 0.00                                 | 0.00                                 | 10,463.47                        |
| 7,518.00          | 0.00                            | 23.555             | 3.930           | 0.00                                 | 0.00                                 | 11,400.48                        |
| 7,518.50          | 0.00                            | 25.548             | 4.044           | 0.00                                 | 0.00                                 | 12,365.32                        |
| 7,519.00          | 0.00                            | 27.599             | 4.160           | 0.00                                 | 0.00                                 | 13,357.99                        |
| 7,519.50          | 0.00                            | 29.709             | 4.279           | 0.00                                 | 0.00                                 | 14,379.10                        |
| 7,520.00          | 0.00                            | 31.879             | 4.400           | 0.00                                 | 0.00                                 | 15,429.24                        |
| 7,520.50          | 0.00                            | 34.108             | 4.519           | 0.00                                 | 0.00                                 | 16,508.43                        |
| 7,521.00          | 0.00                            | 36.398             | 4.640           | 0.00                                 | 0.00                                 | 17,616.66                        |
| 7,521.50          | 0.00                            | 38.748             | 4.759           | 0.00                                 | 0.00                                 | 18,753.94                        |
| 7,522.00          | 0.00                            | 41.158             | 4.880           | 0.00                                 | 0.00                                 | 19,920.26                        |
| 7,522.50          | 0.00                            | 43.630             | 5.009           | 0.00                                 | 0.00                                 | 21,116.81                        |
| 7,523.00          | 0.00                            | 46.167             | 5.140           | 0.00                                 | 0.00                                 | 22,344.83                        |
| 7,523.50          | 0.00                            | 48.764             | 5.249           | 0.00                                 | 0.00                                 | 23,601.92                        |
| 7,524.00          | 0.00                            | 51.417             | 5.360           | 0.00                                 | 0.00                                 | 24,885.64                        |
| 7,524.50          | 0.00                            | 54.125             | 5.474           | 0.00                                 | 0.00                                 | 26,196.58                        |
| 7,525.00          | 0.00                            | 56.891             | 5.590           | 0.00                                 | 0.00                                 | 27,535.35                        |

Subsection: Elevation-Volume-Flow Table (Pond)  
Label: JD Reservoir (Pond 13)

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

| Elevation<br>(ft) | Outflow<br>(ft <sup>3</sup> /s) | Storage<br>(ac-ft) | Area<br>(acres) | Infiltration<br>(ft <sup>3</sup> /s) | Flow (Total)<br>(ft <sup>3</sup> /s) | 2S/t + O<br>(ft <sup>3</sup> /s) |
|-------------------|---------------------------------|--------------------|-----------------|--------------------------------------|--------------------------------------|----------------------------------|
| 7,525.50          | 0.00                            | 59.717             | 5.714           | 0.00                                 | 0.00                                 | 28,903.14                        |
| 7,526.00          | 0.00                            | 62.606             | 5.840           | 0.00                                 | 0.00                                 | 30,301.19                        |
| 7,526.50          | 0.00                            | 65.556             | 5.959           | 0.00                                 | 0.00                                 | 31,728.89                        |
| 7,526.90          | 0.00                            | 67.959             | 6.056           | 0.00                                 | 0.00                                 | 32,891.95                        |
| 7,527.00          | 0.00                            | 68.565             | 6.080           | 0.00                                 | 0.00                                 | 33,185.63                        |
| 7,527.50          | 0.00                            | 71.636             | 6.204           | 0.00                                 | 0.00                                 | 34,672.01                        |
| 7,528.00          | 0.00                            | 74.770             | 6.330           | 0.00                                 | 0.00                                 | 36,188.65                        |
| 7,528.50          | 0.00                            | 77.965             | 6.449           | 0.00                                 | 0.00                                 | 37,734.94                        |
| 7,529.00          | 0.00                            | 81.220             | 6.570           | 0.00                                 | 0.00                                 | 39,310.27                        |
| 7,529.50          | 0.00                            | 84.534             | 6.689           | 0.00                                 | 0.00                                 | 40,914.64                        |
| 7,530.00          | 0.00                            | 87.909             | 6.810           | 0.00                                 | 0.00                                 | 42,548.05                        |
| 7,530.50          | 0.00                            | 91.356             | 6.979           | 0.00                                 | 0.00                                 | 44,216.48                        |
| 7,531.00          | 0.00                            | 94.889             | 7.150           | 0.00                                 | 0.00                                 | 45,926.04                        |
| 7,531.50          | 6.94                            | 98.509             | 7.334           | 0.00                                 | 6.94                                 | 47,685.48                        |
| 7,532.00          | 13.89                           | 102.223            | 7.520           | 0.00                                 | 13.89                                | 49,489.69                        |
| 7,532.50          | 20.83                           | 106.021            | 7.674           | 0.00                                 | 20.83                                | 51,335.10                        |
| 7,533.00          | 27.77                           | 109.897            | 7.830           | 0.00                                 | 27.77                                | 53,218.02                        |
| 7,533.50          | 56.89                           | 113.879            | 8.098           | 0.00                                 | 56.89                                | 55,174.31                        |
| 7,534.00          | 100.36                          | 117.996            | 8.370           | 0.00                                 | 100.36                               | 57,210.28                        |
| 7,534.50          | 152.07                          | 122.230            | 8.569           | 0.00                                 | 152.07                               | 59,311.55                        |
| 7,535.00          | 208.08                          | 126.565            | 8.770           | 0.00                                 | 208.08                               | 61,465.51                        |
| 7,535.50          | 265.76                          | 131.000            | 8.969           | 0.00                                 | 265.76                               | 63,669.55                        |
| 7,536.00          | 329.33                          | 135.534            | 9.170           | 0.00                                 | 329.33                               | 65,927.87                        |

Subsection: Pond Routed Hydrograph (total out)  
Label: JD Reservoir (Pond 13) (OUT)

Return Event: 5 years  
Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

|                   |                          |
|-------------------|--------------------------|
| Peak Discharge    | 12.09 ft <sup>3</sup> /s |
| Time to Peak      | 15.200 hours             |
| Hydrograph Volume | 10.285 ac-ft             |

### HYDROGRAPH ORDINATES (ft<sup>3</sup>/s)

Output Time Increment = 0.050 hours

Time on left represents time for first value in each row.

| Time<br>(hours) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 10.600          | 0.00                         | 0.00                         | 0.00                         | 0.01                         | 0.01                         |
| 10.850          | 0.01                         | 0.02                         | 0.02                         | 0.03                         | 0.04                         |
| 11.100          | 0.05                         | 0.06                         | 0.07                         | 0.08                         | 0.09                         |
| 11.350          | 0.10                         | 0.12                         | 0.13                         | 0.15                         | 0.17                         |
| 11.600          | 0.19                         | 0.22                         | 0.25                         | 0.30                         | 0.37                         |
| 11.850          | 0.48                         | 0.65                         | 0.95                         | 1.40                         | 2.05                         |
| 12.100          | 2.85                         | 3.74                         | 4.63                         | 5.45                         | 6.16                         |
| 12.350          | 6.77                         | 7.27                         | 7.70                         | 8.06                         | 8.37                         |
| 12.600          | 8.65                         | 8.90                         | 9.12                         | 9.32                         | 9.50                         |
| 12.850          | 9.66                         | 9.82                         | 9.96                         | 10.11                        | 10.24                        |
| 13.100          | 10.37                        | 10.49                        | 10.61                        | 10.72                        | 10.82                        |
| 13.350          | 10.92                        | 11.00                        | 11.08                        | 11.16                        | 11.23                        |
| 13.600          | 11.30                        | 11.36                        | 11.42                        | 11.48                        | 11.53                        |
| 13.850          | 11.58                        | 11.63                        | 11.67                        | 11.72                        | 11.76                        |
| 14.100          | 11.79                        | 11.83                        | 11.86                        | 11.89                        | 11.92                        |
| 14.350          | 11.94                        | 11.97                        | 11.99                        | 12.01                        | 12.02                        |
| 14.600          | 12.04                        | 12.05                        | 12.06                        | 12.07                        | 12.08                        |
| 14.850          | 12.08                        | 12.08                        | 12.09                        | 12.09                        | 12.09                        |
| 15.100          | 12.09                        | 12.09                        | 12.09                        | 12.09                        | 12.09                        |
| 15.350          | 12.09                        | 12.09                        | 12.08                        | 12.08                        | 12.07                        |
| 15.600          | 12.07                        | 12.06                        | 12.05                        | 12.04                        | 12.03                        |
| 15.850          | 12.02                        | 12.01                        | 12.00                        | 11.99                        | 11.98                        |
| 16.100          | 11.97                        | 11.95                        | 11.94                        | 11.93                        | 11.92                        |
| 16.350          | 11.91                        | 11.90                        | 11.89                        | 11.88                        | 11.87                        |
| 16.600          | 11.86                        | 11.85                        | 11.84                        | 11.82                        | 11.81                        |
| 16.850          | 11.79                        | 11.77                        | 11.76                        | 11.74                        | 11.72                        |
| 17.100          | 11.70                        | 11.68                        | 11.66                        | 11.64                        | 11.62                        |
| 17.350          | 11.60                        | 11.58                        | 11.56                        | 11.54                        | 11.53                        |
| 17.600          | 11.51                        | 11.49                        | 11.47                        | 11.45                        | 11.43                        |
| 17.850          | 11.42                        | 11.40                        | 11.38                        | 11.36                        | 11.33                        |
| 18.100          | 11.31                        | 11.28                        | 11.25                        | 11.23                        | 11.20                        |
| 18.350          | 11.17                        | 11.14                        | 11.12                        | 11.09                        | 11.06                        |
| 18.600          | 11.03                        | 11.01                        | 10.98                        | 10.95                        | 10.93                        |
| 18.850          | 10.90                        | 10.87                        | 10.85                        | 10.82                        | 10.80                        |
| 19.100          | 10.77                        | 10.74                        | 10.72                        | 10.69                        | 10.67                        |
| 19.350          | 10.64                        | 10.62                        | 10.60                        | 10.57                        | 10.55                        |
| 19.600          | 10.52                        | 10.50                        | 10.48                        | 10.45                        | 10.43                        |
| 19.850          | 10.41                        | 10.38                        | 10.36                        | 10.33                        | 10.30                        |
| 20.100          | 10.28                        | 10.25                        | 10.21                        | 10.18                        | 10.15                        |

Subsection: Pond Routed Hydrograph (total out)  
 Label: JD Reservoir (Pond 13) (OUT)

Return Event: 5 years  
 Storm Event: TYPE II 24 HOUR (Colo. Spgs.)

**HYDROGRAPH ORDINATES (ft<sup>3</sup>/s)**

**Output Time Increment = 0.050 hours**

**Time on left represents time for first value in each row.**

| Time<br>(hours) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 20.350          | 10.12                        | 10.09                        | 10.05                        | 10.02                        | 9.99                         |
| 20.600          | 9.96                         | 9.93                         | 9.90                         | 9.86                         | 9.83                         |
| 20.850          | 9.80                         | 9.77                         | 9.74                         | 9.71                         | 9.68                         |
| 21.100          | 9.65                         | 9.62                         | 9.59                         | 9.56                         | 9.53                         |
| 21.350          | 9.50                         | 9.47                         | 9.45                         | 9.42                         | 9.39                         |
| 21.600          | 9.36                         | 9.33                         | 9.31                         | 9.28                         | 9.25                         |
| 21.850          | 9.23                         | 9.20                         | 9.17                         | 9.15                         | 9.12                         |
| 22.100          | 9.10                         | 9.07                         | 9.04                         | 9.02                         | 8.99                         |
| 22.350          | 8.97                         | 8.95                         | 8.92                         | 8.90                         | 8.87                         |
| 22.600          | 8.85                         | 8.83                         | 8.80                         | 8.78                         | 8.76                         |
| 22.850          | 8.73                         | 8.71                         | 8.69                         | 8.67                         | 8.65                         |
| 23.100          | 8.62                         | 8.60                         | 8.58                         | 8.56                         | 8.54                         |
| 23.350          | 8.52                         | 8.50                         | 8.48                         | 8.46                         | 8.44                         |
| 23.600          | 8.42                         | 8.40                         | 8.38                         | 8.36                         | 8.34                         |
| 23.850          | 8.32                         | 8.30                         | 8.28                         | 8.25                         | (N/A)                        |

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|                            |  |
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| Project Summary            |  |
| Title                      | Flying Horse North<br>Irrigation<br>Reservoir (Pond<br>13) |
| Engineer                   | MAW  |
| Company                    | CCES   |
| Date                       | 8/8/2018   |
| Notes                      |  |
| 50 Year (NOAA 14 - 24 hr.) |  |

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## Subsection: Master Network Summary

### Catchments Summary

| Label              | Scenario              | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) |
|--------------------|-----------------------|----------------------|---------------------------|----------------------|--------------------------------|
| Basin CC-3         | Post-Development 50YR | 50                   | 5.726                     | 12.050               | 75.00                          |
| Basin CC-4A        | Post-Development 50YR | 50                   | 13.623                    | 12.150               | 139.82                         |
| Basin CC-4B        | Post-Development 50YR | 50                   | 3.062                     | 12.050               | 41.47                          |
| Basins OS-12, CC-1 | Post-Development 50YR | 50                   | 11.135                    | 12.100               | 137.81                         |
| Basins OS-13, CC-2 | Post-Development 50YR | 50                   | 9.284                     | 12.150               | 103.18                         |
| Basins OS-14       | Post-Development 50YR | 50                   | 2.805                     | 12.050               | 39.36                          |

### Node Summary

| Label              | Scenario              | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) |
|--------------------|-----------------------|----------------------|---------------------------|----------------------|--------------------------------|
| DP-18 (MDDP DP 16) | Post-Development 50YR | 50                   | 33.772                    | 13.350               | 63.91                          |

### Pond Summary

| Label                        | Scenario              | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ac-ft) |
|------------------------------|-----------------------|----------------------|---------------------------|----------------------|--------------------------------|--------------------------------------|------------------------------|
| Golf Course Pond 12 (IN)     | Post-Development 50YR | 50                   | 8.532                     | 12.050               | 114.36                         | (N/A)                                | (N/A)                        |
| Golf Course Pond 12 (OUT)    | Post-Development 50YR | 50                   | 7.272                     | 12.350               | 37.38                          | 7,545.33                             | 6.220                        |
| JD Reservoir (Pond 13) (IN)  | Post-Development 50YR | 50                   | 44.377                    | 12.150               | 431.27                         | (N/A)                                | (N/A)                        |
| JD Reservoir (Pond 13) (OUT) | Post-Development 50YR | 50                   | 33.772                    | 13.350               | 63.91                          | 7,533.58                             | 114.534                      |



Subsection: Time-Depth Curve  
Label: NOAA 14

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

Time-Depth Curve: Type II 24-Hour (NOAA 14)

|              |                              |
|--------------|------------------------------|
| Label        | Type II 24-Hour<br>(NOAA 14) |
| Start Time   | 0.000 hours                  |
| Increment    | 0.100 hours                  |
| End Time     | 24.000 hours                 |
| Return Event | 50 years                     |

**CUMULATIVE RAINFALL (in)**

**Output Time Increment = 0.100 hours**

**Time on left represents time for first value in each row.**

| Time<br>(hours) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) |
|-----------------|---------------|---------------|---------------|---------------|---------------|
| 0.000           | 0.00          | 0.00          | 0.01          | 0.01          | 0.02          |
| 0.500           | 0.02          | 0.03          | 0.03          | 0.04          | 0.04          |
| 1.000           | 0.05          | 0.05          | 0.06          | 0.06          | 0.06          |
| 1.500           | 0.07          | 0.07          | 0.08          | 0.08          | 0.09          |
| 2.000           | 0.10          | 0.10          | 0.11          | 0.11          | 0.12          |
| 2.500           | 0.12          | 0.13          | 0.13          | 0.14          | 0.14          |
| 3.000           | 0.15          | 0.16          | 0.16          | 0.17          | 0.17          |
| 3.500           | 0.18          | 0.18          | 0.19          | 0.20          | 0.20          |
| 4.000           | 0.21          | 0.21          | 0.22          | 0.23          | 0.23          |
| 4.500           | 0.24          | 0.25          | 0.25          | 0.26          | 0.27          |
| 5.000           | 0.27          | 0.28          | 0.29          | 0.29          | 0.30          |
| 5.500           | 0.31          | 0.32          | 0.32          | 0.33          | 0.34          |
| 6.000           | 0.35          | 0.35          | 0.36          | 0.37          | 0.38          |
| 6.500           | 0.39          | 0.39          | 0.40          | 0.41          | 0.42          |
| 7.000           | 0.43          | 0.44          | 0.45          | 0.46          | 0.46          |
| 7.500           | 0.47          | 0.48          | 0.49          | 0.50          | 0.51          |
| 8.000           | 0.52          | 0.53          | 0.54          | 0.55          | 0.56          |
| 8.500           | 0.57          | 0.58          | 0.60          | 0.61          | 0.62          |
| 9.000           | 0.64          | 0.65          | 0.66          | 0.68          | 0.69          |
| 9.500           | 0.71          | 0.72          | 0.73          | 0.75          | 0.77          |
| 10.000          | 0.78          | 0.80          | 0.82          | 0.84          | 0.86          |
| 10.500          | 0.88          | 0.91          | 0.93          | 0.96          | 0.99          |
| 11.000          | 1.02          | 1.05          | 1.09          | 1.13          | 1.18          |
| 11.500          | 1.23          | 1.33          | 1.53          | 1.87          | 2.46          |
| 12.000          | 2.87          | 2.95          | 3.03          | 3.09          | 3.14          |
| 12.500          | 3.18          | 3.22          | 3.25          | 3.29          | 3.32          |
| 13.000          | 3.34          | 3.37          | 3.39          | 3.42          | 3.44          |
| 13.500          | 3.46          | 3.48          | 3.50          | 3.52          | 3.53          |
| 14.000          | 3.55          | 3.57          | 3.58          | 3.60          | 3.61          |
| 14.500          | 3.63          | 3.64          | 3.66          | 3.67          | 3.68          |
| 15.000          | 3.70          | 3.71          | 3.72          | 3.73          | 3.75          |
| 15.500          | 3.76          | 3.77          | 3.78          | 3.79          | 3.80          |
| 16.000          | 3.81          | 3.82          | 3.83          | 3.84          | 3.85          |
| 16.500          | 3.86          | 3.87          | 3.88          | 3.89          | 3.90          |
| 17.000          | 3.90          | 3.91          | 3.92          | 3.93          | 3.94          |

Subsection: Time-Depth Curve  
 Label: NOAA 14

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

**CUMULATIVE RAINFALL (in)**  
**Output Time Increment = 0.100 hours**  
**Time on left represents time for first value in each row.**

| Time<br>(hours) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) |
|-----------------|---------------|---------------|---------------|---------------|---------------|
| 17.500          | 3.95          | 3.96          | 3.96          | 3.97          | 3.98          |
| 18.000          | 3.99          | 4.00          | 4.00          | 4.01          | 4.02          |
| 18.500          | 4.03          | 4.03          | 4.04          | 4.05          | 4.05          |
| 19.000          | 4.06          | 4.07          | 4.07          | 4.08          | 4.09          |
| 19.500          | 4.09          | 4.10          | 4.10          | 4.11          | 4.12          |
| 20.000          | 4.12          | 4.13          | 4.13          | 4.14          | 4.14          |
| 20.500          | 4.15          | 4.16          | 4.16          | 4.17          | 4.17          |
| 21.000          | 4.18          | 4.18          | 4.19          | 4.19          | 4.20          |
| 21.500          | 4.20          | 4.21          | 4.21          | 4.22          | 4.23          |
| 22.000          | 4.23          | 4.24          | 4.24          | 4.25          | 4.25          |
| 22.500          | 4.26          | 4.26          | 4.27          | 4.27          | 4.28          |
| 23.000          | 4.28          | 4.29          | 4.29          | 4.30          | 4.30          |
| 23.500          | 4.31          | 4.31          | 4.32          | 4.32          | 4.33          |
| 24.000          | 4.33          | (N/A)         | (N/A)         | (N/A)         | (N/A)         |

Subsection: Elevation-Area Volume Curve  
 Label: Golf Course Pond 12

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

| Elevation<br>(ft) | Planimeter<br>(ft <sup>2</sup> ) | Area<br>(acres) | A1+A2+sqr<br>(A1*A2)<br>(acres) | Volume<br>(ac-ft) | Volume (Total)<br>(ac-ft) |
|-------------------|----------------------------------|-----------------|---------------------------------|-------------------|---------------------------|
| 7,534.00          | 0.0                              | 0.043           | 0.000                           | 0.000             | 0.000                     |
| 7,536.00          | 0.0                              | 0.200           | 0.336                           | 0.224             | 0.224                     |
| 7,538.00          | 0.0                              | 0.330           | 0.787                           | 0.525             | 0.748                     |
| 7,540.00          | 0.0                              | 0.470           | 1.194                           | 0.796             | 1.544                     |
| 7,542.00          | 0.0                              | 0.640           | 1.658                           | 1.106             | 2.650                     |
| 7,544.00          | 0.0                              | 1.240           | 2.771                           | 1.847             | 4.497                     |
| 7,546.00          | 0.0                              | 1.400           | 3.958                           | 2.638             | 7.136                     |

Subsection: Elevation-Area Volume Curve  
Label: JD Reservoir (Pond 13)

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

| Elevation<br>(ft) | Planimeter<br>(ft <sup>2</sup> ) | Area<br>(acres) | A1+A2+sqr<br>(A1*A2)<br>(acres) | Volume<br>(ac-ft) | Volume (Total)<br>(ac-ft) |
|-------------------|----------------------------------|-----------------|---------------------------------|-------------------|---------------------------|
| 7,510.00          | 0.0                              | 1.510           | 0.000                           | 0.000             | 0.000                     |
| 7,511.00          | 0.0                              | 1.990           | 5.233                           | 1.744             | 1.744                     |
| 7,512.00          | 0.0                              | 2.520           | 6.749                           | 2.250             | 3.994                     |
| 7,513.00          | 0.0                              | 2.850           | 8.050                           | 2.683             | 6.678                     |
| 7,514.00          | 0.0                              | 3.050           | 8.848                           | 2.949             | 9.627                     |
| 7,515.00          | 0.0                              | 3.260           | 9.463                           | 3.154             | 12.781                    |
| 7,516.00          | 0.0                              | 3.480           | 10.108                          | 3.369             | 16.151                    |
| 7,517.00          | 0.0                              | 3.700           | 10.768                          | 3.589             | 19.740                    |
| 7,518.00          | 0.0                              | 3.930           | 11.443                          | 3.814             | 23.555                    |
| 7,519.00          | 0.0                              | 4.160           | 12.133                          | 4.044             | 27.599                    |
| 7,520.00          | 0.0                              | 4.400           | 12.838                          | 4.279             | 31.879                    |
| 7,521.00          | 0.0                              | 4.640           | 13.558                          | 4.519             | 36.398                    |
| 7,522.00          | 0.0                              | 4.880           | 14.278                          | 4.760             | 41.158                    |
| 7,523.00          | 0.0                              | 5.140           | 15.028                          | 5.009             | 46.167                    |
| 7,524.00          | 0.0                              | 5.360           | 15.749                          | 5.250             | 51.417                    |
| 7,525.00          | 0.0                              | 5.590           | 16.424                          | 5.475             | 56.891                    |
| 7,526.00          | 0.0                              | 5.840           | 17.144                          | 5.715             | 62.606                    |
| 7,527.00          | 0.0                              | 6.080           | 17.879                          | 5.960             | 68.565                    |
| 7,528.00          | 0.0                              | 6.330           | 18.614                          | 6.205             | 74.770                    |
| 7,529.00          | 0.0                              | 6.570           | 19.349                          | 6.450             | 81.220                    |
| 7,530.00          | 0.0                              | 6.810           | 20.069                          | 6.690             | 87.909                    |
| 7,531.00          | 0.0                              | 7.150           | 20.938                          | 6.979             | 94.889                    |
| 7,532.00          | 0.0                              | 7.520           | 22.003                          | 7.334             | 102.223                   |
| 7,533.00          | 0.0                              | 7.830           | 23.023                          | 7.674             | 109.897                   |
| 7,534.00          | 0.0                              | 8.370           | 24.295                          | 8.099             | 117.996                   |
| 7,535.00          | 0.0                              | 8.770           | 25.708                          | 8.569             | 126.565                   |
| 7,536.00          | 0.0                              | 9.170           | 26.908                          | 8.969             | 135.534                   |

Subsection: Outlet Input Data  
 Label: FH North Pond 13

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

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Requested Pond Water Surface Elevations

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|                       |             |
|-----------------------|-------------|
| Minimum (Headwater)   | 7,510.00 ft |
| Increment (Headwater) | 0.50 ft     |
| Maximum (Headwater)   | 7,536.00 ft |

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**Outlet Connectivity**

| Structure Type     | Outlet ID               | Direction | Outfall            | E1<br>(ft) | E2<br>(ft) |
|--------------------|-------------------------|-----------|--------------------|------------|------------|
| Inlet Box          | SWQ<br>Outlet Box       | Forward   | SWQ<br>Outlet Pipe | 7,533.00   | 7,536.00   |
| Orifice-Area       | SWQ<br>Orifice<br>Plate | Forward   | SWQ<br>Outlet Pipe | 7,531.00   | 7,536.00   |
| Culvert-Circular   | SWQ<br>Outlet Pipe      | Forward   | TW                 | 7,526.90   | 7,536.00   |
| Culvert-Box        | Twin CBC<br>Spillway    | Forward   | TW                 | 7,533.00   | 7,536.00   |
| Tailwater Settings | Tailwater               |           |                    | (N/A)      | (N/A)      |

Subsection: Outlet Input Data  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

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Structure ID: SWQ Outlet Box  
Structure Type: Inlet Box

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|                     |                             |
|---------------------|-----------------------------|
| Number of Openings  | 1                           |
| Elevation           | 7,533.00 ft                 |
| Orifice Area        | 20.8 ft <sup>2</sup>        |
| Orifice Coefficient | 0.600                       |
| Weir Length         | 8.00 ft                     |
| Weir Coefficient    | 3.00 (ft <sup>0.5</sup> )/s |
| K Reverse           | 1.000                       |
| Manning's n         | 0.000                       |
| Kev, Charged Riser  | 0.000                       |
| Weir Submergence    | False                       |
| Orifice H to crest  | False                       |

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Structure ID: SWQ Orifice Plate  
Structure Type: Orifice-Area

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|                     |                     |
|---------------------|---------------------|
| Number of Openings  | 3                   |
| Elevation           | 7,531.00 ft         |
| Orifice Area        | 1.4 ft <sup>2</sup> |
| Top Elevation       | 7,533.00 ft         |
| Datum Elevation     | 7,531.00 ft         |
| Orifice Coefficient | 0.600               |

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Subsection: Outlet Input Data  
 Label: FH North Pond 13

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

|                                  |             |
|----------------------------------|-------------|
| Structure ID: SWQ Outlet Pipe    |             |
| Structure Type: Culvert-Circular |             |
| Number of Barrels                | 1           |
| Diameter                         | 30.0 in     |
| Length                           | 100.00 ft   |
| Length (Computed Barrel)         | 100.00 ft   |
| Slope (Computed)                 | 0.010 ft/ft |
| Outlet Control Data              |             |
| Manning's n                      | 0.013       |
| Ke                               | 0.200       |
| Kb                               | 0.009       |
| Kr                               | 0.000       |
| Convergence Tolerance            | 0.00 ft     |
| Inlet Control Data               |             |
| Equation Form                    | Form 1      |
| K                                | 0.0045      |
| M                                | 2.0000      |
| C                                | 0.0317      |
| Y                                | 0.6900      |
| T1 ratio (HW/D)                  | 1.090       |
| T2 ratio (HW/D)                  | 1.192       |
| Slope Correction Factor          | -0.500      |

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...

|              |             |         |                          |
|--------------|-------------|---------|--------------------------|
| T1 Elevation | 7,529.63 ft | T1 Flow | 27.16 ft <sup>3</sup> /s |
| T2 Elevation | 7,529.88 ft | T2 Flow | 31.05 ft <sup>3</sup> /s |

Subsection: Outlet Input Data  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

|                                 |             |
|---------------------------------|-------------|
| Structure ID: Twin CBC Spillway |             |
| Structure Type: Culvert-Box     |             |
| Number of Barrels               | 2           |
| Width                           | 10.00 ft    |
| Height                          | 4.00 ft     |
| Length                          | 65.00 ft    |
| Length (Computed Barrel)        | 65.00 ft    |
| Slope (Computed)                | 0.010 ft/ft |
| Outlet Control Data             |             |
| Manning's n                     | 0.013       |
| Ke                              | 0.500       |
| Kb                              | 0.003       |
| Kr                              | 0.000       |
| Convergence Tolerance           | 0.00 ft     |
| Inlet Control Data              |             |
| Equation Form                   | Form 1      |
| K                               | 0.0260      |
| M                               | 1.0000      |
| C                               | 0.0347      |
| Y                               | 0.8100      |
| T1 ratio (HW/D)                 | 1.173       |
| T2 ratio (HW/D)                 | 1.360       |
| Slope Correction Factor         | -0.500      |

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

|              |             |         |                           |
|--------------|-------------|---------|---------------------------|
| T1 Elevation | 7,537.69 ft | T1 Flow | 280.00 ft <sup>3</sup> /s |
| T2 Elevation | 7,538.44 ft | T2 Flow | 320.00 ft <sup>3</sup> /s |



Subsection: Outlet Input Data  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

|                                      |                           |
|--------------------------------------|---------------------------|
| Structure ID: TW                     |                           |
| Structure Type: TW Setup, DS Channel |                           |
| Tailwater Type                       | Free Outfall              |
| Convergence Tolerances               |                           |
| Maximum Iterations                   | 30                        |
| Tailwater Tolerance (Minimum)        | 0.01 ft                   |
| Tailwater Tolerance (Maximum)        | 0.50 ft                   |
| Headwater Tolerance (Minimum)        | 0.01 ft                   |
| Headwater Tolerance (Maximum)        | 0.50 ft                   |
| Flow Tolerance (Minimum)             | 0.001 ft <sup>3</sup> /s  |
| Flow Tolerance (Maximum)             | 10.000 ft <sup>3</sup> /s |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,510.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,510.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,511.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,512.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,513.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,514.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,515.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,516.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,517.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,518.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,519.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,520.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,521.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,522.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,523.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,524.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,525.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,526.90                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,527.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,527.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 0.00                             | 0.00                                       | 0.00  | 7,528.16                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 0.00                             | 0.00                                       | 0.00  | 7,528.75                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 0.00                             | 0.00                                       | 0.00  | 7,529.24                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 0.00                             | 0.00                                       | 0.00  | 7,529.71                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 8.49                             | 7,533.50                                   | Free Outfall                                  | 7,530.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 24.00                            | 7,534.00                                   | Free Outfall                                  | 7,532.08                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 44.09                            | 7,534.50                                   | 7,533.67                                      | 7,533.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 67.88                            | 7,535.00                                   | 7,534.99                                      | 7,534.99                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 94.87                            | 7,535.50                                   | 7,535.50                                      | 7,535.50                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,536.00                     | 124.71                           | 7,536.00                                   | 7,536.00                                      | 7,536.00                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)

Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Message                          |
|----------------------------------|
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| Weir: H =0.5ft                   |
| Weir: H =1ft                     |
| FULLY CHARGED RISER: ADJUSTED TO |
| WEIR: H =1.5ft                   |
| FULLY CHARGED RISER: ADJUSTED TO |
| WEIR: H =2ft                     |
| FULLY CHARGED RISER: ADJUSTED TO |
| WEIR: H =2.5ft                   |
| FULLY CHARGED RISER,             |
| DOWNSTREAM CONTROL: Kev=0.       |
| Hev=0.000                        |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water<br>Surface<br>Elevation<br>(ft) | Device<br>Flow<br>(ft <sup>3</sup> /s) | (into)<br>Headwater<br>Hydraulic<br>Grade Line<br>(ft) | Converge<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Next<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Downstream<br>Hydraulic<br>Grade Line<br>Error<br>(ft) | Convergence<br>Error<br>(ft <sup>3</sup> /s) | Downstream<br>Channel<br>Tailwater<br>(ft) | Tailwater<br>Error<br>(ft) |
|---------------------------------------|--|--|---|---|--|--|--|----------------------------|
| 7,510.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,510.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.90                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 6.94                             | 7,531.50                                   | Free Outfall                                  | 7,528.16                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 13.89                            | 7,532.00                                   | Free Outfall                                  | 7,528.75                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 20.83                            | 7,532.50                                   | Free Outfall                                  | 7,529.24                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 27.77                            | 7,533.00                                   | Free Outfall                                  | 7,529.71                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 31.05                            | 7,533.50                                   | Free Outfall                                  | 7,530.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 27.25                            | 7,534.00                                   | 7,532.08                                      | 7,532.08                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 17.92                            | 7,534.50                                   | 7,533.67                                      | 7,533.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 1.59                             | 7,535.00                                   | 7,534.99                                      | 7,534.99                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 0.00                             | 7,535.50                                   | 7,535.50                                      | 7,535.50                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,536.00                     | 0.00                             | 7,536.00                                   | 7,536.00                                      | 7,536.00                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

### RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)

Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
Hi=.50; Ht=2.00; Qt=9.26  
Hi=1.00; Ht=2.00; Qt=9.26  
Hi=1.50; Ht=2.00; Qt=9.26  
H =2.00  
H =2.50  
H =1.92  
H =.83  
H =.01  
FLOW PRECEDENCE SET TO  
DOWNSTREAM CONTROLLING  
STRUCTURE  
FLOW PRECEDENCE SET TO  
DOWNSTREAM CONTROLLING  
STRUCTURE

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Water<br>Surface<br>Elevation<br>(ft) | Device<br>Flow<br>(ft <sup>3</sup> /s) | (into)<br>Headwater<br>Hydraulic<br>Grade Line<br>(ft) | Converge<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Next<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Downstream<br>Hydraulic<br>Grade Line<br>Error<br>(ft) | Convergence<br>Error<br>(ft <sup>3</sup> /s) | Downstream<br>Channel<br>Tailwater<br>(ft) | Tailwater<br>Error<br>(ft) |
|---------------------------------------|--|--|---|---|--|--|--|----------------------------|
| 7,510.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,510.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.90                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |



Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,527.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 6.94                             | 7,528.16                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 13.89                            | 7,528.75                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 20.83                            | 7,529.24                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 27.77                            | 7,529.71                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.01                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 39.53                            | 7,530.67                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 51.31                            | 7,532.08                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.06                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 61.99                            | 7,533.67                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.02                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 69.52                            | 7,534.99                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.05                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 72.13                            | 7,535.50                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 22.74                                  | (N/A)                             | 0.00                 |
| 7,536.00                     | 74.61                            | 7,536.00                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 50.10                                  | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

### RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
CRIT.DEPTH CONTROL Vh= .321ft  
Dcr= .874ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .493ft  
Dcr= 1.255ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .659ft  
Dcr= 1.551ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .840ft  
Dcr= 1.797ft CRIT.DEPTH Hev= .00ft  
INLET CONTROL... Submerged: HW  
=3.77  
INLET CONTROL... Submerged: HW  
=5.18  
INLET CONTROL... Submerged: HW  
=6.77

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

-----  
Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Message   |
|---|
| FULL FLOW...Lfull=98.92ft Vh=3.117ft<br>HL=6.583ft Hev= .00ft |
| FULL FLOW...Lfull=99.10ft Vh=3.356ft<br>HL=7.092ft Hev= .00ft |
| FULL FLOW...Lfull=99.31ft Vh=3.590ft<br>HL=7.594ft Hev= .00ft |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Twin CBC Spillway (Culvert-Box)

Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s

Upstream ID = (Pond Water Surface)

Downstream ID = Tailwater (Pond Outfall)

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,510.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,510.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.90                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.00                           | 0.00                         | (N/A)                       | 0.00                      |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = Twin CBC Spillway (Culvert-Box)

Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s  
Upstream ID = (Pond Water Surface)  
Downstream ID = Tailwater (Pond Outfall)

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,528.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,532.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,532.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,533.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,533.50                           | 17.36                        | (N/A)                       | 0.00                      |
| 7,534.00                           | 49.05                        | (N/A)                       | 0.00                      |
| 7,534.50                           | 90.08                        | (N/A)                       | 0.00                      |
| 7,535.00                           | 138.56                       | (N/A)                       | 0.00                      |
| 7,535.50                           | 193.63                       | (N/A)                       | 0.00                      |
| 7,536.00                           | 254.72                       | (N/A)                       | 0.00                      |

Computation Messages

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

### RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Twin CBC Spillway (Culvert-Box)

Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s

Upstream ID = (Pond Water Surface)

Downstream ID = Tailwater (Pond Outfall)

Computation Messages

WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 CRIT.DEPTH CONTROL Vh= .143ft  
 Dcr= .286ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .286ft  
 Dcr= .572ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .429ft  
 Dcr= .858ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .571ft  
 Dcr= 1.143ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .714ft  
 Dcr= 1.428ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .857ft  
 Dcr= 1.715ft CRIT.DEPTH Hev= .00ft

Subsection: Composite Rating Curve  
 Label: FH North Pond 13

Return Event: 50 years  
 Storm Event: Type II 24-Hour (NOAA 14)

Composite Outflow Summary

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,510.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,510.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.90                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.00                           | 0.00                         | (N/A)                       | 0.00                      |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

### Composite Outflow Summary

| Water Surface Elevation (ft) | Flow (ft <sup>3</sup> /s) | Tailwater Elevation (ft) | Convergence Error (ft) |
|------------------------------|---------------------------|--------------------------|------------------------|
| 7,531.50                     | 6.94                      | (N/A)                    | 0.00                   |
| 7,532.00                     | 13.89                     | (N/A)                    | 0.00                   |
| 7,532.50                     | 20.83                     | (N/A)                    | 0.00                   |
| 7,533.00                     | 27.77                     | (N/A)                    | 0.00                   |
| 7,533.50                     | 56.89                     | (N/A)                    | 0.00                   |
| 7,534.00                     | 100.36                    | (N/A)                    | 0.00                   |
| 7,534.50                     | 152.07                    | (N/A)                    | 0.00                   |
| 7,535.00                     | 208.08                    | (N/A)                    | 0.00                   |
| 7,535.50                     | 265.76                    | (N/A)                    | 0.00                   |
| 7,536.00                     | 329.33                    | (N/A)                    | 0.00                   |

### Contributing Structures

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)

(no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway)



Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
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| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
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| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Outlet Pipe,Twin<br>CBC Spillway (no Q: SWQ Orifice<br>Plate) |
| SWQ Outlet Box,SWQ Outlet Pipe,Twin<br>CBC Spillway (no Q: SWQ Orifice<br>Plate) |

Subsection: Elevation-Volume-Flow Table (Pond)  
Label: JD Reservoir (Pond 13)

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

| Infiltration                          |                         |
|---------------------------------------|-------------------------|
| Infiltration Method<br>(Computed)     | No Infiltration         |
| Initial Conditions                    |                         |
| Elevation (Water Surface,<br>Initial) | 7,531.00 ft             |
| Volume (Initial)                      | 94.889 ac-ft            |
| Flow (Initial Outlet)                 | 0.00 ft <sup>3</sup> /s |
| Flow (Initial Infiltration)           | 0.00 ft <sup>3</sup> /s |
| Flow (Initial, Total)                 | 0.00 ft <sup>3</sup> /s |
| Time Increment                        | 0.050 hours             |

| Elevation<br>(ft) | Outflow<br>(ft <sup>3</sup> /s) | Storage<br>(ac-ft) | Area<br>(acres) | Infiltration<br>(ft <sup>3</sup> /s) | Flow (Total)<br>(ft <sup>3</sup> /s) | 2S/t + O<br>(ft <sup>3</sup> /s) |
|-------------------|---------------------------------|--------------------|-----------------|--------------------------------------|--------------------------------------|----------------------------------|
| 7,510.00          | 0.00                            | 0.000              | 1.510           | 0.00                                 | 0.00                                 | 0.00                             |
| 7,510.50          | 0.00                            | 0.812              | 1.742           | 0.00                                 | 0.00                                 | 393.13                           |
| 7,511.00          | 0.00                            | 1.744              | 1.990           | 0.00                                 | 0.00                                 | 844.33                           |
| 7,511.50          | 0.00                            | 2.803              | 2.247           | 0.00                                 | 0.00                                 | 1,356.72                         |
| 7,512.00          | 0.00                            | 3.994              | 2.520           | 0.00                                 | 0.00                                 | 1,933.23                         |
| 7,512.50          | 0.00                            | 5.295              | 2.682           | 0.00                                 | 0.00                                 | 2,562.63                         |
| 7,513.00          | 0.00                            | 6.678              | 2.850           | 0.00                                 | 0.00                                 | 3,231.95                         |
| 7,513.50          | 0.00                            | 8.127              | 2.949           | 0.00                                 | 0.00                                 | 3,933.62                         |
| 7,514.00          | 0.00                            | 9.627              | 3.050           | 0.00                                 | 0.00                                 | 4,659.48                         |
| 7,514.50          | 0.00                            | 11.178             | 3.154           | 0.00                                 | 0.00                                 | 5,410.14                         |
| 7,515.00          | 0.00                            | 12.781             | 3.260           | 0.00                                 | 0.00                                 | 6,186.22                         |
| 7,515.50          | 0.00                            | 14.439             | 3.369           | 0.00                                 | 0.00                                 | 6,988.30                         |
| 7,516.00          | 0.00                            | 16.151             | 3.480           | 0.00                                 | 0.00                                 | 7,817.01                         |
| 7,516.50          | 0.00                            | 17.918             | 3.589           | 0.00                                 | 0.00                                 | 8,672.34                         |
| 7,517.00          | 0.00                            | 19.740             | 3.700           | 0.00                                 | 0.00                                 | 9,554.30                         |
| 7,517.50          | 0.00                            | 21.619             | 3.814           | 0.00                                 | 0.00                                 | 10,463.47                        |
| 7,518.00          | 0.00                            | 23.555             | 3.930           | 0.00                                 | 0.00                                 | 11,400.48                        |
| 7,518.50          | 0.00                            | 25.548             | 4.044           | 0.00                                 | 0.00                                 | 12,365.32                        |
| 7,519.00          | 0.00                            | 27.599             | 4.160           | 0.00                                 | 0.00                                 | 13,357.99                        |
| 7,519.50          | 0.00                            | 29.709             | 4.279           | 0.00                                 | 0.00                                 | 14,379.10                        |
| 7,520.00          | 0.00                            | 31.879             | 4.400           | 0.00                                 | 0.00                                 | 15,429.24                        |
| 7,520.50          | 0.00                            | 34.108             | 4.519           | 0.00                                 | 0.00                                 | 16,508.43                        |
| 7,521.00          | 0.00                            | 36.398             | 4.640           | 0.00                                 | 0.00                                 | 17,616.66                        |
| 7,521.50          | 0.00                            | 38.748             | 4.759           | 0.00                                 | 0.00                                 | 18,753.94                        |
| 7,522.00          | 0.00                            | 41.158             | 4.880           | 0.00                                 | 0.00                                 | 19,920.26                        |
| 7,522.50          | 0.00                            | 43.630             | 5.009           | 0.00                                 | 0.00                                 | 21,116.81                        |
| 7,523.00          | 0.00                            | 46.167             | 5.140           | 0.00                                 | 0.00                                 | 22,344.83                        |
| 7,523.50          | 0.00                            | 48.764             | 5.249           | 0.00                                 | 0.00                                 | 23,601.92                        |
| 7,524.00          | 0.00                            | 51.417             | 5.360           | 0.00                                 | 0.00                                 | 24,885.64                        |
| 7,524.50          | 0.00                            | 54.125             | 5.474           | 0.00                                 | 0.00                                 | 26,196.58                        |
| 7,525.00          | 0.00                            | 56.891             | 5.590           | 0.00                                 | 0.00                                 | 27,535.35                        |

Subsection: Elevation-Volume-Flow Table (Pond)  
Label: JD Reservoir (Pond 13)

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

| Elevation<br>(ft) | Outflow<br>(ft <sup>3</sup> /s) | Storage<br>(ac-ft) | Area<br>(acres) | Infiltration<br>(ft <sup>3</sup> /s) | Flow (Total)<br>(ft <sup>3</sup> /s) | 2S/t + O<br>(ft <sup>3</sup> /s) |
|-------------------|---------------------------------|--------------------|-----------------|--------------------------------------|--------------------------------------|----------------------------------|
| 7,525.50          | 0.00                            | 59.717             | 5.714           | 0.00                                 | 0.00                                 | 28,903.14                        |
| 7,526.00          | 0.00                            | 62.606             | 5.840           | 0.00                                 | 0.00                                 | 30,301.19                        |
| 7,526.50          | 0.00                            | 65.556             | 5.959           | 0.00                                 | 0.00                                 | 31,728.89                        |
| 7,526.90          | 0.00                            | 67.959             | 6.056           | 0.00                                 | 0.00                                 | 32,891.95                        |
| 7,527.00          | 0.00                            | 68.565             | 6.080           | 0.00                                 | 0.00                                 | 33,185.63                        |
| 7,527.50          | 0.00                            | 71.636             | 6.204           | 0.00                                 | 0.00                                 | 34,672.01                        |
| 7,528.00          | 0.00                            | 74.770             | 6.330           | 0.00                                 | 0.00                                 | 36,188.65                        |
| 7,528.50          | 0.00                            | 77.965             | 6.449           | 0.00                                 | 0.00                                 | 37,734.94                        |
| 7,529.00          | 0.00                            | 81.220             | 6.570           | 0.00                                 | 0.00                                 | 39,310.27                        |
| 7,529.50          | 0.00                            | 84.534             | 6.689           | 0.00                                 | 0.00                                 | 40,914.64                        |
| 7,530.00          | 0.00                            | 87.909             | 6.810           | 0.00                                 | 0.00                                 | 42,548.05                        |
| 7,530.50          | 0.00                            | 91.356             | 6.979           | 0.00                                 | 0.00                                 | 44,216.48                        |
| 7,531.00          | 0.00                            | 94.889             | 7.150           | 0.00                                 | 0.00                                 | 45,926.04                        |
| 7,531.50          | 6.94                            | 98.509             | 7.334           | 0.00                                 | 6.94                                 | 47,685.48                        |
| 7,532.00          | 13.89                           | 102.223            | 7.520           | 0.00                                 | 13.89                                | 49,489.69                        |
| 7,532.50          | 20.83                           | 106.021            | 7.674           | 0.00                                 | 20.83                                | 51,335.10                        |
| 7,533.00          | 27.77                           | 109.897            | 7.830           | 0.00                                 | 27.77                                | 53,218.02                        |
| 7,533.50          | 56.89                           | 113.879            | 8.098           | 0.00                                 | 56.89                                | 55,174.31                        |
| 7,534.00          | 100.36                          | 117.996            | 8.370           | 0.00                                 | 100.36                               | 57,210.28                        |
| 7,534.50          | 152.07                          | 122.230            | 8.569           | 0.00                                 | 152.07                               | 59,311.55                        |
| 7,535.00          | 208.08                          | 126.565            | 8.770           | 0.00                                 | 208.08                               | 61,465.51                        |
| 7,535.50          | 265.76                          | 131.000            | 8.969           | 0.00                                 | 265.76                               | 63,669.55                        |
| 7,536.00          | 329.33                          | 135.534            | 9.170           | 0.00                                 | 329.33                               | 65,927.87                        |

Subsection: Pond Routed Hydrograph (total out)  
Label: JD Reservoir (Pond 13) (OUT)

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

|                   |                          |
|-------------------|--------------------------|
| Peak Discharge    | 63.91 ft <sup>3</sup> /s |
| Time to Peak      | 13.350 hours             |
| Hydrograph Volume | 33.772 ac-ft             |

### HYDROGRAPH ORDINATES (ft<sup>3</sup>/s)

Output Time Increment = 0.050 hours

Time on left represents time for first value in each row.

