



922052

November 13, 2013

*Mount Holly Conservation Trust
P.O. Box 85
Belmont, Vermont 05730*

SUBJECT: Star Lake Alternatives Summary Report

Dear Messrs. Ron Unterman & Jim Heald

Introduction

Star Lake Dam, located in the headwaters of the Mill Brook in the Village of Belmont, Mount Holly, Vermont, is owned by the Town of Mount Holly (Owner). The dam is classified by the Vermont Agency of Natural Resources, Department of Environmental Conservation (VT DEC) as a Class 1 – High Hazard dam. The VT DEC has identified the dam as being in poor condition and because of this identification the owner is being compelled to engage the services of an engineer to develop a remedial action plan to address those deficiencies.

DuBois & King, Inc. was retained by the Mount Holly Conservation Trust & Town of Mount Holly to conduct an evaluation of the Star Lake Dam and provide alternatives for remedial action. The evaluation consisted of a site inspection, topographic survey, desktop analyses, and a presentation of repair alternatives to address the identified deficiencies. This Summary Report details that evaluation and provides the owner with alternatives for remedial action to consider for implementation.

Field Investigations & Desktop Analysis

Site Inspection

According a review of VT DEC inspection reports, the dam is considered to be in poor condition and not able to function as designed. Also, the design is considered obsolete regarding the hydraulic capacity of the spillway. Several visits to the site were made to identify and confirm the noted deficiencies with the dam. Site visits to inspect the dam were made on August 6 and October 8, 2013. Additional visits were made to the dam on September 9 and October 21, 2013. In general, the dam is in poor condition due to deteriorating concrete in the spillway and eroded embankment adjacent to the spillway, which confirms the documented concerns. Photographs of the site taken during these visits are presented in Attachment A.

The Star Lake Dam is an earth embankment dam with a concrete cutoff wall at the upstream face of the embankment. At 217 feet long and 15 feet high, the dam

impounds approximately 413 acre feet at normal water level. The concrete cutoff wall extends for approximately 200 feet from the left to right abutments. The top elevation of the wall ranges from El. 1847.3 to 1848.4, with an average top elevation of the embankment of El. 1848. The spillway consists of a concrete 'chute style' weir with a length of approximately 9 feet and a rise of approximately 2.4 feet.

The spillway is designed to accommodate flash boards in order to control the water level at El. 1846.65 +/- . Currently, under order from the VT DEC, the flash boards are removed and the water level is being controlled by the chute apron at El. 1845.15, 1.5 feet below historic water levels.

Topographic Survey

A topographic survey was performed as part of the VT DEC breach analysis and inundation mapping project conducted in 2012. D&K was part of that effort and retained the electronic data files. From this information a base map for the dam site was prepared. Due to the concepts being evaluated additional topographic data was obtained in October 2013 and incorporated into the base map. The base map is presented in Attachment A.

Hydrologic & Hydraulic Analysis

The primary concern the VT DEC has with the Star Lake Dam is its hydraulic capacity. Several engineering studies and previous inspections have identified the capacity of the dam to safely pass flood flows as being very poor. As evidenced in the 70's and as recent as 2011 (Tropical Storm Irene), the dam has overtopped with flood waters discharging around the spillway. This has caused damage to the dam in the form of erosion on the embankment. The concern is that during an overtopping event, a breach could occur causing an uncontrolled release from the lake exacerbating any flooding that already may be occurring in the Village of Belmont. This is the primary justification for the lower water level being maintained currently.

A comprehensive and detailed hydrologic and hydraulic analysis of the dam and contributing watershed was performed. The lake has a 1.1 square mile watershed and from that area approximately 1073 cubic feet per second of inflowing discharge is anticipated at the peak of a 100 year flood event. The spillway at the dam has a capacity of 48 cubic feet per second. Overtopping of the dam by approximately 0.3 feet can be anticipated during this event. Because the dam is classified as high hazard, the dam safety regulations indicate that this dam must pass the ½ Probable Maximum Flood (PMF). A ½ PMF is equivalent to receiving 14.5 inches of rainfall in 24 hours. In comparison a 100 year flood event is estimated at 6.33 inches of rainfall in 24 hours.

The H&H analysis results concur with the concern that the spillway at the dam does not have adequate capacity to pass the regulatory design storm when the water

level is that the historic elevation. Increased capacity will be required as a major component of any remedial action plan. The results of the