| Time<br>(hours) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 8.350           | 0.00                         | 0.00                         | 0.00                         | 0.00                         | 0.01                         |
| 8.600           | 0.01                         | 0.01                         | 0.01                         | 0.02                         | 0.02                         |
| 8.850           | 0.02                         | 0.03                         | 0.03                         | 0.04                         | 0.05                         |
| 9.100           | 0.05                         | 0.06                         | 0.07                         | 0.08                         | 0.08                         |
| 9.350           | 0.09                         | 0.10                         | 0.11                         | 0.12                         | 0.13                         |
| 9.600           | 0.14                         | 0.14                         | 0.15                         | 0.16                         | 0.17                         |
| 9.850           | 0.18                         | 0.19                         | 0.20                         | 0.21                         | 0.22                         |
| 10.100          | 0.23                         | 0.24                         | 0.25                         | 0.26                         | 0.28                         |
| 10.350          | 0.29                         | 0.30                         | 0.31                         | 0.33                         | 0.34                         |
| 10.600          | 0.36                         | 0.37                         | 0.39                         | 0.41                         | 0.42                         |
| 10.850          | 0.44                         | 0.46                         | 0.48                         | 0.50                         | 0.53                         |
| 11.100          | 0.55                         | 0.58                         | 0.61                         | 0.65                         | 0.69                         |
| 11.350          | 0.73                         | 0.79                         | 0.85                         | 0.92                         | 1.00                         |
| 11.600          | 1.10                         | 1.24                         | 1.42                         | 1.71                         | 2.14                         |
| 11.850          | 2.81                         | 3.84                         | 5.36                         | 7.45                         | 10.07                        |
| 12.100          | 13.10                        | 16.25                        | 19.27                        | 22.00                        | 24.34                        |
| 12.350          | 26.33                        | 28.79                        | 34.59                        | 39.42                        | 43.47                        |
| 12.600          | 46.87                        | 49.71                        | 52.09                        | 54.06                        | 55.70                        |
| 12.850          | 57.15                        | 58.77                        | 60.09                        | 61.17                        | 62.03                        |
| 13.100          | 62.70                        | 63.20                        | 63.55                        | 63.78                        | 63.89                        |
| 13.350          | 63.91                        | 63.84                        | 63.69                        | 63.48                        | 63.20                        |
| 13.600          | 62.88                        | 62.50                        | 62.08                        | 61.61                        | 61.12                        |
| 13.850          | 60.59                        | 60.03                        | 59.45                        | 58.84                        | 58.22                        |
| 14.100          | 57.58                        | 56.92                        | 56.45                        | 55.97                        | 55.48                        |
| 14.350          | 54.99                        | 54.50                        | 54.00                        | 53.50                        | 53.01                        |
| 14.600          | 52.51                        | 52.02                        | 51.54                        | 51.06                        | 50.58                        |
| 14.850          | 50.11                        | 49.64                        | 49.17                        | 48.71                        | 48.25                        |
| 15.100          | 47.80                        | 47.35                        | 46.90                        | 46.46                        | 46.01                        |
| 15.350          | 45.58                        | 45.14                        | 44.71                        | 44.28                        | 43.86                        |
| 15.600          | 43.44                        | 43.02                        | 42.60                        | 42.18                        | 41.77                        |
| 15.850          | 41.36                        | 40.95                        | 40.55                        | 40.14                        | 39.74                        |
| 16.100          | 39.34                        | 38.94                        | 38.55                        | 38.15                        | 37.77                        |
| 16.350          | 37.38                        | 37.01                        | 36.63                        | 36.27                        | 35.91                        |
| 16.600          | 35.55                        | 35.21                        | 34.86                        | 34.53                        | 34.19                        |
| 16.850          | 33.87                        | 33.55                        | 33.24                        | 32.93                        | 32.62                        |
| 17.100          | 32.32                        | 32.03                        | 31.74                        | 31.46                        | 31.18                        |
| 17.350          | 30.90                        | 30.63                        | 30.37                        | 30.10                        | 29.85                        |
| 17.600          | 29.59                        | 29.34                        | 29.10                        | 28.85                        | 28.61                        |
| 17.850          | 28.38                        | 28.14                        | 27.91                        | 27.75                        | 27.69                        |

Subsection: Pond Routed Hydrograph (total out)  
Label: JD Reservoir (Pond 13) (OUT)

Return Event: 50 years  
Storm Event: Type II 24-Hour (NOAA 14)

### HYDROGRAPH ORDINATES (ft<sup>3</sup>/s)

Output Time Increment = 0.050 hours

Time on left represents time for first value in each row.

| Time<br>(hours) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 18.100          | 27.63                        | 27.58                        | 27.52                        | 27.46                        | 27.40                        |
| 18.350          | 27.34                        | 27.29                        | 27.23                        | 27.17                        | 27.10                        |
| 18.600          | 27.04                        | 26.98                        | 26.92                        | 26.86                        | 26.79                        |
| 18.850          | 26.73                        | 26.67                        | 26.60                        | 26.54                        | 26.47                        |
| 19.100          | 26.41                        | 26.34                        | 26.27                        | 26.21                        | 26.14                        |
| 19.350          | 26.07                        | 26.00                        | 25.93                        | 25.86                        | 25.79                        |
| 19.600          | 25.72                        | 25.65                        | 25.58                        | 25.51                        | 25.44                        |
| 19.850          | 25.37                        | 25.30                        | 25.22                        | 25.15                        | 25.08                        |
| 20.100          | 25.00                        | 24.93                        | 24.85                        | 24.78                        | 24.70                        |
| 20.350          | 24.63                        | 24.55                        | 24.48                        | 24.40                        | 24.33                        |
| 20.600          | 24.25                        | 24.18                        | 24.11                        | 24.03                        | 23.96                        |
| 20.850          | 23.89                        | 23.81                        | 23.74                        | 23.67                        | 23.60                        |
| 21.100          | 23.53                        | 23.46                        | 23.38                        | 23.31                        | 23.24                        |
| 21.350          | 23.17                        | 23.10                        | 23.03                        | 22.97                        | 22.90                        |
| 21.600          | 22.83                        | 22.76                        | 22.69                        | 22.63                        | 22.56                        |
| 21.850          | 22.49                        | 22.42                        | 22.36                        | 22.29                        | 22.23                        |
| 22.100          | 22.16                        | 22.10                        | 22.03                        | 21.97                        | 21.90                        |
| 22.350          | 21.84                        | 21.78                        | 21.71                        | 21.65                        | 21.59                        |
| 22.600          | 21.52                        | 21.46                        | 21.40                        | 21.34                        | 21.28                        |
| 22.850          | 21.22                        | 21.16                        | 21.09                        | 21.03                        | 20.97                        |
| 23.100          | 20.91                        | 20.86                        | 20.80                        | 20.74                        | 20.68                        |
| 23.350          | 20.62                        | 20.56                        | 20.50                        | 20.44                        | 20.38                        |
| 23.600          | 20.32                        | 20.26                        | 20.21                        | 20.15                        | 20.09                        |
| 23.850          | 20.03                        | 19.98                        | 19.92                        | 19.86                        | (N/A)                        |

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|                             |  |
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| Title                       | Flying Horse North<br>Irrigation<br>Reservoir (Pond<br>13) |
| Engineer                    | MAW  |
| Company                     | CCES   |
| Date                        | 8/8/2017   |
| Notes                       |  |
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## Subsection: Master Network Summary

### Catchments Summary

| Label              | Scenario               | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) |
|--------------------|------------------------|----------------------|---------------------------|----------------------|--------------------------------|
| Basin CC-3         | Post-Development 100YR | 100                  | 7.786                     | 12.050               | 105.30                         |
| Basin CC-4A        | Post-Development 100YR | 100                  | 18.271                    | 12.150               | 193.06                         |
| Basin CC-4B        | Post-Development 100YR | 100                  | 3.973                     | 12.050               | 54.30                          |
| Basins OS-12, CC-1 | Post-Development 100YR | 100                  | 14.935                    | 12.100               | 188.72                         |
| Basins OS-13, CC-2 | Post-Development 100YR | 100                  | 12.423                    | 12.150               | 140.96                         |
| Basins OS-14       | Post-Development 100YR | 100                  | 3.828                     | 12.050               | 55.12                          |

### Node Summary

| Label              | Scenario               | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) |
|--------------------|------------------------|----------------------|---------------------------|----------------------|--------------------------------|
| DP-18 (MDDP DP 16) | Post-Development 100YR | 100                  | 47.791                    | 12.900               | 124.23                         |

### Pond Summary

| Label                        | Scenario               | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (hours) | Peak Flow (ft <sup>3</sup> /s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ac-ft) |
|------------------------------|------------------------|----------------------|---------------------------|----------------------|--------------------------------|--------------------------------------|------------------------------|
| Golf Course Pond 12 (IN)     | Post-Development 100YR | 100                  | 11.614                    | 12.050               | 160.42                         | (N/A)                                | (N/A)                        |
| Golf Course Pond 12 (OUT)    | Post-Development 100YR | 100                  | 10.304                    | 12.300               | 65.90                          | 7,545.96                             | 7.077                        |
| JD Reservoir (Pond 13) (IN)  | Post-Development 100YR | 100                  | 59.906                    | 12.150               | 608.53                         | (N/A)                                | (N/A)                        |
| JD Reservoir (Pond 13) (OUT) | Post-Development 100YR | 100                  | 47.791                    | 12.900               | 124.23                         | 7,534.23                             | 119.938                      |

Subsection: Time-Depth Curve  
Label: NOAA 14

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

Time-Depth Curve: Type II 24-Hour (NOAA 14)

|              |                              |
|--------------|------------------------------|
| Label        | Type II 24-Hour<br>(NOAA 14) |
| Start Time   | 0.000 hours                  |
| Increment    | 0.100 hours                  |
| End Time     | 24.000 hours                 |
| Return Event | 100 years                    |

**CUMULATIVE RAINFALL (in)**

**Output Time Increment = 0.100 hours**

**Time on left represents time for first value in each row.**

| Time<br>(hours) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) |
|-----------------|---------------|---------------|---------------|---------------|---------------|
| 0.000           | 0.00          | 0.01          | 0.01          | 0.02          | 0.02          |
| 0.500           | 0.03          | 0.03          | 0.04          | 0.04          | 0.05          |
| 1.000           | 0.05          | 0.06          | 0.06          | 0.07          | 0.08          |
| 1.500           | 0.08          | 0.09          | 0.09          | 0.10          | 0.10          |
| 2.000           | 0.11          | 0.12          | 0.12          | 0.13          | 0.14          |
| 2.500           | 0.14          | 0.15          | 0.15          | 0.16          | 0.17          |
| 3.000           | 0.17          | 0.18          | 0.19          | 0.19          | 0.20          |
| 3.500           | 0.21          | 0.21          | 0.22          | 0.23          | 0.23          |
| 4.000           | 0.24          | 0.25          | 0.26          | 0.26          | 0.27          |
| 4.500           | 0.28          | 0.29          | 0.29          | 0.30          | 0.31          |
| 5.000           | 0.32          | 0.33          | 0.33          | 0.34          | 0.35          |
| 5.500           | 0.36          | 0.37          | 0.38          | 0.39          | 0.39          |
| 6.000           | 0.40          | 0.41          | 0.42          | 0.43          | 0.44          |
| 6.500           | 0.45          | 0.46          | 0.47          | 0.48          | 0.49          |
| 7.000           | 0.50          | 0.51          | 0.52          | 0.53          | 0.54          |
| 7.500           | 0.55          | 0.56          | 0.57          | 0.58          | 0.59          |
| 8.000           | 0.60          | 0.62          | 0.63          | 0.64          | 0.65          |
| 8.500           | 0.67          | 0.68          | 0.69          | 0.71          | 0.73          |
| 9.000           | 0.74          | 0.76          | 0.77          | 0.79          | 0.81          |
| 9.500           | 0.82          | 0.84          | 0.86          | 0.87          | 0.89          |
| 10.000          | 0.91          | 0.93          | 0.95          | 0.98          | 1.00          |
| 10.500          | 1.03          | 1.06          | 1.08          | 1.12          | 1.15          |
| 11.000          | 1.18          | 1.22          | 1.27          | 1.32          | 1.37          |
| 11.500          | 1.43          | 1.55          | 1.79          | 2.17          | 2.86          |
| 12.000          | 3.34          | 3.44          | 3.52          | 3.59          | 3.65          |
| 12.500          | 3.70          | 3.75          | 3.79          | 3.82          | 3.86          |
| 13.000          | 3.89          | 3.92          | 3.95          | 3.98          | 4.00          |
| 13.500          | 4.03          | 4.05          | 4.07          | 4.09          | 4.11          |
| 14.000          | 4.13          | 4.15          | 4.17          | 4.19          | 4.20          |
| 14.500          | 4.22          | 4.24          | 4.25          | 4.27          | 4.29          |
| 15.000          | 4.30          | 4.32          | 4.33          | 4.35          | 4.36          |
| 15.500          | 4.37          | 4.39          | 4.40          | 4.41          | 4.42          |
| 16.000          | 4.44          | 4.45          | 4.46          | 4.47          | 4.48          |
| 16.500          | 4.49          | 4.50          | 4.51          | 4.52          | 4.53          |
| 17.000          | 4.54          | 4.56          | 4.57          | 4.58          | 4.59          |

Subsection: Time-Depth Curve  
 Label: NOAA 14

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

**CUMULATIVE RAINFALL (in)**  
**Output Time Increment = 0.100 hours**  
**Time on left represents time for first value in each row.**

| Time<br>(hours) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) | Depth<br>(in) |
|-----------------|---------------|---------------|---------------|---------------|---------------|
| 17.500          | 4.59          | 4.60          | 4.61          | 4.62          | 4.63          |
| 18.000          | 4.64          | 4.65          | 4.66          | 4.67          | 4.68          |
| 18.500          | 4.69          | 4.69          | 4.70          | 4.71          | 4.72          |
| 19.000          | 4.73          | 4.73          | 4.74          | 4.75          | 4.76          |
| 19.500          | 4.76          | 4.77          | 4.78          | 4.78          | 4.79          |
| 20.000          | 4.80          | 4.80          | 4.81          | 4.82          | 4.82          |
| 20.500          | 4.83          | 4.84          | 4.84          | 4.85          | 4.86          |
| 21.000          | 4.86          | 4.87          | 4.87          | 4.88          | 4.89          |
| 21.500          | 4.89          | 4.90          | 4.91          | 4.91          | 4.92          |
| 22.000          | 4.92          | 4.93          | 4.94          | 4.94          | 4.95          |
| 22.500          | 4.95          | 4.96          | 4.97          | 4.97          | 4.98          |
| 23.000          | 4.98          | 4.99          | 4.99          | 5.00          | 5.01          |
| 23.500          | 5.01          | 5.02          | 5.02          | 5.03          | 5.03          |
| 24.000          | 5.04          | (N/A)         | (N/A)         | (N/A)         | (N/A)         |

Subsection: Elevation-Area Volume Curve  
 Label: Golf Course Pond 12

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

| Elevation<br>(ft) | Planimeter<br>(ft <sup>2</sup> ) | Area<br>(acres) | A1+A2+sqr<br>(A1*A2)<br>(acres) | Volume<br>(ac-ft) | Volume (Total)<br>(ac-ft) |
|-------------------|----------------------------------|-----------------|---------------------------------|-------------------|---------------------------|
| 7,534.00          | 0.0                              | 0.043           | 0.000                           | 0.000             | 0.000                     |
| 7,536.00          | 0.0                              | 0.200           | 0.336                           | 0.224             | 0.224                     |
| 7,538.00          | 0.0                              | 0.330           | 0.787                           | 0.525             | 0.748                     |
| 7,540.00          | 0.0                              | 0.470           | 1.194                           | 0.796             | 1.544                     |
| 7,542.00          | 0.0                              | 0.640           | 1.658                           | 1.106             | 2.650                     |
| 7,544.00          | 0.0                              | 1.240           | 2.771                           | 1.847             | 4.497                     |
| 7,546.00          | 0.0                              | 1.400           | 3.958                           | 2.638             | 7.136                     |

Subsection: Elevation-Area Volume Curve  
Label: JD Reservoir (Pond 13)

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

| Elevation<br>(ft) | Planimeter<br>(ft <sup>2</sup> ) | Area<br>(acres) | A1+A2+sqr<br>(A1*A2)<br>(acres) | Volume<br>(ac-ft) | Volume (Total)<br>(ac-ft) |
|-------------------|----------------------------------|-----------------|---------------------------------|-------------------|---------------------------|
| 7,510.00          | 0.0                              | 1.510           | 0.000                           | 0.000             | 0.000                     |
| 7,511.00          | 0.0                              | 1.990           | 5.233                           | 1.744             | 1.744                     |
| 7,512.00          | 0.0                              | 2.520           | 6.749                           | 2.250             | 3.994                     |
| 7,513.00          | 0.0                              | 2.850           | 8.050                           | 2.683             | 6.678                     |
| 7,514.00          | 0.0                              | 3.050           | 8.848                           | 2.949             | 9.627                     |
| 7,515.00          | 0.0                              | 3.260           | 9.463                           | 3.154             | 12.781                    |
| 7,516.00          | 0.0                              | 3.480           | 10.108                          | 3.369             | 16.151                    |
| 7,517.00          | 0.0                              | 3.700           | 10.768                          | 3.589             | 19.740                    |
| 7,518.00          | 0.0                              | 3.930           | 11.443                          | 3.814             | 23.555                    |
| 7,519.00          | 0.0                              | 4.160           | 12.133                          | 4.044             | 27.599                    |
| 7,520.00          | 0.0                              | 4.400           | 12.838                          | 4.279             | 31.879                    |
| 7,521.00          | 0.0                              | 4.640           | 13.558                          | 4.519             | 36.398                    |
| 7,522.00          | 0.0                              | 4.880           | 14.278                          | 4.760             | 41.158                    |
| 7,523.00          | 0.0                              | 5.140           | 15.028                          | 5.009             | 46.167                    |
| 7,524.00          | 0.0                              | 5.360           | 15.749                          | 5.250             | 51.417                    |
| 7,525.00          | 0.0                              | 5.590           | 16.424                          | 5.475             | 56.891                    |
| 7,526.00          | 0.0                              | 5.840           | 17.144                          | 5.715             | 62.606                    |
| 7,527.00          | 0.0                              | 6.080           | 17.879                          | 5.960             | 68.565                    |
| 7,528.00          | 0.0                              | 6.330           | 18.614                          | 6.205             | 74.770                    |
| 7,529.00          | 0.0                              | 6.570           | 19.349                          | 6.450             | 81.220                    |
| 7,530.00          | 0.0                              | 6.810           | 20.069                          | 6.690             | 87.909                    |
| 7,531.00          | 0.0                              | 7.150           | 20.938                          | 6.979             | 94.889                    |
| 7,532.00          | 0.0                              | 7.520           | 22.003                          | 7.334             | 102.223                   |
| 7,533.00          | 0.0                              | 7.830           | 23.023                          | 7.674             | 109.897                   |
| 7,534.00          | 0.0                              | 8.370           | 24.295                          | 8.099             | 117.996                   |
| 7,535.00          | 0.0                              | 8.770           | 25.708                          | 8.569             | 126.565                   |
| 7,536.00          | 0.0                              | 9.170           | 26.908                          | 8.969             | 135.534                   |

Subsection: Outlet Input Data  
 Label: FH North Pond 13

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

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Requested Pond Water Surface Elevations

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|                       |             |
|-----------------------|-------------|
| Minimum (Headwater)   | 7,510.00 ft |
| Increment (Headwater) | 0.50 ft     |
| Maximum (Headwater)   | 7,536.00 ft |

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**Outlet Connectivity**

| Structure Type     | Outlet ID               | Direction | Outfall            | E1<br>(ft) | E2<br>(ft) |
|--------------------|-------------------------|-----------|--------------------|------------|------------|
| Inlet Box          | SWQ<br>Outlet Box       | Forward   | SWQ<br>Outlet Pipe | 7,533.00   | 7,536.00   |
| Orifice-Area       | SWQ<br>Orifice<br>Plate | Forward   | SWQ<br>Outlet Pipe | 7,531.00   | 7,536.00   |
| Culvert-Circular   | SWQ<br>Outlet Pipe      | Forward   | TW                 | 7,526.90   | 7,536.00   |
| Culvert-Box        | Twin CBC<br>Spillway    | Forward   | TW                 | 7,533.00   | 7,536.00   |
| Tailwater Settings | Tailwater               |           |                    | (N/A)      | (N/A)      |



Subsection: Outlet Input Data  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

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Structure ID: SWQ Outlet Box  
Structure Type: Inlet Box

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|                     |                             |
|---------------------|-----------------------------|
| Number of Openings  | 1                           |
| Elevation           | 7,533.00 ft                 |
| Orifice Area        | 20.8 ft <sup>2</sup>        |
| Orifice Coefficient | 0.600                       |
| Weir Length         | 8.00 ft                     |
| Weir Coefficient    | 3.00 (ft <sup>0.5</sup> )/s |
| K Reverse           | 1.000                       |
| Manning's n         | 0.000                       |
| Kev, Charged Riser  | 0.000                       |
| Weir Submergence    | False                       |
| Orifice H to crest  | False                       |

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Structure ID: SWQ Orifice Plate  
Structure Type: Orifice-Area

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|                     |                     |
|---------------------|---------------------|
| Number of Openings  | 3                   |
| Elevation           | 7,531.00 ft         |
| Orifice Area        | 1.4 ft <sup>2</sup> |
| Top Elevation       | 7,533.00 ft         |
| Datum Elevation     | 7,531.00 ft         |
| Orifice Coefficient | 0.600               |

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Subsection: Outlet Input Data  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

|                                  |             |
|----------------------------------|-------------|
| Structure ID: SWQ Outlet Pipe    |             |
| Structure Type: Culvert-Circular |             |
| Number of Barrels                | 1           |
| Diameter                         | 30.0 in     |
| Length                           | 100.00 ft   |
| Length (Computed Barrel)         | 100.00 ft   |
| Slope (Computed)                 | 0.010 ft/ft |
| Outlet Control Data              |             |
| Manning's n                      | 0.013       |
| Ke                               | 0.200       |
| Kb                               | 0.009       |
| Kr                               | 0.000       |
| Convergence Tolerance            | 0.00 ft     |
| Inlet Control Data               |             |
| Equation Form                    | Form 1      |
| K                                | 0.0045      |
| M                                | 2.0000      |
| C                                | 0.0317      |
| Y                                | 0.6900      |
| T1 ratio (HW/D)                  | 1.090       |
| T2 ratio (HW/D)                  | 1.192       |
| Slope Correction Factor          | -0.500      |

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...

|              |             |         |                          |
|--------------|-------------|---------|--------------------------|
| T1 Elevation | 7,529.63 ft | T1 Flow | 27.16 ft <sup>3</sup> /s |
| T2 Elevation | 7,529.88 ft | T2 Flow | 31.05 ft <sup>3</sup> /s |

Subsection: Outlet Input Data  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

|                                 |             |
|---------------------------------|-------------|
| Structure ID: Twin CBC Spillway |             |
| Structure Type: Culvert-Box     |             |
| Number of Barrels               | 2           |
| Width                           | 10.00 ft    |
| Height                          | 4.00 ft     |
| Length                          | 65.00 ft    |
| Length (Computed Barrel)        | 65.00 ft    |
| Slope (Computed)                | 0.010 ft/ft |
| Outlet Control Data             |             |
| Manning's n                     | 0.013       |
| Ke                              | 0.500       |
| Kb                              | 0.003       |
| Kr                              | 0.000       |
| Convergence Tolerance           | 0.00 ft     |
| Inlet Control Data              |             |
| Equation Form                   | Form 1      |
| K                               | 0.0260      |
| M                               | 1.0000      |
| C                               | 0.0347      |
| Y                               | 0.8100      |
| T1 ratio (HW/D)                 | 1.173       |
| T2 ratio (HW/D)                 | 1.360       |
| Slope Correction Factor         | -0.500      |

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

|              |             |         |                           |
|--------------|-------------|---------|---------------------------|
| T1 Elevation | 7,537.69 ft | T1 Flow | 280.00 ft <sup>3</sup> /s |
| T2 Elevation | 7,538.44 ft | T2 Flow | 320.00 ft <sup>3</sup> /s |

Subsection: Outlet Input Data  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

|                                      |                           |
|--------------------------------------|---------------------------|
| Structure ID: TW                     |                           |
| Structure Type: TW Setup, DS Channel |                           |
| Tailwater Type                       | Free Outfall              |
| Convergence Tolerances               |                           |
| Maximum Iterations                   | 30                        |
| Tailwater Tolerance (Minimum)        | 0.01 ft                   |
| Tailwater Tolerance (Maximum)        | 0.50 ft                   |
| Headwater Tolerance (Minimum)        | 0.01 ft                   |
| Headwater Tolerance (Maximum)        | 0.50 ft                   |
| Flow Tolerance (Minimum)             | 0.001 ft <sup>3</sup> /s  |
| Flow Tolerance (Maximum)             | 10.000 ft <sup>3</sup> /s |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water<br>Surface<br>Elevation<br>(ft) | Device<br>Flow<br>(ft <sup>3</sup> /s) | (into)<br>Headwater<br>Hydraulic<br>Grade Line<br>(ft) | Converge<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Next<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Downstream<br>Hydraulic<br>Grade Line<br>Error<br>(ft) | Convergence<br>Error<br>(ft <sup>3</sup> /s) | Downstream<br>Channel<br>Tailwater<br>(ft) | Tailwater<br>Error<br>(ft) |
|---------------------------------------|--|--|---|---|--|--|--|----------------------------|
| 7,510.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,510.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.90                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

# RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)

Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 0.00                             | 0.00                                       | 0.00  | 7,528.16                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 0.00                             | 0.00                                       | 0.00  | 7,528.75                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 0.00                             | 0.00                                       | 0.00  | 7,529.24                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 0.00                             | 0.00                                       | 0.00  | 7,529.71                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 8.49                             | 7,533.50                                   | Free Outfall                                  | 7,530.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 24.00                            | 7,534.00                                   | Free Outfall                                  | 7,532.08                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 44.09                            | 7,534.50                                   | 7,533.67                                      | 7,533.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 67.88                            | 7,535.00                                   | 7,534.99                                      | 7,534.99                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 94.87                            | 7,535.50                                   | 7,535.50                                      | 7,535.50                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,536.00                     | 124.71                           | 7,536.00                                   | 7,536.00                                      | 7,536.00                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

## Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Box (Inlet Box)

Upstream ID = (Pond Water Surface)

Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Message                          |
|----------------------------------|
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| WS below an invert; no flow.     |
| Weir: H =0.5ft                   |
| Weir: H =1ft                     |
| FULLY CHARGED RISER: ADJUSTED TO |
| WEIR: H =1.5ft                   |
| FULLY CHARGED RISER: ADJUSTED TO |
| WEIR: H =2ft                     |
| FULLY CHARGED RISER: ADJUSTED TO |
| WEIR: H =2.5ft                   |
| FULLY CHARGED RISER,             |
| DOWNSTREAM CONTROL: Kev=0.       |
| Hev=0.000                        |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water<br>Surface<br>Elevation<br>(ft) | Device<br>Flow<br>(ft <sup>3</sup> /s) | (into)<br>Headwater<br>Hydraulic<br>Grade Line<br>(ft) | Converge<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Next<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Downstream<br>Hydraulic<br>Grade Line<br>Error<br>(ft) | Convergence<br>Error<br>(ft <sup>3</sup> /s) | Downstream<br>Channel<br>Tailwater<br>(ft) | Tailwater<br>Error<br>(ft) |
|---------------------------------------|--|--|---|---|--|--|--|----------------------------|
| 7,510.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,510.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.90                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.00                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.50                              | 0.00                                   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |



Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE  
 Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)  
 Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | 0.00                                      | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 6.94                             | 7,531.50                                   | Free Outfall                                  | 7,528.16                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 13.89                            | 7,532.00                                   | Free Outfall                                  | 7,528.75                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 20.83                            | 7,532.50                                   | Free Outfall                                  | 7,529.24                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 27.77                            | 7,533.00                                   | Free Outfall                                  | 7,529.71                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 31.05                            | 7,533.50                                   | Free Outfall                                  | 7,530.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 27.25                            | 7,534.00                                   | 7,532.08                                      | 7,532.08                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 17.92                            | 7,534.50                                   | 7,533.67                                      | 7,533.67                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 1.59                             | 7,535.00                                   | 7,534.99                                      | 7,534.99                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 0.00                             | 7,535.50                                   | 7,535.50                                      | 7,535.50                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,536.00                     | 0.00                             | 7,536.00                                   | 7,536.00                                      | 7,536.00                                  | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

### RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Orifice Plate (Orifice-Area)

Upstream ID = (Pond Water Surface)

Downstream ID = SWQ Outlet Pipe (Culvert-Circular)

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
Hi=.50; Ht=2.00; Qt=9.26  
Hi=1.00; Ht=2.00; Qt=9.26  
Hi=1.50; Ht=2.00; Qt=9.26  
H =2.00  
H =2.50  
H =1.92  
H =.83  
H =.01  
FLOW PRECEDENCE SET TO  
DOWNSTREAM CONTROLLING  
STRUCTURE  
FLOW PRECEDENCE SET TO  
DOWNSTREAM CONTROLLING  
STRUCTURE

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Water<br>Surface<br>Elevation<br>(ft) | Device<br>Flow<br>(ft <sup>3</sup> /s) | (into)<br>Headwater<br>Hydraulic<br>Grade Line<br>(ft) | Converge<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Next<br>Downstream<br>Hydraulic<br>Grade Line<br>(ft) | Downstream<br>Hydraulic<br>Grade Line<br>Error<br>(ft) | Convergence<br>Error<br>(ft <sup>3</sup> /s) | Downstream<br>Channel<br>Tailwater<br>(ft) | Tailwater<br>Error<br>(ft) |
|---------------------------------------|--|--|---|---|--|--|--|----------------------------|
| 7,510.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,510.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,511.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,512.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,513.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,514.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,515.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,516.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,517.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,518.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,519.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,520.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,521.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,522.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,523.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,524.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,525.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.50                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,526.90                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |
| 7,527.00                              | 0.00                                   | 0.00   | 0.00  | Free Outfall  | 0.00   | 0.00   | (N/A)                                      | 0.00                       |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Water Surface Elevation (ft) | Device Flow (ft <sup>3</sup> /s) | (into) Headwater Hydraulic Grade Line (ft) | Converge Downstream Hydraulic Grade Line (ft) | Next Downstream Hydraulic Grade Line (ft) | Downstream Hydraulic Grade Line Error (ft) | Convergence Error (ft <sup>3</sup> /s) | Downstream Channel Tailwater (ft) | Tailwater Error (ft) |
|------------------------------|----------------------------------|--|---|---|--|--|-----------------------------------|----------------------|
| 7,527.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,528.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,529.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,530.50                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.00                     | 0.00                             | 0.00                                       | 0.00  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,531.50                     | 6.94                             | 7,528.16                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.00                     | 13.89                            | 7,528.75                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,532.50                     | 20.83                            | 7,529.24                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,533.00                     | 27.77                            | 7,529.71                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.01                                   | (N/A)                             | 0.00                 |
| 7,533.50                     | 39.53                            | 7,530.67                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.00                                   | (N/A)                             | 0.00                 |
| 7,534.00                     | 51.31                            | 7,532.08                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.06                                   | (N/A)                             | 0.00                 |
| 7,534.50                     | 61.99                            | 7,533.67                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.02                                   | (N/A)                             | 0.00                 |
| 7,535.00                     | 69.52                            | 7,534.99                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 0.05                                   | (N/A)                             | 0.00                 |
| 7,535.50                     | 72.13                            | 7,535.50                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 22.74                                  | (N/A)                             | 0.00                 |
| 7,536.00                     | 74.61                            | 7,536.00                                   | Free Outfall                                  | Free Outfall                              | 0.00                                       | 50.10                                  | (N/A)                             | 0.00                 |

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

### RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

Message

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
CRIT.DEPTH CONTROL Vh= .321ft  
Dcr= .874ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .493ft  
Dcr= 1.255ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .659ft  
Dcr= 1.551ft CRIT.DEPTH Hev= .00ft  
CRIT.DEPTH CONTROL Vh= .840ft  
Dcr= 1.797ft CRIT.DEPTH Hev= .00ft  
INLET CONTROL... Submerged: HW  
=3.77  
INLET CONTROL... Submerged: HW  
=5.18  
INLET CONTROL... Submerged: HW  
=6.77

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = SWQ Outlet Pipe (Culvert-Circular)

-----  
Mannings open channel maximum capacity: 44.12 ft<sup>3</sup>/s

Upstream ID = SWQ Outlet Box, SWQ Orifice Plate

Downstream ID = Tailwater (Pond Outfall)

| Message   |
|---|
| FULL FLOW...Lfull=98.92ft Vh=3.117ft<br>HL=6.583ft Hev= .00ft |
| FULL FLOW...Lfull=99.10ft Vh=3.356ft<br>HL=7.092ft Hev= .00ft |
| FULL FLOW...Lfull=99.31ft Vh=3.590ft<br>HL=7.594ft Hev= .00ft |

Subsection: Individual Outlet Curves  
 Label: FH North Pond 13

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Twin CBC Spillway (Culvert-Box)

Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s

Upstream ID = (Pond Water Surface)

Downstream ID = Tailwater (Pond Outfall)

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,510.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,510.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.90                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.00                           | 0.00                         | (N/A)                       | 0.00                      |

Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

RATING TABLE FOR ONE OUTLET TYPE  
Structure ID = Twin CBC Spillway (Culvert-Box)

Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s  
Upstream ID = (Pond Water Surface)  
Downstream ID = Tailwater (Pond Outfall)

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,528.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,532.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,532.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,533.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,533.50                           | 17.36                        | (N/A)                       | 0.00                      |
| 7,534.00                           | 49.05                        | (N/A)                       | 0.00                      |
| 7,534.50                           | 90.08                        | (N/A)                       | 0.00                      |
| 7,535.00                           | 138.56                       | (N/A)                       | 0.00                      |
| 7,535.50                           | 193.63                       | (N/A)                       | 0.00                      |
| 7,536.00                           | 254.72                       | (N/A)                       | 0.00                      |

Computation Messages

WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.  
WS below an invert; no flow.



Subsection: Individual Outlet Curves  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

### RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Twin CBC Spillway (Culvert-Box)

Mannings open channel maximum capacity: 778.58 ft<sup>3</sup>/s

Upstream ID = (Pond Water Surface)

Downstream ID = Tailwater (Pond Outfall)

Computation Messages

WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 WS below an invert; no flow.  
 CRIT.DEPTH CONTROL Vh= .143ft  
 Dcr= .286ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .286ft  
 Dcr= .572ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .429ft  
 Dcr= .858ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .571ft  
 Dcr= 1.143ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .714ft  
 Dcr= 1.428ft CRIT.DEPTH Hev= .00ft  
 CRIT.DEPTH CONTROL Vh= .857ft  
 Dcr= 1.715ft CRIT.DEPTH Hev= .00ft

Subsection: Composite Rating Curve  
 Label: FH North Pond 13

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

Composite Outflow Summary

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,510.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,510.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,511.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,512.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,513.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,514.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,515.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,516.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,517.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,518.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,519.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,520.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,521.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,522.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,523.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,524.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,525.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,526.90                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,527.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,528.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,529.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.00                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,530.50                           | 0.00                         | (N/A)                       | 0.00                      |
| 7,531.00                           | 0.00                         | (N/A)                       | 0.00                      |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

Composite Outflow Summary

| Water Surface<br>Elevation<br>(ft) | Flow<br>(ft <sup>3</sup> /s) | Tailwater Elevation<br>(ft) | Convergence Error<br>(ft) |
|------------------------------------|------------------------------|-----------------------------|---------------------------|
| 7,531.50                           | 6.94                         | (N/A)                       | 0.00                      |
| 7,532.00                           | 13.89                        | (N/A)                       | 0.00                      |
| 7,532.50                           | 20.83                        | (N/A)                       | 0.00                      |
| 7,533.00                           | 27.77                        | (N/A)                       | 0.00                      |
| 7,533.50                           | 56.89                        | (N/A)                       | 0.00                      |
| 7,534.00                           | 100.36                       | (N/A)                       | 0.00                      |
| 7,534.50                           | 152.07                       | (N/A)                       | 0.00                      |
| 7,535.00                           | 208.08                       | (N/A)                       | 0.00                      |
| 7,535.50                           | 265.76                       | (N/A)                       | 0.00                      |
| 7,536.00                           | 329.33                       | (N/A)                       | 0.00                      |

Contributing Structures

(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)  
(no Q: SWQ Outlet Box,SWQ Orifice  
Plate,SWQ Outlet Pipe,Twin CBC  
Spillway)

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |
| (no Q: SWQ Outlet Box,SWQ Orifice Plate,SWQ Outlet Pipe,Twin CBC Spillway) |

Subsection: Composite Rating Curve  
Label: FH North Pond 13

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

#### Composite Outflow Summary

| Contributing Structures  |
|--|
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Orifice Plate,SWQ Outlet Pipe<br>(no Q: SWQ Outlet Box,Twin CBC<br>Spillway) |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Orifice<br>Plate,SWQ Outlet Pipe,Twin CBC<br>Spillway         |
| SWQ Outlet Box,SWQ Outlet Pipe,Twin<br>CBC Spillway (no Q: SWQ Orifice<br>Plate) |
| SWQ Outlet Box,SWQ Outlet Pipe,Twin<br>CBC Spillway (no Q: SWQ Orifice<br>Plate) |

Subsection: Elevation-Volume-Flow Table (Pond)  
Label: JD Reservoir (Pond 13)

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

| Infiltration                          |                         |
|---------------------------------------|-------------------------|
| Infiltration Method<br>(Computed)     | No Infiltration         |
| Initial Conditions                    |                         |
| Elevation (Water Surface,<br>Initial) | 7,531.00 ft             |
| Volume (Initial)                      | 94.889 ac-ft            |
| Flow (Initial Outlet)                 | 0.00 ft <sup>3</sup> /s |
| Flow (Initial Infiltration)           | 0.00 ft <sup>3</sup> /s |
| Flow (Initial, Total)                 | 0.00 ft <sup>3</sup> /s |
| Time Increment                        | 0.050 hours             |

| Elevation<br>(ft) | Outflow<br>(ft <sup>3</sup> /s) | Storage<br>(ac-ft) | Area<br>(acres) | Infiltration<br>(ft <sup>3</sup> /s) | Flow (Total)<br>(ft <sup>3</sup> /s) | 2S/t + O<br>(ft <sup>3</sup> /s) |
|-------------------|---------------------------------|--------------------|-----------------|--------------------------------------|--------------------------------------|----------------------------------|
| 7,510.00          | 0.00                            | 0.000              | 1.510           | 0.00                                 | 0.00                                 | 0.00                             |
| 7,510.50          | 0.00                            | 0.812              | 1.742           | 0.00                                 | 0.00                                 | 393.13                           |
| 7,511.00          | 0.00                            | 1.744              | 1.990           | 0.00                                 | 0.00                                 | 844.33                           |
| 7,511.50          | 0.00                            | 2.803              | 2.247           | 0.00                                 | 0.00                                 | 1,356.72                         |
| 7,512.00          | 0.00                            | 3.994              | 2.520           | 0.00                                 | 0.00                                 | 1,933.23                         |
| 7,512.50          | 0.00                            | 5.295              | 2.682           | 0.00                                 | 0.00                                 | 2,562.63                         |
| 7,513.00          | 0.00                            | 6.678              | 2.850           | 0.00                                 | 0.00                                 | 3,231.95                         |
| 7,513.50          | 0.00                            | 8.127              | 2.949           | 0.00                                 | 0.00                                 | 3,933.62                         |
| 7,514.00          | 0.00                            | 9.627              | 3.050           | 0.00                                 | 0.00                                 | 4,659.48                         |
| 7,514.50          | 0.00                            | 11.178             | 3.154           | 0.00                                 | 0.00                                 | 5,410.14                         |
| 7,515.00          | 0.00                            | 12.781             | 3.260           | 0.00                                 | 0.00                                 | 6,186.22                         |
| 7,515.50          | 0.00                            | 14.439             | 3.369           | 0.00                                 | 0.00                                 | 6,988.30                         |
| 7,516.00          | 0.00                            | 16.151             | 3.480           | 0.00                                 | 0.00                                 | 7,817.01                         |
| 7,516.50          | 0.00                            | 17.918             | 3.589           | 0.00                                 | 0.00                                 | 8,672.34                         |
| 7,517.00          | 0.00                            | 19.740             | 3.700           | 0.00                                 | 0.00                                 | 9,554.30                         |
| 7,517.50          | 0.00                            | 21.619             | 3.814           | 0.00                                 | 0.00                                 | 10,463.47                        |
| 7,518.00          | 0.00                            | 23.555             | 3.930           | 0.00                                 | 0.00                                 | 11,400.48                        |
| 7,518.50          | 0.00                            | 25.548             | 4.044           | 0.00                                 | 0.00                                 | 12,365.32                        |
| 7,519.00          | 0.00                            | 27.599             | 4.160           | 0.00                                 | 0.00                                 | 13,357.99                        |
| 7,519.50          | 0.00                            | 29.709             | 4.279           | 0.00                                 | 0.00                                 | 14,379.10                        |
| 7,520.00          | 0.00                            | 31.879             | 4.400           | 0.00                                 | 0.00                                 | 15,429.24                        |
| 7,520.50          | 0.00                            | 34.108             | 4.519           | 0.00                                 | 0.00                                 | 16,508.43                        |
| 7,521.00          | 0.00                            | 36.398             | 4.640           | 0.00                                 | 0.00                                 | 17,616.66                        |
| 7,521.50          | 0.00                            | 38.748             | 4.759           | 0.00                                 | 0.00                                 | 18,753.94                        |
| 7,522.00          | 0.00                            | 41.158             | 4.880           | 0.00                                 | 0.00                                 | 19,920.26                        |
| 7,522.50          | 0.00                            | 43.630             | 5.009           | 0.00                                 | 0.00                                 | 21,116.81                        |
| 7,523.00          | 0.00                            | 46.167             | 5.140           | 0.00                                 | 0.00                                 | 22,344.83                        |
| 7,523.50          | 0.00                            | 48.764             | 5.249           | 0.00                                 | 0.00                                 | 23,601.92                        |
| 7,524.00          | 0.00                            | 51.417             | 5.360           | 0.00                                 | 0.00                                 | 24,885.64                        |
| 7,524.50          | 0.00                            | 54.125             | 5.474           | 0.00                                 | 0.00                                 | 26,196.58                        |
| 7,525.00          | 0.00                            | 56.891             | 5.590           | 0.00                                 | 0.00                                 | 27,535.35                        |

Subsection: Elevation-Volume-Flow Table (Pond)  
Label: JD Reservoir (Pond 13)

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

| Elevation<br>(ft) | Outflow<br>(ft <sup>3</sup> /s) | Storage<br>(ac-ft) | Area<br>(acres) | Infiltration<br>(ft <sup>3</sup> /s) | Flow (Total)<br>(ft <sup>3</sup> /s) | 2S/t + O<br>(ft <sup>3</sup> /s) |
|-------------------|---------------------------------|--------------------|-----------------|--------------------------------------|--------------------------------------|----------------------------------|
| 7,525.50          | 0.00                            | 59.717             | 5.714           | 0.00                                 | 0.00                                 | 28,903.14                        |
| 7,526.00          | 0.00                            | 62.606             | 5.840           | 0.00                                 | 0.00                                 | 30,301.19                        |
| 7,526.50          | 0.00                            | 65.556             | 5.959           | 0.00                                 | 0.00                                 | 31,728.89                        |
| 7,526.90          | 0.00                            | 67.959             | 6.056           | 0.00                                 | 0.00                                 | 32,891.95                        |
| 7,527.00          | 0.00                            | 68.565             | 6.080           | 0.00                                 | 0.00                                 | 33,185.63                        |
| 7,527.50          | 0.00                            | 71.636             | 6.204           | 0.00                                 | 0.00                                 | 34,672.01                        |
| 7,528.00          | 0.00                            | 74.770             | 6.330           | 0.00                                 | 0.00                                 | 36,188.65                        |
| 7,528.50          | 0.00                            | 77.965             | 6.449           | 0.00                                 | 0.00                                 | 37,734.94                        |
| 7,529.00          | 0.00                            | 81.220             | 6.570           | 0.00                                 | 0.00                                 | 39,310.27                        |
| 7,529.50          | 0.00                            | 84.534             | 6.689           | 0.00                                 | 0.00                                 | 40,914.64                        |
| 7,530.00          | 0.00                            | 87.909             | 6.810           | 0.00                                 | 0.00                                 | 42,548.05                        |
| 7,530.50          | 0.00                            | 91.356             | 6.979           | 0.00                                 | 0.00                                 | 44,216.48                        |
| 7,531.00          | 0.00                            | 94.889             | 7.150           | 0.00                                 | 0.00                                 | 45,926.04                        |
| 7,531.50          | 6.94                            | 98.509             | 7.334           | 0.00                                 | 6.94                                 | 47,685.48                        |
| 7,532.00          | 13.89                           | 102.223            | 7.520           | 0.00                                 | 13.89                                | 49,489.69                        |
| 7,532.50          | 20.83                           | 106.021            | 7.674           | 0.00                                 | 20.83                                | 51,335.10                        |
| 7,533.00          | 27.77                           | 109.897            | 7.830           | 0.00                                 | 27.77                                | 53,218.02                        |
| 7,533.50          | 56.89                           | 113.879            | 8.098           | 0.00                                 | 56.89                                | 55,174.31                        |
| 7,534.00          | 100.36                          | 117.996            | 8.370           | 0.00                                 | 100.36                               | 57,210.28                        |
| 7,534.50          | 152.07                          | 122.230            | 8.569           | 0.00                                 | 152.07                               | 59,311.55                        |
| 7,535.00          | 208.08                          | 126.565            | 8.770           | 0.00                                 | 208.08                               | 61,465.51                        |
| 7,535.50          | 265.76                          | 131.000            | 8.969           | 0.00                                 | 265.76                               | 63,669.55                        |
| 7,536.00          | 329.33                          | 135.534            | 9.170           | 0.00                                 | 329.33                               | 65,927.87                        |



Subsection: Pond Routed Hydrograph (total out)  
Label: JD Reservoir (Pond 13) (OUT)

Return Event: 100 years  
Storm Event: Type II 24-Hour (NOAA 14)

|                   |                           |
|-------------------|---------------------------|
| Peak Discharge    | 124.23 ft <sup>3</sup> /s |
| Time to Peak      | 12.900 hours              |
| Hydrograph Volume | 47.791 ac-ft              |

### HYDROGRAPH ORDINATES (ft<sup>3</sup>/s)

Output Time Increment = 0.050 hours

Time on left represents time for first value in each row.

| Time<br>(hours) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 7.550           | 0.00                         | 0.00                         | 0.00                         | 0.00                         | 0.01                         |
| 7.800           | 0.01                         | 0.01                         | 0.01                         | 0.02                         | 0.02                         |
| 8.050           | 0.02                         | 0.03                         | 0.03                         | 0.04                         | 0.04                         |
| 8.300           | 0.05                         | 0.05                         | 0.06                         | 0.07                         | 0.07                         |
| 8.550           | 0.08                         | 0.09                         | 0.10                         | 0.10                         | 0.11                         |
| 8.800           | 0.12                         | 0.13                         | 0.14                         | 0.15                         | 0.16                         |
| 9.050           | 0.17                         | 0.18                         | 0.19                         | 0.20                         | 0.21                         |
| 9.300           | 0.22                         | 0.23                         | 0.24                         | 0.25                         | 0.26                         |
| 9.550           | 0.27                         | 0.28                         | 0.29                         | 0.30                         | 0.31                         |
| 9.800           | 0.33                         | 0.34                         | 0.35                         | 0.36                         | 0.38                         |
| 10.050          | 0.39                         | 0.40                         | 0.42                         | 0.43                         | 0.45                         |
| 10.300          | 0.46                         | 0.48                         | 0.50                         | 0.51                         | 0.53                         |
| 10.550          | 0.55                         | 0.58                         | 0.60                         | 0.63                         | 0.66                         |
| 10.800          | 0.69                         | 0.72                         | 0.76                         | 0.81                         | 0.86                         |
| 11.050          | 0.92                         | 0.98                         | 1.05                         | 1.12                         | 1.21                         |
| 11.300          | 1.30                         | 1.41                         | 1.53                         | 1.66                         | 1.80                         |
| 11.550          | 1.97                         | 2.16                         | 2.41                         | 2.74                         | 3.21                         |
| 11.800          | 3.91                         | 4.94                         | 6.47                         | 8.65                         | 11.61                        |
| 12.050          | 15.33                        | 19.53                        | 23.88                        | 28.89                        | 44.08                        |
| 12.300          | 56.89                        | 72.02                        | 84.11                        | 93.72                        | 101.45                       |
| 12.550          | 108.31                       | 113.57                       | 117.51                       | 120.34                       | 122.27                       |
| 12.800          | 123.47                       | 124.09                       | 124.23                       | 123.99                       | 123.44                       |
| 13.050          | 122.63                       | 121.61                       | 120.41                       | 119.06                       | 117.59                       |
| 13.300          | 116.03                       | 114.41                       | 112.74                       | 111.03                       | 109.30                       |
| 13.550          | 107.54                       | 105.77                       | 104.00                       | 102.22                       | 100.43                       |
| 13.800          | 98.88                        | 97.34                        | 95.80                        | 94.25                        | 92.72                        |
| 14.050          | 91.19                        | 89.66                        | 88.15                        | 86.65                        | 85.17                        |
| 14.300          | 83.70                        | 82.26                        | 80.85                        | 79.47                        | 78.12                        |
| 14.550          | 76.80                        | 75.51                        | 74.25                        | 73.02                        | 71.82                        |
| 14.800          | 70.65                        | 69.51                        | 68.40                        | 67.31                        | 66.25                        |
| 15.050          | 65.22                        | 64.21                        | 63.22                        | 62.26                        | 61.32                        |
| 15.300          | 60.40                        | 59.50                        | 58.62                        | 57.77                        | 56.93                        |
| 15.550          | 56.35                        | 55.78                        | 55.22                        | 54.66                        | 54.11                        |
| 15.800          | 53.56                        | 53.02                        | 52.48                        | 51.94                        | 51.41                        |
| 16.050          | 50.88                        | 50.35                        | 49.83                        | 49.31                        | 48.80                        |
| 16.300          | 48.29                        | 47.79                        | 47.30                        | 46.82                        | 46.34                        |
| 16.550          | 45.87                        | 45.41                        | 44.95                        | 44.51                        | 44.07                        |
| 16.800          | 43.64                        | 43.22                        | 42.80                        | 42.40                        | 42.00                        |
| 17.050          | 41.60                        | 41.22                        | 40.84                        | 40.46                        | 40.09                        |

Subsection: Pond Routed Hydrograph (total out)  
 Label: JD Reservoir (Pond 13) (OUT)

Return Event: 100 years  
 Storm Event: Type II 24-Hour (NOAA 14)

### HYDROGRAPH ORDINATES (ft<sup>3</sup>/s)

Output Time Increment = 0.050 hours

Time on left represents time for first value in each row.

| Time<br>(hours) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) | Flow<br>(ft <sup>3</sup> /s) |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 17.300          | 39.73                        | 39.38                        | 39.03                        | 38.68                        | 38.34                        |
| 17.550          | 38.01                        | 37.68                        | 37.36                        | 37.04                        | 36.73                        |
| 17.800          | 36.42                        | 36.11                        | 35.81                        | 35.52                        | 35.22                        |
| 18.050          | 34.94                        | 34.65                        | 34.37                        | 34.09                        | 33.82                        |
| 18.300          | 33.55                        | 33.28                        | 33.02                        | 32.76                        | 32.50                        |
| 18.550          | 32.25                        | 32.00                        | 31.75                        | 31.50                        | 31.26                        |
| 18.800          | 31.02                        | 30.78                        | 30.54                        | 30.31                        | 30.07                        |
| 19.050          | 29.84                        | 29.62                        | 29.39                        | 29.17                        | 28.94                        |
| 19.300          | 28.72                        | 28.51                        | 28.29                        | 28.07                        | 27.86                        |
| 19.550          | 27.74                        | 27.68                        | 27.63                        | 27.58                        | 27.52                        |
| 19.800          | 27.46                        | 27.41                        | 27.35                        | 27.29                        | 27.23                        |
| 20.050          | 27.17                        | 27.11                        | 27.05                        | 26.99                        | 26.93                        |
| 20.300          | 26.87                        | 26.80                        | 26.74                        | 26.68                        | 26.61                        |
| 20.550          | 26.55                        | 26.49                        | 26.42                        | 26.36                        | 26.30                        |
| 20.800          | 26.24                        | 26.17                        | 26.11                        | 26.05                        | 25.99                        |
| 21.050          | 25.92                        | 25.86                        | 25.80                        | 25.74                        | 25.68                        |
| 21.300          | 25.62                        | 25.56                        | 25.50                        | 25.43                        | 25.37                        |
| 21.550          | 25.31                        | 25.25                        | 25.19                        | 25.13                        | 25.08                        |
| 21.800          | 25.02                        | 24.96                        | 24.90                        | 24.84                        | 24.78                        |
| 22.050          | 24.72                        | 24.66                        | 24.61                        | 24.55                        | 24.49                        |
| 22.300          | 24.43                        | 24.38                        | 24.32                        | 24.26                        | 24.21                        |
| 22.550          | 24.15                        | 24.09                        | 24.04                        | 23.98                        | 23.93                        |
| 22.800          | 23.87                        | 23.81                        | 23.76                        | 23.70                        | 23.65                        |
| 23.050          | 23.59                        | 23.54                        | 23.49                        | 23.43                        | 23.38                        |
| 23.300          | 23.32                        | 23.27                        | 23.22                        | 23.16                        | 23.11                        |
| 23.550          | 23.06                        | 23.00                        | 22.95                        | 22.90                        | 22.85                        |
| 23.800          | 22.79                        | 22.74                        | 22.69                        | 22.64                        | 22.59                        |

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# Design Procedure Form: Retention Pond (RP)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 3

**Designer:** Marc A. Whorton, P.E.  
**Company:** Classic Consulting  
**Date:** August 20, 2018  
**Project:** Flying Horse North - JD Pond  
**Location:** Black Forest, CO El Paso County

|  |   |
|--|---|
| <p>1. Baseflow</p> <p>A) Is the permanent pool established by groundwater?</p>   | <div> <div>Choose One</div> <div> <input type="radio"/> YES           <input checked="" type="radio"/> NO         </div> </div> <p>THE NET INFLUX OF WATER MUST BE AVAILABLE THROUGH A PERENNIAL BASEFLOW AND MUST EXCEED THE LOSSES.</p>   |
| <p>2. Surcharge Volume</p> <p>A) Effective Imperviousness of Tributary Area, <math>I_a</math></p> <p>B) Tributary Area's Imperviousness Ratio (<math>i = I_a / 100</math>)</p> <p>C) Contributing Watershed Area</p> <p>D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm</p> <p>E) Design Concept<br/>(Select EURV when also designing for flood control)</p> <p>F) Water Quality Capture Volume (WQCV)<br/>Based on 12-hour Drain Time<br/>(<math>V_{WQCV} = (0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * \text{Area})</math>)</p> <p>G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV)<br/>(<math>V_{WQCV \text{ OTHER}} = (d_b * V_{WQCV} / 0.43)</math>)</p> <p>H) User Input of Water Quality Capture Volume (WQCV)<br/>(Only if a different WQCV Design Volume is desired)</p> <p>I) Predominant Watershed NRCS Soil Group</p> <p>J) Excess Urban Runoff Volume (EURV) Design Volume<br/>For HSG A: <math>EURV_A = 1.68 * i^{1.28}</math><br/>For HSG B: <math>EURV_B = 1.36 * i^{1.08}</math><br/>For HSG C/D: <math>EURV_{C/D} = 1.20 * i^{1.08}</math></p> | <p><math>I_a =</math> <u>8.3</u> %</p> <p><math>i =</math> <u>0.083</u></p> <p>Area = <u>366.800</u> ac</p> <p><math>d_b =</math> <u>0.42</u> in</p> <div> <div>Choose One</div> <div> <input type="radio"/> Water Quality Capture Volume (WQCV)           <input checked="" type="radio"/> Excess Urban Runoff Volume (EURV)         </div> </div> <p><math>V_{WQCV} =</math> <u>1.395</u> ac-ft</p> <p><math>V_{WQCV \text{ OTHER}} =</math> <u>1.363</u> ac-ft</p> <p><math>V_{WQCV \text{ USER}} =</math> _____ ac-ft</p> <div> <div>Choose One</div> <div> <input type="radio"/> A           <input checked="" type="radio"/> B           <input type="radio"/> C / D         </div> </div> <p>EURV = <u>2.827</u> ac-ft</p> |
| <p>3. Basin Shape<br/>(It is recommended to have a basin length-to-width ratio between 2:1 and 3:1)</p>  | <p>L : W = <u>5.0</u> : 1</p>   |
| <p>4. Permanent Pool</p> <p>A) Minimum Permanent Pool Volume</p> <p>B) Depth of the Safety Wetland Bench<br/>(Depth between 6 to 12 inches recommended)</p> <p>C) Depth of the Open Water Zone<br/>(Maximum depth of 12 feet)</p>  | <p><math>V_{POOL} =</math> <u>1.363</u> ac-ft</p> <p><math>D_{LZ} =</math> <u>12</u> in</p> <p><math>D_{OWZ} =</math> <u>21.0</u> ft <span style="color: red;">D &gt; 12 FEET</span></p>  |
| <p>5. Side Slopes</p> <p>A) Maximum Side Slopes Above the Safety Wetland Bench<br/>(Horiz. dist. per unit vertical, should be no steeper than 4:1)</p> <p>B) Maximum Side Slopes Below the Safety Wetland Bench<br/>(Horiz. dist. per unit vertical, should be no steeper than 3:1)</p>  | <p><math>Z_{PP} =</math> <u>4.00</u> ft / ft</p> <p><math>Z_{OWZ} =</math> <u>4.00</u> ft / ft</p>  |

**Design Procedure Form: Retention Pond (RP)**

Sheet 2 of 3

Designer: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Date: August 20, 2018  
 Project: \_\_\_\_\_  
 Location: \_\_\_\_\_

|  |  |
|--|--|
| <p>6. Inlet</p> <p>A) Describe means of providing energy dissipation at concentrated inflow locations:</p> <p>7. Forebay</p> <p>A) Minimum Forebay Volume<br/>(<math>V_{FMIN} = 3\%</math> of the WQCV)</p> <p>B) Actual Forebay Volume</p>  | <p>Rip-Rap</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p><math>V_{FMIN} = </math> <u>0.041</u> ac-ft</p> <p><math>V_F = </math> <u>0.041</u> ac-ft</p>  |
| <p>8. Outlet</p> <p>A) Outlet Type</p> <p>C) Smallest Dimension of Orifice Opening Based on Hydrograph Routing<br/>(Use UD-Detention)</p> <p>D) Total Outlet Area (<math>A_{ot}</math>)</p>  | <p>Choose One</p> <p><input checked="" type="radio"/> Orifice Plate</p> <p><input type="radio"/> Other (Describe): _____</p> <p>_____</p> <p><math>D_{orifice} = </math> <u>15.8</u> inches</p> <p><math>A_{ot} = </math> <u>585.000</u> square inches</p>   |
| <p>9. Trash Rack</p> <p>A) Water Quality Screen Open Area: <math>A_t = A_{ot} * 38.5 * (e^{-0.095D})</math></p> <p>B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open area to the total screen area for the material specified.)</p> <p>Other (Y/N): <u>N</u></p> <p>C) Ratio of Total Open Area to Total Area (only for type 'Other')</p> <p>D) Total Water Quality Screen Area (based on screen type)</p> <p>E) Inundated Depth of Water Quality Screen below Permanent Pool</p> <p>F) Depth of Design Volume (EURV or WQCV) Based on the Design Concept Chosen Under 1.E</p> <p>G) Height of Water Quality Screen (<math>H_{TR}</math>)</p> <p>H) Width of Water Quality Screen Opening (<math>W_{opening}</math>)<br/>(Minimum of 12 inches is recommended)</p> | <p><math>A_t = </math> <u>5020</u> square inches</p> <p><u>Aluminum Amico-Klemp SR Series with Cross Rods 4" O.C.</u></p> <p>_____</p> <p>User Ratio = _____</p> <p><math>A_{total} = </math> <u>6520</u> square inches</p> <p><math>D_{inundated} = </math> <u>0.7</u> ft</p> <p><math>H = </math> <u>2.0</u> ft</p> <p><math>H_{TR} = </math> <u>32.04</u> inches</p> <p><math>W_{opening} = </math> <u>203.5</u> inches</p> |

# Design Procedure Form: Retention Pond (RP)

Sheet 3 of 3

Designer: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Date: \_\_\_\_\_ August 20, 2018  
 Project: \_\_\_\_\_  
 Location: \_\_\_\_\_

|  |   |
|--|---|
| 10. Overflow Embankment<br><br>A) Describe embankment protection for 100-year and greater overtopping:<br><br>B) Maximum Embankment Side Slopes<br>(Horiz. dist. per unit vertical, should be no steeper than 4:1) | _____<br>Twin 4'x10' CBC<br>_____<br>_____<br>4.00  |
| 11. Maintenance Considerations<br><br>A) Describe Means of Draining the Pond   | Pond can be drained by pumping water out via adjacent irrigation pump station<br>_____<br>_____ |
| 12. Vegetation   | Choose One<br><input checked="" type="radio"/> Irrigated<br><input type="radio"/> Not Irrigated |
| 13. Access<br><br>A) Describe Sediment Removal Procedures  | Routine Maintenance<br>_____<br>_____<br>_____<br>_____   |
| Notes: _____<br>_____<br>_____<br>_____  |   |

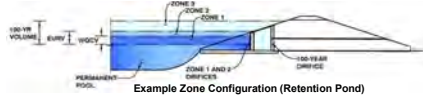
## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

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Project: Flying Horse North

Basin ID: Golf Course Irrigation Reservoir (Pond - 13)



### Required Volume Calculation

| Selected BMP Type =                     | RP         |           |
|---|------------|-----------|
| Watershed Area =                        | 366.80     | acres     |
| Watershed Length =                      | 5.175      | ft        |
| Watershed Slope =                       | 0.015      | ft        |
| Watershed Imperviousness =              | 8.30%      | percent   |
| Percentage Hydrologic Soil Group A =    | 0.0%       | percent   |
| Percentage Hydrologic Soil Group B =    | 100.0%     | percent   |
| Percentage Hydrologic Soil Groups C/D = | 0.0%       | percent   |
| Desired WQCV Drain Time =               | 12.0       | hours     |
| Location for 1-yr Rainfall Depths =     |            |           |
|   | User Input |           |
| Water Quality Capture Volume (WQCV) =   | 1.395      | acre-feet |
| Excess Urban Runoff Volume (EURV) =     | 2.819      | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) =    | 1.903      | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) =     | 3.006      | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) =   | 7.525      | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) =      | 21.442     | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) =   | 30.109     | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) =  | 41.427     | acre-feet |
| 500-yr Runoff Volume (P1 = 3.39 in.) =  | 68.375     | acre-feet |
| Approximate 2-yr Detention Volume =     | 1.765      | acre-feet |
| Approximate 5-yr Detention Volume =     | 2.813      | acre-feet |
| Approximate 10-yr Detention Volume =    | 6.361      | acre-feet |
| Approximate 25-yr Detention Volume =    | 9.142      | acre-feet |
| Approximate 50-yr Detention Volume =    | 9.507      | acre-feet |
| Approximate 100-yr Detention Volume =   | 12.417     | acre-feet |

| Water Quality Capture Volume (WQCV) =  | 1.395  | acre-feet | Optional User Override<br>1-hr Precipitation |
|--|--------|-----------|--|
| Excess Urban Runoff Volume (EURV) =    | 2.819  | acre-feet |  |
| 2-yr Runoff Volume (P1 = 1.19 in.) =   | 1.903  | acre-feet | 1.19 inches                                  |
| 5-yr Runoff Volume (P1 = 1.5 in.) =    | 3.006  | acre-feet | 1.50 inches                                  |
| 10-yr Runoff Volume (P1 = 1.75 in.) =  | 7.525  | acre-feet | 1.75 inches                                  |
| 25-yr Runoff Volume (P1 = 2 in.) =     | 21.442 | acre-feet | 2.00 inches                                  |
| 50-yr Runoff Volume (P1 = 2.25 in.) =  | 30.109 | acre-feet | 2.25 inches                                  |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 41.427 | acre-feet | 2.52 inches                                  |
| 500-yr Runoff Volume (P1 = 3.39 in.) = | 68.375 | acre-feet | 3.39 inches                                  |

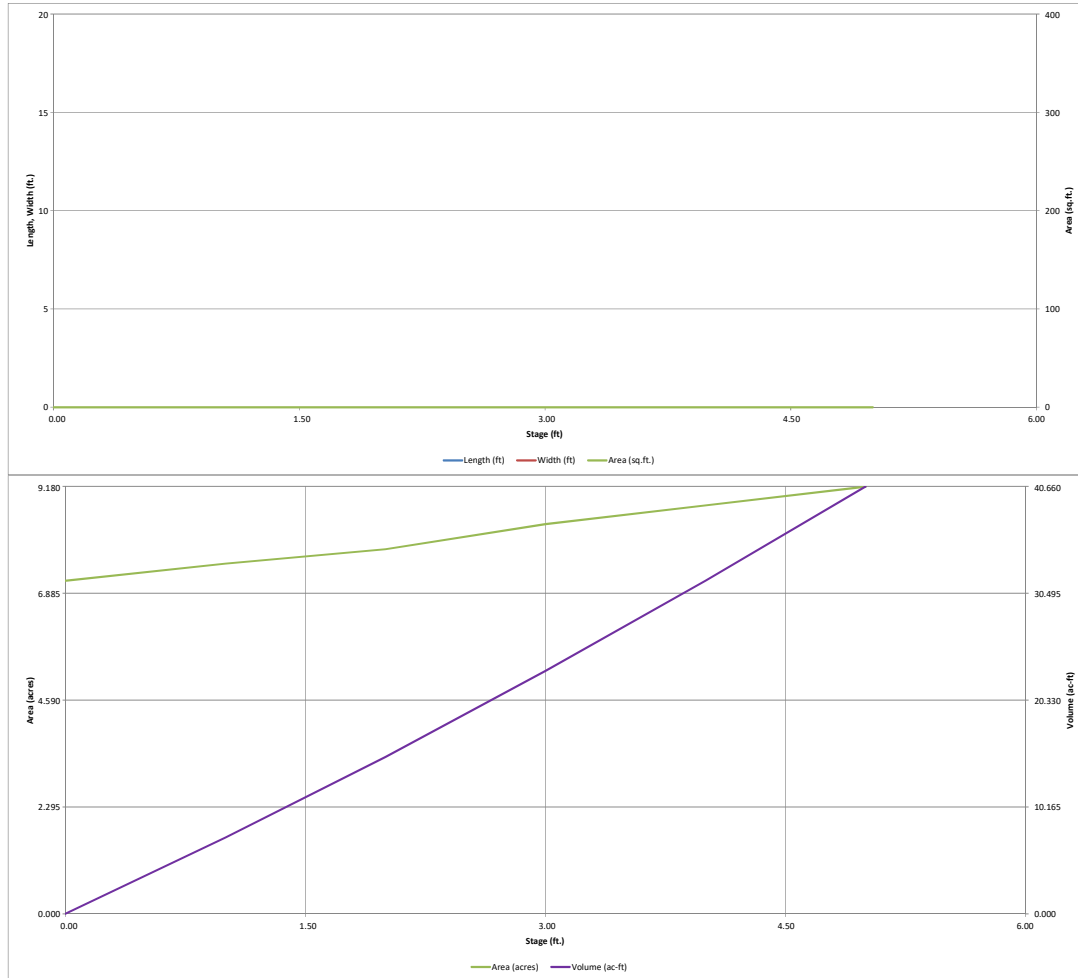
### Stage-Storage Calculation

|   |        |                 |
|---|--------|-----------------|
| Zone 1 Volume ( $V_{WCV}$ ) =                     | 1.395  | acre-feet       |
| Zone 2 Volume ( $V_{EURV}$ - Zone 1) =            | 1.424  | acre-feet       |
| Zone 3 Volume (100 Year - Zones 1 & 2) =          | 9.598  | acre-feet       |
| Total Detention Basin Volume =                    | 12.417 | acre-feet       |
| Initial Surge Volume ( $ISV$ ) =                  | N/A    | ft <sup>3</sup> |
| Initial Surge Depth ( $ISD$ ) =                   | N/A    | ft              |
| Total Available Detention Depth ( $H_{(MAX)}$ ) = | user   | ft              |
| Depth of Trickle Channel ( $H_{TC}$ ) =           | N/A    | ft              |
| Slope of Trickle Channel ( $S_{TC}$ ) =           | N/A    | ft/ft           |
| Slopes of Main Basin Bays ( $S_{(MAX)}$ ) =       | user   | H-V             |
| Basin Length-to-Width Ratio ( $R_{(W)}$ ) =       | user   |                 |
| Initial Surge Area ( $A_{(S)}$ ) =                | user   | ft <sup>2</sup> |
| Surcharge Volume Length ( $L_{(S)}$ ) =           | user   | ft              |
| Surcharge Volume Width ( $W_{(S)}$ ) =            | user   | ft              |
| Depth of Basin Floor ( $H_{(LCCF)}$ ) =           | user   | ft              |
| Length of Basin Floor ( $L_{(LCCF)}$ ) =          | user   | ft              |
| Width of Basin Floor ( $W_{(LCCF)}$ ) =           | user   | ft              |
| Area of Basin Floor ( $A_{(LCCF)}$ ) =            | user   | ft <sup>2</sup> |
| Volume of Basin Floor ( $V_{(LCCF)}$ ) =          | user   | ft <sup>3</sup> |
| Depth of Main Basin ( $H_{(MAX)}$ ) =             | user   | ft              |
| Length of Main Basin ( $L_{(MAX)}$ ) =            | user   | ft              |
| Width of Main Basin ( $W_{(MAX)}$ ) =             | user   | ft              |
| Area of Main Basin ( $A_{(MAX)}$ ) =              | user   | ft <sup>2</sup> |
| Volume of Main Basin ( $V_{(MAX)}$ ) =            | user   | ft <sup>3</sup> |
| Calculated Total Basin Volume ( $V_{(MAX)}$ ) =   | user   | acre-feet       |

[illegible]

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



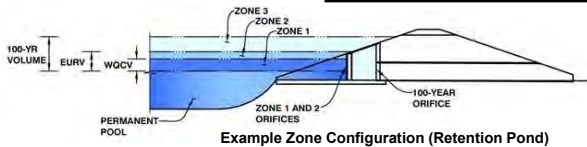


## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: **Flying Horse North**

Basin ID: **Golf Course Irrigation Reservoir (Pond - 13)**



**Example Zone Configuration (Retention Pond)**

|                   | Stage (ft) | Zone Volume (ac-ft) | Outlet Type          |
|-------------------|------------|---------------------|----------------------|
| Zone 1 (WQCV)     | 0.20       | 1.395               | Orifice Plate        |
| Zone 2 (EURV)     | 0.40       | 1.424               | Orifice Plate        |
| Zone 3 (100-year) | 1.67       | 9.598               | Weir&Pipe (Restrict) |
|                   |            | 12.417              | Total                |

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

|                                   |     |  |
|-----------------------------------|-----|--|
| Underdrain Orifice Invert Depth = | N/A | ft (distance below the filtration media surface) |
| Underdrain Orifice Diameter =     | N/A | inches   |

Calculated Parameters for Underdrain

|                               |     |                 |
|-------------------------------|-----|-----------------|
| Underdrain Orifice Area =     | N/A | ft <sup>2</sup> |
| Underdrain Orifice Centroid = | N/A | feet            |

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

|  |        |   |
|--|--------|---|
| Invert of Lowest Orifice =                 | 0.00   | ft (relative to basin bottom at Stage = 0 ft) |
| Depth at top of Zone using Orifice Plate = | 2.00   | ft (relative to basin bottom at Stage = 0 ft) |
| Orifice Plate: Orifice Vertical Spacing =  | 8.00   | inches  |
| Orifice Plate: Orifice Area per Row =      | 195.00 | sq. inches (use rectangular openings)         |

Calculated Parameters for Plate

|                            |           |                 |
|----------------------------|-----------|-----------------|
| WQ Orifice Area per Row =  | 1.354E+00 | ft <sup>2</sup> |
| Elliptical Half-Width =    | N/A       | feet            |
| Elliptical Slot Centroid = | N/A       | feet            |
| Elliptical Slot Area =     | N/A       | ft <sup>2</sup> |

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

|                                | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|--------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Stage of Orifice Centroid (ft) | 0.00             | 0.70             | 1.40             |                  |                  |                  |                  |                  |
| Orifice Area (sq. inches)      | 195.00           | 195.00           | 195.00           |                  |                  |                  |                  |                  |

|                                | Row 9 (optional) | Row 10 (optional) | Row 11 (optional) | Row 12 (optional) | Row 13 (optional) | Row 14 (optional) | Row 15 (optional) | Row 16 (optional) |
|--------------------------------|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Stage of Orifice Centroid (ft) |                  |                   |                   |                   |                   |                   |                   |                   |
| Orifice Area (sq. inches)      |                  |                   |                   |                   |                   |                   |                   |                   |

User Input: Vertical Orifice (Circular or Rectangular)

|   | Not Selected | Not Selected |   |
|---|--------------|--------------|---|
| Invert of Vertical Orifice =                  | N/A          | N/A          | ft (relative to basin bottom at Stage = 0 ft) |
| Depth at top of Zone using Vertical Orifice = | N/A          | N/A          | ft (relative to basin bottom at Stage = 0 ft) |
| Vertical Orifice Diameter =                   | N/A          | N/A          | inches  |

Calculated Parameters for Vertical Orifice

|                             | Not Selected | Not Selected |                 |
|-----------------------------|--------------|--------------|-----------------|
| Vertical Orifice Area =     | N/A          | N/A          | ft <sup>2</sup> |
| Vertical Orifice Centroid = | N/A          | N/A          | feet            |

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

|                                       | Zone 3 Weir | Not Selected |   |
|---------------------------------------|-------------|--------------|---|
| Overflow Weir Front Edge Height, Ho = | 2.00        | N/A          | ft (relative to basin bottom at Stage = 0 ft) |
| Overflow Weir Front Edge Length =     | 8.00        | N/A          | feet  |
| Overflow Weir Slope =                 | 4.00        | N/A          | H:V (enter zero for flat grate)               |
| Horiz. Length of Weir Sides =         | 4.00        | N/A          | feet  |
| Overflow Grate Open Area % =          | 75%         | N/A          | %, grate open area/total area                 |
| Debris Clogging % =                   | 50%         | N/A          | %   |

Calculated Parameters for Overflow Weir

|  | Zone 3 Weir | Not Selected |                 |
|--|-------------|--------------|-----------------|
| Height of Grate Upper Edge, H <sub>c</sub> = | 3.00        | N/A          | feet            |
| Over Flow Weir Slope Length =                | 4.12        | N/A          | feet            |
| Grate Open Area / 100-yr Orifice Area =      | 5.04        | N/A          | should be ≥ 4   |
| Overflow Grate Open Area w/o Debris =        | 24.74       | N/A          | ft <sup>2</sup> |
| Overflow Grate Open Area w/ Debris =         | 12.37       | N/A          | ft <sup>2</sup> |

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

|   | Zone 3 Restrictor | Not Selected |  |
|---|-------------------|--------------|--|
| Depth to Invert of Outlet Pipe =            | 4.00              | N/A          | ft (distance below basin bottom at Stage = 0 ft) |
| Outlet Pipe Diameter =                      | 30.00             | N/A          | inches   |
| Restrictor Plate Height Above Pipe Invert = | 30.00             |              | inches   |

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

|  | Zone 3 Restrictor | Not Selected |                 |
|--|-------------------|--------------|-----------------|
| Outlet Orifice Area =                            | 4.91              | N/A          | ft <sup>2</sup> |
| Outlet Orifice Centroid =                        | 1.25              | N/A          | feet            |
| Half-Central Angle of Restrictor Plate on Pipe = | 3.14              | N/A          | radians         |

User Input: Emergency Spillway (Rectangular or Trapezoidal)

|                                     |       |   |
|-------------------------------------|-------|---|
| Spillway Invert Stage=              | 2.00  | ft (relative to basin bottom at Stage = 0 ft) |
| Spillway Crest Length =             | 20.00 | feet  |
| Spillway End Slopes =               | 0.00  | H:V   |
| Freeboard above Max Water Surface = | 1.00  | feet  |

Calculated Parameters for Spillway

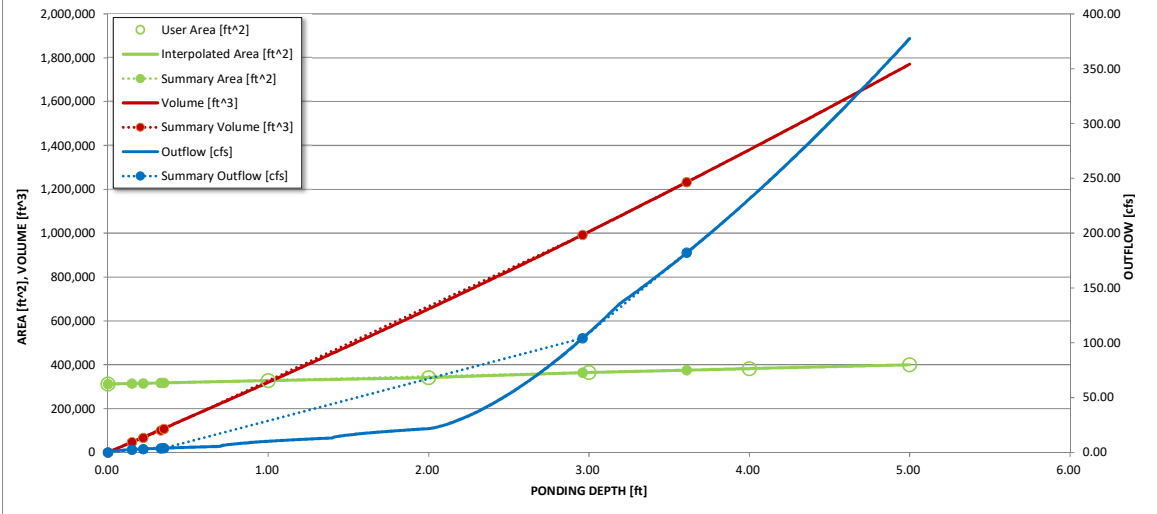
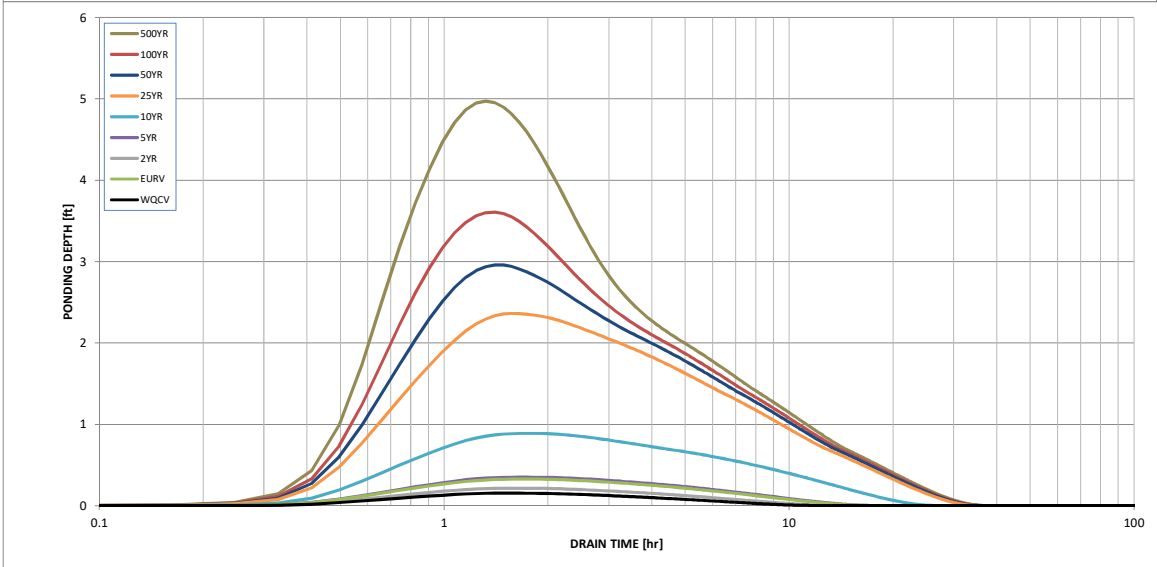
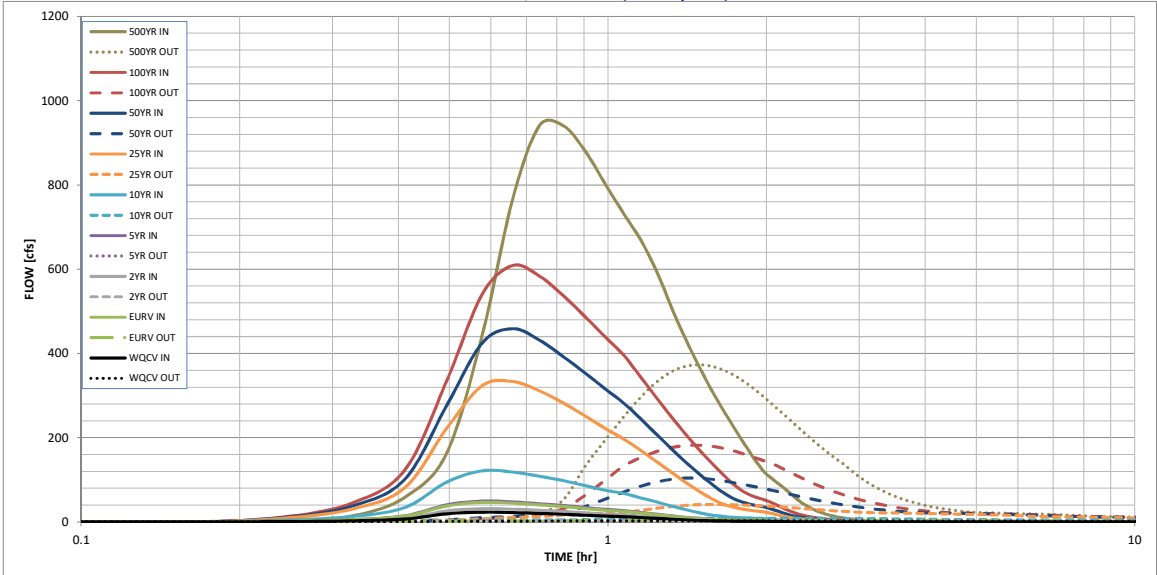
|                                  |      |       |
|----------------------------------|------|-------|
| Spillway Design Flow Depth=      | 4.13 | feet  |
| Stage at Top of Freeboard =      | 7.13 | feet  |
| Basin Area at Top of Freeboard = | 9.17 | acres |

### Routed Hydrograph Results

|   | WQCV  | EURV  | 2 Year | 5 Year | 10 Year | 25 Year  | 50 Year  | 100 Year | 500 Year |
|---|-------|-------|--------|--------|---------|----------|----------|----------|----------|
| Design Storm Return Period =                  |       |       |        |        |         |          |          |          |          |
| One-Hour Rainfall Depth (in) =                | 0.53  | 1.07  | 1.19   | 1.50   | 1.75    | 2.00     | 2.25     | 2.52     | 3.39     |
| Calculated Runoff Volume (acre-ft) =          | 1.395 | 2.819 | 1.903  | 3.006  | 7.525   | 21.442   | 30.109   | 41.427   | 68.375   |
| OPTIONAL Override Runoff Volume (acre-ft) =   |       |       |        |        |         |          |          |          |          |
| Inflow Hydrograph Volume (acre-ft) =          | 1.395 | 2.819 | 1.902  | 3.006  | 7.522   | 21.445   | 30.113   | 41.428   | 68.385   |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | 0.00  | 0.00  | 0.01   | 0.02   | 0.20    | 0.67     | 0.93     | 1.25     | 2.00     |
| Predevelopment Peak Q (cfs) =                 | 0.0   | 0.0   | 4.5    | 7.8    | 75.1    | 247.4    | 342.3    | 460.1    | 734.0    |
| Peak Inflow Q (cfs) =                         | 23.2  | 46.4  | 31.5   | 49.5   | 121.4   | 333.1    | 458.5    | 608.8    | 941.9    |
| Peak Outflow Q (cfs) =                        | 2.6   | 3.7   | 3.0    | 3.9    | 9.0     | 41.5     | 103.9    | 182.0    | 373.2    |
| Ratio Peak Outflow to Predevelopment Q =      | N/A   | N/A   | N/A    | 0.5    | 0.1     | 0.2      | 0.3      | 0.4      | 0.5      |
| Structure Controlling Flow =                  | Plate | Plate | Plate  | Plate  | Plate   | Spillway | Spillway | Spillway | Spillway |
| Max Velocity through Grate 1 (fps) =          | N/A   | N/A   | N/A    | N/A    | N/A     | 0.1      | 0.7      | 1.1      | 1.0      |
| Max Velocity through Grate 2 (fps) =          | N/A   | N/A   | N/A    | N/A    | N/A     | N/A      | N/A      | N/A      | N/A      |
| Time to Drain 97% of Inflow Volume (hours) =  | 11    | 15    | 12     | 15     | 22      | 27       | 27       | 25       | 23       |
| Time to Drain 99% of Inflow Volume (hours) =  | 12    | 16    | 14     | 16     | 24      | 31       | 31       | 30       | 29       |
| Maximum Ponding Depth (ft) =                  | 0.15  | 0.33  | 0.22   | 0.35   | 0.89    | 2.36     | 2.96     | 3.61     | 4.97     |
| Area at Maximum Ponding Depth (acres) =       | 7.21  | 7.27  | 7.23   | 7.28   | 7.48    | 8.02     | 8.34     | 8.61     | 9.16     |
| Maximum Volume Stored (acre-ft) =             | 1.077 | 2.308 | 1.510  | 2.453  | 6.436   | 17.865   | 22.693   | 28.205   | 40.376   |

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



| S-A-V-D Chart Axis Override | X-axis | Left Y-Axis | Right Y-Axis |
|-----------------------------|--------|-------------|--------------|
| minimum bound               |        |             |              |
| maximum bound               |        |             |              |



## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

### Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]

## Rock Chute Design Data

(Version 4.01 - 04/23/03, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

**Project:** Flying Horse North - JD Pond Outlet  
**Designer:** Marc Whorton  
**Date:** 8/20/2018

**County:** EL Paso  
**Checked by:** \_\_\_\_\_  
**Date:** \_\_\_\_\_

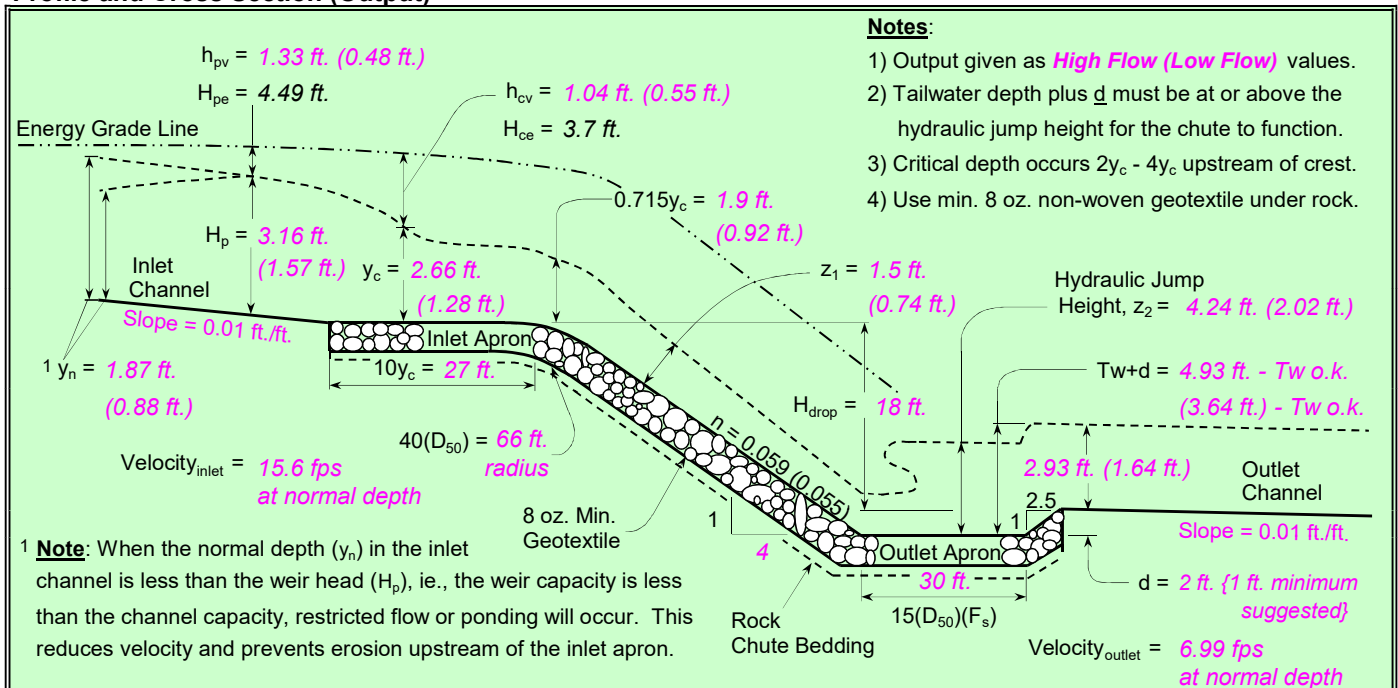
### Input Channel Geometry

| Inlet Channel              | Chute  | Outlet Channel             |
|----------------------------|--|----------------------------|
| Bw = 20.8 ft.              | Bw = 20.0 ft.                                | Bw = 20.0 ft.              |
| Side slopes = 0.0 (m:1)    | Factor of safety = 1.20 ( $F_s$ )            | Side slopes = 4.0 (m:1)    |
| n-value = 0.013            | Side slopes = 3.0 (m:1) → 2.0:1 max.         | n-value = 0.035            |
| Bed slope = 0.0100 ft./ft. | Bed slope (4:1) = 0.250 ft./ft. → 2.5:1 max. | Bed slope = 0.0100 ft./ft. |
| Freeboard = 1.0 ft.        | Outlet apron depth, d = 2.0 ft.              | Base flow = 40.0 cfs       |

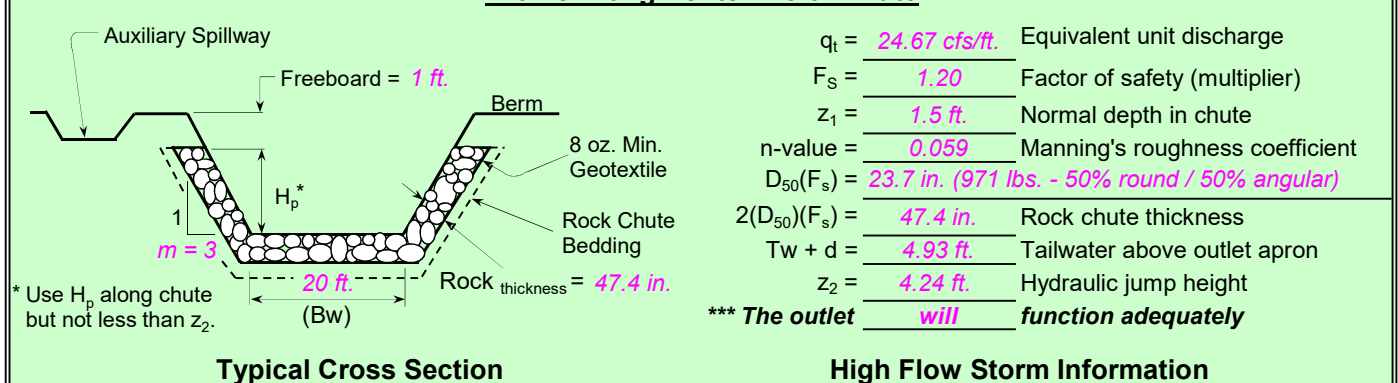
### Design Storm Data (Table 2, NHCP, NRCS Grade Stabilization Structure No. 410)

|   |  |   |
|---|--|---|
| Drainage area = _____ acres   | Rainfall = <input type="radio"/> 0 - 3 in. <input checked="" type="radio"/> 3 - 5 in. <input type="radio"/> 5+ in. | <b>Note:</b> The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway. |
| Apron elev. --- Inlet = 7531.2 ft. --- Outlet = 7511.2 ft. --- ( $H_{drop} = 18$ ft.) |  | <b>Input tailwater (<math>T_w</math>):</b>  |
| Chute capacity = Q25-year   | Minimum capacity (based on a 5-year, 24-hour storm with a 3 - 5 inch rainfall)                                     | $T_w$ (ft.) = Program 0.25  |
| Total capacity = Q100-year  |  |   |
| $Q_{high} = 609.0$ cfs  | High flow storm through chute  | $T_w$ (ft.) = Program   |
| $Q_{low} = 182.0$ cfs   | Low flow storm through chute   | $T_w$ (ft.) = Program   |

### Profile and Cross Section (Output)



### Profile Along Centerline of Chute



# Rock Chute Design - Plan Sheet

(Version 4.0 - 07/10/00, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

**Project:** Flying Horse North - JD Pond Outlet  
**Designer:** Marc Whorton  
**Date:** 8/20/2018

**County:** EL Paso  
**Checked by:** \_\_\_\_\_  
**Date:** \_\_\_\_\_

## Design Values

**Angular**  $D_{50}$  dia. = **23.7** in.  
 Rock<sub>chute</sub> thickness = **47.4** in.  
 Inlet apron length = **27** ft.  
 Outlet apron length = **30** ft.  
 Radius = **66** ft.

## Rock Gradation Envelope

| % Passing       | Diameter, in. (weight, lbs.) |
|-----------------|------------------------------|
| $D_{100}$ ----- | 36 - 47 (3274 - 7761)        |
| $D_{85}$ -----  | 31 - 43 (2131 - 5658)        |
| $D_{50}$ -----  | 24 - 36 (970 - 3274)         |
| $D_{10}$ -----  | 19 - 31 (497 - 2131)         |

## Quantities<sup>a</sup>

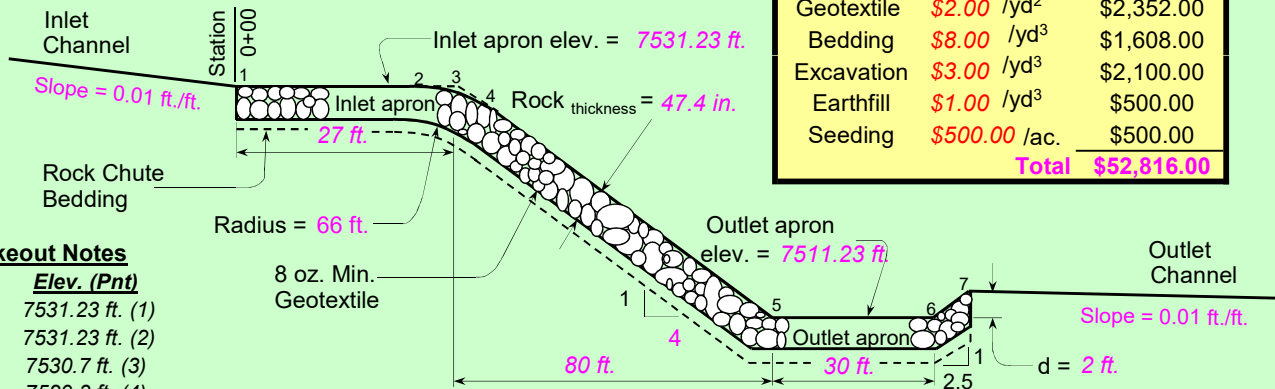
**Angular** Rock = **1271** yd<sup>3</sup>  
 Geotextile (8 oz.)<sup>b</sup> = **1176** yd<sup>2</sup>  
 Bedding (6 in.) = **201** yd<sup>3</sup>  
 Excavation = **700** yd<sup>3</sup>  
 Earthfill = **500** yd<sup>3</sup>  
 Seeding = **1.0** acres

Will bedding be used? **Yes** ----- Depth (in.) = **6.0**

**Notes:** <sup>a</sup> Rock, bedding, and geotextile quantities are determined from the x-section below (neglect radius).  
<sup>b</sup> Geotextile shall be overlapped (18-in. min.) and anchored (18-in. min. along sides and 24-in. min. on the ends).

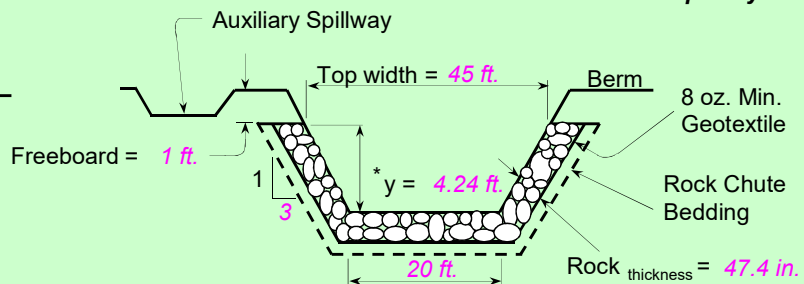
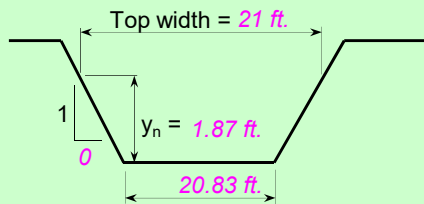
## Rock Chute Cost Estimate

| Unit         | Unit Cost                       | Cost               |
|--------------|---------------------------------|--------------------|
| Rock         | <b>\$36.00</b> /yd <sup>3</sup> | \$45,756.00        |
| Geotextile   | <b>\$2.00</b> /yd <sup>2</sup>  | \$2,352.00         |
| Bedding      | <b>\$8.00</b> /yd <sup>3</sup>  | \$1,608.00         |
| Excavation   | <b>\$3.00</b> /yd <sup>3</sup>  | \$2,100.00         |
| Earthfill    | <b>\$1.00</b> /yd <sup>3</sup>  | \$500.00           |
| Seeding      | <b>\$500.00</b> /ac.            | \$500.00           |
| <b>Total</b> |                                 | <b>\$52,816.00</b> |



## Stakeout Notes

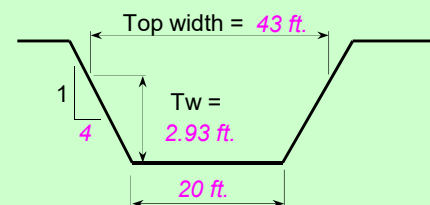
| Sta.   | Elev. (Pnt)     |
|--------|-----------------|
| 0+00   | 7531.23 ft. (1) |
| 0+18.9 | 7531.23 ft. (2) |
| 0+27   | 7530.7 ft. (3)  |
| 0+34.9 | 7529.3 ft. (4)  |
| 1+7    | 7511.23 ft. (5) |
| 1+37   | 7511.23 ft. (6) |
| 1+42   | 7513.23 ft. (7) |



\* Use  $H_p$  throughout chute but not less than  $Z_2$ .

**Inlet Channel Cross Section**

**Rock Chute Cross Section**



## Profile, Cross Sections, and Quantities

**Project:** Flying Horse North - JD Pond Outlet  
**Location:** EL Paso County

**U.S. Department of Agriculture**  
**Natural Resources Conservation Service**

|                                  |                    |
|----------------------------------|--------------------|
| Designed: <u>Marc Whorton</u>    | Approved by: _____ |
| Drawn: <u>NRCS Standard Dwg.</u> | Title: _____       |
| Traced: _____                    | Title: _____       |
| Checked: _____                   | Sheet No. _____    |
|                                  | Drawing No. _____  |

# Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Monday, Aug 20 2018

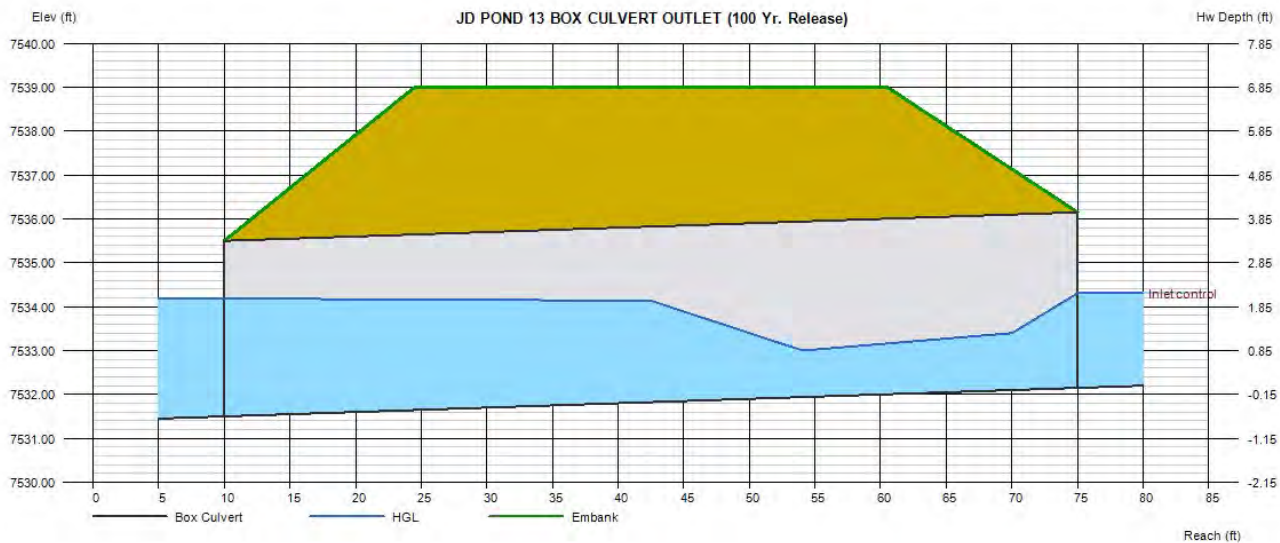
## JD POND 13 BOX CULVERT OUTLET (100 Yr. Release)

Invert Elev Dn (ft) = 7531.50  
Pipe Length (ft) = 65.00  
Slope (%) = 1.00  
Invert Elev Up (ft) = 7532.15  
Rise (in) = 48.0  
Shape = Box  
Span (in) = 120.0  
No. Barrels = 2  
n-Value = 0.013  
Culvert Type = Flared Wingwalls  
Culvert Entrance = 30D to 75D wingwall flares  
Coeff. K,M,c,Y,k = 0.026, 1, 0.0347, 0.81, 0.4

**Embankment**  
Top Elevation (ft) = 7539.00  
Top Width (ft) = 36.00  
Crest Width (ft) = 230.00

**Calculations**  
Qmin (cfs) = 0.00  
Qmax (cfs) = 182.00  
Tailwater Elev (ft) = (dc+D)/2

**Highlighted**  
Qtotal (cfs) = 182.00  
Qpipe (cfs) = 182.00  
Qovertop (cfs) = 0.00  
Veloc Dn (ft/s) = 3.39  
Veloc Up (ft/s) = 6.64  
HGL Dn (ft) = 7534.19  
HGL Up (ft) = 7533.52  
Hw Elev (ft) = 7534.30  
Hw/D (ft) = 0.54  
Flow Regime = Inlet Control





# Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Monday, Aug 20 2018

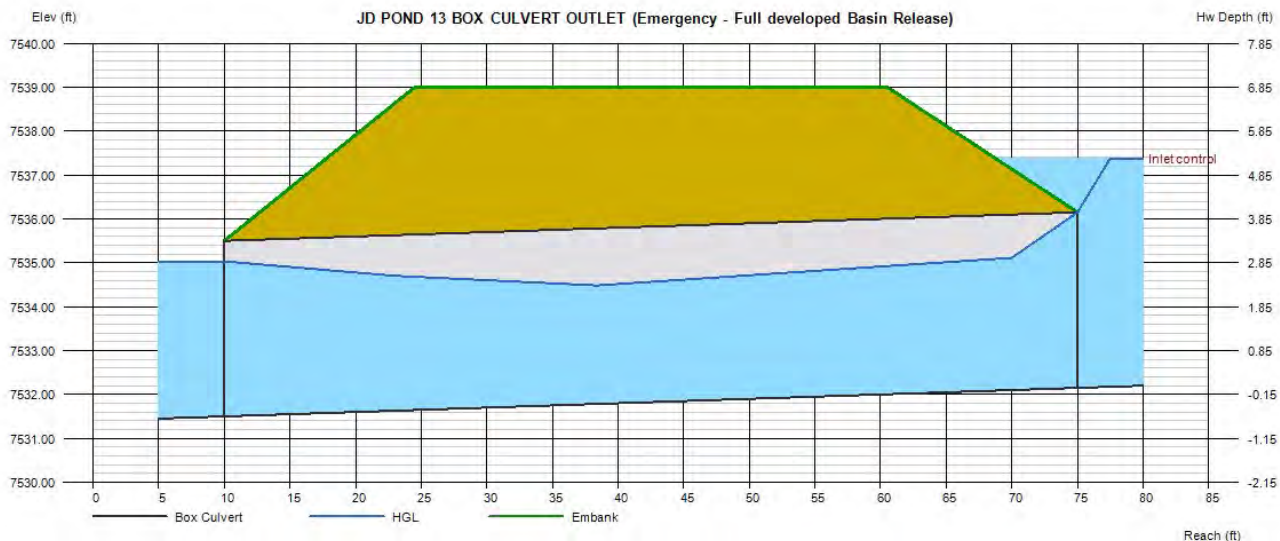
## JD POND 13 BOX CULVERT OUTLET (Emergency - Full developed Basin Release)

|                     |                               |
|---------------------|-------------------------------|
| Invert Elev Dn (ft) | = 7531.50                     |
| Pipe Length (ft)    | = 65.00                       |
| Slope (%)           | = 1.00                        |
| Invert Elev Up (ft) | = 7532.15                     |
| Rise (in)           | = 48.0                        |
| Shape               | = Box                         |
| Span (in)           | = 120.0                       |
| No. Barrels         | = 2                           |
| n-Value             | = 0.013                       |
| Culvert Type        | = Flared Wingwalls            |
| Culvert Entrance    | = 30D to 75D wingwall flares  |
| Coeff. K,M,c,Y,k    | = 0.026, 1, 0.0347, 0.81, 0.4 |

|                    |           |
|--------------------|-----------|
| <b>Embankment</b>  |           |
| Top Elevation (ft) | = 7539.00 |
| Top Width (ft)     | = 36.00   |
| Crest Width (ft)   | = 230.00  |

|                     |            |
|---------------------|------------|
| <b>Calculations</b> |            |
| Qmin (cfs)          | = 0.00     |
| Qmax (cfs)          | = 609.00   |
| Tailwater Elev (ft) | = (dc+D)/2 |

|                    |                 |
|--------------------|-----------------|
| <b>Highlighted</b> |                 |
| Qtotal (cfs)       | = 609.00        |
| Qpipe (cfs)        | = 609.00        |
| Qovertop (cfs)     | = 0.00          |
| Veloc Dn (ft/s)    | = 8.62          |
| Veloc Up (ft/s)    | = 9.94          |
| HGL Dn (ft)        | = 7535.03       |
| HGL Up (ft)        | = 7535.21       |
| Hw Elev (ft)       | = 7537.38       |
| Hw/D (ft)          | = 1.31          |
| Flow Regime        | = Inlet Control |





# Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Monday, Aug 20 2018

## JD POND 13 BOX CULVERT OUTLET (Max. Capacity with 1.0' Freeboard)

Invert Elev Dn (ft) = 7531.50  
Pipe Length (ft) = 65.00  
Slope (%) = 1.00  
Invert Elev Up (ft) = 7532.15  
Rise (in) = 48.0  
Shape = Box  
Span (in) = 120.0  
No. Barrels = 2  
n-Value = 0.013  
Culvert Type = Flared Wingwalls  
Culvert Entrance = 30D to 75D wingwall flares  
Coeff. K,M,c,Y,k = 0.026, 1, 0.0347, 0.81, 0.4

**Embankment**  
Top Elevation (ft) = 7539.00  
Top Width (ft) = 36.00  
Crest Width (ft) = 230.00

**Calculations**  
Qmin (cfs) = 0.00  
Qmax (cfs) = 700.00  
Tailwater Elev (ft) = (dc+D)/2

**Highlighted**  
Qtotal (cfs) = 700.00  
Qpipe (cfs) = 700.00  
Qovertop (cfs) = 0.00  
Veloc Dn (ft/s) = 9.51  
Veloc Up (ft/s) = 10.42  
HGL Dn (ft) = 7535.18  
HGL Up (ft) = 7535.51  
Hw Elev (ft) = 7538.03  
Hw/D (ft) = 1.47  
Flow Regime = Inlet Control

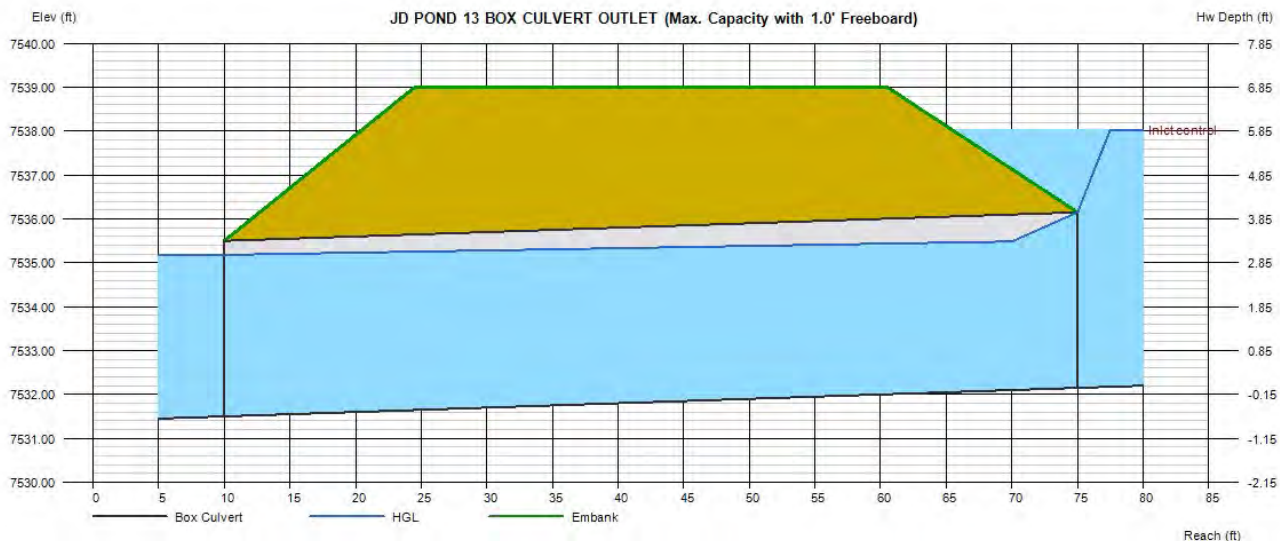




Table 5.2: Sub-basin CN Values

| ALL LAND ASSUMED 2 ACRE RESIDENTIAL LOTS OR<br>GOOD CONDITION OPEN SPACE (LAWNS, PARKS GOLF COURSES, CEMETARIES ETC.) |                       |                 |               |                       |               |
|---|-----------------------|-----------------|---------------|-----------------------|---------------|
| CN VALUES - DEVELOPED CONDITIONS  |                       |                 |               |                       |               |
| BASIN<br>(label)  | BASIN<br>AREA<br>(Ac) | GOLF COURSE (B) |               | 2 AC. RESIDENTIAL (B) |               |
|   |                       | CN              | AREA<br>(Ac.) | CN                    | AREA<br>(Ac.) |
| CC-1  | 22.3                  | 61              | 0.0           | 65                    | 22.3          |
| CC-2  | 36.4                  | 61              | 0.0           | 65                    | 36.4          |
| CC-3  | 51.9                  | 61              | 19.1          | 65                    | 32.8          |
| CC-4A   | 108.2                 | 61              | 63.2          | 65                    | 45.0          |
| CC-4B   | 17.0                  | 61              | 5.5           | 65                    | 11.5          |
| OS-12   | 67.7                  | 61              | 0.0           | 65                    | 67.7          |
| OS-13   | 36.9                  | 61              | 0.0           | 65                    | 36.9          |
| OS-14   | 26.4                  | 61              | 0.0           | 65                    | 26.4          |

Table 5.5: Inflow Design Flood (IDF) Summary Table

| Storm Event         | Peak Inflow<br>(cfs) | Max. WSE<br>(ft.) | Total<br>Discharge<br>(cfs) |
|---------------------|----------------------|-------------------|-----------------------------|
| 2-yr (City/ County) | 48                   | 7531.40           | 6                           |
| 5-yr (City/ County) | 119                  | 7531.87           | 12                          |
| 50-yr (NOAA 14)     | 431                  | 7533.58           | 64                          |
| 100-yr (NOAA 14)    | 609                  | 7534.23           | 124                         |

Table 5.3 Sub-basin Time of Concentration

| TIME OF CONCENTRATION DEVELOPED |                 |                |                           |            |   |              |                    |            |                     |
|---------------------------------|-----------------|----------------|---------------------------|------------|---|--------------|--------------------|------------|---------------------|
| BASIN                           | COMPOSITE<br>Cn | Length<br>(ft) | Channel<br>Height<br>(ft) | Tc<br>(hr) | Street / Channel Flow<br>Length<br>(ft) | Slope<br>(%) | Velocity<br>(ft/s) | Tc<br>(hr) | Tc<br>TOTAL<br>(hr) |
|                                 |                 |                |                           |            |   |              |                    |            |                     |
| CC-1                            | 65.0            | 300            | 10                        | 0.40       | 900                                     | 2.0%         | 1.8                | 0.14       | 0.53                |
| CC-2                            | 65.0            | 300            | 10                        | 0.40       | 1700                                    | 2.0%         | 1.8                | 0.26       | 0.66                |
| CC-3                            | 63.5            | 300            | 14                        | 0.35       | 900                                     | 2.5%         | 2.4                | 0.10       | 0.45                |
| CC-4A                           | 62.7            | 300            | 14                        | 0.35       | 2900                                    | 2.0%         | 2.1                | 0.38       | 0.73                |
| CC-4B                           | 63.7            | 300            | 12                        | 0.37       | 900                                     | 3.0%         | 2.5                | 0.10       | 0.47                |
| OS-12                           | 65.0            | 300            | 14                        | 0.35       | 1500                                    | 3.0%         | 2.5                | 0.17       | 0.51                |
| OS-13                           | 65.0            | 300            | 16                        | 0.33       | 900                                     | 3.0%         | 2.5                | 0.10       | 0.43                |
| OS-14                           | 65.0            | 300            | 14                        | 0.35       | 600                                     | 3.5%         | 2.7                | 0.06       | 0.41                |

Table 5.6: Reservoir Discharge Table

| Elevation | Discharge (cfs)<br>(SWQ Outlet Box) | Discharge (cfs)<br>(Twin CBC Spillway) | Discharge (cfs)<br>(Total) |
|-----------|-------------------------------------|--|----------------------------|
| 7531.0    | 0.0                                 | 0.0                                    | 0.0                        |
| 7532.0    | 13.89                               | 0.0                                    | 13.89                      |
| 7533.0    | 27.77                               | 0.0                                    | 27.77                      |
| 7534.0    | 51.31                               | 49.05                                  | 100.36                     |
| 7535.0    | 69.52                               | 138.56                                 | 208.08                     |
| 7536.0    | 74.61                               | 254.72                                 | 329.33                     |

Permanent WSE = 7531.0

Top of SWQ Outlet box = 7533.0

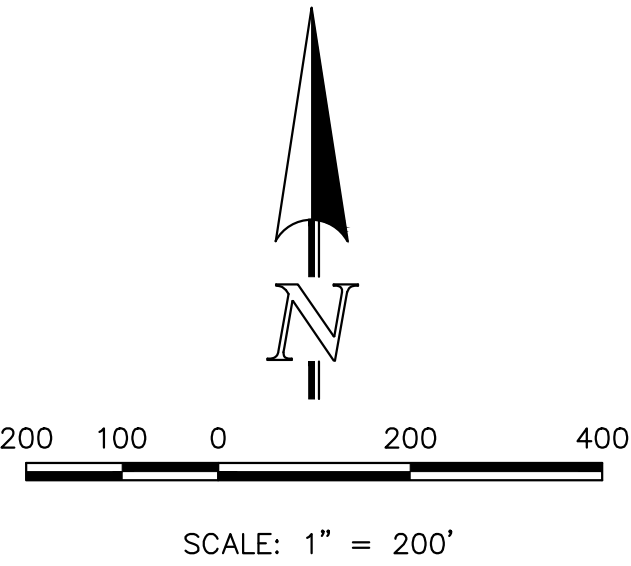
Spillway elevation = 7533.0

Table 5.4: Storage Capacity Table

| Elevation<br>NGVD 1929 | Area<br>(Acres) | Storage Volume<br>(Ac. Ft.) |
|------------------------|-----------------|-----------------------------|
| *7510.0                | 1.51            | 0.00                        |
| *7511.0                | 1.99            | 1.74                        |
| *7512.0                | 2.52            | 3.99                        |
| *7513.0                | 2.85            | 6.68                        |
| *7514.0                | 3.05            | 9.63                        |
| *7515.0                | 3.26            | 12.78                       |
| 7516.0                 | 3.48            | 16.15                       |
| 7517.0                 | 3.70            | 19.74                       |
| 7518.0                 | 3.93            | 23.56                       |
| 7519.0                 | 4.16            | 27.60                       |
| 7520.0                 | 4.40            | 31.88                       |
| 7521.0                 | 4.64            | 36.40                       |
| 7522.0                 | 4.88            | 41.16                       |
| 7523.0                 | 5.14            | 46.17                       |
| 7524.0                 | 5.36            | 51.42                       |
| 7525.0                 | 5.59            | 56.89                       |
| 7526.0                 | 5.84            | 62.61                       |
| 7527.0                 | 6.08            | 68.57                       |
| 7528.0                 | 6.33            | 74.77                       |
| 7529.0                 | 6.57            | 81.22                       |
| 7530.0                 | 6.81            | 87.91                       |
| 7531.0                 | 7.15            | 94.89                       |
| 7532.0                 | 7.52            | 102.22                      |
| 7533.0                 | 7.83            | 109.90                      |
| 7534.0                 | 8.37            | 118.00                      |
| 7535.0                 | 8.77            | 126.57                      |
| 7536.0                 | 9.17            | 135.53                      |

\*Indicates dead storage below pumping ability

| LEGEND                           |         |
|----------------------------------|---------|
| DESCRIPTION                      | SYMBOL  |
| EXISTING GROUND CONTOUR          | 6910    |
| PROPOSED FINISHED CONTOUR        | 6910    |
| BASIN BOUNDARY EAST CHERRY CREEK | ---     |
| MAJOR BASIN BOUNDARY             | ---     |
| BASIN IDENTIFIER                 | BB 10.0 |
| AREA IN ACRES                    | 10.0    |
| EXISTING DIRECTION OF FLOW       | →       |
| PROPOSED DIRECTION OF FLOW       | →       |
| STORM SEWER                      | ---     |



FLYING HORSE NORTH  
IRRIGATION RESERVOIR  
DEVELOPED DRAINAGE MAP

|             |              |               |         |         |
|-------------|--------------|---------------|---------|---------|
| DESIGNED BY | MAW          | SCALE         | DATE    | 9-20-17 |
| DRAWN BY    | MAW          | (H) 1" = 200' | SHEET   | 1 OF 1  |
| CHECKED BY  | (V) 1" = N/A | JOB NO.       | 1096.11 |         |

619 N. Cascade Avenue, Suite 200  
Colorado Springs, Colorado 80903

(719) 785-0790  
(719) 785-0799 (Fax)

CLASSIC  
CONSULTING  
ENGINEERS & SURVEYORS



**APPENDIX C**  
**GEOTECHNICAL REPORT**



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, CO 80907  
PHONE (719) 531-5599  
FAX (719) 531-5238

**SUBSURFACE SOIL INVESTIGATION  
FLYING HORSE NORTH DAM  
COLORADO SPRINGS, COLORADO**

Prepared for:

**Pulpit Rock, LLC  
6385 Corporate Drive, Suite 200  
Colorado Springs, Colorado 80919**

**Attn: Drew Balsick**

December 28, 2017

Respectfully Submitted,

ENTECH ENGINEERING, INC.

  
Stan C. Culp, P.E.  
Senior Engineer

SCC/rm

Encl.

Entech Job No. 171249  
AA projects/2017/171249 ssi\_final



Reviewed By:

  
Joseph C. Goode, Jr., P.E.  
President

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**Tables**

Table 1: Summary of Laboratory Test Results

**Figures**

Figure 1: Test Boring Location Map

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Appendix A: Test Boring Logs

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Appendix D: Filter Calculations

Appendix E: Slope Stability Calculations

**SUBSURFACE SOIL INVESTIGATION  
FLYING HORSE NORTH DAM  
COLORADO SPRINGS, COLORADO**

**1.0 INTRODUCTION**

As requested, personnel of Entech Engineering, Inc. have performed a Subsurface Soil Investigation at the proposed dam site and soil borrow site. The investigation was conducted to evaluate the soils to construct a new embankment; and perform laboratory testing within the dam footprint and proposed soil borrow areas. This report presents the results of our soils investigation, site evaluation, laboratory testing, and embankment recommendations. Specific design of the appurtenances within the embankment are beyond the scope of this report, however suggested geotechnical remediation is included based on our field exploration, laboratory testing, and engineering analysis' of the soils recovered from the sites investigated.

**2.0 FIELD INVESTIGATION AND LABORATORY TESTING PROGRAM**

Subsurface conditions within the dam footprint and soil borrow areas were explored by drilling thirteen test borings. The locations of the soil borings were determined based on the anticipated size of the proposed embankment and access points on the property at the time of drilling. Six test borings were drilled in the proposed dam footprint, two test borings were drilled in the proposed west borrow area, and five test borings were drilled in the proposed east borrow area to obtain soils information for use to construct the new dam embankment. The borings were advanced to depths ranging from 10 to 40 feet below ground surface (bgs) with one tested area, Test Boring No. 13, that was excavated with a small backhoe by an onsite contractor, to 3 feet (bgs) in the proposed east borrow area. The soils in all but Test Boring No. 13 were obtained using a truck mounted, drilling rig with continuous flight auger supplied and operated by Entech.

Notably, the soil borrow area in the vicinity of Test Boring Nos. 7 and 8 were abandoned while developing this report. The soil was used elsewhere on the property. The test boring logs for these two borings are included in the report but have been removed from the Test Boring Location Map, included as Figure 1.

Representative soil samples were recovered from each of the borings at approximate 5-foot intervals using 2-inch O.D. split barrel and California samplers following Standard Penetration Test (ASTM D-1586) procedures. Boring logs describing the subsurface conditions encountered in each of the borings are included in Appendix A. Laboratory classification testing was completed on selected soil samples recovered from the borings and soil borrow area for purposes of determining water content, evaluating engineering properties, classification and for grouping the materials by soil type. The water content testing results and soil types (by number) are included on the boring logs with respect to the sample depth measured from the existing ground surface.

Table 1 presents a summary of the laboratory testing and the Unified Soil Classification System (USCS) designations for each of the soils encountered in the borings and the soils borrow area. The standard laboratory testing results are presented in Appendix B.

In addition to the classification testing sulfate, pH, resistivity, permeability, and direct shear testing was completed. This additional testing was conducted on samples from within the proposed embankment footprint at various depths and from soils recovered from the proposed east soil borrow site. In brief, the sulfate testing results indicate that the soils within the embankment footprint and the soils obtained from the east soil borrow site exhibit a negligible potential for sulfate attack. The sulfate, permeability, and direct shear testing are included in Appendix C.

The tables below present a summary of the permeability and direct shear testing for soils tested in the proposed embankment and soils borrow area. The permeability test results are included in Appendix D, and Filter Calculations are included in Appendix E.

The permeability testing was performed in the laboratory using a falling head permeameter arrangement. The samples were compacted in molds at 95% of their standard proctor dry density and optimum moisture content and saturated for six hours prior to initiating the test. The tests were performed for a duration of seven days.

### **3.0 SUMMARY OF STANDARD PROCTOR TESTING (ASTM D-698)**

| Sample Location | Sample Description  | Depth Sampled (Feet) | Maximum Dry Density (pcf) | Optimum Moisture (%) |
|-----------------|---------------------|----------------------|---------------------------|----------------------|
| Test Boring 3   | Silty Sand (SM)     | 0-5                  | 124.1                     | 9.0                  |
| Test Boring 6   | V. Clayey Sand (SC) | 5-10                 | 115.5                     | 13.5                 |
| Test Boring 13  | V. Clayey Sand (SC) | 0-3                  | 116.6                     | 13.3                 |

### **4.0 SUMMARY OF PERMEABILITY TESTING**

| Sample Location | Sample Description  | Depth Sampled (Feet) | Final Permeability (cm/s) |
|-----------------|---------------------|----------------------|---------------------------|
| Test Boring 6   | V. Clayey Sand (SC) | 5-10                 | $1.48 \times 10^{-7}$     |
| Test Boring 13  | V. Clayey Sand (SC) | 0-3                  | $3.82 \times 10^{-7}$     |

The direct shear testing was performed in the laboratory using a remodeled sample confined in a ring and drained. The samples were compacted in molds at 95% of their Standard Proctor Dry Density and optimum moisture content. The tests were performed for a duration of three days under a constant horizontal load and staged for each point.

### **5.0 SUMMARY OF DIRECT SHEAR TESTING**

| Sample Location | Sample Description  | Depth Sampled (Feet) | Friction Angle (degrees) | Cohesion (psf) |
|-----------------|---------------------|----------------------|--------------------------|----------------|
| Test Boring 3   | Silty Sand (SM)     | 0-5                  | 34                       | 52             |
| Test Boring 6   | V. Clayey Sand (SC) | 5-10                 | 30                       | 134            |
| Test Boring 13  | V. Clayey Sand (SC) | 0-3                  | 28                       | 179            |



## **6.0 SOIL ROCK AND GROUNDWATER**

Two primary soil types and two rock types were encountered in the borings:

| <u>Type No.</u> | <u>Description</u>  | <u>USCS Designation</u> |
|-----------------|---|-------------------------|
| Type 1          | Slightly Silty to Very Silty Sand and Very Clayey Sand                | SM, SM-SW, SC           |
| Type 2          | Very Sandy Silt-Clay and Sandy to Very Sandy Clay                     | CL-ML, CL               |
| Type 3          | Clayey to Very Clayey Sandstone and Slightly Silty to Silty Sandstone | SC, SM-SW, SM           |
| Type 4          | Sandy Claystone   | CL                      |

## **7.0 SULFATE, PH, AND RESISTIVITY TESTING**

| Sample Description    | TB # and Depth | Sulfate           | pH  | Resistivity |
|-----------------------|----------------|-------------------|-----|-------------|
|                       | (ft)           | (%solublesulfate) |     | (ohm-cm)    |
| Silty Sand            | 1 @ 2-3        | 0.02              | 6.0 | 14706       |
| Very Clayey Sandstone | 1 @ 20         | <0.01             | 6.1 | >20000      |
| Silty Sandstone       | 2 @ 20         | 0.02              | 5.9 | >20000      |
| Sandy Claystone       | 3 @ 15         | <0.01             | 5.8 | >20000      |
| Slightly Silty Sand   | 5 @ 15         | <0.01             | 6.1 | >20000      |
| Sandy Clay            | 7 @ 2-3        | <0.01             | 5.9 | 17867       |
| Very Sandy Clay       | 8 @ 15         | <0.01             |     |             |
| Silty Sand            | 3 @ 5          | <0.01             |     |             |
| Very Clayey Sand      | 13 @ 0-3       | <0.01             | 5.9 | 19129       |

Soil Type 1 is described as slightly silty to very silty sand and very clayey sand (SM-SW, SM, SC). The sand was encountered in Test Boring Nos. 1 – 6, 10, 11, and 13 from the existing ground surface and underlying Soil Type 2 to depths of 3 to 39 feet (bgs). SPT Testing conducted on the sand resulted in N-values of 7 to 42 blows-per-foot (bpf), indicating loose to medium dense states. Moisture content and grain size analysis indicated moisture contents of 1.4 to 14.8 percent and 7.7 to 42.7 percent of the soil particles passing the No. 200 Sieve. Atterberg Limits testing resulted in Liquid Limits of no value, 29, and 32 and Plastic Indexes of being non-plastic, 13, and 13. Sulfate testing on the sand resulted in less than 0.01 to 0.02 percent soluble sulfate, indicating a negligible potential for below grade concrete degradation due to sulfate attack. pH Testing on the sands resulted in values between 5.9 and 6.1. These results indicate the soils are slightly to moderately acidic. Resistivity Testing on the sands resulted in soil resistivities between 14706 and greater than 20000 ohm-cm. The test results indicate that the sand soils are mildly corrosive to non-corrosive.

Soil Type 2 is described as sandy to very sandy clay and very sandy silt-clay (CL, CL-ML). The clay was encountered in Test Boring Nos. 2, 4, 6, 7, 8, 9 and 12 from the existing ground surfaces and underlying Soil Type 1 to approximate depths of 5 to 30 feet (bgs). SPT Testing conducted on the sandy clay resulted in N-values of 7 to 25 (bpf). This testing indicates the clays relative density ranges from firm to stiff consistencies. Moisture content indicated moisture contents ranging from 7.7 to 20.5 percent indicating moist conditions. Grain size analysis indicated a range of 51.6 to 88.4 percent of the soil particles passing the No. 200 Sieve. Atterberg Limits testing resulted in Liquid Limits of 24 to 42 and Plastic Indexes of 5 to 19. FHA Swell Testing performed on a sample of very sandy clay-silt resulted in a swell pressure of 150 psf, indicating a low swell potential. Swell/Consolidation Testing on a sample of sandy clay resulted in a volume change of 1.2 percent, also indicating a low swell potential. Sulfate testing on the clays resulted in less than 0.01 percent soluble sulfate, indicating a negligible potential for below grade concrete degradation due to sulfate attack. pH Testing on a clay sample resulted in a value of 5.9. This result indicates the clay soils are moderately acidic. Resistivity Testing on a sample of clay resulted in soil a resistivity of 17867 ohm-cm. This result indicates that the clay soils are mildly corrosive.

Soil Type 3 is described as weathered and formational clayey to very clayey sandstone and slightly silty to silty sandstone (SC, SM, SM-SW). The sandstone was encountered in Test Boring Nos. 1-5 underlying Soil Types 1 and 4 ranging from 14 to 40 feet (bgs). SPT Testing conducted on the sandstone resulted in N-values of 31 and greater than 50 blows per foot, indicating dense to very dense states. Moisture content and grain size analysis indicated moisture contents of 2.8 to 19.5 percent and 11.0 to 38.2 percent of the soil particles passing the No. 200 Sieve. Atterberg Limits testing resulted in the sandstone having a Liquid Limit of 42 and no value and Plastic Indexes of 11 and of being non-plastic. Sulfate testing on the sandstone resulted in less than 0.01 and 0.02 percent soluble sulfate, indicating a negligible potential for below grade concrete degradation due to sulfate attack. pH and Resistivity Testing on the sandstone resulted in values of 6.1 and greater than 20000 ohm-cm. These results indicate the sandstone materials are slightly acidic and non-corrosive.

Soil Type 4 is classified as weathered to formational sandy claystone (CL). The claystone was encountered in Test Boring Nos. 3 and 6 underlying Soil Type 1 between 14 and 40 feet below the ground surface (bgs). Standard Penetration Testing conducted on the claystone resulted in SPT N-values of 45 to greater than 50 blows per foot (bpf), which indicated very stiff to hard consistencies. Moisture content and grain size testing resulted in moisture contents of 11.0 and 17.6 percent with 69.3 to 96.0 percent of the soil size particles passing the No. 200 sieve. Atterberg limits testing was performed on samples of claystone resulted in Liquid Limits of 37 and 49 and Plastic Indexes of 19 and 23, respectively. Swell/Consolidation Testing performed on a sample of claystone resulted in a 1.6 percent volume change, indicating a low swell potential. Sulfate testing on the claystone resulted in less than 0.01 percent soluble sulfate by weight, indicating negligible potential for below grade concrete degradation due to sulfate attack. pH and Resistivity Testing on the claystone resulted in values of 5.8 and greater than 20000 ohm-cm. These results indicate the claystone materials are moderately acidic and non-corrosive.

## **8.0 SUMMARY OF TEST BORING DRILL AND GROUNDWATER DEPTHS**

| Test Boring No. | Depth Drilled (feet) | Depth to Groundwater (feet) |
|-----------------|----------------------|-----------------------------|
| 1               | 25                   | Dry                         |
| 2               | 30                   | Dry                         |
| 3               | 25                   | 16                          |
| 4               | 40                   | Dry                         |
| 5               | 30                   | Dry                         |
| 6               | 40                   | Dry                         |
| 7               | 10                   | Dry                         |
| 8               | 20                   | Dry                         |
| 9               | 10                   | Dry                         |
| 10              | 10                   | Dry                         |
| 11              | 10                   | Dry                         |
| 12              | 10                   | Dry                         |
| 13              | 3                    | Dry                         |

It should be noted that groundwater conditions at the site will vary as a result of changes in precipitation, runoff, changes in site use/drainage as well as a result of development on the property or adjacent nearby properties.

## **9.0 NEW DAM EMBANKMENT**

The new dam height will likely not exceed 25 feet, with a jurisdictional height of less than 20 feet, and have a 4:1 upstream slope and 3:1 downstream slope. The dam crest will be 36 feet in width supporting a paved 32-foot wide County Road. The new dam will be constructed on the same alignment of the proposed extension of Stagecoach Road. The new dam embankment will be comprised of a homogenous very sandy clay and clayey sand. During the development of this report the west soil borrow area was used on other areas of the property and additional drilling was performed at an east borrow area also located on the property. The east borrow area is approximately 0.5 miles east-southeast of the new dam embankment. Based on soils obtained from our soil borings and site evaluation of the east soils borrow area for the dam, this ~ 25-acres of land should provide a close and ample soils source to construct the new dam embankment.

The following two report sections present permeability testing, filter design, and a slope stability analysis based on the soils recovered from the field investigations, laboratory test results, and assuming an unlined homogeneous earthen embankment in direct contact with the stored waters. This proposed dam and entire pond will be lined with a man-made 30-mil LDPE liner. Approximately 12 to 18 inches of soil is proposed overlying the liner. The results of the testing and analysis assuming the earthen embankment is in direct contact with the stored waters will be conservative as seepage through the liner should be minimal.

## **10.0 PERMEABILITY TESTING AND FILTER DESIGN**

Based on the results of the permeability testing on two remolded very clayey sand samples obtained from within the footprint of the proposed dam embankment and east soils borrow area proposed to construct the new dam embankment. The soils should provide a structure with minimal seepage. The seepage collection system for the new embankment should include a toe drain system constructed with a blanket drain. The collection systems should include a drain pipe encapsulated in a soil filter for the toe drain with a blanket drain. The toe drain pipe should consist of the minimum sized pipe acceptable by the Dam Safety Branch. The drain pipe shall be made of PVC and mill slotted. The blanket drain should extend from the upper toe drain trench parallel to the dam downstream face with a thickness of one foot. The blanket filter should be constructed with approximately 2 feet of cover and extending to within two feet of the proposed impoundments free surface. The blanket drain cover should consist of site sands proposed to construct the embankment.

The drain filter design was conducted following the National Engineering Handbook developed by the United States Department of Agriculture Natural Resources Conservation Service Division, Part 633, Chapter 26 – Gradation Design of Sand and Gravel Filters. The gradation design was conducted using sieves of the proposed dam shell materials. Coarse and fine filters are suggested to prevent migration of very clayey proposed to construct the new earthen embankment. The filter designs provide an acceptable band range for the coarse and fine filters. The fine filter should consist of a washed concrete sand and the coarse filter comprised

of a No. 8 aggregate. The coarse filter shall encapsulate the drain pipe a minimum of six inches beyond the pipe outside diameter with the fine sand filter encapsulating the coarse filter within the toe drain trench and the downstream blanket filter. Outlet pipes constructed in the new dam embankment shall also be designed with a fine and coarse grained filter constructed near the outlet below the downstream face of the dam, covered with dam shell materials. The contractor should submit sieve analysis' of the proposed filter materials prior to hauling to the site.

The spreadsheets developed for the filter design and a filter detail are included in Appendix D.

### **11.0 SLOPE STABILITY ANALYSIS**

A slope stability analysis was performed on the new dam embankment. Soil values used were determined from our site evaluations and laboratory testing. Two primary soil types and two rock types were tested; site sands, clays, sandstone, and claystone. A slope stability analysis was performed on one section of the proposed dam embankment to quantify its structural integrity based on the geometry and soil properties obtained from this investigation. The slope section analyzed was located at approximately midspan across the length of the new dam. Refer to the Topographic Plan in Appendix E for the location of the slope section on the new dam. The slope stability analysis' were conducted utilizing the STEDwin GSTABL7 computer program. Two models were created in this analysis, both providing profiles of the new dam.

Factors of Safety were calculated by the Modified Bishop Method for Circular Failure Surface. A Factor of Safety of 1.81 was obtained on the initial slope analysis of the new dam embankment, approximately midspan at its deepest section. A Factor of Safety of 1.5 is recommended for earthen dams as specified in the Colorado Department of Natural Resources, Division of Water Resources, Rules and Regulations for Dam Safety and Dam Construction. Refer to Appendix E for the results of these slope stability analysis'.

The potential of accelerated slope failure for the new dam is relatively low due to the proposed liner which will minimize seepage through the embankment. The new dam will have a



downstream face seepage monitoring system. The dam embankment will be a homogenous structure comprised of sands and clays containing clay and silt fines.

Loose native soils were encountered below the proposed dam embankment in a couple of test borings which could be an active or future conduit for swift groundwater movement. Increased groundwater velocities tend to transport soils from below the structure and increased seepage rates are expected over time. The loose zones could be from groundwater movement. These areas will be mitigated during the dam foundation work.

## **12.0 EMBANKMENT CONSTRUCTION**

After the dam foundation is exposed, the excavation shall be observed to determine if additional field exploration or laboratory testing is required. These evaluations will verify the condition of the underlying geology for support and construction of the dam foundation and outlet structures. Based on our Sulfate, pH, and Resistivity Testing conducted on the soils proposed to construct the new dam, the soils exhibit a negligible potential for attack on concrete structures and Type II concrete is recommended. The soils are slightly to moderately acidic and mildly corrosive and should not be corrosive in direct contact with steel; however, due to the nature of this project it is recommended that all steel materials in contact with the new dam embankment soils should be cathodically protected.

The property in the vicinity of the new dam would provide a close staging area for construction equipment and storage of usable soils removed from the dam. The east borrow area was determined to provide an ample and close soil source for the dam embankment. Laboratory testing performed on the soils located at the east borrow area determined the soil suitable for the construction of a new earthen embankment. Initial slope stability analysis' indicates the embankment stability with elevated groundwater seepage through the embankment would meet acceptable factors of safety based on the soils tested for this investigation. Notably, it is likely that the groundwater within the embankment will never reach this elevated state with the proposed manmade pond liner and active toe drains proposed with this project. Additional testing may be required prior to and during construction of the new earthen embankment depending on the contractor's construction materials submittals. It is likely that a toe drain will

be required consisting of manmade and earthen materials during construction of the new dam embankment.

After the dam embankment foundation soils are exposed, mitigated as required, and approved by the Dam Safety Branch and Geotechnical Engineers, the new embankment shall be constructed and periodically observed and tested. The foundation granular materials (site sands) as approved by the geotechnical engineer shall be compacted to a minimum of 100% of its maximum Standard Proctor Dry Density, ASTM D-698 at 0 to +3 percent of optimum moisture content. The embankment shell materials (site sands and very sandy clays) as approved by the geotechnical engineer shall be compacted to a minimum of 98% of its maximum Standard Proctor Dry Density, ASTM D-698 at 0 to +3 percent of optimum moisture content. The filter materials shall be tamped and observed by a construction materials testing agency prior to covering the filters with embankment materials to verify thicknesses and compaction efforts. The soils testing requirements and frequencies of testing will be noted on the construction drawings and technical specifications.

### **13.0 CLOSURE**

The test borings were located to provide general geotechnical information and subsurface profiles at the new embankment location and soil borrow areas. Variations in subsurface conditions may be encountered across the site. Pockets of low soil densities determined from the standard penetration testing conducted during drilling indicated isolated zones within the surficial native soil exist in the existing drainageway. The loose zones were encountered in Test Boring Nos. 2 and 3. Surficial clays and silts with low bearing capacities were encountered in Test Boring Nos. 2, 4, and 6 were also encountered in the existing drainageway within the location of the proposed dam embankment. During excavations for the dam foundation, the loose and potentially low bearing soils will be excavated to the underlying medium dense to dense soil strata below. It is likely the granular soils removed from the foundation areas will be reused in the embankment foundation or reused in the new dam embankment. Spoils removed will likely be used elsewhere on the golf course property in softscape areas.



This report has been prepared for Pulpit Rock, LLC for application to the proposed project in accordance with generally accepted soil engineering practices. No other warranty expressed or implied is made. We trust this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

If there are any questions regarding the information provided herein or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.

## TABLE

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TABLE 1

## SUMMARY OF LABORATORY TEST RESULTS

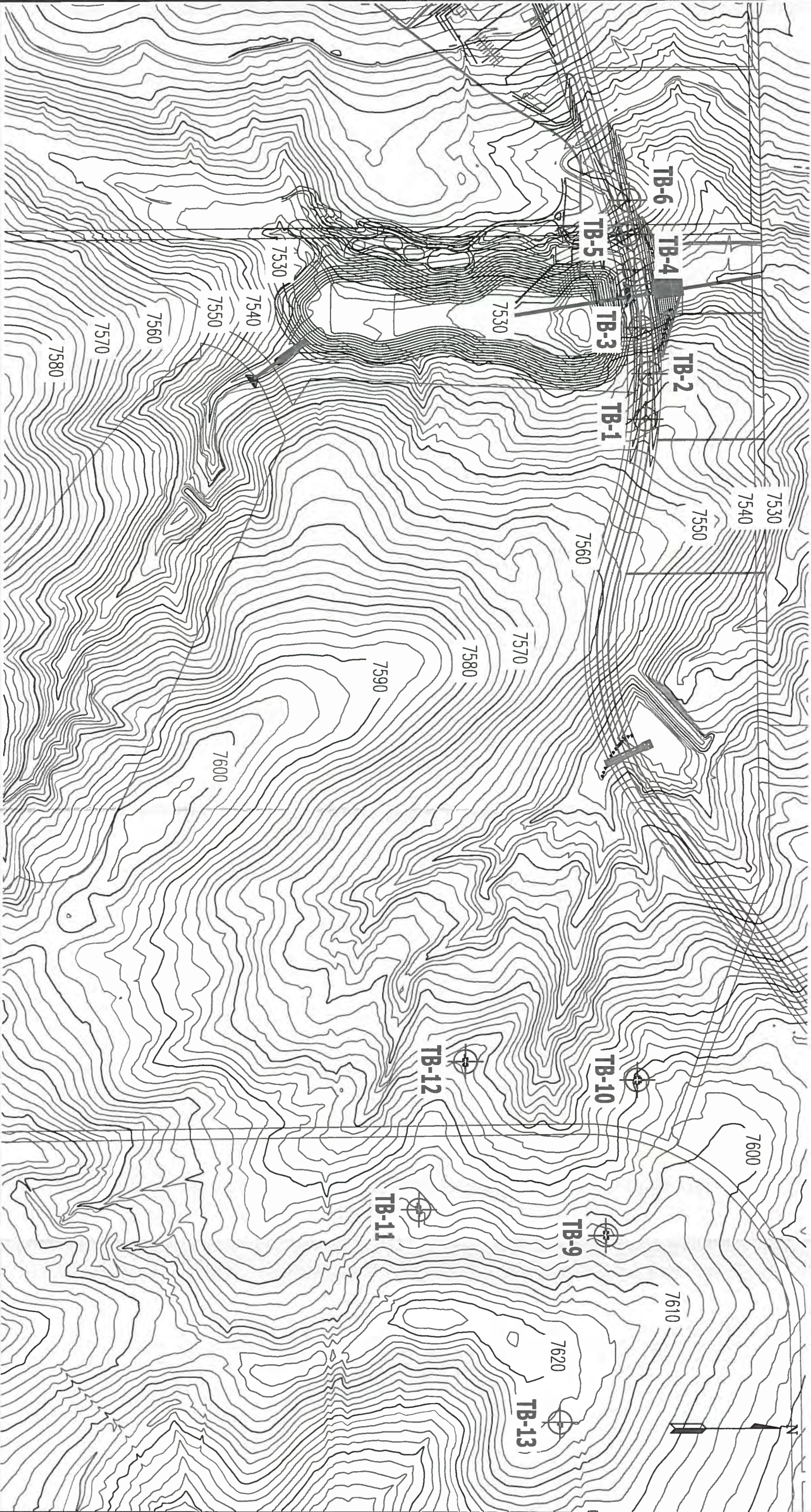
CLIENT PULPIT ROCK, LLC  
 PROJECT FLYING HORSE NORTH, DAM  
 JOB NO. 171249

| SOIL TYPE | TEST BORING NO. | DEPTH (FT) | WATER (%) | DRY DENSITY (PCF) | PASSING NO. 200 SIEVE (%) | LIQUID LIMIT (%) | PLASTIC INDEX (%) | SULFATE (WT %) | FHA SWELL (PSF) | SWELL/CONSOL (%) | UNIFIED CLASSIFICATION | SOIL DESCRIPTION          |
|-----------|-----------------|------------|-----------|-------------------|---------------------------|------------------|-------------------|----------------|-----------------|------------------|------------------------|---------------------------|
| 1         | 1               | 2-3        |           |                   | 30.0                      | NV               | NP                | 0.02           |                 |                  | SM                     | SAND, SILTY               |
| 1         | 4               | 0-5        |           |                   | 42.7                      |                  |                   |                |                 |                  | SM                     | SAND, VERY SILTY          |
| 1         | 5               | 15         |           |                   | 7.7                       |                  |                   | <0.01          |                 |                  | SM-SW                  | SAND, SLIGHTLY SILTY      |
| 1         | 3               | 5          |           |                   | 22.3                      | NV               | NP                | <0.01          |                 |                  | SM                     | SAND, SILTY               |
| 1         | 5               | 5          |           |                   | 17.8                      |                  |                   |                |                 |                  | SM                     | SAND, SILTY               |
| 1         | 10              | 2-5        |           |                   | 47.0                      |                  |                   |                |                 |                  | SC                     | SAND, VERY CLAYEY         |
| 1         | 11              | 0-10       |           |                   | 42.5                      | 32               | 13                |                |                 |                  | SC                     | SAND, VERY CLAYEY         |
| 1         | 13              | 0-3        |           |                   | 43.7                      | 29               | 13                | <0.01          |                 |                  | SC                     | SAND, VERY CLAYEY         |
| 2         | 9               | 1-5        |           |                   | 54.7                      |                  |                   |                |                 |                  | CL                     | CLAY, VERY SANDY          |
| 2         | 12              | 1-8        |           |                   | 65.8                      | 29               | 19                |                |                 |                  | CL                     | CLAY, SANDY               |
| 2         | 8               | 15         |           |                   | 73.8                      | 28               | 15                | <0.01          |                 |                  | CL                     | CLAY, SANDY               |
| 2         | 2               | 10         |           |                   | 55.5                      | 24               | 5                 |                | 150             |                  | CL-ML                  | CLAY, SILT, VERY SANDY    |
| 2         | 4               | 2-3        |           |                   | 81.1                      | 31               | 16                |                |                 |                  | CL                     | CLAY, SANDY               |
| 2         | 4               | 25-30      |           |                   | 68.9                      |                  |                   |                |                 |                  | CL                     | CLAY, SANDY               |
| 2         | 6               | 5-10       |           |                   | 58.8                      |                  |                   |                |                 |                  | CL                     | CLAY, VERY SANDY          |
| 2         | 6               | 10         | 17.3      | 107.8             | 88.4                      | 42               | 19                |                |                 | 1.2              | CL                     | CLAY, SANDY               |
| 2         | 7               | 2-3        |           |                   | 72.7                      |                  |                   | <0.01          |                 |                  | CL                     | CLAY, SANDY               |
| 2         | 8               | 0-5        |           |                   | 72.0                      |                  |                   |                |                 |                  | CL                     | CLAY, SANDY               |
| 2         | 8               | 5          |           |                   | 51.6                      | 26               | 11                |                |                 |                  | CL                     | CLAY, VERY SANDY          |
| 3         | 1               | 20         |           |                   | 38.2                      |                  |                   | <0.01          |                 |                  | SC                     | SANDSTONE, VERY CLAYEY    |
| 3         | 1               | 15-20      |           |                   | 31.3                      |                  |                   |                |                 |                  | SC                     | SANDSTONE, CLAYEY         |
| 3         | 2               | 20         |           |                   | 13.3                      | 42               | 11                | 0.02           |                 |                  | SM                     | SANDSTONE, SILTY          |
| 3         | 4               | 40         |           |                   | 20.6                      | NV               | NP                |                |                 |                  | SM                     | SANDSTONE, SILTY          |
| 3         | 5               | 25         |           |                   | 11.0                      |                  |                   |                |                 |                  | SM-SW                  | SANDSTONE, SLIGHTLY SILTY |
| 4         | 3               | 15         | 16.8      | 109.3             | 96.0                      | 49               | 23                | <0.01          |                 | 1.6              | CL                     | CLAYSTONE, SANDY          |
| 4         | 6               | 40         |           |                   | 69.3                      | 37               | 19                |                |                 |                  | CL                     | CLAYSTONE, SANDY          |

## TEST BORING LOCATION MAP

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FLYING HORSE NORTH GOLF COURSE

11" x 17" - SCALE: 1" = 300'

TB-2 - APPROXIMATE TEST BORING LOCATION AND NUMBER

REVISIONS BY:

|  |  |  |  |  |  |
|--|--|--|--|--|--|
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**ENTECH**  
ENGINEERING, INC.  
505 ELKTON DRIVE  
COLORADO SPRINGS, CO. 80907 (719) 531-5599

TEST BORING LOCATION MAP  
FLYING HORSE NORTH DAM  
COLORADO SPRINGS, CO  
FOR: PULPIT ROCK, LLC

DRAWN BY: S. CUDZ.

DESIGNED BY: S. CUDZ.

CHECKED BY:

DATE: 9/30/17

SCALE: AS SHOWN

JOB NO.: 171249

FIGURE NO.:

1

STATE OF COLORADO P.E.



## **APPENDIX A: Test Boring Logs**

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TEST BORING NO. 1  
 DATE DRILLED 8/23/2017  
 Job # 171249

TEST BORING NO. 2  
 DATE DRILLED 8/23/2017  
 CLIENT PULPIT ROCK, LLC  
 LOCATION FLYING HORSE NORTH, DAM

REMARKS

DRY TO 19.5', 9/7/17

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, MEDIUM DENSE,  
 MOIST

SANDSTONE, VERY CLAYEY  
 TO CLAYEY, FINE TO COARSE  
 GRAINED, RED BROWN, VERY  
 DENSE, MOIST

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
|            |        |         | 15             | 7.0            | 1         |
| 5          |        |         | 19             | 4.0            | 1         |
| 10         |        |         | 16             | 7.9            | 1         |
| 15         |        |         | 50<br>11"      | 19.5           | 3         |
| 20         |        |         | 50<br>6"       | 18.6           | 3         |
| 25         |        |         | 50<br>7"       | 11.9           | 3         |

REMARKS

DRY TO 26.5', 9/7/17

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, LOOSE TO  
 DENSE, MOIST

CLAY-SILT, VERY SANDY, TAN,  
 FIRM, MOIST

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, MEDIUM DENSE,  
 MOIST

WEATHERED TO FORMATIONAL  
 SANDSTONE, SILTY, FINE  
 TO COARSE GRAINED, TAN,  
 DENSE TO VERY DENSE,  
 MOIST

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
|            |        |         | 7              | 9.2            | 1         |
| 5          |        |         | 31             | 4.4            | 1         |
| 10         |        |         | 7              | 16.6           | 2         |
| 15         |        |         | 17             | 6.6            | 1         |
| 20         |        |         | 31             | 13.1           | 3         |
| 25         |        |         | 50<br>4"       | 11.0           | 3         |
| 30         |        |         | 50<br>4"       | 8.7            | 3         |



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

SCC

8/16/17

JOB NO.:  
 171249

FIG NO.:

A- 1

TEST BORING NO. 3  
 DATE DRILLED 8/23/2017  
 Job # 171249

TEST BORING NO. 4  
 DATE DRILLED 8/23/2017  
 CLIENT PULPIT ROCK, LLC  
 LOCATION FLYING HORSE NORTH, DAM

REMARKS

WATER @ 16', 9/7/17

SAND, SILTY, FINE TO COARSE  
 GRAINED, BROWN, MEDIUM  
 DENSE TO LOOSE, MOIST

WEATHERED CLAYSTONE,  
 SANDY, TAN, VERY STIFF,  
 MOIST

SANDSTONE, CLAYEY, FINE  
 TO COARSE GRAINED, TAN,  
 VERY DENSE, MOIST

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
|            |        |         | 12             | 4.5            | 1         |
| 5          |        |         | 7              | 11.6           | 1         |
| 10         |        |         | 9              | 12.1           | 1         |
| 15         |        |         | 45             | 17.6           | 4         |
| 20         |        |         | 50<br>5"       | 15.0           | 3         |
| 25         |        |         | 50<br>7"       | 13.3           | 3         |

REMARKS

DRY TO 27.5', 9/7/17

CLAY, SANDY, TAN, STIFF,  
 MOIST

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, MEDIUM  
 DENSE, MOIST TO VERY MOIST

CLAYEY LENSES

CLAY, SANDY, BROWN,  
 STIFF, MOIST

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, LOOSE,  
 MOIST

WEATHERED SANDSTONE,  
 SILTY, FINE TO MEDIUM GRAINED,  
 TAN, DENSE, MOIST

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
|            |        |         | 20             | 8.6            | 2         |
| 5          |        |         | 25             | 6.4            | 2         |
| 10         |        |         | 27             | 1.7            | 1         |
| 15         |        |         | 25             | 3.4            | 1         |
| 20         |        |         | 12             | 14.8           | 1         |
| 25         |        |         | 38             | 4.9            | 1         |
| 30         |        |         | 15             | 9.2            | 2         |
| 35         |        |         | 8              | 6.1            | 1         |
| 40         |        |         | 40             | 18.5           | 3         |



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 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

SCC

11/16/17

JOB NO.:  
 171249

FIG NO.:  
 A- 2



TEST BORING NO. 5  
 DATE DRILLED 8/23/2017  
 Job # 171249

TEST BORING NO. 6  
 DATE DRILLED 8/23/2017  
 CLIENT PULPIT ROCK, LLC  
 LOCATION FLYING HORSE NORTH, DAM

REMARKS

DRY TO 27.5', 9/7/17

SAND, SLIGHTLY SILTY TO  
 SILTY, FINE TO COARSE  
 GRAINED, TAN, MEDIUM  
 DENSE, MOIST

SANDSTONE, SLIGHTLY SILTY,  
 FINE TO COARSE GRAINED,  
 TAN, VERY DENSE TO DENSE,  
 MOIST

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
|            |        |         | 15             | 7.2            | 1         |
| 5          |        |         | 20             | 7.7            | 1         |
| 10         |        |         | 16             | 12.1           | 1         |
| 15         |        |         | 22             | 1.4            | 1         |
| 20         |        |         | 27             | 4.0            | 1         |
| 25         |        |         | 50<br>11"      | 2.8            | 3         |
| 30         |        |         | 47             | 11.6           | 3         |

REMARKS

DRY TO 18.5', 9/7/17

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, DENSE TO  
 MEDIUM DENSE, MOIST

CLAY, SANDY, TAN, STIFF,  
 MOIST

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, MEDIUM  
 DENSE, MOIST

CLAYEY LENSE

\* - BULK SAMPLE TAKEN

CLAYSTONE, SANDY, GRAY  
 BROWN, HARD, MOIST

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
|            |        |         | 42             | 1.9            | 1         |
| 5          |        |         | 13             | 13.2           | 1         |
| 10         |        |         | 15             | 20.5           | 2         |
| 15         |        |         | 16             | 5.7            | 1         |
| 20         |        |         | 20             | 4.7            | 1         |
| 25         |        |         | 26             | 4.2            | 1         |
|            |        |         | *              | 13.6           | 1         |
| 30         |        |         | 25             | 4.7            | 1         |
| 35         |        |         | 24             | 5.4            | 1         |
| 40         |        |         | 50<br>10"      | 11.0           | 4         |



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 ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

SCC

8/26/17

JOB NO.:  
 171249

FIG NO.:  
 A- 3

TEST BORING NO. 7  
 DATE DRILLED 9/6/2017  
 Job # 171249

TEST BORING NO. 8  
 DATE DRILLED 9/6/2017  
 CLIENT PULPIT ROCK, LLC  
 LOCATION FLYING HORSE NORTH, DAM

REMARKS

DRY TO 19.5', 9/7/17

CLAY, SANDY, TAN, FIRM TO  
 STIFF, MOIST

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
| 5          |        |         | 12             | 9.7            | 2         |
| 5          |        |         | 15             | 7.8            | 2         |
| 10         |        |         | 22             | 9.5            | 2         |
| 15         |        |         |                |                |           |
| 20         |        |         |                |                |           |

REMARKS

DRY TO 20', 9/6/17

CLAY, VERY SANDY TO  
 SANDY WITH DEPTH, TAN,  
 FIRM TO STIFF, MOIST

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
| 5          |        |         | 11             | 7.7            | 2         |
| 5          |        |         | 10             | 10.6           | 2         |
| 10         |        |         | 8              | 10.3           | 2         |
| 15         |        |         | 15             | 12.3           | 2         |
| 20         |        |         | 13             | 9.4            | 2         |



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**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

SCC


11/16/17


JOB NO.:  
 171249

FIG NO.:  
 A- 4

TEST BORING NO. 9  
 DATE DRILLED 10/20/2017  
 Job # 171249

TEST BORING NO. 10  
 DATE DRILLED 10/20/2017  
 CLIENT PULPIT ROCK, LLC  
 LOCATION FLYING HORSE NORTH, DAM

| REMARKS  | Depth (ft)               | Symbol  | Samples | Blows per foot | Watercontent % | Soil Type |
|--|--------------------------|---|---------|----------------|----------------|-----------|
| DRY TO 10',<br>10/20/17<br>CLAY, VERY SANDY, TAN | 0<br>5<br>10<br>15<br>20 |  |         |                |                | 2         |

| REMARKS   | Depth (ft)               | Symbol  | Samples | Blows per foot | Watercontent % | Soil Type |
|---|--------------------------|---|---------|----------------|----------------|-----------|
| DRY TO 10',<br>10/20/17<br>SAND, VERY CLAYEY, TAN | 0<br>5<br>10<br>15<br>20 |  |         |                |                | 1         |



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

### TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

*SCC*

*11/16/17*

JOB NO.:  
171249

FIG NO.:  
A- 5

TEST BORING NO. 11  
 DATE DRILLED 10/20/2017  
 Job # 171249

TEST BORING NO. 12  
 DATE DRILLED 10/20/2017  
 CLIENT PULPIT ROCK, LLC  
 LOCATION FLYING HORSE NORTH, DAM

REMARKS

DRY TO 10',  
 10/20/17

SAND, VERY CLAYEY, TAN

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
| 1          |        |         |                |                |           |
| 5          |        |         |                |                |           |
| 10         |        |         |                |                |           |
| 15         |        |         |                |                |           |
| 20         |        |         |                |                |           |

REMARKS

DRY TO 10',  
 10/20/17

CLAY, SANDY, TAN

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|--------|---------|----------------|----------------|-----------|
| 1          |        |         |                |                |           |
| 5          |        |         |                |                |           |
| 10         |        |         |                |                |           |
| 15         |        |         |                |                |           |
| 20         |        |         |                |                |           |



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

SCC


11/16/17

JOB NO.:  
 171249

FIG NO.:  
 A- 6

TEST BORING NO. 13  
 DATE DRILLED 10/20/2017  
 Job # 171249

TEST BORING NO.  
 DATE DRILLED  
 CLIENT PULPIT ROCK, LLC  
 LOCATION FLYING HORSE NORTH, DAM

| REMARKS   | Depth (ft) | Symbol  | Samples | Blows per foot | Watercontent % | Soil Type | REMARKS | Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|---|------------|---|---------|----------------|----------------|-----------|---------|------------|--------|---------|----------------|----------------|-----------|
| SAND, VERY CLAYEY, FINE<br>TO COARSE GRAINED, TAN | 5          |  |         |                |                | -1        |         | 5          |        |         |                |                |           |
|   | 10         |   |         |                |                |           |         | 10         |        |         |                |                |           |
|   | 15         |   |         |                |                |           |         | 15         |        |         |                |                |           |
|   | 20         |   |         |                |                |           |         | 20         |        |         |                |                |           |



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### TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

SCC

11/16/17

JOB NO.:  
171249

FIG NO.:  
A- 7

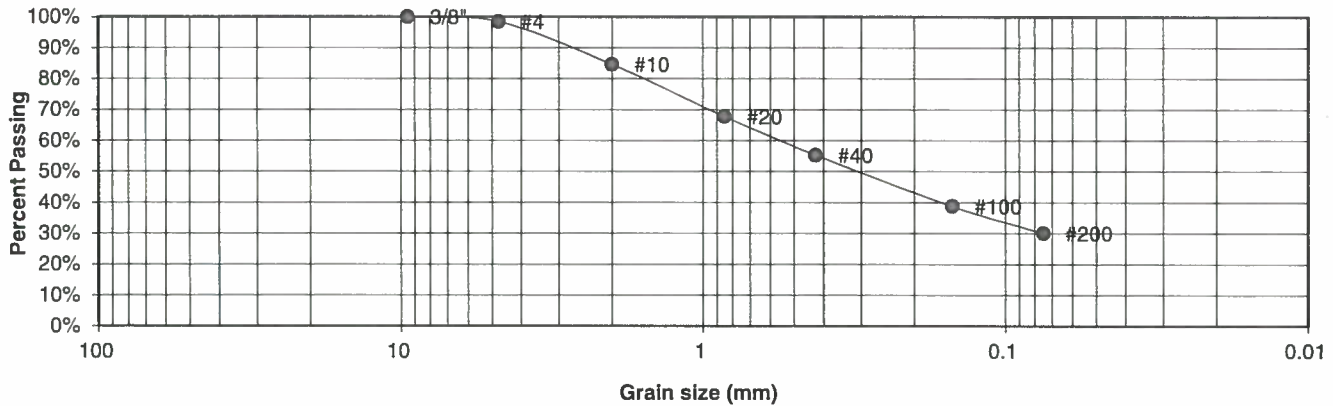
## **APPENDIX B: Laboratory Test Results**

---

|                               |     |
|-------------------------------|-----|
| <b>UNIFIED CLASSIFICATION</b> | SM  |
| <b>SOIL TYPE #</b>            | 1   |
| <b>TEST BORING #</b>          | 1   |
| <b>DEPTH (FT)</b>             | 2-3 |

|                |                         |
|----------------|-------------------------|
| <b>CLIENT</b>  | PULPIT ROCK, LLC        |
| <b>PROJECT</b> | FLYING HORSE NORTH, DAM |
| <b>JOB NO.</b> | 171249                  |
| <b>TEST BY</b> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            | 100.0%           |
| 4               | 98.5%            |
| 10              | 84.7%            |
| 20              | 67.8%            |
| 40              | 55.3%            |
| 100             | 38.8%            |
| 200             | 30.0%            |

**Atterberg  
Limits**

|               |    |
|---------------|----|
| Plastic Limit | NP |
| Liquid Limit  | NV |
| Plastic Index | NP |

**Swell**

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

*SLC*

*11/16/17*

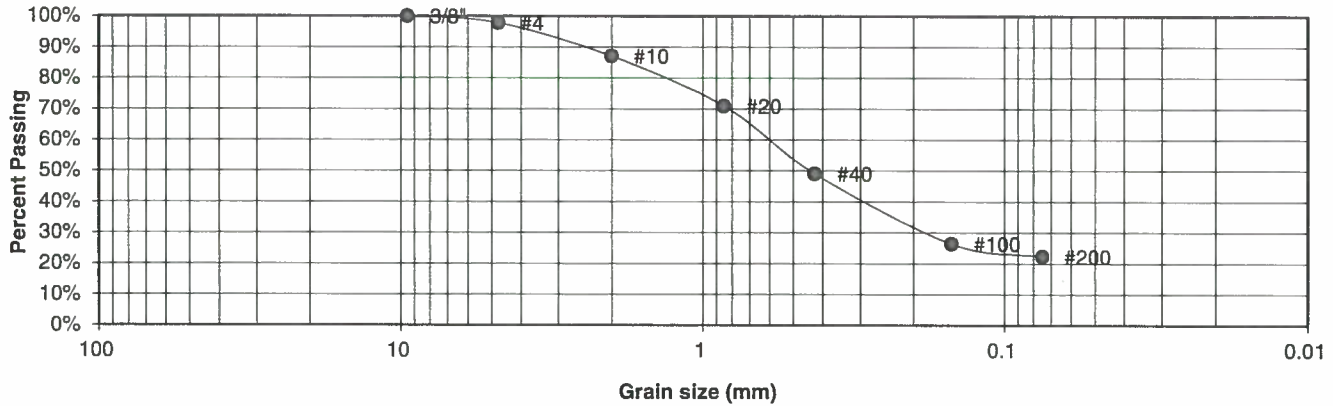
JOB NO.:  
171249

FIG NO.:

*B-1*

|                               |    |                |                         |
|-------------------------------|----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | SM | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 1  | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 3  | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 5  | <u>TEST BY</u> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    | 100.0%                   |
| 4                       | 97.8%                    |
| 10                      | 87.1%                    |
| 20                      | 71.0%                    |
| 40                      | 49.1%                    |
| 100                     | 26.4%                    |
| 200                     | 22.3%                    |

| <u>Atterberg<br/>Limits</u> |    |
|-----------------------------|----|
| Plastic Limit               | NP |
| Liquid Limit                | NV |
| Plastic Index               | NP |

| <u>Swell</u>              |
|---------------------------|
| Moisture at start         |
| Moisture at finish        |
| Moisture increase         |
| Initial dry density (pcf) |
| Swell (psf)               |



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

|        |       |              |                |
|--------|-------|--------------|----------------|
| DRAWN: | DATE: | CHECKED: SCC | DATE: 11/16/17 |
|--------|-------|--------------|----------------|

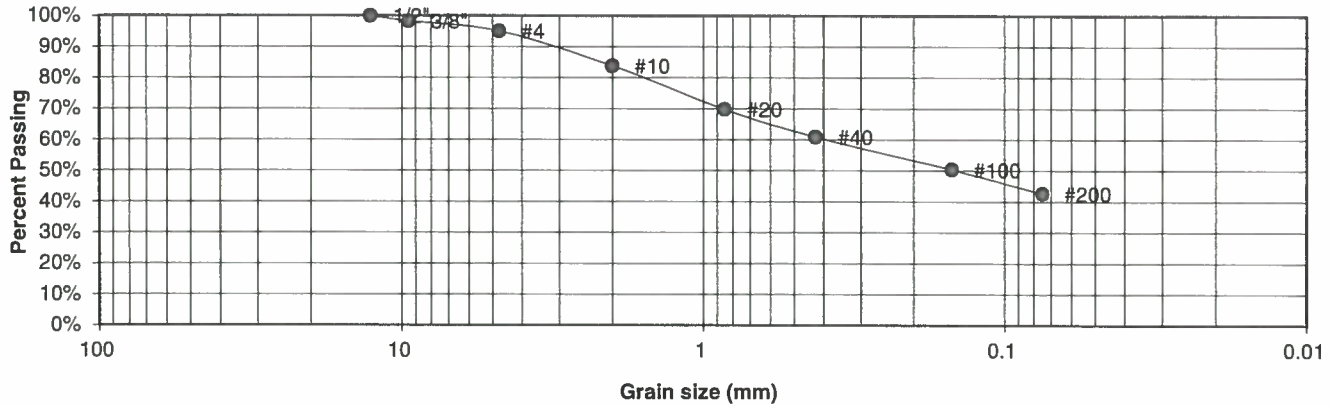
JOB NO.:  
171249

FIG NO.:  
B-2



|                               |     |                |                         |
|-------------------------------|-----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | SM  | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 1   | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 4   | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 0-5 | <u>TEST BY</u> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    | 100.0%                   |
| 3/8"                    | 98.3%                    |
| 4                       | 95.0%                    |
| 10                      | 83.8%                    |
| 20                      | 69.8%                    |
| 40                      | 60.9%                    |
| 100                     | 50.4%                    |
| 200                     | 42.7%                    |

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

Swell  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

SCC

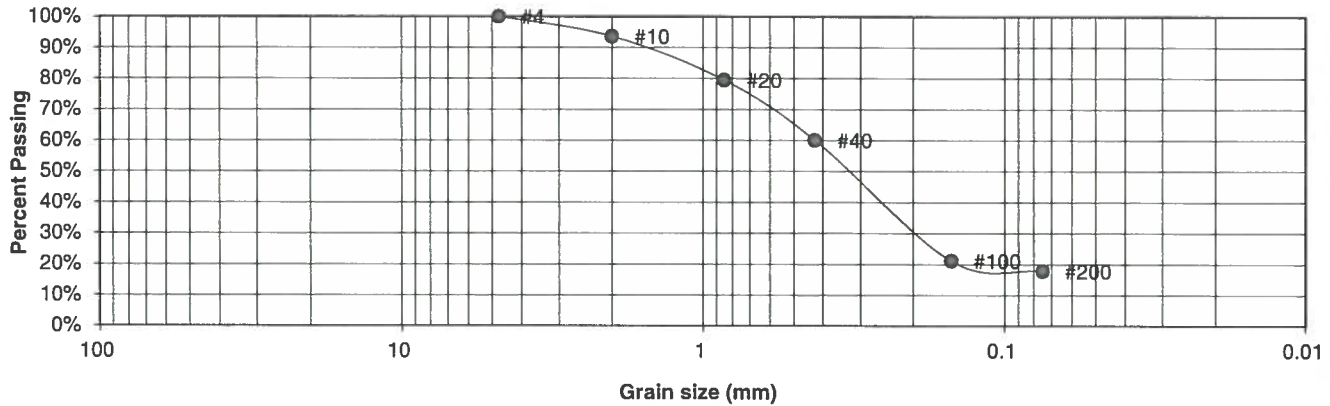
11/16/17

JOB NO.:  
171249

FIG NO.:  
B-3

|                               |    |                |                         |
|-------------------------------|----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | SM | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 1  | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 5  | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 5  | <u>TEST BY</u> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



U.S.  
Sieve #

3"  
1 1/2"  
3/4"  
1/2"  
3/8"  
4  
10  
20  
40  
100  
200

Percent  
Finer

100.0%  
93.6%  
79.5%  
60.0%  
21.1%  
17.8%

Atterberg  
Limits

Plastic Limit  
Liquid Limit  
Plastic Index

Swell

Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

*SCC*

*11/17*

JOB NO.:  
171249

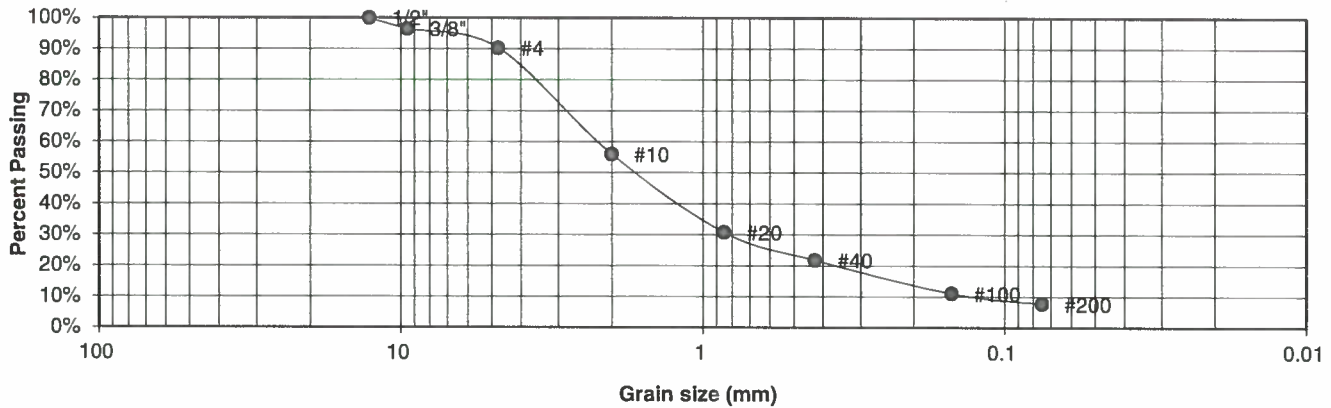
FIG NO.:

**B-4**

|                               |       |
|-------------------------------|-------|
| <b>UNIFIED CLASSIFICATION</b> | SM-SW |
| <b>SOIL TYPE #</b>            | 1     |
| <b>TEST BORING #</b>          | 5     |
| <b>DEPTH (FT)</b>             | 15    |

|                |                         |
|----------------|-------------------------|
| <b>CLIENT</b>  | PULPIT ROCK, LLC        |
| <b>PROJECT</b> | FLYING HORSE NORTH, DAM |
| <b>JOB NO.</b> | 171249                  |
| <b>TEST BY</b> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            | 100.0%           |
| 3/8"            | 96.5%            |
| 4               | 90.3%            |
| 10              | 56.0%            |
| 20              | 30.8%            |
| 40              | 21.7%            |
| 100             | 11.0%            |
| 200             | 7.7%             |

**Atterberg  
Limits**  
Plastic Limit  
Liquid Limit  
Plastic Index

**Swell**  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

SCC

11/16/17

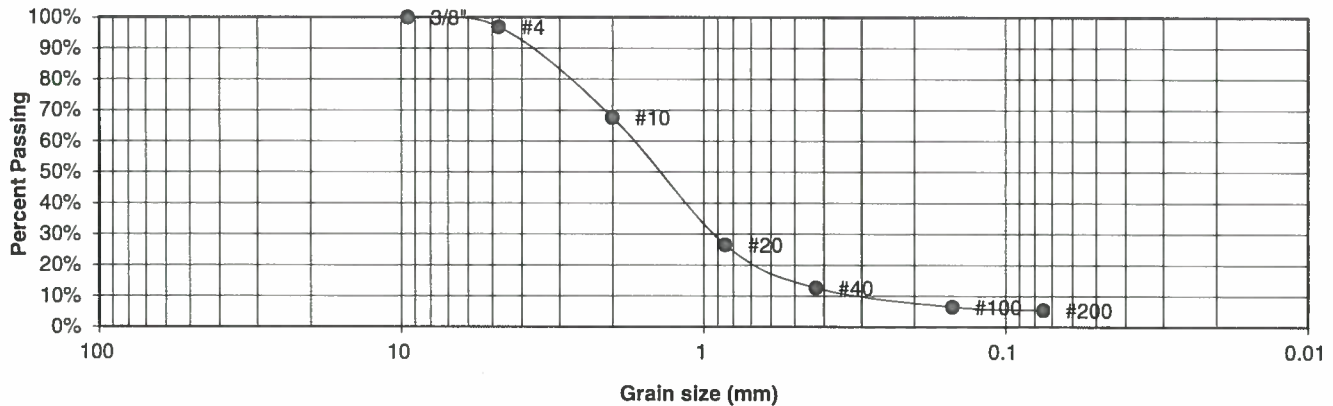
JOB NO.:  
171249

FIG NO.:

B-5

|                        |       |         |                         |
|------------------------|-------|---------|-------------------------|
| UNIFIED CLASSIFICATION | SM-SW | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 1     | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 9     | JOB NO. | 171249                  |
| DEPTH (FT)             | 2-3   | TEST BY | BL                      |

### Sieve Analysis Grain Size Distribution



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            | 100.0%           |
| 4               | 96.9%            |
| 10              | 67.6%            |
| 20              | 26.5%            |
| 40              | 12.6%            |
| 100             | 6.5%             |
| 200             | 5.5%             |

| Atterberg<br>Limits |    |
|---------------------|----|
| Plastic Limit       | NP |
| Liquid Limit        | NV |
| Plastic Index       | NP |

| Swell                     |  |
|---------------------------|--|
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

SCC

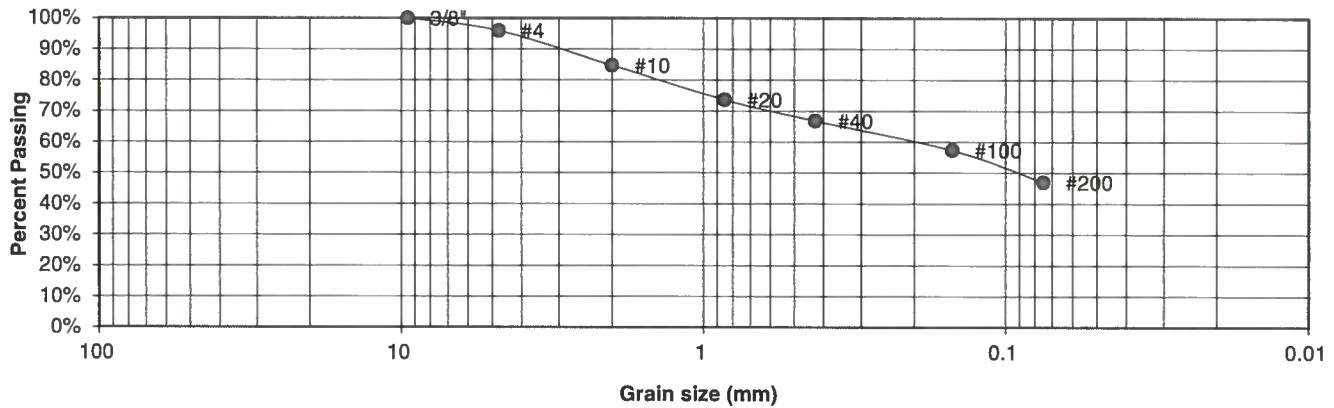
11/16/17

JOB NO.:  
171249

FIG NO.:  
B-6

|                        |     |         |                         |
|------------------------|-----|---------|-------------------------|
| UNIFIED CLASSIFICATION | SC  | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 1   | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 10  | JOB NO. | 171249                  |
| DEPTH (FT)             | 2-5 | TEST BY | BL                      |

### Sieve Analysis Grain Size Distribution



U.S.  
Sieve #

3"  
1 1/2"  
3/4"  
1/2"  
3/8"  
4  
10  
20  
40  
100  
200

Percent  
Finer

100.0%  
96.0%  
84.7%  
73.6%  
66.8%  
57.4%  
47.0%

Atterberg

Limits

Plastic Limit

Liquid Limit

Plastic Index

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)



**ENTECH  
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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED:

SCC

DATE:

11/6/17

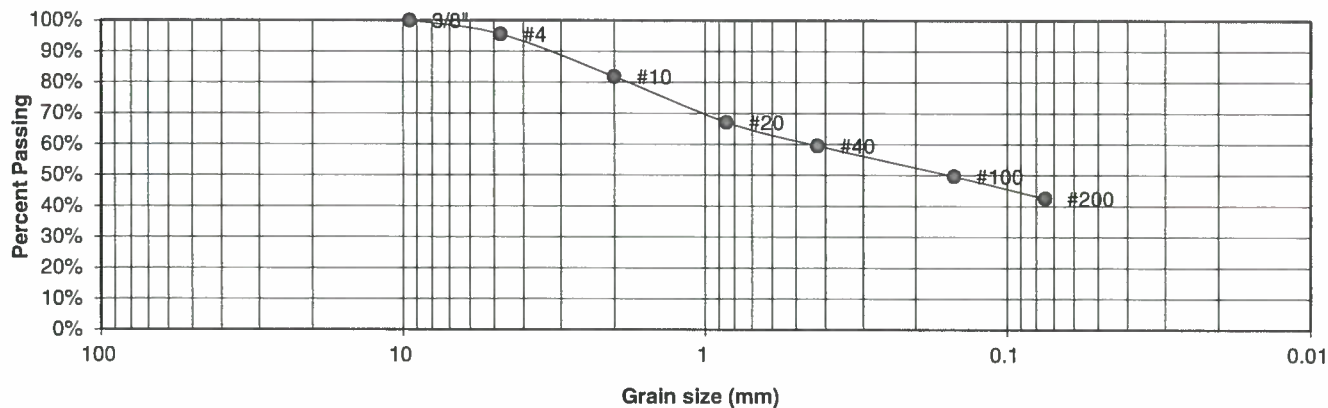
JOB NO.:  
171249

FIG NO.:

B-7

|                        |      |         |                         |
|------------------------|------|---------|-------------------------|
| UNIFIED CLASSIFICATION | SC   | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 1    | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 11   | JOB NO. | 171249                  |
| DEPTH (FT)             | 0-10 | TEST BY | BL                      |

### Sieve Analysis Grain Size Distribution



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            | 100.0%           |
| 4               | 95.5%            |
| 10              | 81.8%            |
| 20              | 67.1%            |
| 40              | 59.5%            |
| 100             | 49.7%            |
| 200             | 42.5%            |

| Atterberg<br>Limits |    |
|---------------------|----|
| Plastic Limit       | 19 |
| Liquid Limit        | 32 |
| Plastic Index       | 13 |

| Swell                     |  |
|---------------------------|--|
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED:

SCC

DATE:

11/16/17

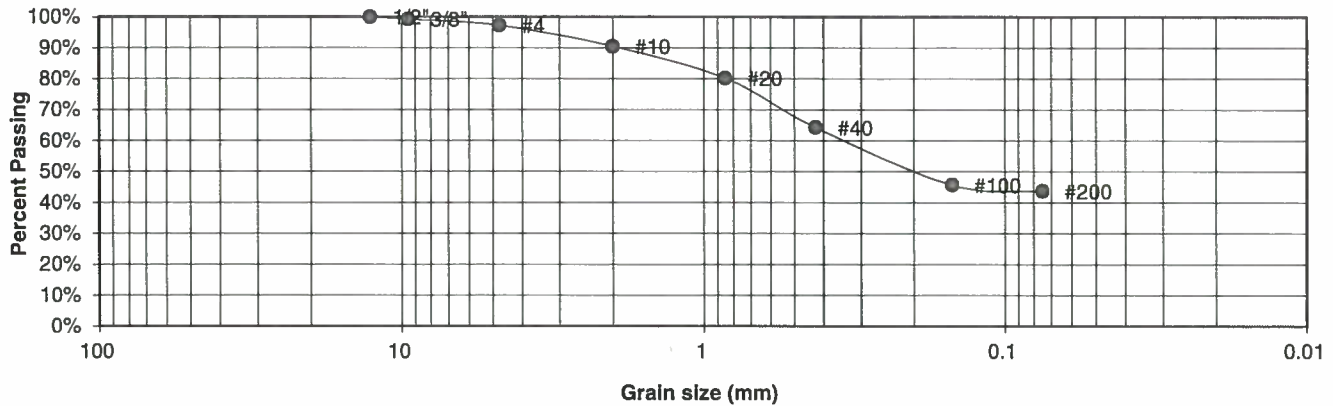
JOB NO.:  
171249

FIG NO.:

B-8

|                        |     |         |                         |
|------------------------|-----|---------|-------------------------|
| UNIFIED CLASSIFICATION | SC  | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 1   | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 13  | JOB NO. | 171249                  |
| DEPTH (FT)             | 0-3 | TEST BY | BL                      |

### Sieve Analysis Grain Size Distribution



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            | 100.0%           |
| 3/8"            | 99.3%            |
| 4               | 97.3%            |
| 10              | 90.5%            |
| 20              | 80.2%            |
| 40              | 64.3%            |
| 100             | 45.7%            |
| 200             | 43.7%            |

|                     |    |
|---------------------|----|
| Atterberg<br>Limits |    |
| Plastic Limit       | 16 |
| Liquid Limit        | 29 |
| Plastic Index       | 13 |

|                           |  |
|---------------------------|--|
| Swell                     |  |
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



**ENTECH  
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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED: *SCC*

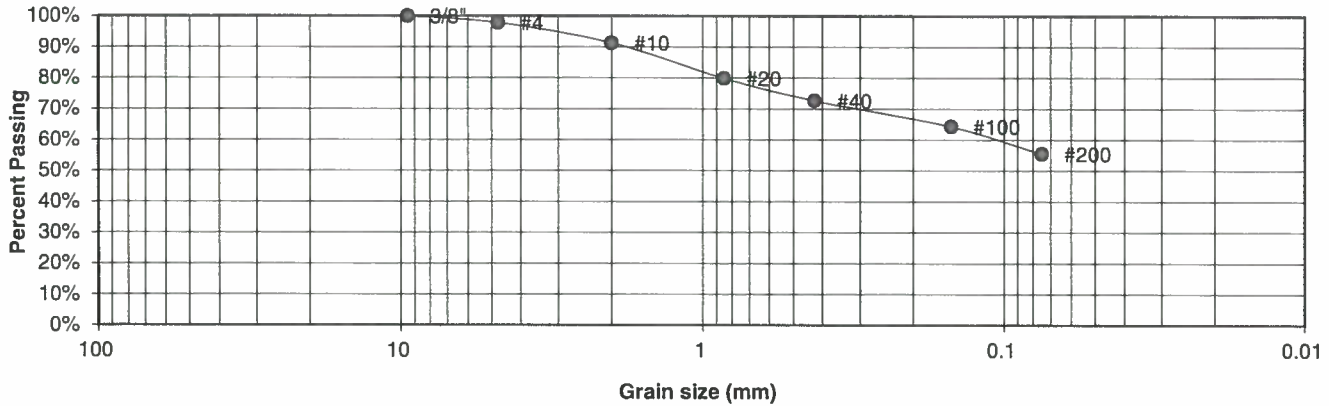
DATE: *11/16/17*

JOB NO.:  
171249

FIG NO.:  
*B-9*

|                               |       |                |                         |
|-------------------------------|-------|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | CL-ML | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 2     | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 2     | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 10    | <u>TEST BY</u> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    | 100.0%                   |
| 4                       | 97.8%                    |
| 10                      | 91.3%                    |
| 20                      | 79.9%                    |
| 40                      | 72.6%                    |
| 100                     | 64.3%                    |
| 200                     | 55.5%                    |

| <u>Atterberg<br/>Limits</u> |    |
|-----------------------------|----|
| Plastic Limit               | 19 |
| Liquid Limit                | 24 |
| Plastic Index               | 5  |

| <u>Swell</u>              |       |
|---------------------------|-------|
| Moisture at start         | 10.0% |
| Moisture at finish        | 16.4% |
| Moisture increase         | 6.4%  |
| Initial dry density (pcf) | 111   |
| Swell (psf)               | 150   |



**ENTECH  
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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

|        |       |                     |                       |
|--------|-------|---------------------|-----------------------|
| DRAWN: | DATE: | CHECKED: <i>SCC</i> | DATE: <i>11/16/17</i> |
|--------|-------|---------------------|-----------------------|

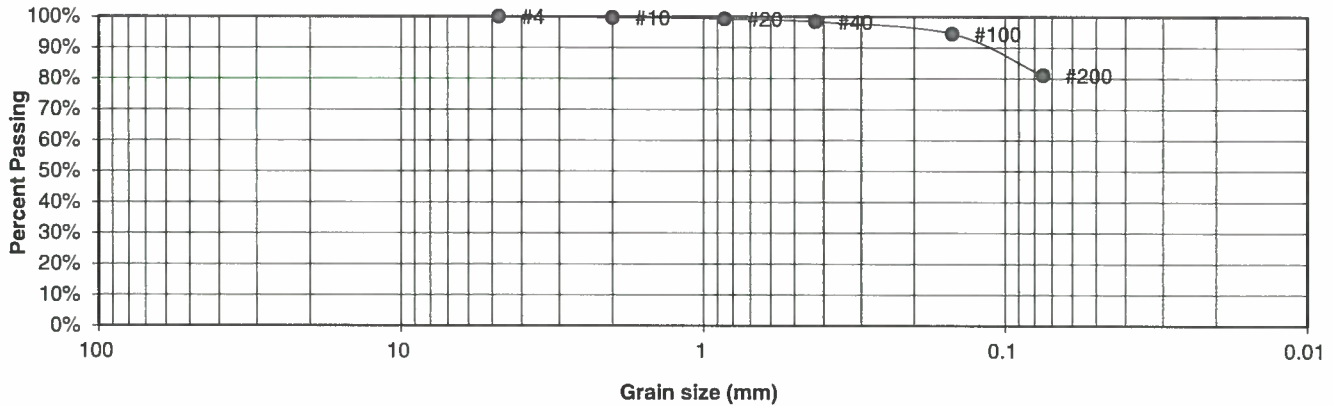
JOB NO.:  
171249

FIG NO.:  
**B-10**



|                               |     |                |                         |
|-------------------------------|-----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | CL  | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 2   | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 4   | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 2-3 | <u>TEST BY</u> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    |                          |
| 4                       | 100.0%                   |
| 10                      | 99.7%                    |
| 20                      | 99.3%                    |
| 40                      | 98.4%                    |
| 100                     | 94.5%                    |
| 200                     | 81.1%                    |

|                             |    |
|-----------------------------|----|
| <u>Atterberg<br/>Limits</u> |    |
| Plastic Limit               | 15 |
| Liquid Limit                | 31 |
| Plastic Index               | 16 |

|                           |  |
|---------------------------|--|
| <u>Swell</u>              |  |
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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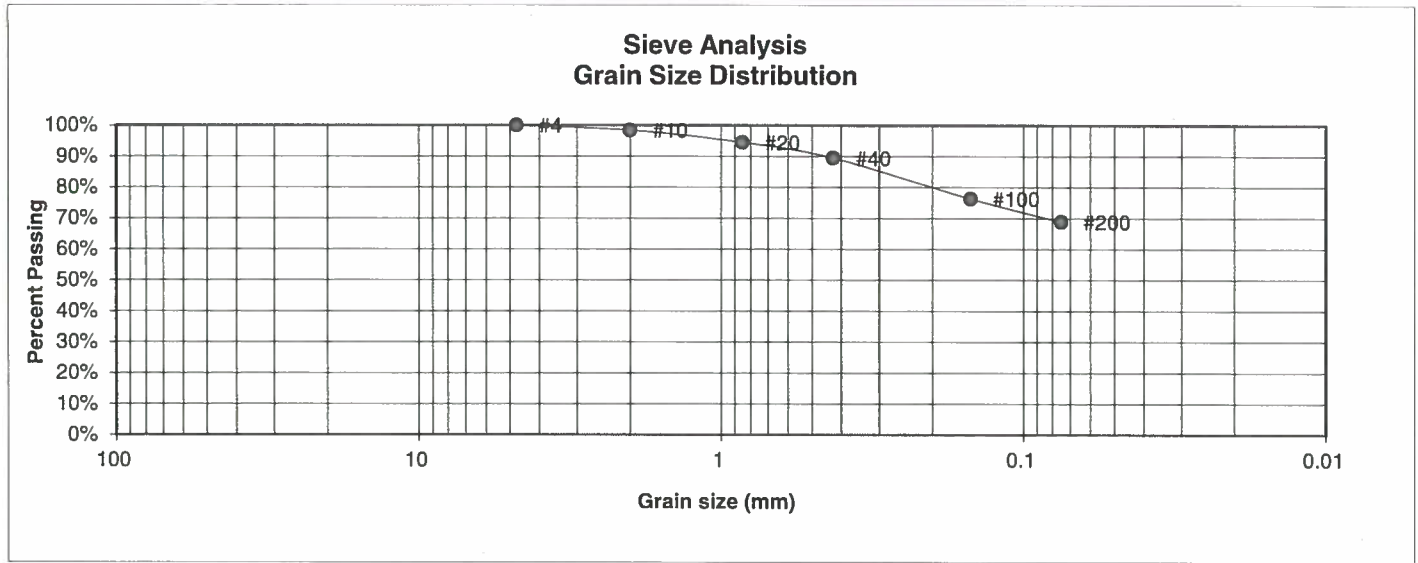
**LABORATORY TEST  
RESULTS**

|        |       |          |         |
|--------|-------|----------|---------|
| DRAWN: | DATE: | CHECKED: | DATE:   |
|        |       | SCC      | 11/6/17 |

JOB NO.:  
171249

FIG NO.:  
B-11

|                        |       |         |                         |
|------------------------|-------|---------|-------------------------|
| UNIFIED CLASSIFICATION | CL    | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 2     | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 4     | JOB NO. | 171249                  |
| DEPTH (FT)             | 25-30 | TEST BY | BL                      |



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            |                  |
| 4               | 100.0%           |
| 10              | 98.4%            |
| 20              | 94.5%            |
| 40              | 89.5%            |
| 100             | 76.4%            |
| 200             | 68.9%            |

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

Swell  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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### LABORATORY TEST RESULTS

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*11/16/17*

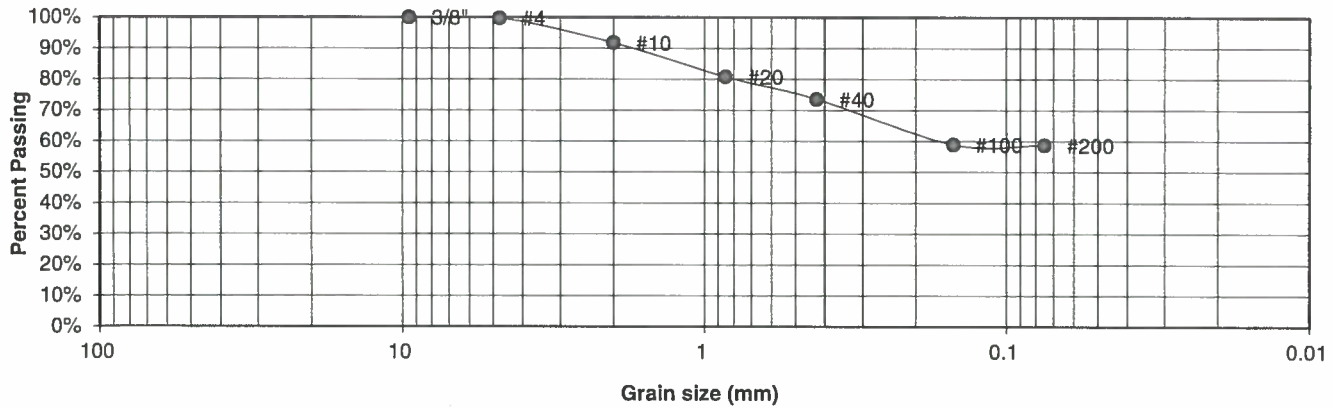
JOB NO.:  
171249

FIG NO.:

*B-12*

|                               |      |                |                         |
|-------------------------------|------|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | CL   | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 2    | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 6    | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 5-10 | <u>TEST BY</u> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    | 100.0%                   |
| 4                       | 99.7%                    |
| 10                      | 91.8%                    |
| 20                      | 80.8%                    |
| 40                      | 73.6%                    |
| 100                     | 58.9%                    |
| 200                     | 58.8%                    |

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

Swell  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

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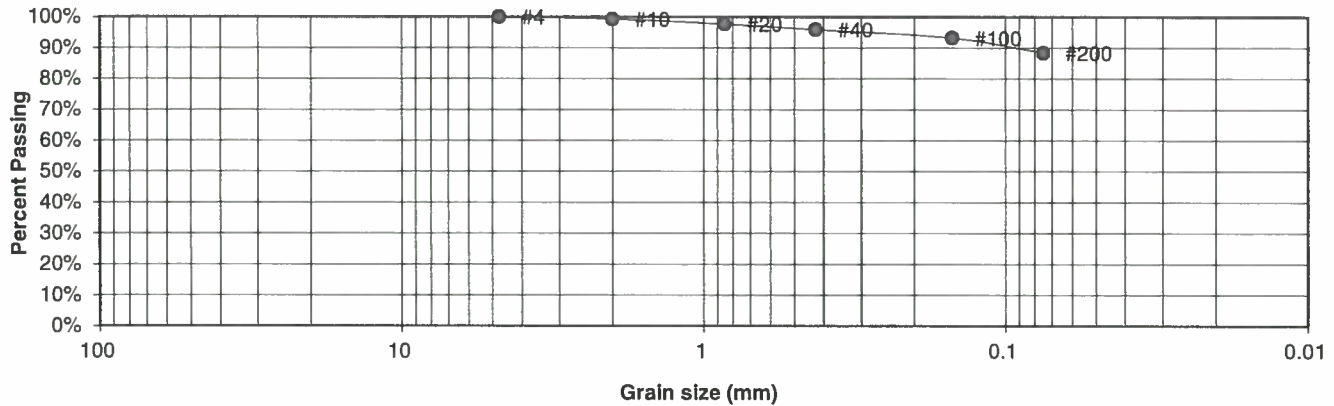
DATE: *11/16/17*

JOB NO.:  
171249

FIG NO.:  
*B-13*

|                               |    |                |                         |
|-------------------------------|----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | CL | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 2  | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 6  | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 10 | <u>TEST BY</u> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    |                          |
| 4                       | 100.0%                   |
| 10                      | 99.3%                    |
| 20                      | 97.7%                    |
| 40                      | 95.9%                    |
| 100                     | 93.2%                    |
| 200                     | 88.4%                    |

|                             |    |
|-----------------------------|----|
| <u>Atterberg<br/>Limits</u> |    |
| Plastic Limit               | 23 |
| Liquid Limit                | 42 |
| Plastic Index               | 19 |

|                           |  |
|---------------------------|--|
| <u>Swell</u>              |  |
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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**LABORATORY TEST  
RESULTS**

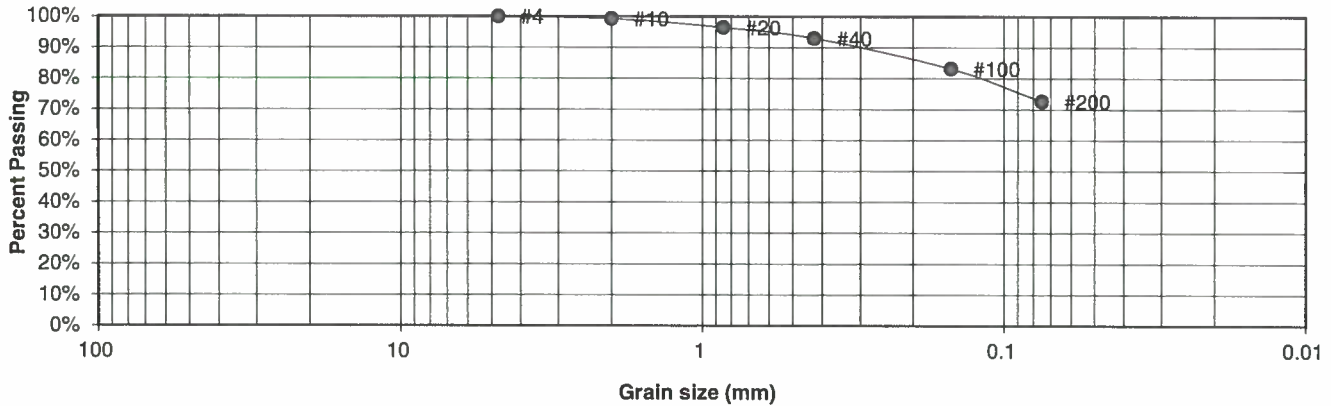
|        |       |          |          |
|--------|-------|----------|----------|
| DRAWN: | DATE: | CHECKED: | DATE:    |
|        |       | SCC      | 11/16/17 |

JOB NO.:  
171249

FIG NO.:  
B-14

|                               |     |                |                         |
|-------------------------------|-----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | CL  | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 2   | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 7   | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 2-3 | <u>TEST BY</u> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    |                          |
| 4                       | 100.0%                   |
| 10                      | 99.3%                    |
| 20                      | 96.5%                    |
| 40                      | 93.0%                    |
| 100                     | 83.2%                    |
| 200                     | 72.7%                    |

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

Swell  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

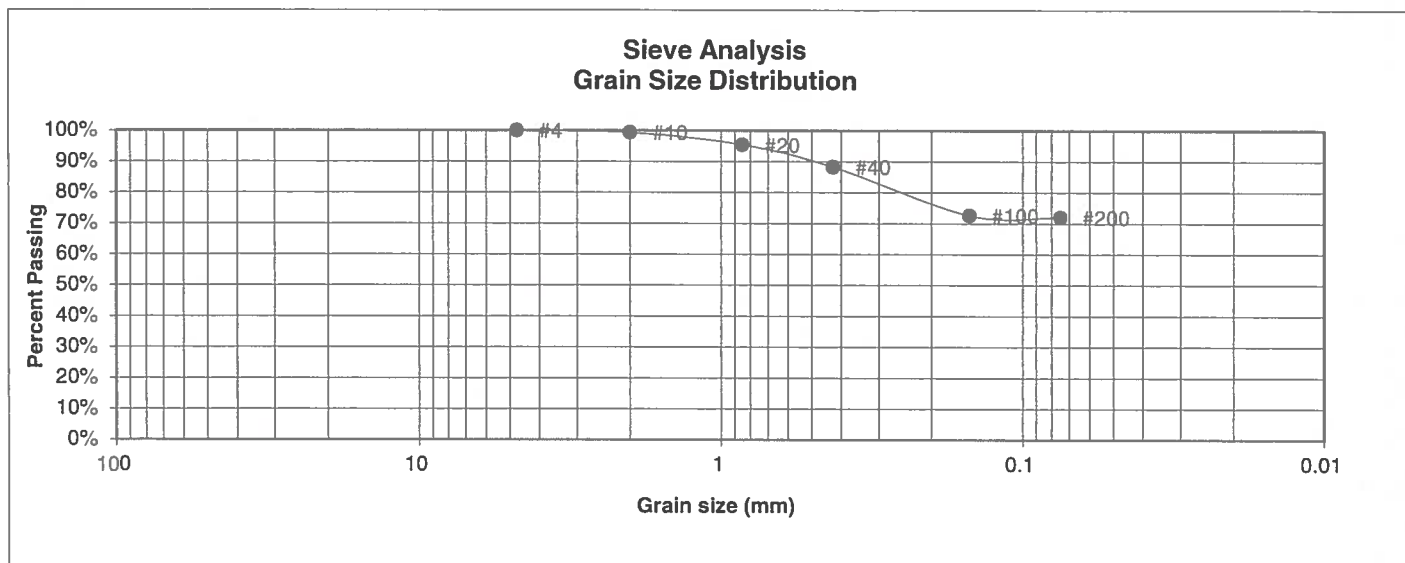
CHECKED: *SCC*

DATE: *11/6/17*

JOB NO.:  
171249

FIG NO.:  
*B-15*

|                               |     |                |                         |
|-------------------------------|-----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | CL  | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 2   | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 8   | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 0-5 | <u>TEST BY</u> | BL                      |



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    |                          |
| 4                       | 100.0%                   |
| 10                      | 99.4%                    |
| 20                      | 95.4%                    |
| 40                      | 88.3%                    |
| 100                     | 72.6%                    |
| 200                     | 72.0%                    |

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

Swell  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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### LABORATORY TEST RESULTS

DRAWN:

DATE:

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SCC

DATE:

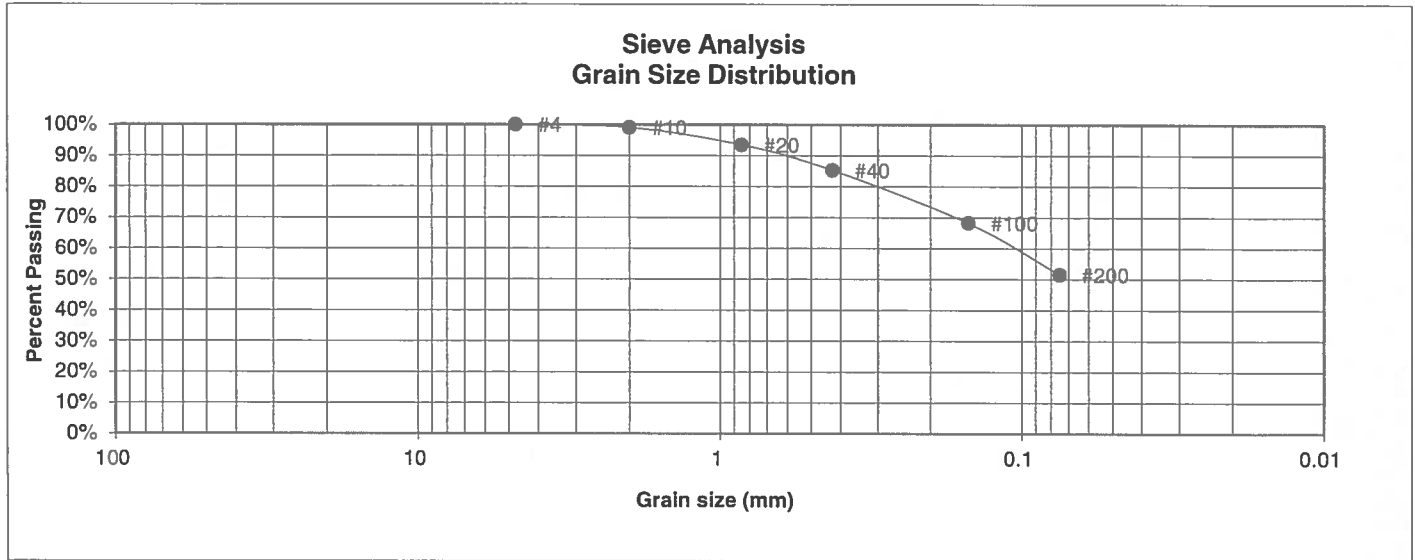
11/16/17

JOB NO.:  
171249

FIG NO.:

B-16

|                               |    |                |                         |
|-------------------------------|----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | CL | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 2  | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 8  | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 5  | <u>TEST BY</u> | BL                      |



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    |                          |
| 4                       | 100.0%                   |
| 10                      | 99.1%                    |
| 20                      | 93.5%                    |
| 40                      | 85.3%                    |
| 100                     | 68.2%                    |
| 200                     | 51.6%                    |

|                             |    |
|-----------------------------|----|
| <u>Atterberg<br/>Limits</u> |    |
| Plastic Limit               | 15 |
| Liquid Limit                | 26 |
| Plastic Index               | 11 |

|                           |  |
|---------------------------|--|
| <u>Swell</u>              |  |
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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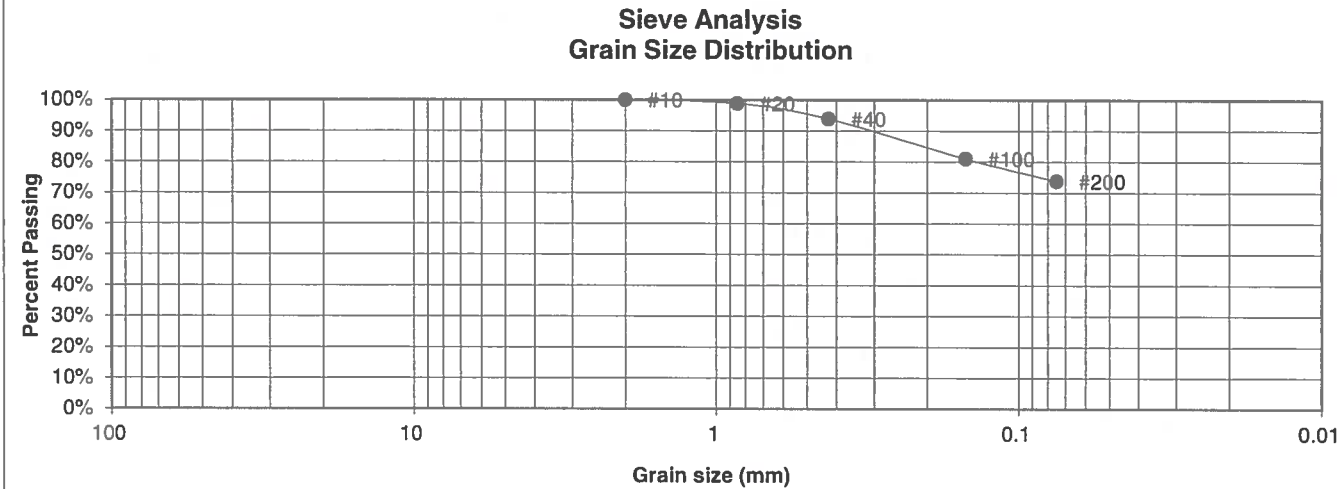
### LABORATORY TEST RESULTS

|        |       |          |          |
|--------|-------|----------|----------|
| DRAWN: | DATE: | CHECKED: | DATE:    |
|        |       | SCC      | 11/16/17 |

JOB NO.:  
171249

FIG NO.:  
B-17

|                        |    |         |                         |
|------------------------|----|---------|-------------------------|
| UNIFIED CLASSIFICATION | CL | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 2  | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 8  | JOB NO. | 171249                  |
| DEPTH (FT)             | 15 | TEST BY | BL                      |



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            |                  |
| 4               |                  |
| 10              | 100.0%           |
| 20              | 98.9%            |
| 40              | 93.9%            |
| 100             | 81.0%            |
| 200             | 73.8%            |

|               |    |
|---------------|----|
| Atterberg     |    |
| Limits        |    |
| Plastic Limit | 13 |
| Liquid Limit  | 28 |
| Plastic Index | 15 |

|                           |  |
|---------------------------|--|
| Swell                     |  |
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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**LABORATORY TEST  
RESULTS**

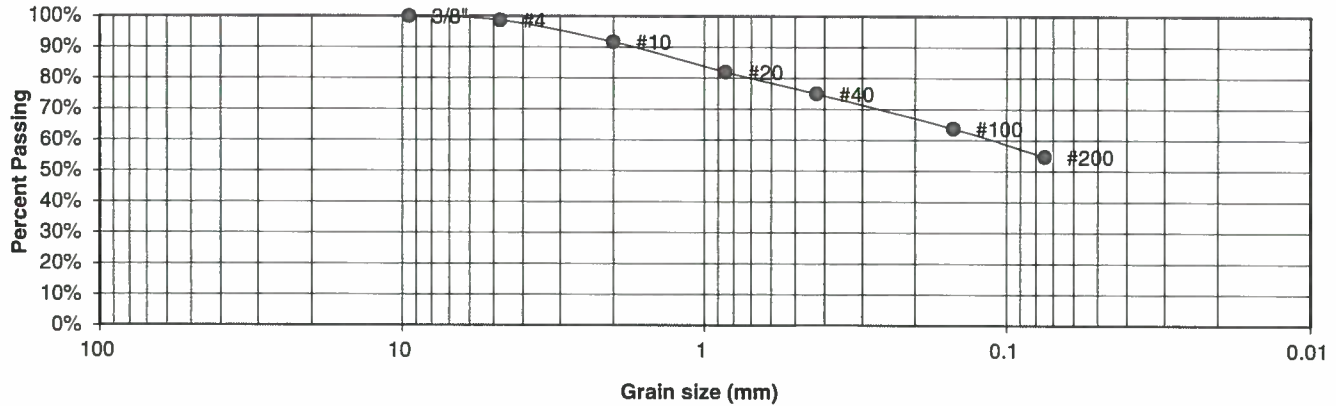
|        |       |                     |                       |
|--------|-------|---------------------|-----------------------|
| DRAWN: | DATE: | CHECKED: <i>SCC</i> | DATE: <i>11/16/17</i> |
|--------|-------|---------------------|-----------------------|

JOB NO.:  
171249  
  
FIG NO.:  
*B-18*



|                               |     |                |                         |
|-------------------------------|-----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | CL  | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 2   | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 9   | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 1-5 | <u>TEST BY</u> | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    | 100.0%                   |
| 4                       | 98.7%                    |
| 10                      | 91.7%                    |
| 20                      | 81.9%                    |
| 40                      | 75.0%                    |
| 100                     | 63.8%                    |
| 200                     | 54.7%                    |

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

Swell  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

CHECKED: *SCC*

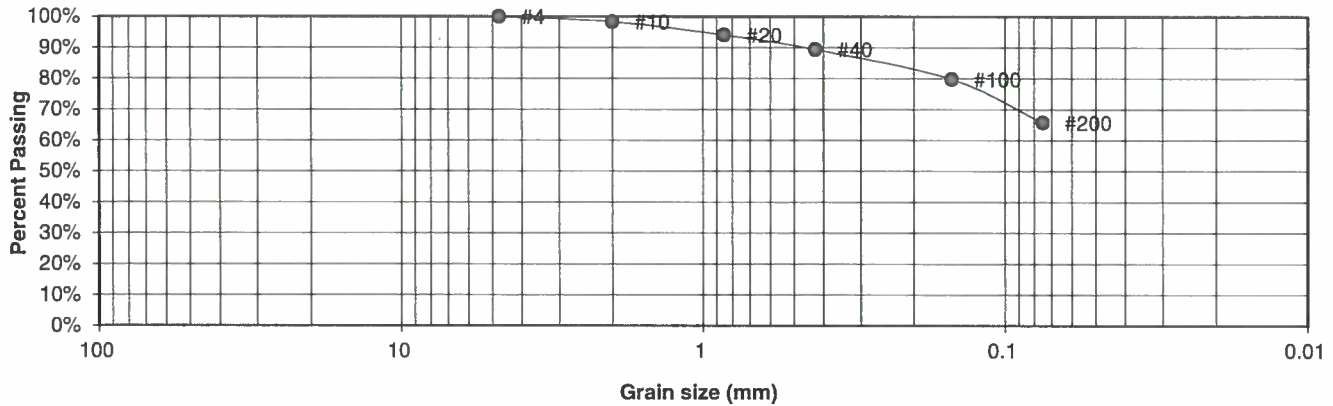
DATE: *11/16/17*

JOB NO.:  
171249

FIG NO.:  
*B-19*

|                        |     |         |                         |
|------------------------|-----|---------|-------------------------|
| UNIFIED CLASSIFICATION | CL  | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 2   | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 12  | JOB NO. | 171249                  |
| DEPTH (FT)             | 1-8 | TEST BY | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            |                  |
| 4               | 100.0%           |
| 10              | 98.3%            |
| 20              | 94.1%            |
| 40              | 89.4%            |
| 100             | 79.8%            |
| 200             | 65.8%            |

| Atterberg<br>Limits |    |
|---------------------|----|
| Plastic Limit       | 10 |
| Liquid Limit        | 29 |
| Plastic Index       | 19 |

| Swell                     |  |
|---------------------------|--|
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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**LABORATORY TEST  
RESULTS**

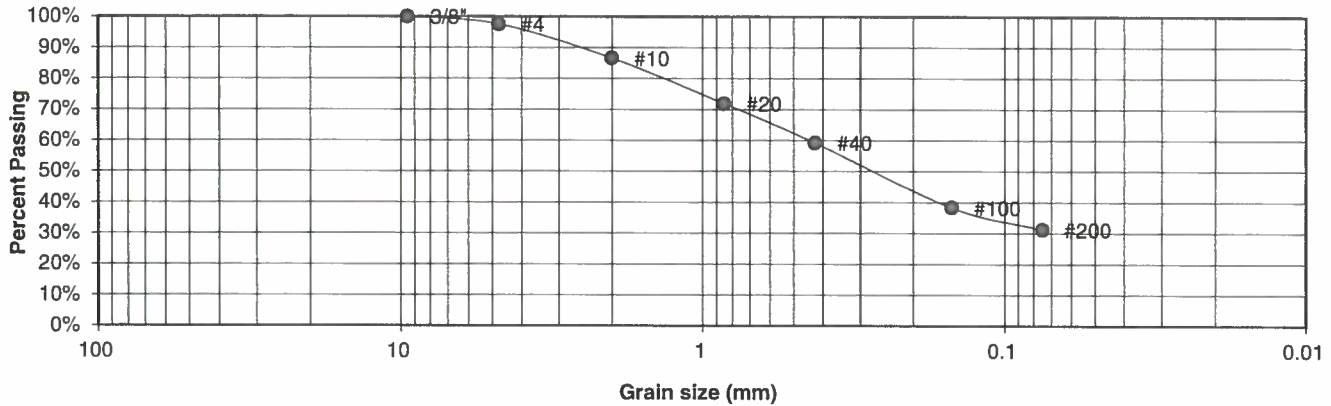
|        |       |                     |                      |
|--------|-------|---------------------|----------------------|
| DRAWN: | DATE: | CHECKED: <i>SCC</i> | DATE: <i>1/16/17</i> |
|--------|-------|---------------------|----------------------|

JOB NO.:  
171249

FIG NO.:  
*B-20*

|                        |       |         |                         |
|------------------------|-------|---------|-------------------------|
| UNIFIED CLASSIFICATION | SC    | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 3     | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 1     | JOB NO. | 171249                  |
| DEPTH (FT)             | 15-20 | TEST BY | BL                      |

**Sieve Analysis  
Grain Size Distribution**



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            | 100.0%           |
| 4               | 97.6%            |
| 10              | 86.6%            |
| 20              | 71.9%            |
| 40              | 59.2%            |
| 100             | 38.3%            |
| 200             | 31.3%            |

**Atterberg  
Limits**  
Plastic Limit  
Liquid Limit  
Plastic Index

**Swell**  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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505 ELKTON DRIVE  
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**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

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*SCC*

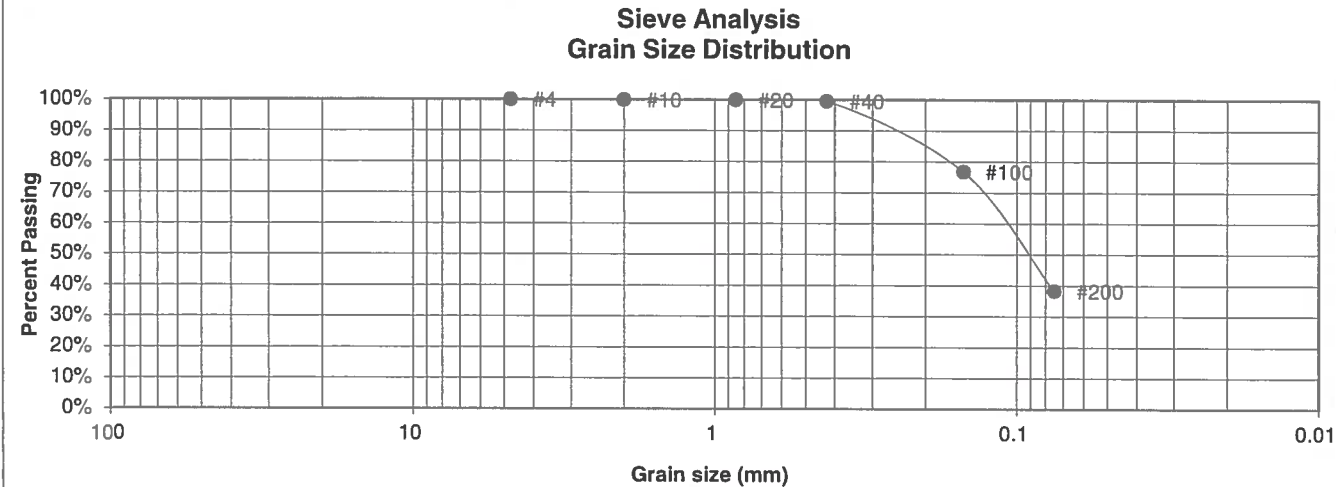
DATE:

*11/16/17*

JOB NO.:  
171249

FIG NO.:  
*B-21*

|                        |    |         |                         |
|------------------------|----|---------|-------------------------|
| UNIFIED CLASSIFICATION | SC | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 3  | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 1  | JOB NO. | 171249                  |
| DEPTH (FT)             | 20 | TEST BY | BL                      |



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            |                  |
| 4               | 100.0%           |
| 10              | 99.9%            |
| 20              | 99.9%            |
| 40              | 99.5%            |
| 100             | 76.7%            |
| 200             | 38.2%            |

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

Swell  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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505 ELKTON DRIVE  
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LABORATORY TEST  
RESULTS

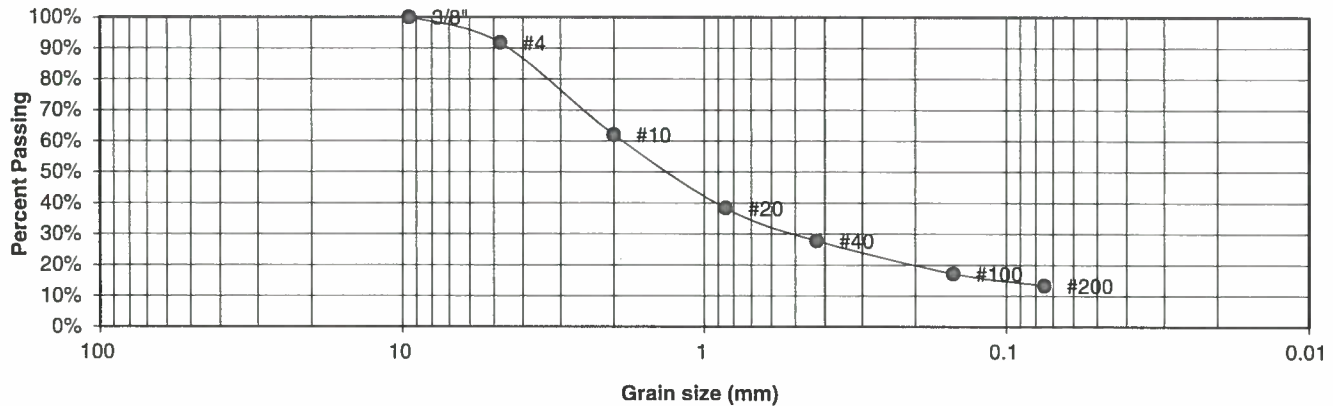
|        |       |                     |                      |
|--------|-------|---------------------|----------------------|
| DRAWN: | DATE: | CHECKED: <i>SCC</i> | DATE: <i>11/6/17</i> |
|--------|-------|---------------------|----------------------|

JOB NO.:  
171249  
  
FIG NO.:  
*B-22*

|                        |    |
|------------------------|----|
| UNIFIED CLASSIFICATION | SM |
| SOIL TYPE #            | 3  |
| TEST BORING #          | 2  |
| DEPTH (FT)             | 20 |

|         |                         |
|---------|-------------------------|
| CLIENT  | PULPIT ROCK, LLC        |
| PROJECT | FLYING HORSE NORTH, DAM |
| JOB NO. | 171249                  |
| TEST BY | BL                      |

### Sieve Analysis Grain Size Distribution



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            | 100.0%           |
| 4               | 91.8%            |
| 10              | 62.0%            |
| 20              | 38.3%            |
| 40              | 27.8%            |
| 100             | 17.2%            |
| 200             | 13.3%            |

|                         |    |
|-------------------------|----|
| <u>Atterberg Limits</u> |    |
| Plastic Limit           | 31 |
| Liquid Limit            | 42 |
| Plastic Index           | 11 |

|                           |  |
|---------------------------|--|
| <u>Swell</u>              |  |
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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### LABORATORY TEST RESULTS

DRAWN:

DATE:

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DATE:

*SCC*

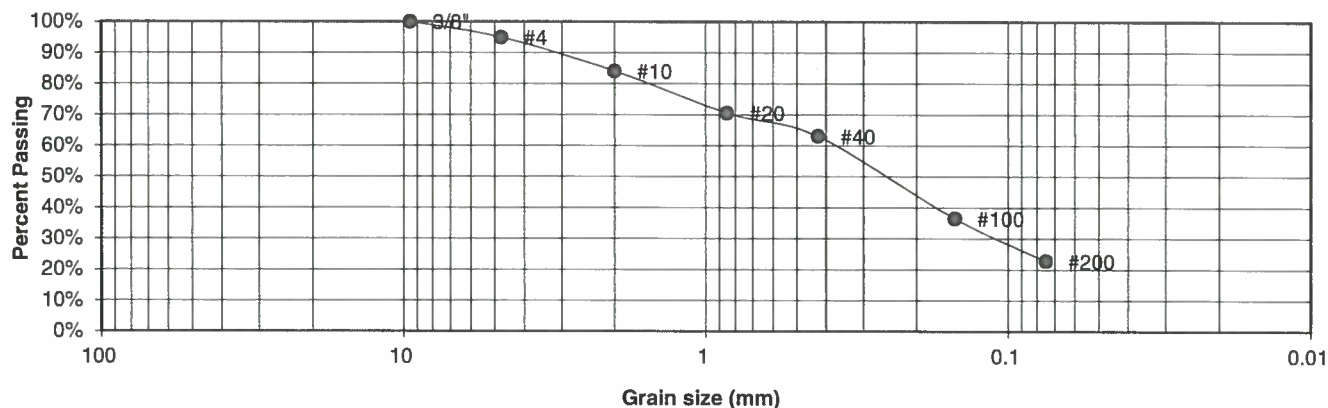
*11/16/17*

JOB NO.:  
171249

FIG NO.:  
**B-23**

|                        |       |         |                         |
|------------------------|-------|---------|-------------------------|
| UNIFIED CLASSIFICATION | SC-SM | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 3     | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 4     | JOB NO. | 171249                  |
| DEPTH (FT)             | 10    | TEST BY | BL                      |

### Sieve Analysis Grain Size Distribution



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            | 100.0%           |
| 4               | 94.9%            |
| 10              | 84.1%            |
| 20              | 70.6%            |
| 40              | 63.0%            |
| 100             | 36.6%            |
| 200             | 22.8%            |

|                     |    |
|---------------------|----|
| Atterberg<br>Limits |    |
| Plastic Limit       | 20 |
| Liquid Limit        | 27 |
| Plastic Index       | 7  |

|                           |  |
|---------------------------|--|
| Swell                     |  |
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

SCC

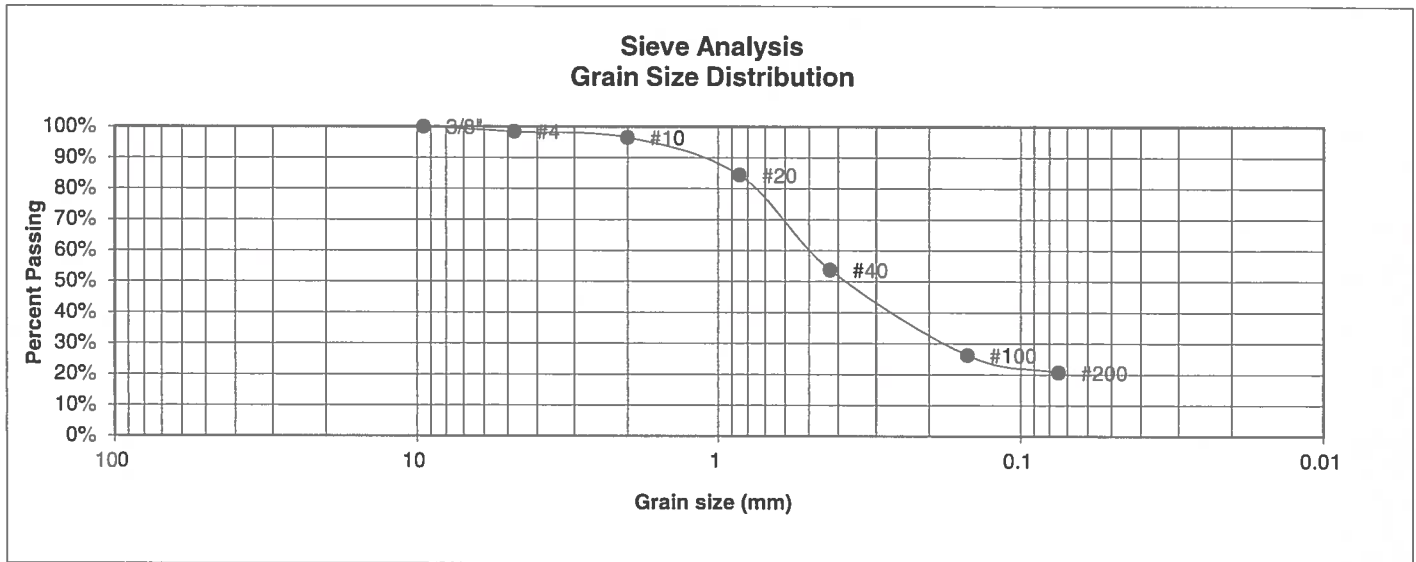
11/16/17

JOB NO.:  
171249

FIG NO.:

B-24

|                               |    |                |                         |
|-------------------------------|----|----------------|-------------------------|
| <u>UNIFIED CLASSIFICATION</u> | SM | <u>CLIENT</u>  | PULPIT ROCK, LLC        |
| <u>SOIL TYPE #</u>            | 3  | <u>PROJECT</u> | FLYING HORSE NORTH, DAM |
| <u>TEST BORING #</u>          | 4  | <u>JOB NO.</u> | 171249                  |
| <u>DEPTH (FT)</u>             | 40 | <u>TEST BY</u> | BL                      |



| <u>U.S.<br/>Sieve #</u> | <u>Percent<br/>Finer</u> |
|-------------------------|--------------------------|
| 3"                      |                          |
| 1 1/2"                  |                          |
| 3/4"                    |                          |
| 1/2"                    |                          |
| 3/8"                    | 100.0%                   |
| 4                       | 98.4%                    |
| 10                      | 96.5%                    |
| 20                      | 84.4%                    |
| 40                      | 53.7%                    |
| 100                     | 26.3%                    |
| 200                     | 20.6%                    |

| <u>Atterberg<br/>Limits</u> |    |
|-----------------------------|----|
| Plastic Limit               | NP |
| Liquid Limit                | NV |
| Plastic Index               | NP |

| <u>Swell</u>              |
|---------------------------|
| Moisture at start         |
| Moisture at finish        |
| Moisture increase         |
| Initial dry density (pcf) |
| Swell (psf)               |



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### LABORATORY TEST RESULTS

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*11/16/17*

JOB NO.:  
171249

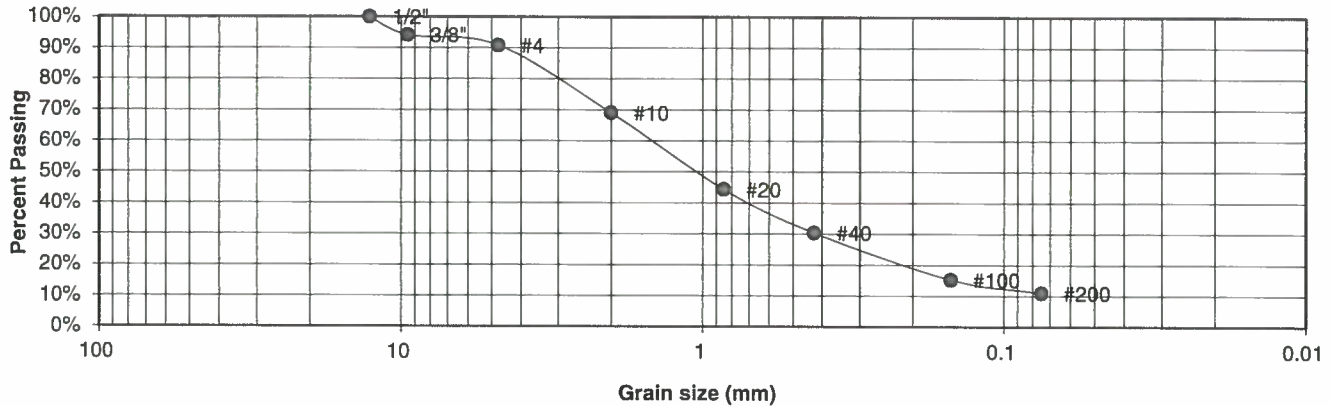
FIG NO.:

**B-25**

|                               |       |
|-------------------------------|-------|
| <b>UNIFIED CLASSIFICATION</b> | SM-SW |
| <b>SOIL TYPE #</b>            | 3     |
| <b>TEST BORING #</b>          | 5     |
| <b>DEPTH (FT)</b>             | 25    |

|                |                         |
|----------------|-------------------------|
| <b>CLIENT</b>  | PULPIT ROCK, LLC        |
| <b>PROJECT</b> | FLYING HORSE NORTH, DAM |
| <b>JOB NO.</b> | 171249                  |
| <b>TEST BY</b> | BL                      |

### Sieve Analysis Grain Size Distribution



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            | 100.0%           |
| 3/8"            | 94.2%            |
| 4               | 90.8%            |
| 10              | 69.0%            |
| 20              | 44.3%            |
| 40              | 30.4%            |
| 100             | 15.3%            |
| 200             | 11.0%            |

**Atterberg  
Limits**  
Plastic Limit  
Liquid Limit  
Plastic Index

**Swell**  
Moisture at start  
Moisture at finish  
Moisture increase  
Initial dry density (pcf)  
Swell (psf)



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

*SCC*

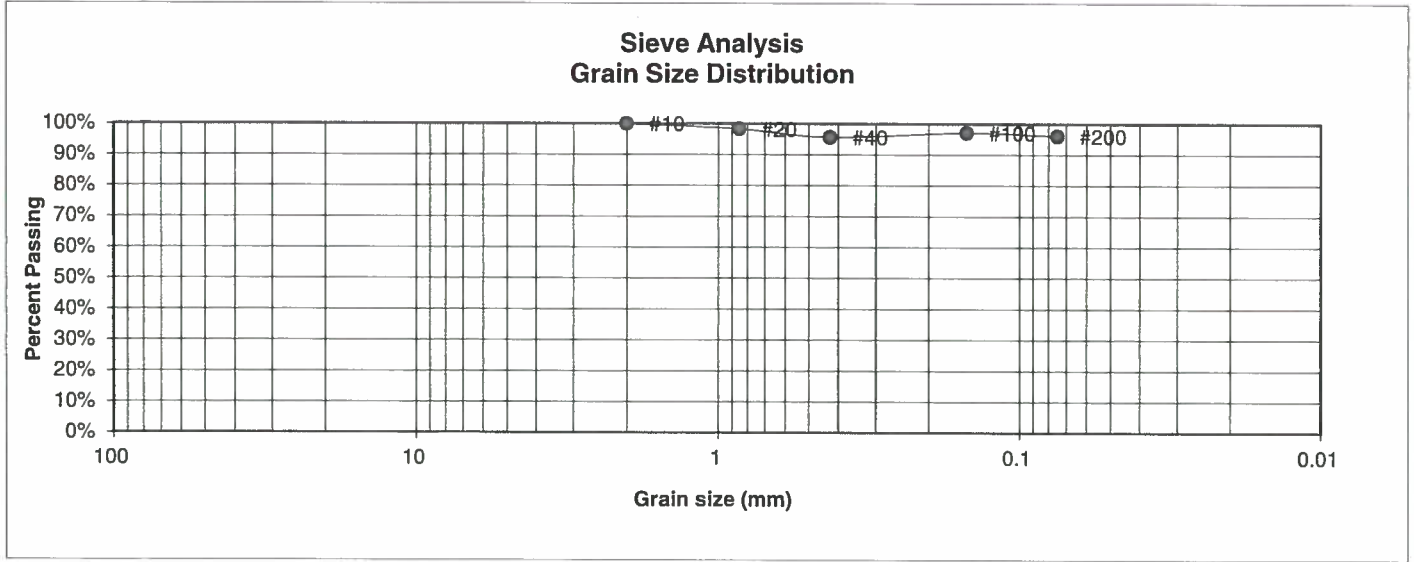
*11/16/17*

JOB NO.:  
171249

FIG NO.:  
**B-26**



|                        |    |         |                         |
|------------------------|----|---------|-------------------------|
| UNIFIED CLASSIFICATION | CL | CLIENT  | PULPIT ROCK, LLC        |
| SOIL TYPE #            | 4  | PROJECT | FLYING HORSE NORTH, DAM |
| TEST BORING #          | 3  | JOB NO. | 171249                  |
| DEPTH (FT)             | 15 | TEST BY | BL                      |



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            |                  |
| 4               |                  |
| 10              | 100.0%           |
| 20              | 98.3%            |
| 40              | 95.7%            |
| 100             | 97.1%            |
| 200             | 96.0%            |

|                         |    |
|-------------------------|----|
| <u>Atterberg Limits</u> |    |
| Plastic Limit           | 26 |
| Liquid Limit            | 49 |
| Plastic Index           | 23 |

|                           |  |
|---------------------------|--|
| <u>Swell</u>              |  |
| Moisture at start         |  |
| Moisture at finish        |  |
| Moisture increase         |  |
| Initial dry density (pcf) |  |
| Swell (psf)               |  |



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

|        |       |                     |                       |
|--------|-------|---------------------|-----------------------|
| DRAWN: | DATE: | CHECKED: <i>SCC</i> | DATE: <i>11/16/17</i> |
|--------|-------|---------------------|-----------------------|

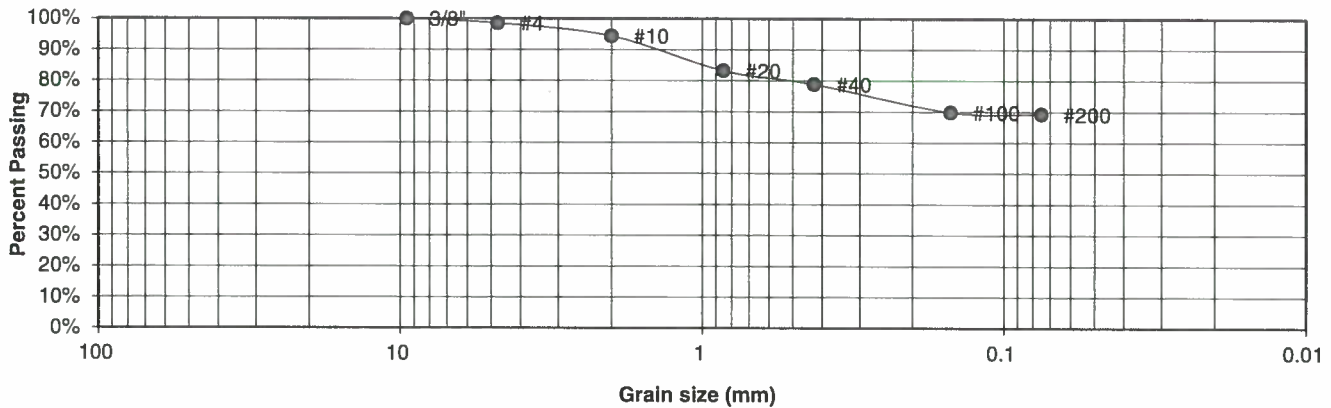
JOB NO.:  
171249

FIG NO.:  
*B-27*

UNIFIED CLASSIFICATION CL  
 SOIL TYPE # 4  
 TEST BORING # 6  
 DEPTH (FT) 40

CLIENT PULPIT ROCK, LLC  
 PROJECT FLYING HORSE NORTH, DAM  
 JOB NO. 171249  
 TEST BY BL

**Sieve Analysis  
 Grain Size Distribution**



| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            | 100.0%           |
| 4               | 98.6%            |
| 10              | 94.4%            |
| 20              | 83.2%            |
| 40              | 78.8%            |
| 100             | 69.9%            |
| 200             | 69.3%            |

Atterberg  
Limits  
 Plastic Limit 18  
 Liquid Limit 37  
 Plastic Index 19

Swell  
 Moisture at start  
 Moisture at finish  
 Moisture increase  
 Initial dry density (pcf)  
 Swell (psf)



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
 RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

*SCC*

*11/6/17*

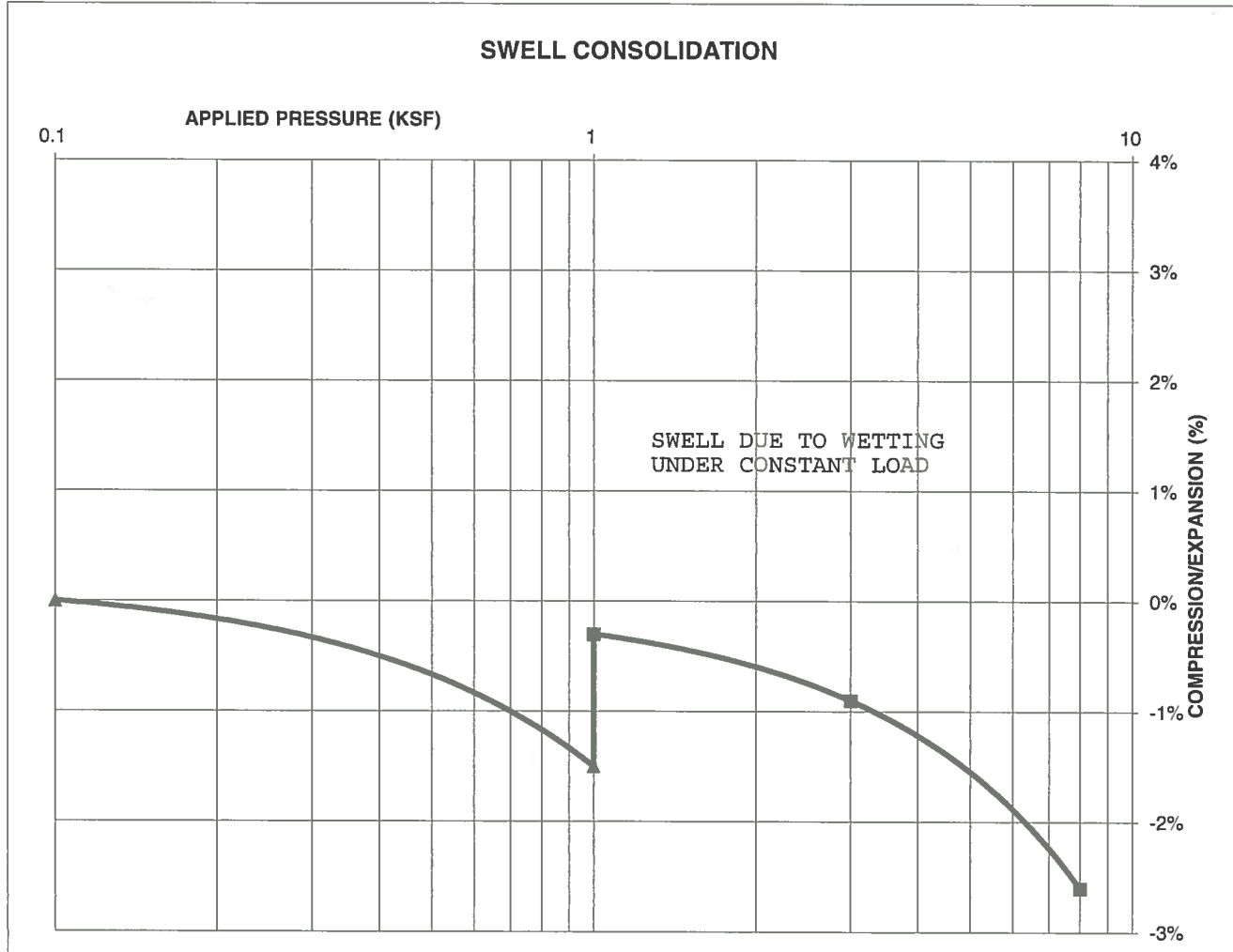
JOB NO.:  
 171249

FIG NO.:  
**B-28**

# **CONSOLIDATION TEST RESULTS**

|                               |    |           |       |
|-------------------------------|----|-----------|-------|
| TEST BORING #                 | 6  | DEPTH(ft) | 10    |
| DESCRIPTION                   | CL | SOIL TYPE | 2     |
| NATURAL UNIT DRY WEIGHT (PCF) |    |           | 108   |
| NATURAL MOISTURE CONTENT      |    |           | 17.3% |
| SWELL/CONSOLIDATION (%)       |    |           | 1.2%  |

JOB NO. 171249  
 CLIENT PULPIT ROCK, LLC  
 PROJECT FLYING HORSE NORTH, DAM



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

## **SWELL CONSOLIDATION TEST RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

*SCC*

*1/16/17*

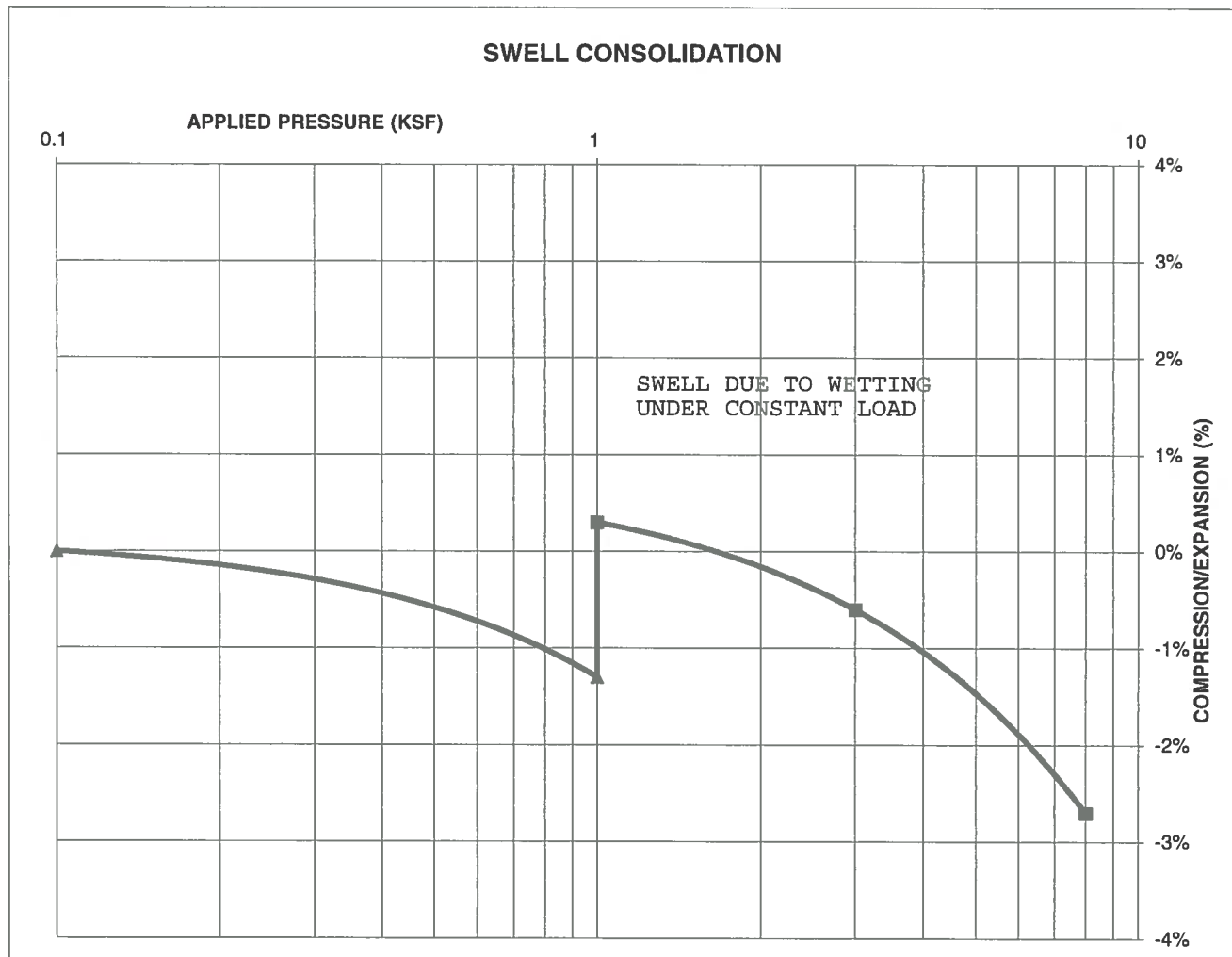
JOB NO.:  
171249

FIG NO.:  
**B-29**

# **CONSOLIDATION TEST RESULTS**

|                               |       |           |    |
|-------------------------------|-------|-----------|----|
| TEST BORING #                 | 3     | DEPTH(ft) | 15 |
| DESCRIPTION                   | CL    | SOIL TYPE | 4  |
| NATURAL UNIT DRY WEIGHT (PCF) | 109   |           |    |
| NATURAL MOISTURE CONTENT      | 16.8% |           |    |
| SWELL/CONSOLIDATION (%)       | 1.6%  |           |    |

JOB NO. 171249  
 CLIENT PULPIT ROCK, LLC  
 PROJECT FLYING HORSE NORTH, DAM



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

## **SWELL CONSOLIDATION TEST RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

*SCC*

*11/16/17*

JOB NO.:  
171249

FIG NO.:  
**B-30**

## **APPENDIX C: Additional Laboratory Test Results**

---



JOB # 171249  
CLIENT PULPIT ROCK, LLC  
PROJECT FLYING HORSE NORTH, DAM  
LOCATION FLYING HORSE NORTH, DAM

DATE 9/8/2017

BY BL

| SAMPLE LOCATION | UNIFIED CLASS. | RESISTIVITY, (ohm-cm) | pH  |
|-----------------|----------------|-----------------------|-----|
| TB-1 @ 2-3'     | SM             | 14706                 | 6.0 |
| TB-5 @ 15'      | SM-SW          | >20000                | 6.1 |
| TB-2 @ 20'      | CL-ML          | >20000                | 5.9 |
| TB-3 @ 15'      | CL             | >20000                | 5.8 |
| TB-1 @ 20'      | SC             | >20000                | 6.1 |
| TB-7 @ 2-3'     | CL             | 17857                 | 5.9 |
| TB-13 @ 0-3'    | SC             | 16129                 | 5.9 |
|                 |                |                       |     |
|                 |                |                       |     |
|                 |                |                       |     |
|                 |                |                       |     |

NOTES: All analysis QC checks passed



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**pH & RESISTIVITY  
REPORT**

DRAWN:

DATE:

CHECKED:

DATE:

*SXC*

*11/16/17*

JOB NO.:  
171249

FIG NO.:

*C-2*

# PERMEABILITY WORKSHEET

CLIENT PULPIT ROCK, LLC  
 PROJECT FLYING HORSE NORTH, DAM  
 LOCATION TB-6 @ 5-10'

PROCTOR % MC 13.50%  
 PROCTOR DENSITY 115.5  
 TARGET COMPACTION 95%

JOB # 171249  
 DATE 10/06/17  
 TEST BY BL

|                       |        |                   |       |                 |            |        |              |       |
|-----------------------|--------|-------------------|-------|-----------------|------------|--------|--------------|-------|
| INITIAL SAMPLE + MOLD | 7104   | AREA OF SAMPLE    | 81.07 | cm <sup>2</sup> | DISH WT.   | 266.24 | FINAL % MC   | 19.8% |
| MOLD WT.              | 5400   | HT. OF SAMPLE     | 10.45 | cm              | DISH + WET | 384.24 | WHOLE SAMPLE |       |
| INITIAL SAMPLE WT.    | 1704   | VOL. OF SAMPLE    | 847   | cm <sup>3</sup> | DISH + DRY | 364.71 |              |       |
| INITIAL SAMPLE % MC   | 13.50% | AREA OF TUBING    | 0.7   | cm <sup>2</sup> | DISH WT.   | 261.32 | FINAL % MC   | 23.2% |
| INIT. SAMPLE DENSITY  | 110.67 | FINAL SAMPLE+MOLD |       |                 | DISH + WET | 299.23 | BOTTOM 1"    |       |
| INITIAL % COMPACTION  | 95.8   | FINAL SAMPLE % MC | 19.8% |                 | DISH + DRY | 292.10 |              |       |

## FALLING HEAD DATA

| STARTING |      |        |       | ENDING |      |        |       | SECONDS | cc<br>OUTFLOW | cc<br>INFLOW | TEMP<br>°C | k <sub>T</sub> | k <sub>20</sub> |
|----------|------|--------|-------|--------|------|--------|-------|---------|---------------|--------------|------------|----------------|-----------------|
| DATE     | TIME | HEIGHT | CATCH | DATE   | TIME | HEIGHT | CATCH |         |               |              |            |                |                 |
| 10/6     | 1214 | 523    | 0.00  | 10/6   | 1314 | 518    | 0.00  | 3600    | 0.0           | 3.5          | 21         | 2.41E-07       | 2.42E-07        |
| 10/6     | 1314 | 518    | 0.00  | 10/6   | 1357 | 511    | 0.00  | 1548    | 0.0           | 4.9          | 21         | 7.93E-07       | 7.97E-07        |
| 10/6     | 1357 | 511    | 0.00  | 10/6   | 1600 | 496    | 2.00  | 8748    | 2.0           | 10.5         | 21         | 3.07E-07       | 3.09E-07        |
| 10/6     | 1600 | 496    | 2.00  | 10/7   | 1100 | 454    | 6.00  | 68400   | 4.0           | 29.4         | 21         | 1.17E-07       | 1.17E-07        |
| 10/7     | 1100 | 454    | 6.00  | 10/9   | 800  | 342    | 12.00 | 162000  | 6.0           | 78.4         | 21         | 1.58E-07       | 1.59E-07        |
| 10/9     | 800  | 342    | 12.00 | 10/9   | 1100 | 336    | 13.00 | 10800   | 1.0           | 4.2          | 21         | 1.48E-07       | 1.49E-07        |
|          |      |        |       |        |      |        |       |         |               |              |            |                |                 |
|          |      |        |       |        |      |        |       |         |               |              |            |                |                 |
|          |      |        |       |        |      |        |       |         |               |              |            |                |                 |
|          |      |        |       |        |      |        |       |         |               |              |            |                |                 |
|          |      |        |       |        |      |        |       |         |               |              |            |                |                 |
|          |      |        |       |        |      |        |       |         |               |              |            |                |                 |
|          |      |        |       |        |      |        |       |         |               |              |            |                |                 |
|          |      |        |       |        |      |        |       |         |               |              |            |                |                 |

Calculations based on:  
 Bowles, Joseph E.; "Physical and Geotechnical Properties of Soils," 2nd Edition, 1984



# PERMEABILITY WORKSHEET

|                       |                         |         |              |
|-----------------------|-------------------------|---------|--------------|
| CLIENT                | PULPIT ROCK, LLC        | JOB #   | 171249       |
| PROJECT               | FLYING HORSE NORTH, DAM | DATE    | 11/10/17     |
| LOCATION              | TB-13 @ 0-3'            | TEST BY | BL           |
| INITIAL SAMPLE + MOLD | 7123                    | 261.36  | FINAL % MC   |
| MOLD WT.              | 5400                    | 322.45  | WHOLE SAMPLE |
| INITIAL SAMPLE WT.    | 1723                    | 314.63  |              |
| INITIAL SAMPLE % MC   | 13.50%                  | 266.45  | FINAL % MC   |
| INIT. SAMPLE DENSITY  | 111.90 Dry (PCF)        | 313.96  | BOTTOM 1"    |
| INITIAL % COMPACTION  | 96.0                    | 305.21  |              |
| AREA OF SAMPLE        | 81.07 cm <sup>2</sup>   |         | DISH WT.     |
| HT. OF SAMPLE         | 10.45 cm                |         | DISH + WET   |
| VOL. OF SAMPLE        | 847 cm <sup>3</sup>     |         | DISH + DRY   |
| AREA OF TUBING        | 0.7 cm <sup>2</sup>     |         | DISH WT.     |
| FINAL SAMPLE+MOLD     |                         |         | DISH + WET   |
| FINAL SAMPLE % MC     | 14.7%                   |         | DISH + DRY   |

## FALLING HEAD DATA

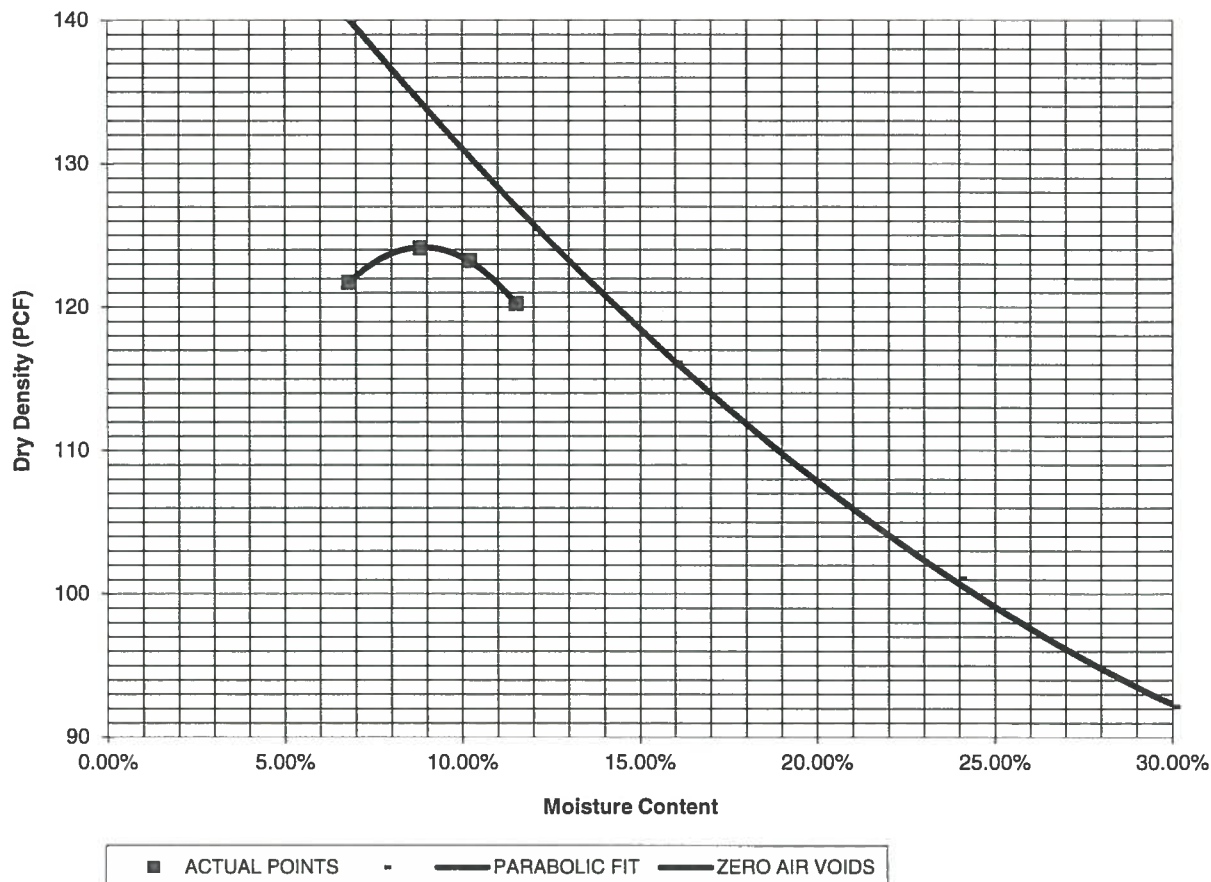
| STARTING |      |        |       | ENDING |      |        |       | CC<br>OUTFLOW | CC<br>INFLOW | TEMP<br>°C | k <sub>T</sub> | k <sub>20</sub> |
|----------|------|--------|-------|--------|------|--------|-------|---------------|--------------|------------|----------------|-----------------|
| DATE     | TIME | HEIGHT | CATCH | DATE   | TIME | HEIGHT | CATCH |               |              |            |                |                 |
| 11/3     | 1425 | 527    | 0.00  | 11/3   | 1447 | 508    | 0.00  | 0.0           | 13.3         | 21         | 4.18E-06       | 4.22E-06        |
| 11/3     | 1447 | 508    | 0.00  | 11/3   | 1555 | 492    | 0.00  | 0.0           | 11.2         | 21         | 7.43E-07       | 7.49E-07        |
| 11/3     | 1555 | 492    | 0.00  | 11/4   | 845  | 431    | 0.00  | 0.0           | 42.7         | 21         | 1.96E-07       | 1.98E-07        |
| 11/4     | 845  | 431    | 0.00  | 11/6   | 805  | 223    | 0.00  | 0.0           | 145.6        | 21         | 3.47E-07       | 3.5E-07         |
| 11/6     | 815  | 519    | 0.00  | 11/6   | 1130 | 506    | 2.00  | 2.0           | 9.1          | 21         | 2.02E-07       | 2.03E-07        |
| 11/6     | 1130 | 506    | 2.00  | 11/6   | 1600 | 498    | 5.00  | 3.0           | 5.6          | 22         | 8.5E-08        | 8.32E-08        |
| 11/6     | 1600 | 498    | 5.00  | 11/7   | 805  | 472    | 11.00 | 6.0           | 18.2         | 23         | 8.37E-08       | 7.96E-08        |
| 11/7     | 805  | 472    | 11.00 | 11/7   | 1100 | 466    | 19.00 | 8.0           | 4.2          | 24         | 1.09E-07       | 1E-07           |
| 11/7     | 1100 | 466    | 19.00 | 11/7   | 1300 | 452    | 36.00 | 17.0          | 9.8          | 25         | 3.82E-07       | 3.41E-07        |

Calculations based on:  
Bowles, Joseph E.; "Physical and Geotechnical Properties of Soils," 2nd Edition, 1984

|                         |                    |                |             |
|-------------------------|--------------------|----------------|-------------|
| <u>PROJECT</u>          | FLYING HORSE DAM   | <u>CLIENT</u>  | PULPIT ROCK |
| <u>SAMPLE LOCATION</u>  | TB-3 @ 0-5'        | <u>JOB NO.</u> | 171249      |
| <u>SOIL DESCRIPTION</u> | SAND, SILTY, BROWN | <u>DATE</u>    | 09/28/17    |

|                                  |               |                          |      |
|----------------------------------|---------------|--------------------------|------|
| <u>IDENTIFICATION</u>            | SM            | <u>COMPACTION TEST #</u> | 3    |
| <u>TEST DESIGNATION / METHOD</u> | ASTM D-1557-A | <u>TEST BY</u>           | AS   |
| <u>MAXIMUM DRY DENSITY (PCF)</u> | 124.1         | <u>OPTIMUM MOISTURE</u>  | 9.0% |

Compaction Curve



**ENTECH**  
ENGINEERING, INC.

605 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

MOISTURE DENSITY RELATION

DRAWN:

DATE:

CHECKED:

SCC

DATE:

11/16/17

JOB NO.:

171249

FIG NO.:

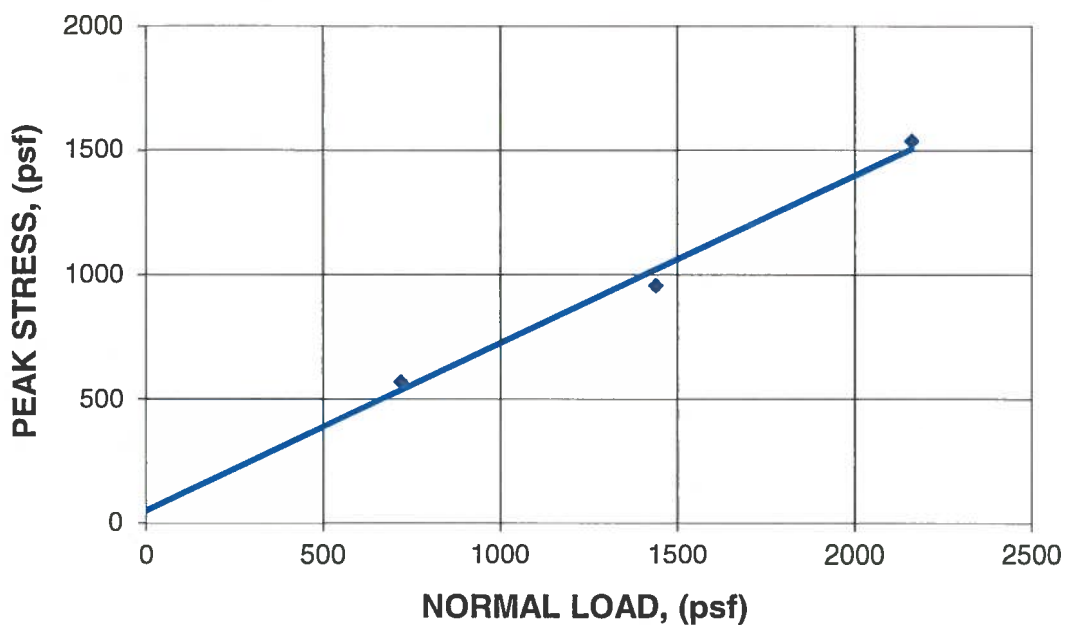
C-5

CLIENT  
PROJECT  
LOCATION

PULPIT ROCK  
FLYING HORSE DAM  
TB-3 @ 0-5'

JOB NO 171249

$C = 52$  psf  
 $\phi = 34^\circ$



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### FRICITION ANGLES

DRAWN:

DATE:

CHECKED:

DATE:

SCC

11/10/17

JOB NO.:

171249

FIG NO.:

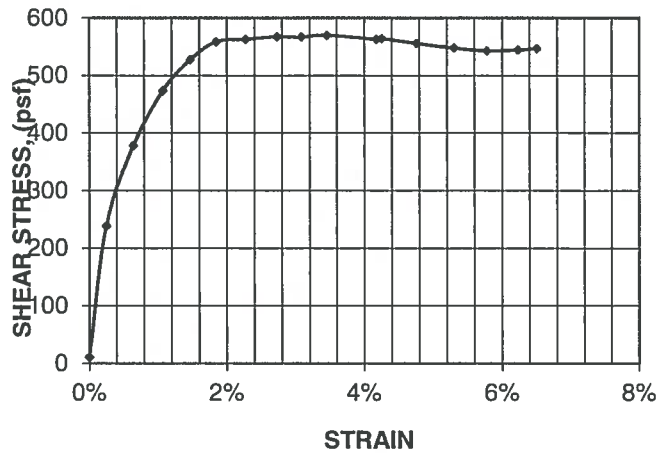
C-6

CLIENT PULPIT ROCK  
 PROJECT FLYING HORSE DAM  
 LOCATION TB-3 @ 0-5'

JOB NO 171249

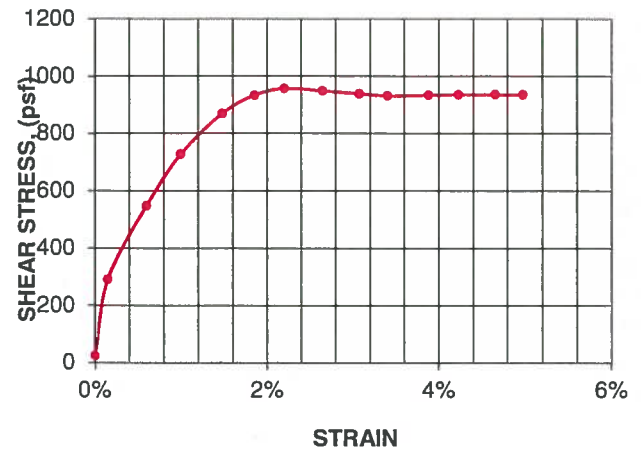
SHEAR STRESS vs SAMPLE STRAIN

—●— nLOAD 720



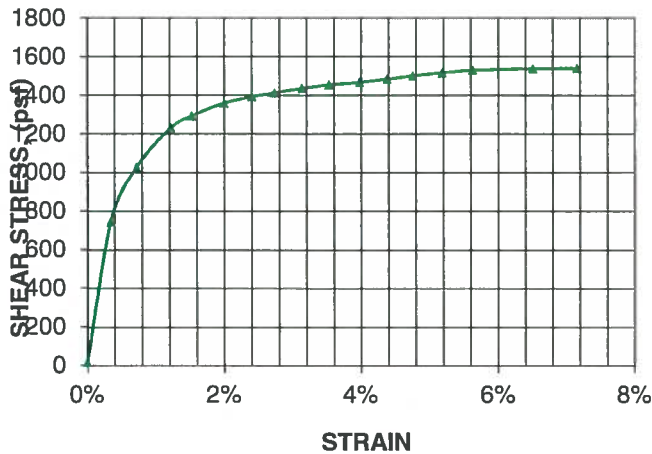
SHEAR STRESS vs SAMPLE STRAIN

—●— nLOAD 1440



SHEAR STRESS vs SAMPLE STRAIN

—▲— nLOAD 2160



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

INDIVIDUAL SHEAR POINTS

DRAWN:

DATE:

CHECKED:

DATE:

SCC

11/16/17

JOB NO.:

171249

FIG NO.:

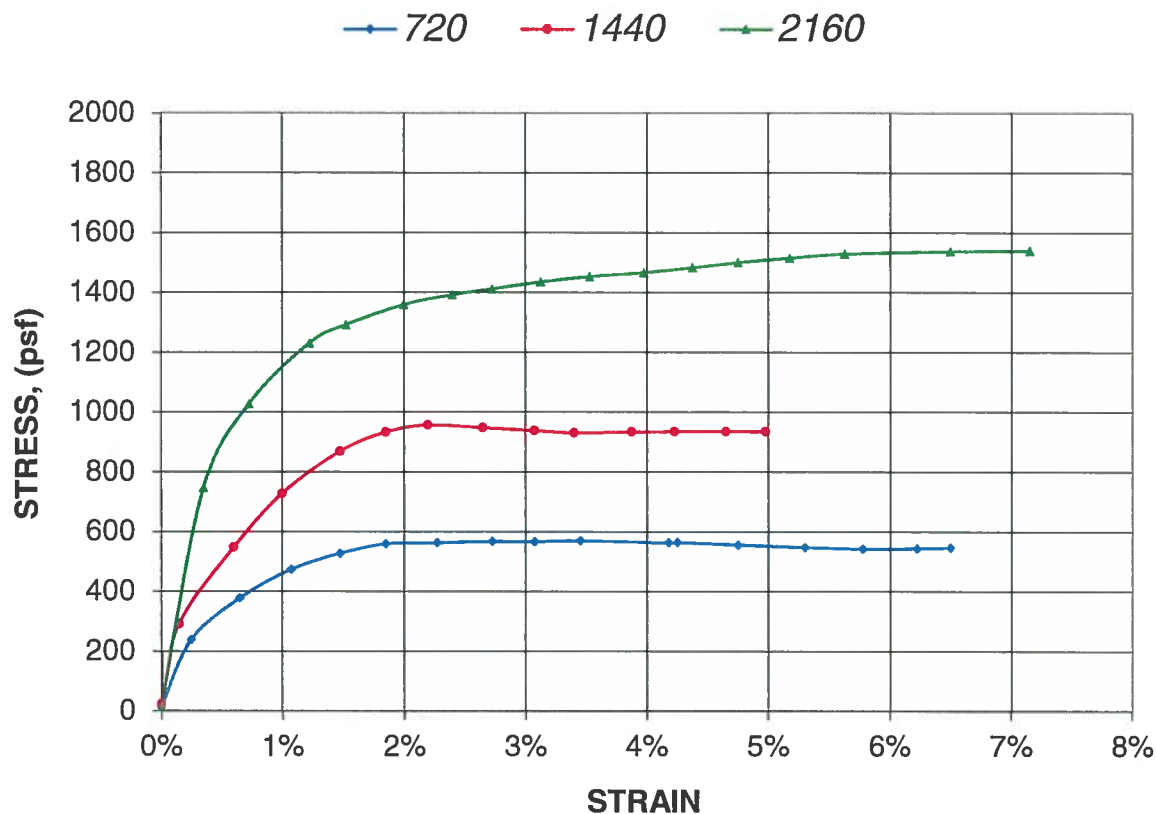
C-7

CLIENT  
PROJECT  
LOCATION

PULPIT ROCK  
FLYING HORSE DAM  
TB-3 @ 0-5'

JOB NO 171249

### SHEAR STRESS vs SAMPLE STRAIN



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

#### DIRECT SHEAR COMPOSITE

DRAWN:

DATE:

CHECKED:

DATE:

SCC

11/16/17

JOB NO.:

171249

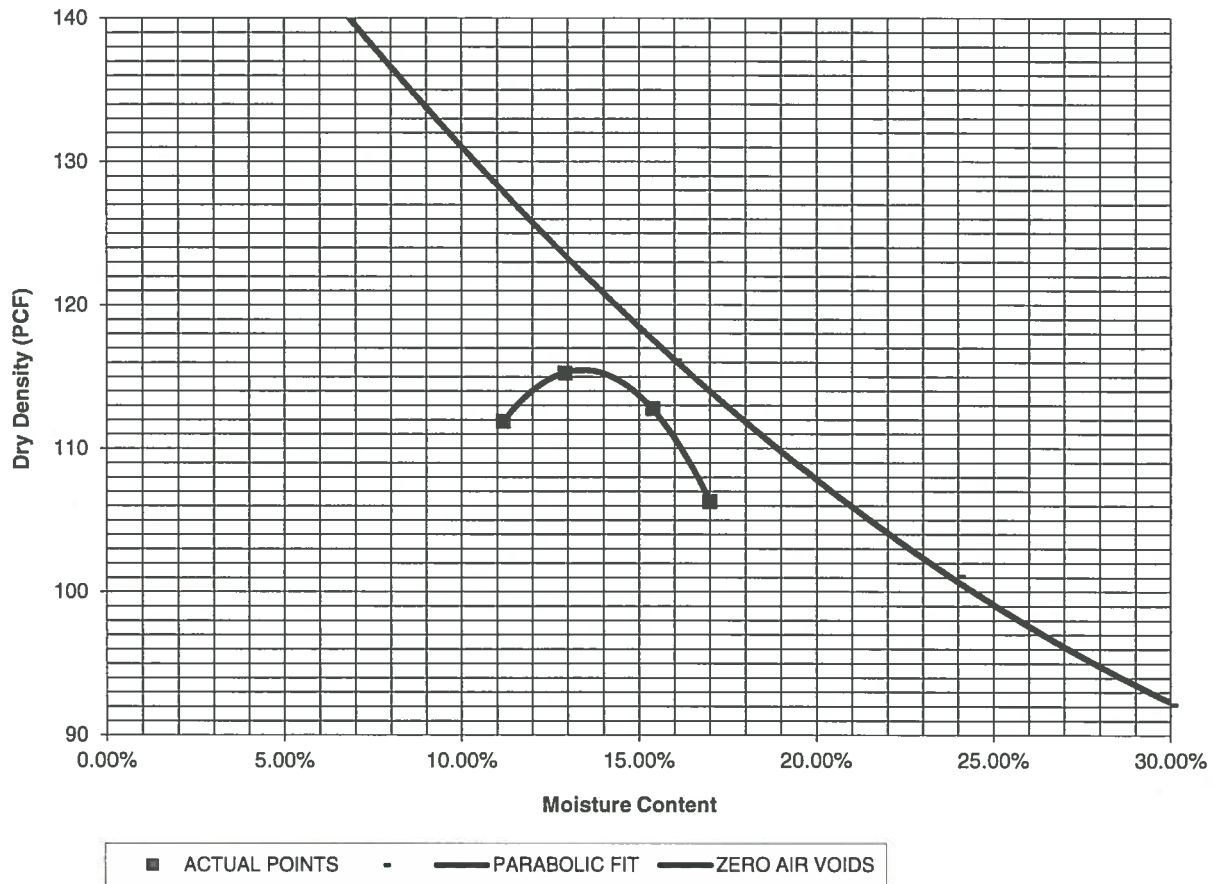
FIG NO.:

C-8

|                         |                        |                |             |
|-------------------------|------------------------|----------------|-------------|
| <u>PROJECT</u>          | FLYING HORSE DAM       | <u>CLIENT</u>  | PULPIT ROCK |
| <u>SAMPLE LOCATION</u>  | TB-6 @ 5-10            | <u>JOB NO.</u> | 171249      |
| <u>SOIL DESCRIPTION</u> | SAND, V. CLAYEY, BROWN | <u>DATE</u>    | 09/28/17    |

|                                  |              |                          |       |
|----------------------------------|--------------|--------------------------|-------|
| <u>IDENTIFICATION</u>            | SC           | <u>COMPACTION TEST #</u> | 2     |
| <u>TEST DESIGNATION / METHOD</u> | ASTM D-698-A | <u>TEST BY</u>           | AS    |
| <u>MAXIMUM DRY DENSITY (PCF)</u> | 115.5        | <u>OPTIMUM MOISTURE</u>  | 13.5% |

Compaction Curve



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

MOISTURE DENSITY RELATION

DRAWN:

DATE:

CHECKED:

DATE:

SCC

11/6/17

JOB NO.:

171249

FIG NO.:

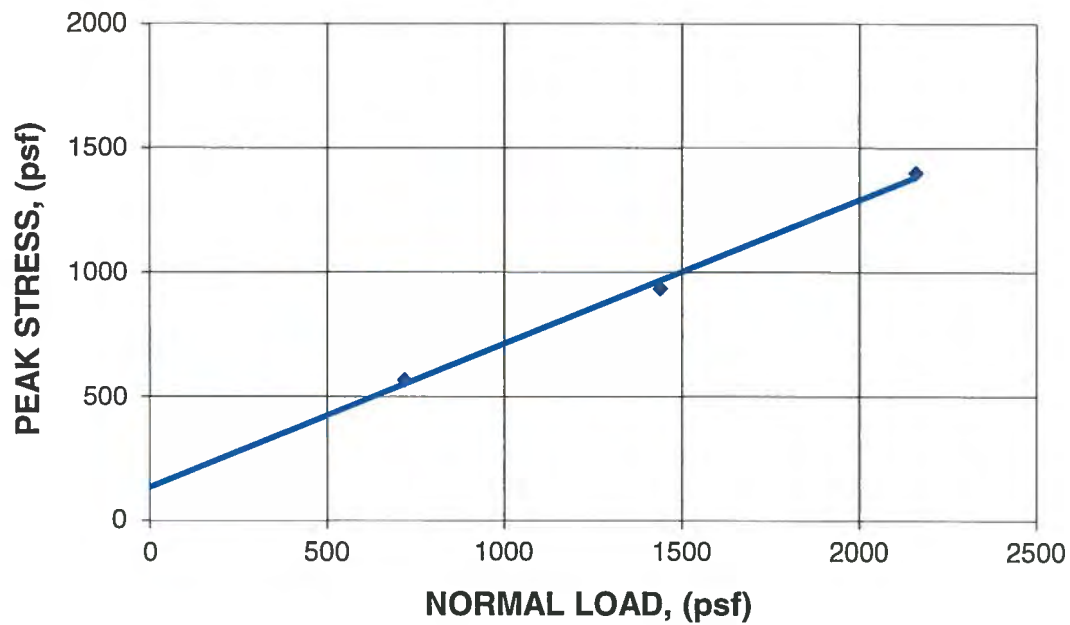
C-9

CLIENT  
PROJECT  
LOCATION

PULPIT ROCK  
FLYING HORSE DAM  
TB-6 @ 5-10'

JOB NO 171249

$C = 134$  psf  
 $\phi = 30^\circ$



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### FRICTION ANGLES

DRAWN:

DATE:

CHECKED:

DATE:

SLL

11/16/17

JOB NO.:

171249

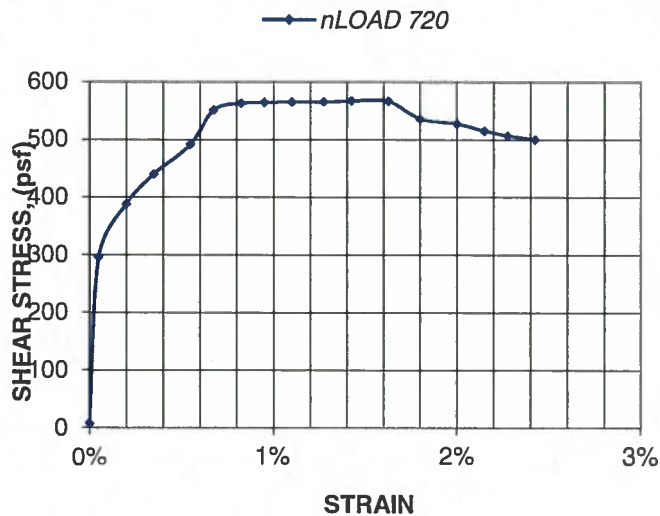
FIG NO.:

C-10

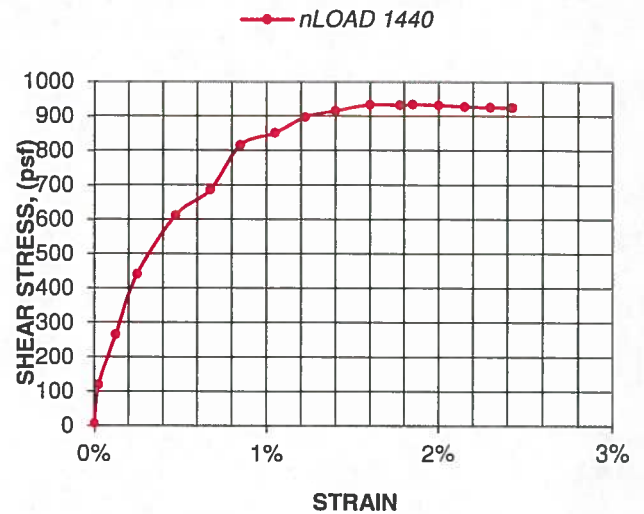
CLIENT PULPIT ROCK  
 PROJECT FLYING HORSE DAM  
 LOCATION TB-6 @ 5-10'

JOB NO 171249

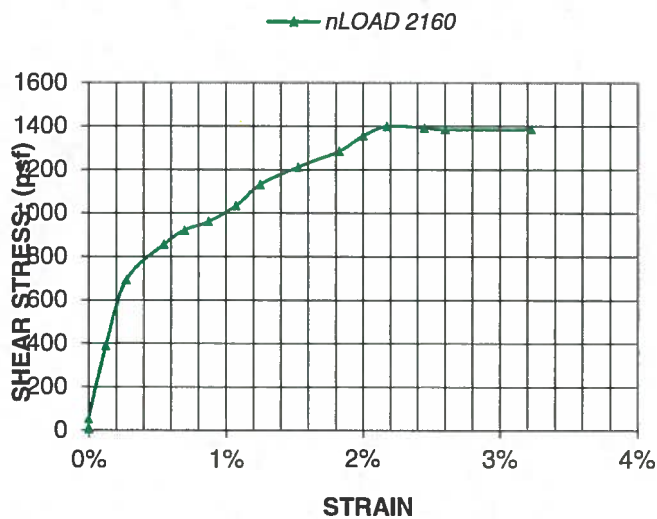
SHEAR STRESS vs SAMPLE STRAIN



SHEAR STRESS vs SAMPLE STRAIN



SHEAR STRESS vs SAMPLE STRAIN



**ENTECH**  
 ENGINEERING, INC.

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

INDIVIDUAL SHEAR POINTS

DRAWN:

DATE:

CHECKED:

SCC

DATE:

11/16/17

JOB NO.:

171249

FIG NO.:

C-11

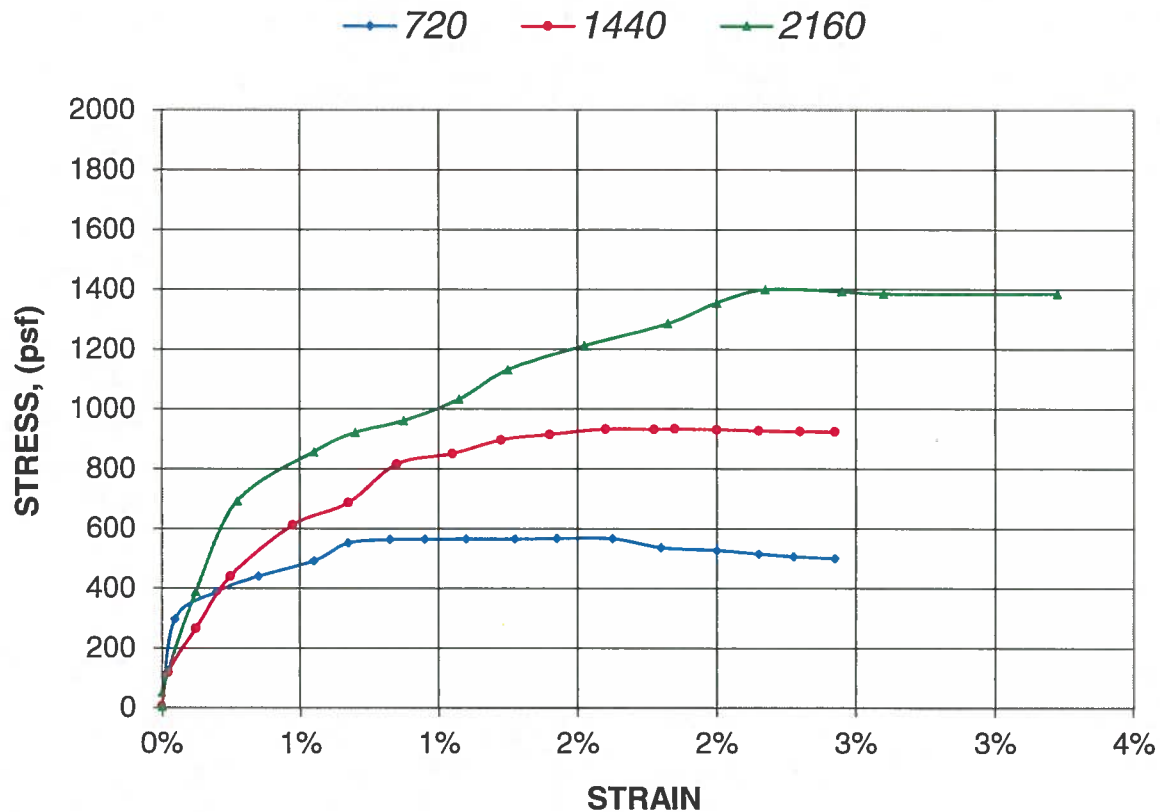


CLIENT  
PROJECT  
LOCATION

PULPIT ROCK  
FLYING HORSE DAM  
TB-6 @ 5-10'

JOB NO 171249

### SHEAR STRESS vs SAMPLE STRAIN



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### DIRECT SHEAR COMPOSITE

DRAWN:

DATE:

CHECKED:

DATE:

SLC

11/16/17

JOB NO.:

171249

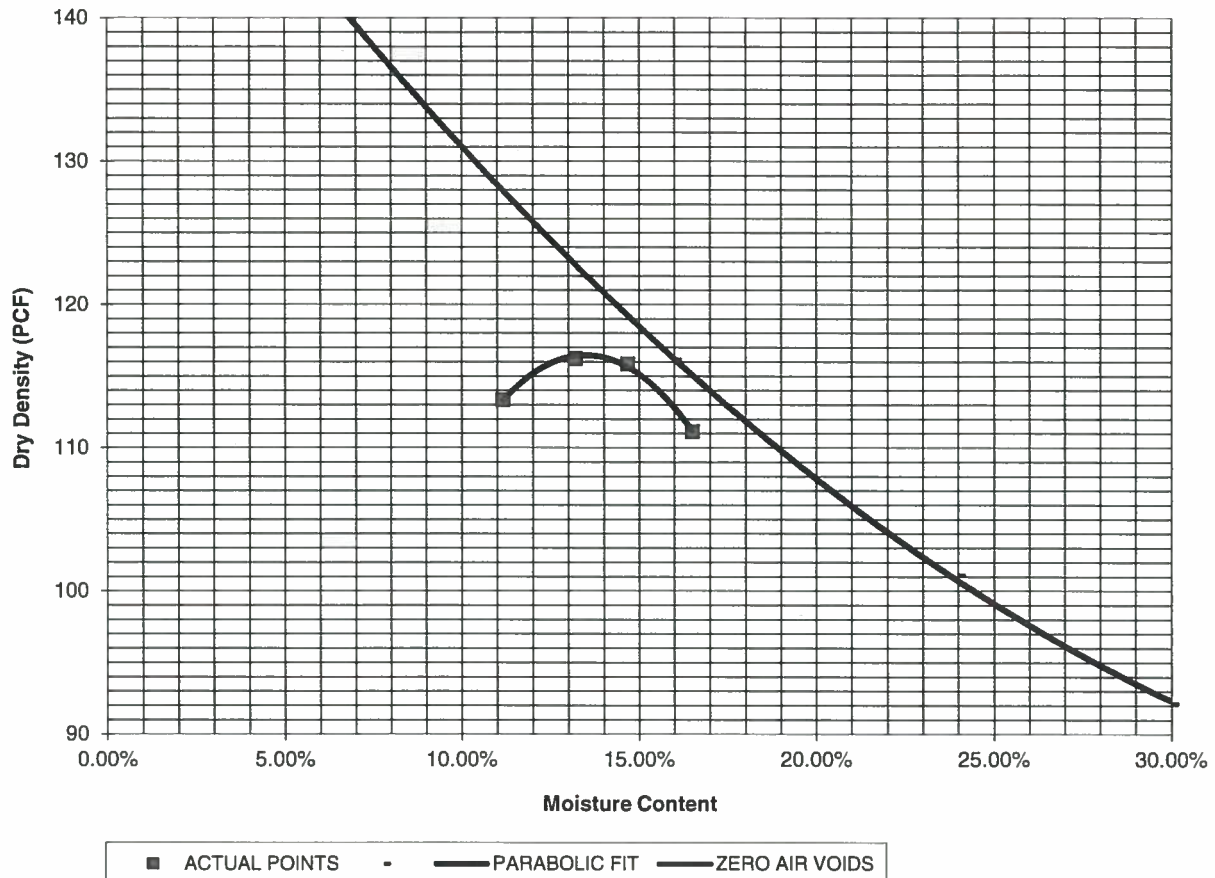
FIG NO.:

C-12

|                         |                        |                |             |
|-------------------------|------------------------|----------------|-------------|
| <u>PROJECT</u>          | FLYING HORSE DAM       | <u>CLIENT</u>  | PULPIT ROCK |
| <u>SAMPLE LOCATION</u>  | TB-13 @ 0-3'           | <u>JOB NO.</u> | 171249      |
| <u>SOIL DESCRIPTION</u> | SAND, VERY CLAYEY, TAN | <u>DATE</u>    | 10/27/17    |

|                                  |              |                          |       |
|----------------------------------|--------------|--------------------------|-------|
| <u>IDENTIFICATION</u>            | SC           | <u>COMPACTION TEST #</u> | 4     |
| <u>TEST DESIGNATION / METHOD</u> | ASTM D-698-A | <u>TEST BY</u>           | BL    |
| <u>MAXIMUM DRY DENSITY (PCF)</u> | 116.6        | <u>OPTIMUM MOISTURE</u>  | 13.3% |

Compaction Curve



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

MOISTURE DENSITY RELATION

DRAWN:

DATE:

CHECKED:

DATE:

SCC

11/16/17

JOB NO.:

171249

FIG NO.:

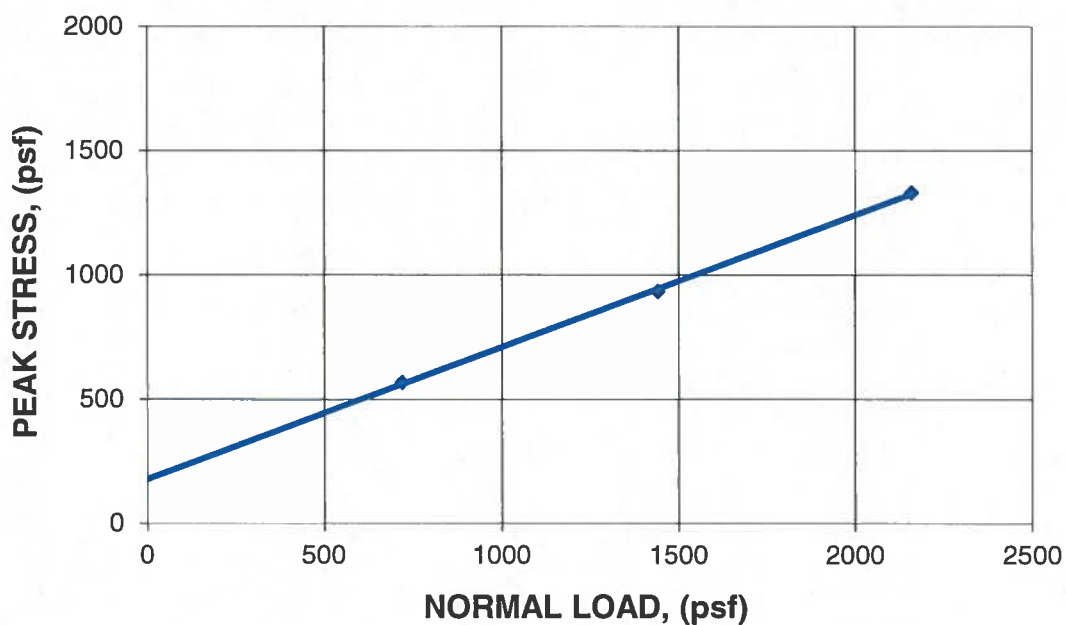
C-13

CLIENT  
PROJECT  
LOCATION

PULPIT ROCK  
FLYING HORSE DAM  
TB-13 @ 0-3'

JOB NO 171249

$C = 179$  psf  
 $\phi = 28^\circ$



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### FRICTION ANGLES

DRAWN:

DATE:

CHECKED:

DATE:

SCC

11/10/17

JOB NO.:

171249

FIG NO.:

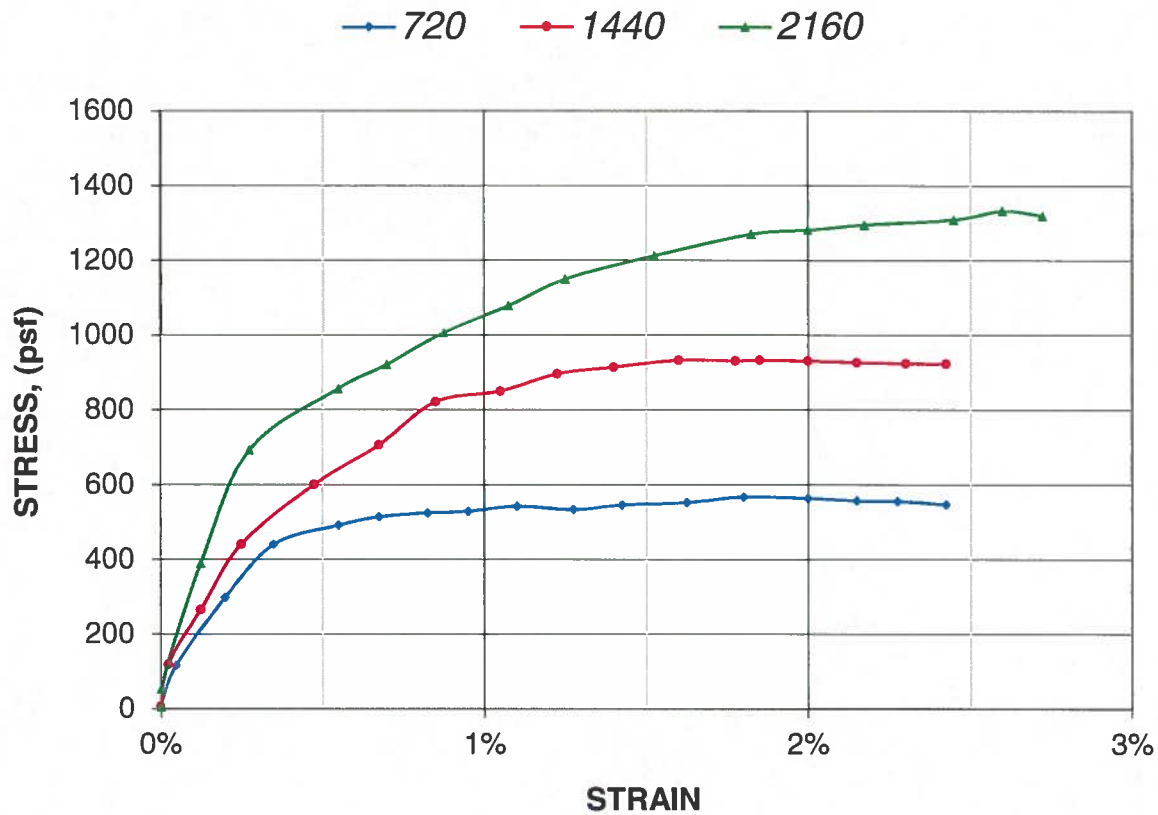
C-14

CLIENT  
PROJECT  
LOCATION

PULPIT ROCK  
FLYING HORSE DAM  
TB-13 @ 0-3'

JOB NO 171249

### SHEAR STRESS vs SAMPLE STRAIN



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### DIRECT SHEAR COMPOSITE

DRAWN:

DATE:

CHECKED:

DATE:

SLC

11/6/17

JOB NO.:

171249

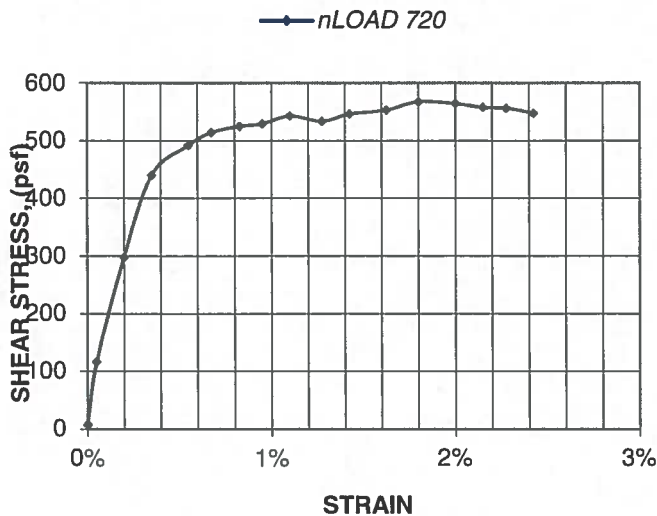
FIG NO.:

C-15

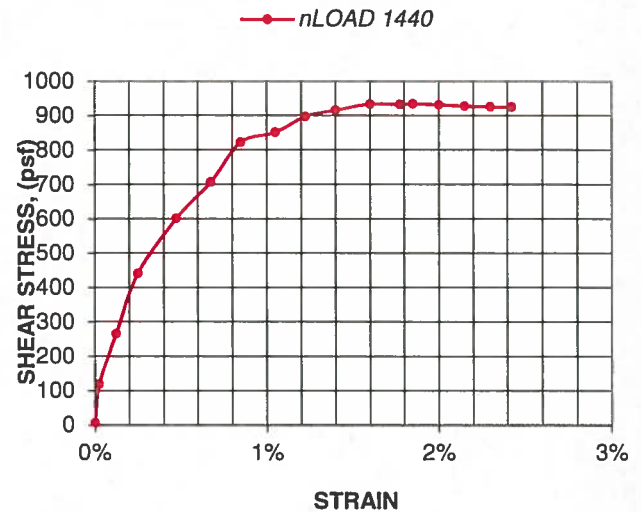
CLIENT PULPIT ROCK  
 PROJECT FLYING HORSE DAM  
 LOCATION TB-13 @ 0-3'

JOB NO 171249

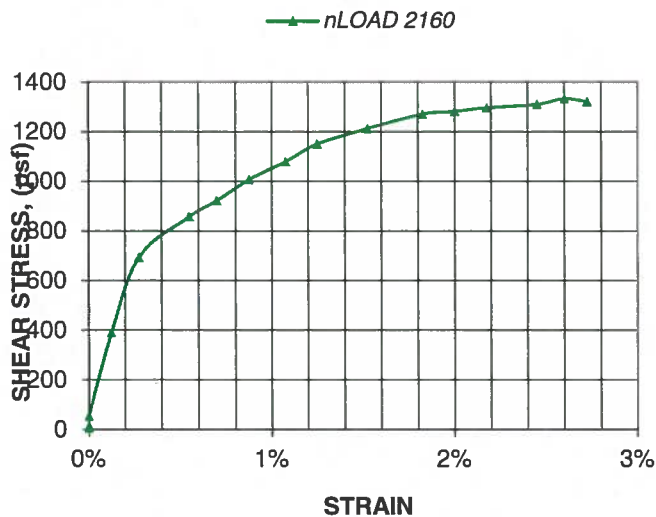
SHEAR STRESS vs SAMPLE STRAIN



SHEAR STRESS vs SAMPLE STRAIN



SHEAR STRESS vs SAMPLE STRAIN



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

INDIVIDUAL SHEAR POINTS

DRAWN:

DATE:

CHECKED:

DATE:

*Sce*

*11/16/17*

JOB NO.:

*171249*

FIG NO.:

*C-16*

## **APPENDIX D: Filter Calculations**

---

Flying Horse North Dam  
Filter Compatibility for Dam Embankment

Sieve Analysis TB12 at 1 to 8 feet

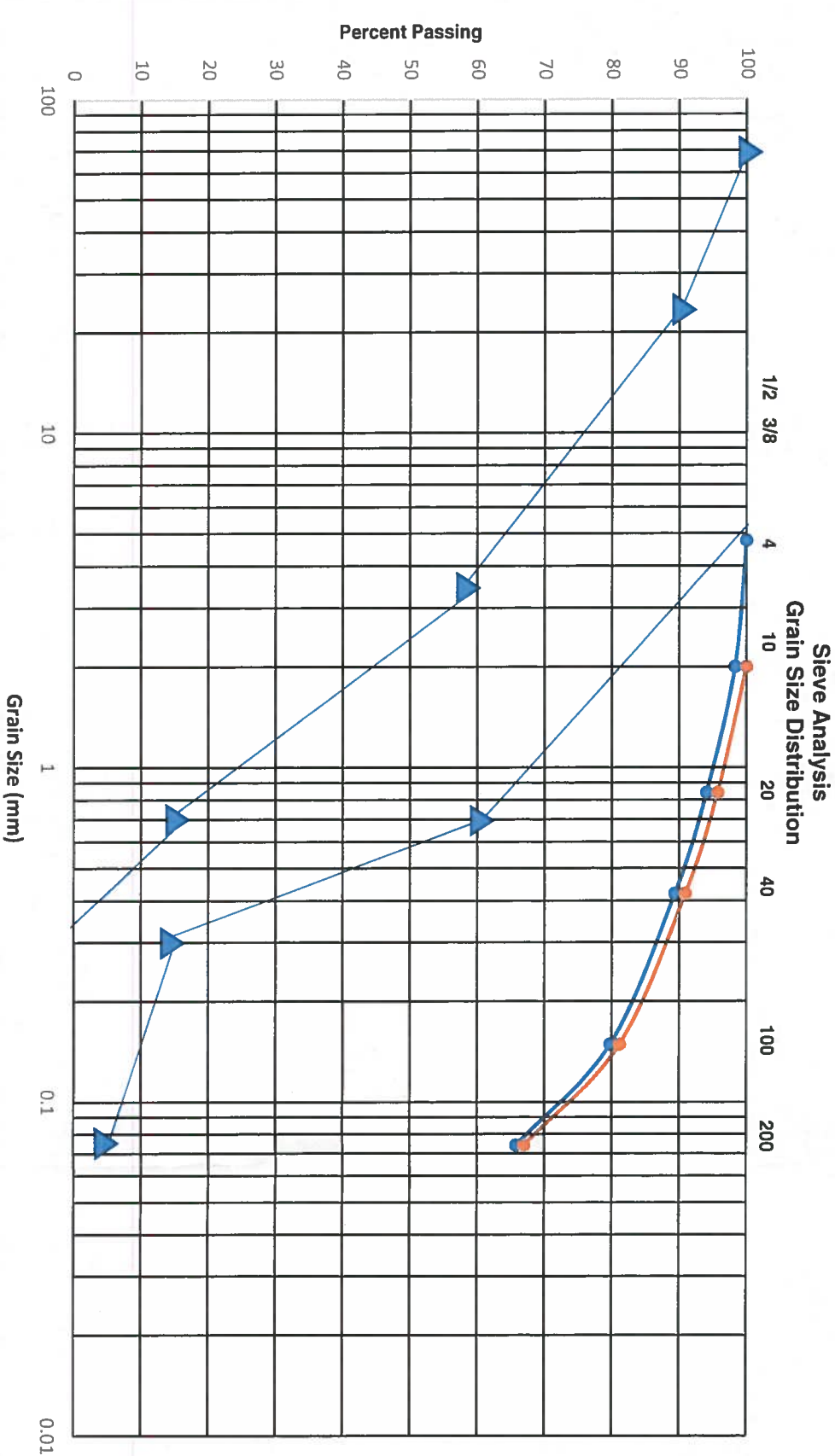
| Sieve # | Opening (mm) | % Finer (%) | Regraded (%) |
|---------|--------------|-------------|--------------|
| 1.5     | 37.5         |             |              |
| 3/4     | 19.05        |             |              |
| 1/2     | 12.7         |             |              |
| 3/8     | 9.53         |             |              |
| 4       | 4.76         | 100         |              |
| 10      | 2            | 98.3        | 100.0        |
| 20      | 0.841        | 94.1        | 95.7         |
| 40      | 0.42         | 89.4        | 90.9         |
| 100     | 0.149        | 79.8        | 81.2         |
| 200     | 0.074        | 65.8        | 66.9         |

|     |                                |          |
|-----|--------------------------------|----------|
| 1)  | Regrade Factor                 | 0        |
| 2)  | Base Soil Category, Table 26-1 | 2        |
| 3)  | Max D15, Table 26-2            | 0.7 mm   |
| 4)  | Min D15, Table 26-3            | 0.3 mm   |
| 5)  | Band Width                     | mm       |
| 6)  | Max D10                        | 0.58 mm  |
| 7)  | Max D60                        | 3.5 mm   |
| 8)  | Min D60                        | 0.7 mm   |
| 9)  | Min D5                         | 0.075 mm |
| 10) | Max D100                       | 75 mm    |
| 11) | Max D90                        | 25 mm    |
|     | Min D10                        | 0.95     |

NEH - Part 633 - Example 26-2

Acceptable Band Range - washed concrete sand

| Sieve # | Minimum (%) | Maximum (%) |
|---------|-------------|-------------|
| 1.5"    | 95          | 100         |
| 3/4"    | 87          | 100         |
| 1/2"    | 80          | 100         |
| 3/8"    | 74          | 100         |
| 4       | 63          | 97          |
| 10      | 44          | 80          |
| 20      | 18          | 65          |
| 40      | 5           | 31          |
| 100     | 0           | 10          |
| 200     | 0           | 5           |



Flying Horse North Dam  
Coarse Filter Compatibility

Sieve Analysis TB11 at 0 to 10 feet

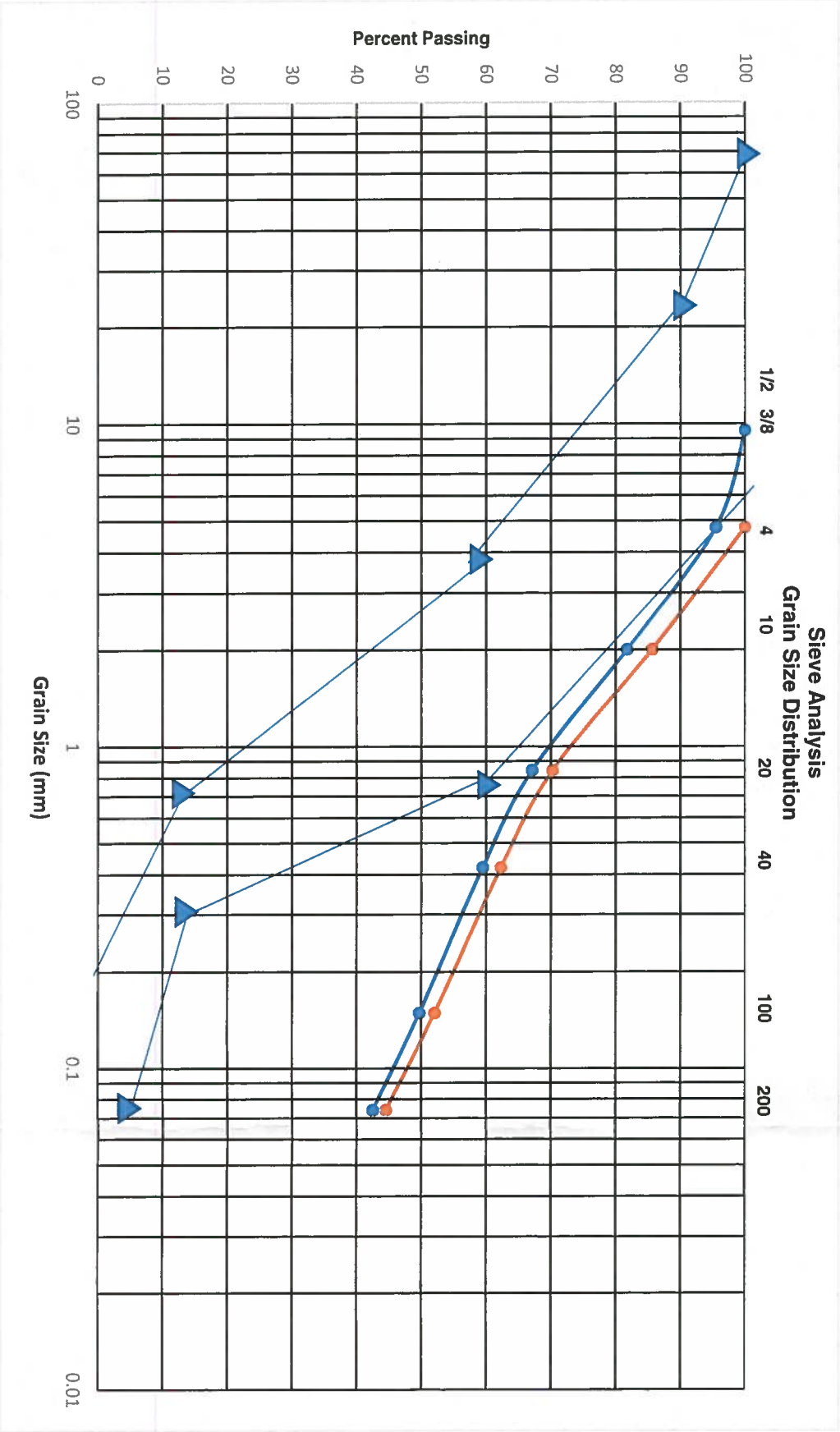
| Sieve # | Opening (mm) | % Finer (%) | Regraded (%) |
|---------|--------------|-------------|--------------|
| 1.5     | 37.5         |             |              |
| 3/4     | 19.05        |             |              |
| 1/2     | 12.7         |             |              |
| 3/8     | 9.53         | 100         |              |
| 4       | 4.76         | 95.5        | 100.0        |
| 10      | 2            | 81.8        | 85.7         |
| 20      | 0.841        | 67.1        | 70.3         |
| 40      | 0.42         | 59.5        | 62.3         |
| 100     | 0.149        | 49.7        | 52.0         |
| 200     | 0.074        | 42.5        | 44.5         |

NEH - Part 633 - Example 26-5

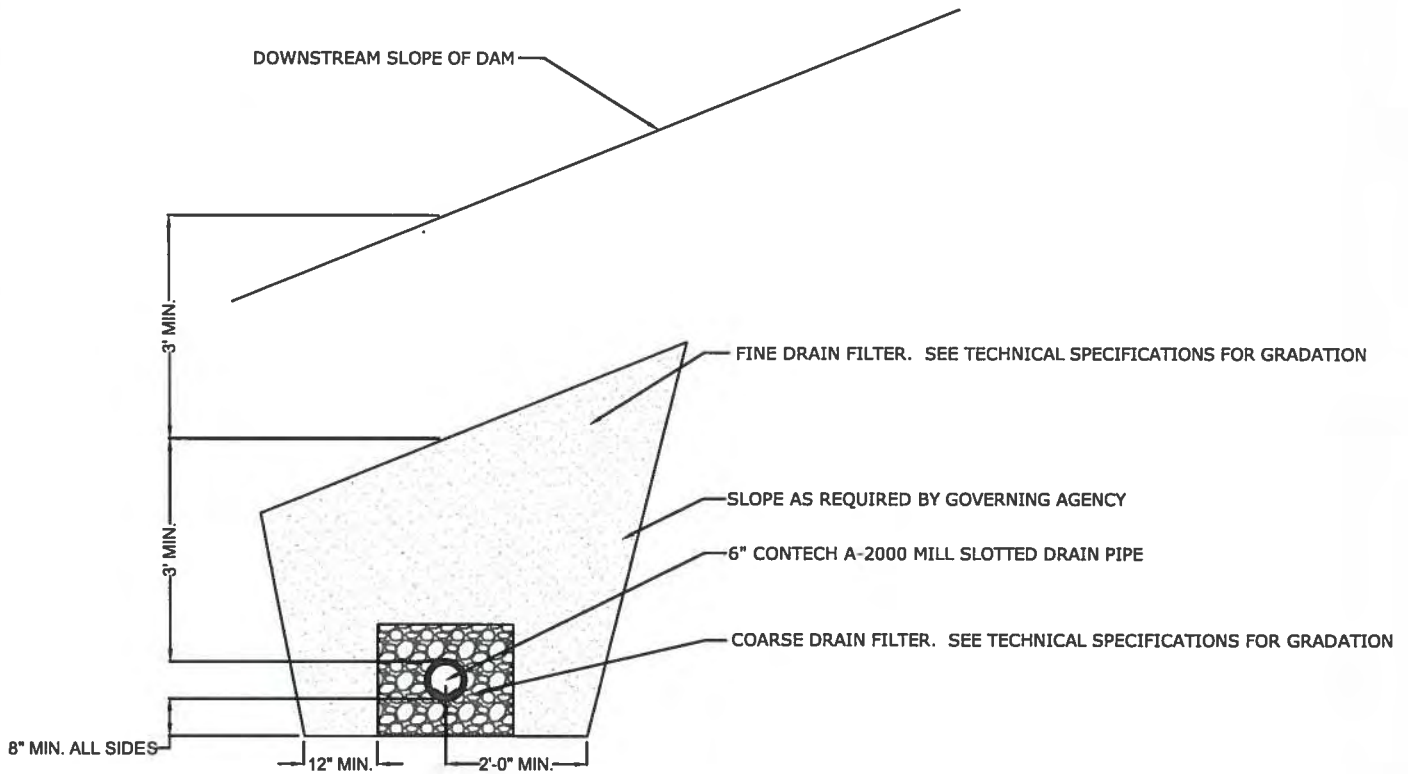
|     |                                |          |
|-----|--------------------------------|----------|
| 1)  | Regrade Factor                 | 1.04712  |
| 2)  | Base Soil Category, Table 26-1 | 2        |
| 3)  | Max D15                        | 0.7 mm   |
| 4)  | Min D15, Table 26-3            | 0.3 mm   |
| 5)  | Band Width                     | mm       |
| 6)  | Max D10                        | 0.58 mm  |
| 7)  | Max D60                        | 3.5 mm   |
| 8)  | Min D60                        | 0.7 mm   |
| 9)  | Min D5                         | 0.075 mm |
| 10) | Max D100                       | 75 mm    |
| 11) | Max D90                        | 25 mm    |
|     | Min D10                        | 0.95     |

Acceptable Band Range - #8

| Sieve # | Minimum (%) | Maximum (%) |
|---------|-------------|-------------|
| 1.5"    | 95          | 100         |
| 3/4"    | 87          | 100         |
| 1/2"    | 80          | 100         |
| 3/8"    | 74          | 100         |
| 4       | 63          | 95          |
| 10      | 42          | 78          |
| 20      | 15          | 63          |
| 40      | 8           | 31          |
| 100     | 0           | 10          |
| 200     | 0           | 5           |







**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, CO. 80907 (719) 531-5599

*TOE DRAIN SECTION  
FLYING HORSE NORTH DAM  
FOR: PULPIT ROCK, LLC*

DRAWN BY:  
SCC

DATE DRAWN:  
11/16/17

DESIGNED BY:  
SCC

CHECKED:  
SCC

JOB NO.:  
171249  
FIG. NO.:

1

## **APPENDIX E: Slope Stability Calculations**

---

# Flying Horse North Golf Course Dam

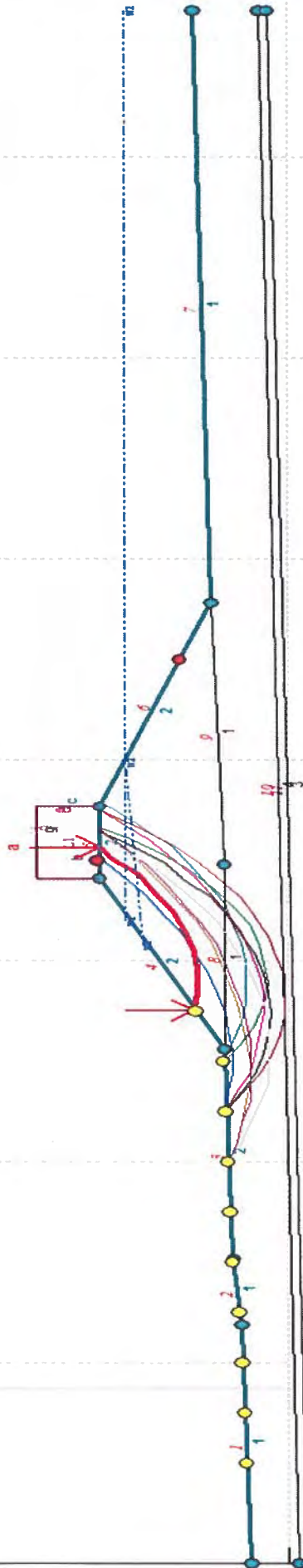
f:\aa projects\2017\171249-pulpit rock-flying horse north, dam investigation-ss-200\proposed contour - classic - updated p2 Run By: insert\name\company Here 11/15/2017 04:53PM

| # | FS   | Soil Desc. | Soil Type | Total Unit Wt. | Saturated Unit Wt. | Cohesion Intercept | Friction Angle | Pore Pressure Param. | Pressure Constant | Piez. Surface |
|---|------|------------|-----------|----------------|--------------------|--------------------|----------------|----------------------|-------------------|---------------|
| a | 1.91 | SM         | 1         | 120.0          | 125.0              | 25.0               | 30.0           | 0.00                 | 0.0               | W1            |
| b | 2.12 | SC         | 2         | 100.0          | 105.0              | 75.0               | 24.0           | 0.00                 | 0.0               | W1            |
| c | 2.14 | SS         | 3         | 130.0          | 135.0              | 0.0                | 34.0           | 0.00                 | 0.0               | W1            |
| d | 2.15 | CS         | 4         | 100.0          | 105.0              | 100.0              | 14.0           | 0.00                 | 0.0               | W1            |
| e | 2.18 |            |           |                |                    |                    |                |                      |                   |               |
| f | 2.18 |            |           |                |                    |                    |                |                      |                   |               |
| g | 2.19 |            |           |                |                    |                    |                |                      |                   |               |
| h | 2.25 |            |           |                |                    |                    |                |                      |                   |               |
| i | 2.25 |            |           |                |                    |                    |                |                      |                   |               |
| j | 2.31 |            |           |                |                    |                    |                |                      |                   |               |

7600

7500

7400



GSTABL7 v2 FSmin=1.81

Safety Factors Are Calculated By The Modified Bishop Method

-2150.764433

1-1

## \*\*\* GSTABL7 \*\*\*

\*\* GSTABL7 by Dr. Garry H. Gregory, Ph.D., P.E., D.GE \*\*

\*\* Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 \*\*

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\*\*\*\*\*

## SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.

(Includes Spencer &amp; Morgenstern-Price Type Analysis)

Including Pier/Pile, Reinforcement, Soil Nail, Tieback,

Nonlinear Undrained Shear Strength, Curved Phi Envelope,

Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water

Surfaces, Pseudo-Static &amp; Newmark Earthquake, and Applied Forces.

\*\*\*\*\*

Analysis Run Date: 11/15/2017

Time of Run: 04:53PM

Run By: Insert Name/company Here

Input Data Filename: F:\AA projects\2017\171249-Pulpit Rock-Flying Horse North, D

am Investigation-SSI-200\proposed contour - classic - updated.in

Output Filename: F:\AA projects\2017\171249-Pulpit Rock-Flying Horse North, D

am Investigation-SSI-200\proposed contour - classic - updated.OUT

Unit System: English

Plotted Output Filename: F:\AA projects\2017\171249-Pulpit Rock-Flying Horse North, D

am Investigation-SSI-200\proposed contour - classic - updated.PLT

PROBLEM DESCRIPTION: Flying Horse North

Golf Course Dam

## BOUNDARY COORDINATES

7 Top Boundaries

11 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|--------------|-------------|-------------|--------------|--------------|---------------------|
| 1            | 0.00        | 7508.50     | 119.00       | 7510.50      | 1                   |
| 2            | 119.00      | 7510.50     | 152.00       | 7512.50      | 1                   |
| 3            | 152.00      | 7512.50     | 256.50       | 7514.50      | 2                   |
| 4            | 256.50      | 7514.50     | 341.00       | 7542.50      | 2                   |
| 5            | 341.00      | 7542.50     | 376.50       | 7542.50      | 2                   |
| 6            | 376.50      | 7542.50     | 478.00       | 7517.00      | 2                   |
| 7            | 478.00      | 7517.00     | 773.00       | 7520.50      | 1                   |
| 8            | 256.50      | 7514.50     | 348.00       | 7514.40      | 1                   |
| 9            | 348.00      | 7514.40     | 478.00       | 7517.00      | 1                   |
| 10           | 0.00        | 7498.00     | 773.00       | 7506.00      | 4                   |
| 11           | 0.00        | 7496.00     | 773.00       | 7504.00      | 3                   |

User Specified Y-Origin = 7400.00(ft)

Default X-Plus Value = 0.00(ft)

User Specified Y-Plus Value = 7458.00(ft)

## ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. (psf) | Pressure Constant (psf) | Piez. Surface No. |
|---------------|----------------------|--------------------------|--------------------------|----------------------|----------------------------|-------------------------|-------------------|
| 1             | 120.0                | 125.0                    | 25.0                     | 30.0                 | 0.00                       | 0.0                     | 1                 |
| 2             | 100.0                | 105.0                    | 75.0                     | 24.0                 | 0.00                       | 0.0                     | 1                 |
| 3             | 130.0                | 135.0                    | 0.0                      | 34.0                 | 0.00                       | 0.0                     | 1                 |
| 4             | 100.0                | 105.0                    | 100.0                    | 14.0                 | 0.00                       | 0.0                     | 1                 |

## 2 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|-----------|--------------|--------------|
| 1         | 320.00       | 7536.00      |
| 2         | 773.00       | 7536.00      |

Piezometric Surface No. 2 Specified by 3 Coordinate Points

Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|-----------|--------------|--------------|
| 1         | 308.00       | 7532.00      |
| 2         | 399.00       | 7536.00      |

3 773.00 7536.00  
BOUNDARY LOAD(S)

## 1 Load(s) Specified

| Load No. | X-Left (ft) | X-Right (ft) | Intensity (psf) | Deflection (deg) |
|----------|-------------|--------------|-----------------|------------------|
| 1        | 341.00      | 376.50       | 250.0           | 0.0              |

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.  
100 Trial Surfaces Have Been Generated.

10 Surface(s) Initiate(s) From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 50.00(ft)  
and X = 275.00(ft)

Each Surface Terminates Between X = 350.00(ft)  
and X = 450.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00(ft)

10.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial

Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

\* \* Safety Factors Are Calculated By The Modified Bishop Method \* \*

Total Number of Trial Surfaces Attempted = 100

Number of Trial Surfaces With Valid FS = 100

Statistical Data On All Valid FS Values:

FS Max = 29.761 FS Min = 1.812 FS Ave = 6.530

Standard Deviation = 3.954 Coefficient of Variation = 60.55 %

Failure Surface Specified By 10 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|-----------|-------------|-------------|
| 1         | 275.000     | 7520.630    |
| 2         | 284.973     | 7519.895    |
| 3         | 294.972     | 7520.040    |
| 4         | 304.919     | 7521.064    |
| 5         | 314.738     | 7522.961    |
| 6         | 324.351     | 7525.715    |
| 7         | 333.684     | 7529.305    |
| 8         | 342.665     | 7533.703    |
| 9         | 351.224     | 7538.875    |
| 10        | 356.179     | 7542.500    |

Circle Center At X = 288.368 ; Y = 7632.608 ; and Radius = 112.773

Factor of Safety

\*\*\* 1.812 \*\*\*

Individual data on the 14 slices

| Slice No. | Width (ft) | Weight (lbs) | Water Force |           | Tie Force  |           | Earthquake Force |           |                      |
|-----------|------------|--------------|-------------|-----------|------------|-----------|------------------|-----------|----------------------|
|           |            |              | Top (lbs)   | Bot (lbs) | Norm (lbs) | Tan (lbs) | Hor (lbs)        | Ver (lbs) | Surcharge Load (lbs) |
| 1         | 10.0       | 2115.3       | 8992.8      | 9820.1    | 0.         | 0.        | 0.0              | 0.0       | 0.0                  |
| 2         | 10.0       | 5905.1       | 6841.6      | 10004.7   | 0.         | 0.        | 0.0              | 0.0       | 0.0                  |
| 3         | 9.9        | 8715.3       | 4645.3      | 9639.7    | 0.         | 0.        | 0.0              | 0.0       | 0.0                  |
| 4         | 3.1        | 3135.4       | 1001.5      | 2866.1    | 0.         | 0.        | 0.0              | 0.0       | 0.0                  |
| 5         | 6.7        | 7336.6       | 1469.9      | 5861.8    | 0.         | 0.        | 0.0              | 0.0       | 0.0                  |
| 6         | 5.3        | 6052.7       | 460.3       | 4196.2    | 0.         | 0.        | 0.0              | 0.0       | 0.0                  |
| 7         | 4.4        | 5097.1       | 0.0         | 3080.5    | 0.         | 0.        | 0.0              | 0.0       | 0.0                  |
| 8         | 9.3        | 10680.7      | 0.0         | 5297.6    | 0.         | 0.        | 0.0              | 0.0       | 0.0                  |
| 9         | 7.3        | 7635.5       | 0.0         | 2492.6    | 0.         | 0.        | 0.0              | 0.0       | 0.0                  |
| 10        | 1.3        | 1192.6       | 0.0         | 246.0     | 0.         | 0.        | 0.0              | 0.0       | 315.7                |
| 11        | 0.4        | 362.8        | 0.0         | 67.0      | 0.         | 0.        | 0.0              | 0.0       | 100.6                |
| 12        | 3.8        | 2929.4       | 0.0         | 318.3     | 0.         | 0.        | 0.0              | 0.0       | 950.4                |
| 13        | 4.8        | 2408.7       | 0.0         | 0.0       | 0.         | 0.        | 0.0              | 0.0       | 1189.4               |
| 14        | 5.0        | 898.0        | 0.0         | 0.0       | 0.         | 0.        | 0.0              | 0.0       | 1238.7               |

Failure Surface Specified By 15 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|-----------|-------------|-------------|
| 1         | 225.000     | 7513.897    |

|    |         |          |
|----|---------|----------|
| 2  | 234.952 | 7512.922 |
| 3  | 244.942 | 7512.467 |
| 4  | 254.942 | 7512.535 |
| 5  | 264.924 | 7513.124 |
| 6  | 274.863 | 7514.233 |
| 7  | 284.729 | 7515.860 |
| 8  | 294.498 | 7518.000 |
| 9  | 304.141 | 7520.646 |
| 10 | 313.634 | 7523.792 |
| 11 | 322.949 | 7527.430 |
| 12 | 332.061 | 7531.548 |
| 13 | 340.946 | 7536.136 |
| 14 | 349.580 | 7541.182 |
| 15 | 351.587 | 7542.500 |

Circle Center At X = 248.649 ; Y = 7703.969 ; and Radius = 191.537

Factor of Safety

\*\*\* 2.124 \*\*\*

Failure Surface Specified By 15 Coordinate Points

| Point<br>No. | X-Surf<br>(ft) | Y-Surf<br>(ft) |
|--------------|----------------|----------------|
| 1            | 250.000        | 7514.375       |
| 2            | 259.694        | 7511.919       |
| 3            | 269.537        | 7510.159       |
| 4            | 279.482        | 7509.104       |
| 5            | 289.476        | 7508.760       |
| 6            | 299.469        | 7509.129       |
| 7            | 309.410        | 7510.208       |
| 8            | 319.250        | 7511.993       |
| 9            | 328.937        | 7514.474       |
| 10           | 338.423        | 7517.639       |
| 11           | 347.660        | 7521.471       |
| 12           | 356.600        | 7525.951       |
| 13           | 365.199        | 7531.056       |
| 14           | 373.412        | 7536.760       |
| 15           | 379.576        | 7541.727       |

Circle Center At X = 289.301 ; Y = 7649.096 ; and Radius = 140.336

Factor of Safety

\*\*\* 2.136 \*\*\*

Failure Surface Specified By 18 Coordinate Points

| Point<br>No. | X-Surf<br>(ft) | Y-Surf<br>(ft) |
|--------------|----------------|----------------|
| 1            | 225.000        | 7513.897       |
| 2            | 234.085        | 7509.718       |
| 3            | 243.475        | 7506.279       |
| 4            | 253.110        | 7503.601       |
| 5            | 262.927        | 7501.701       |
| 6            | 272.866        | 7500.591       |
| 7            | 282.861        | 7500.279       |
| 8            | 292.849        | 7500.767       |
| 9            | 302.766        | 7502.051       |
| 10           | 312.549        | 7504.124       |
| 11           | 322.135        | 7506.971       |
| 12           | 331.463        | 7510.575       |
| 13           | 340.473        | 7514.913       |
| 14           | 349.108        | 7519.957       |
| 15           | 357.312        | 7525.674       |
| 16           | 365.034        | 7532.028       |
| 17           | 372.223        | 7538.979       |
| 18           | 375.324        | 7542.500       |

Circle Center At X = 281.724 ; Y = 7625.099 ; and Radius = 124.834

Factor of Safety

\*\*\* 2.147 \*\*\*

Failure Surface Specified By 17 Coordinate Points

| Point<br>No. | X-Surf<br>(ft) | Y-Surf<br>(ft) |
|--------------|----------------|----------------|
| 1            | 225.000        | 7513.897       |
| 2            | 234.553        | 7510.939       |

|    |         |          |
|----|---------|----------|
| 3  | 244.279 | 7508.614 |
| 4  | 254.136 | 7506.930 |
| 5  | 264.082 | 7505.896 |
| 6  | 274.075 | 7505.514 |
| 7  | 284.071 | 7505.788 |
| 8  | 294.028 | 7506.716 |
| 9  | 303.903 | 7508.293 |
| 10 | 313.653 | 7510.514 |
| 11 | 323.237 | 7513.369 |
| 12 | 332.613 | 7516.844 |
| 13 | 341.742 | 7520.927 |
| 14 | 350.584 | 7525.598 |
| 15 | 359.101 | 7530.838 |
| 16 | 367.257 | 7536.625 |
| 17 | 374.484 | 7542.500 |

Circle Center At X = 274.896 ; Y = 7658.160 ; and Radius = 152.648

Factor of Safety

\*\*\* 2.178 \*\*\*

Failure Surface Specified By 14 Coordinate Points

| Point<br>No. | X-Surf<br>(ft) | Y-Surf<br>(ft) |
|--------------|----------------|----------------|
| 1            | 250.000        | 7514.375       |
| 2            | 259.183        | 7510.416       |
| 3            | 268.738        | 7507.468       |
| 4            | 278.556        | 7505.565       |
| 5            | 288.521        | 7504.729       |
| 6            | 298.518        | 7504.971       |
| 7            | 308.431        | 7506.286       |
| 8            | 318.145        | 7508.661       |
| 9            | 327.547        | 7512.067       |
| 10           | 336.528        | 7516.465       |
| 11           | 344.983        | 7521.804       |
| 12           | 352.816        | 7528.021       |
| 13           | 359.933        | 7535.045       |
| 14           | 366.014        | 7542.500       |

Circle Center At X = 291.277 ; Y = 7597.451 ; and Radius = 92.765

Factor of Safety

\*\*\* 2.182 \*\*\*

Failure Surface Specified By 17 Coordinate Points

| Point<br>No. | X-Surf<br>(ft) | Y-Surf<br>(ft) |
|--------------|----------------|----------------|
| 1            | 225.000        | 7513.897       |
| 2            | 234.331        | 7510.300       |
| 3            | 243.919        | 7507.461       |
| 4            | 253.704        | 7505.399       |
| 5            | 263.623        | 7504.127       |
| 6            | 273.612        | 7503.653       |
| 7            | 283.606        | 7503.980       |
| 8            | 293.543        | 7505.106       |
| 9            | 303.357        | 7507.023       |
| 10           | 312.987        | 7509.721       |
| 11           | 322.369        | 7513.180       |
| 12           | 331.445        | 7517.379       |
| 13           | 340.155        | 7522.292       |
| 14           | 348.445        | 7527.885       |
| 15           | 356.259        | 7534.125       |
| 16           | 363.550        | 7540.969       |
| 17           | 364.939        | 7542.500       |

Circle Center At X = 274.531 ; Y = 7628.479 ; and Radius = 124.829

Factor of Safety

\*\*\* 2.193 \*\*\*

Failure Surface Specified By 19 Coordinate Points

| Point<br>No. | X-Surf<br>(ft) | Y-Surf<br>(ft) |
|--------------|----------------|----------------|
| 1            | 200.000        | 7513.418       |
| 2            | 209.831        | 7511.589       |
| 3            | 219.733        | 7510.191       |

|    |         |          |
|----|---------|----------|
| 4  | 229.687 | 7509.228 |
| 5  | 239.673 | 7508.700 |
| 6  | 249.672 | 7508.609 |
| 7  | 259.666 | 7508.955 |
| 8  | 269.636 | 7509.738 |
| 9  | 279.561 | 7510.956 |
| 10 | 289.424 | 7512.606 |
| 11 | 299.205 | 7514.686 |
| 12 | 308.887 | 7517.191 |
| 13 | 318.449 | 7520.117 |
| 14 | 327.874 | 7523.458 |
| 15 | 337.145 | 7527.207 |
| 16 | 346.242 | 7531.358 |
| 17 | 355.150 | 7535.903 |
| 18 | 363.850 | 7540.833 |
| 19 | 366.514 | 7542.500 |

Circle Center At X = 246.751 ; Y = 7737.354 ; and Radius = 228.764

Factor of Safety

\*\*\* 2.252 \*\*\*

Failure Surface Specified By 19 Coordinate Points

| Point<br>No. | X-Surf<br>(ft) | Y-Surf<br>(ft) |
|--------------|----------------|----------------|
| 1            | 200.000        | 7513.418       |
| 2            | 209.789        | 7511.377       |
| 3            | 219.663        | 7509.792       |
| 4            | 229.600        | 7508.667       |
| 5            | 239.578        | 7508.005       |
| 6            | 249.576        | 7507.806       |
| 7            | 259.572        | 7508.071       |
| 8            | 269.546        | 7508.800       |
| 9            | 279.474        | 7509.991       |
| 10           | 289.337        | 7511.641       |
| 11           | 299.113        | 7513.747       |
| 12           | 308.781        | 7516.304       |
| 13           | 318.319        | 7519.307       |
| 14           | 327.708        | 7522.749       |
| 15           | 336.927        | 7526.624       |
| 16           | 345.956        | 7530.921       |
| 17           | 354.776        | 7535.634       |
| 18           | 363.368        | 7540.750       |
| 19           | 366.019        | 7542.500       |

Circle Center At X = 248.862 ; Y = 7723.270 ; and Radius = 215.465

Factor of Safety

\*\*\* 2.254 \*\*\*

Failure Surface Specified By 19 Coordinate Points

| Point<br>No. | X-Surf<br>(ft) | Y-Surf<br>(ft) |
|--------------|----------------|----------------|
| 1            | 200.000        | 7513.418       |
| 2            | 209.530        | 7510.390       |
| 3            | 219.223        | 7507.929       |
| 4            | 229.043        | 7506.043       |
| 5            | 238.958        | 7504.740       |
| 6            | 248.932        | 7504.023       |
| 7            | 258.932        | 7503.896       |
| 8            | 268.921        | 7504.359       |
| 9            | 278.866        | 7505.411       |
| 10           | 288.731        | 7507.046       |
| 11           | 298.483        | 7509.261       |
| 12           | 308.087        | 7512.046       |
| 13           | 317.510        | 7515.394       |
| 14           | 326.719        | 7519.291       |
| 15           | 335.683        | 7523.724       |
| 16           | 344.370        | 7528.678       |
| 17           | 352.749        | 7534.135       |
| 18           | 360.792        | 7540.077       |
| 19           | 363.697        | 7542.500       |

Circle Center At X = 256.083 ; Y = 7673.395 ; and Radius = 169.522



Factor of Safety  
\*\*\* 2.310 \*\*\*  
\*\*\*\* END OF GSTABL7 OUTPUT \*\*\*\*

**APPENDIX D**  
**LAKE DRAWDOWN PROCEDURE**

# **Standard Operating Procedure:**

## **Flying Horse North Dam Lake Drawdown**

August 2018

### Purpose

The Flying Horse North Dam impounds water held for irrigation use for the Flying Horse North private golf course. This facility is not equipped with a low level outlet for emergency drawdown of the lake as the adjacent irrigation pump station serves as both irrigation pump and lake drawdown pump. The purpose of this procedure is to briefly describe the process for the lake drawdown, if the need arises.

### Scope

The Flying Horse North irrigation pump station has its own Standard Operating Procedures (SOPs) for the irrigation of the golf course. Please reference those for further information of the standard operations of the pump station. This specific SOP is for the lake drawdown only. This procedure may be used in an emergency situation if there is a concern with the embankment or outlet structure, or if there is a need to release water downstream.

### Prerequisites

The following are requirements prior to utilizing this SOP:

3-Phase underground power provided

Emergency situation is imminent that may cause damage to the embankment

State Engineer's Office calls for release of water from this facility

### Responsibilities

The Flying Horse North Golf Course maintenance supervisor/staff are the primary personnel that will use this SOP. The following is the contact information:

Dan Hawkins, Director of Agronomy & Facility Operations  
The Club at Flying Horse & Flying Horse North Golf Club  
1880 Weiskopf Point, Colorado Springs, CO 80132  
719-487-2631 (Office)  
719-492-0648 (Cell)

### Standard Procedure

This plan is to use the irrigation system pumping equipment to remove water from the lake to a specified level. The water is then released through the 30" RCP gravity piping system constructed as a part of the stormwater quality design component. This system drains directly to the base of the rock chute below the embankment spillway. The following are the steps required to perform this SOP:

- Ensure pump station is powered up and in automatic mode

- Close mainline isolation valve located outside of pump station just north of #6 tee

- Close mainline isolation valve located outside of pump station just NE of #5 green

- Open lake drain isolation valve located outside of pump station just NE of #5 green

- Start-up Irrigation pumps in normal mode

- Visually confirm the release of water through the 30" RCP

- Monitor water release until desired lake elevation is reached

### Alternate Procedure

This procedure should be used if there is a total loss of power at pump station or pump failure. However, the pump station is served by Mountain View Electric via multiple buried 3-phase conduits serving this facility from two directions. So the likelihood of a complete power failure to this facility is extremely unlikely. Also, the pump station is equipped with 3 – 75 hp. Pumps with a total performance of 2250 GPM. Thus, even if one of the pumps were to fail, the other two could still provide pumping ability if needed. The following steps are required to perform this alternate SOP:

- If total power loss, a generator must be rented and delivered to the site immediately

- The generator is hooked up to provide power to pump station

- Proceed to Standard Procedure

- If pump failure, disconnect failed pump and proceed to Standard Procedure with remaining two pumps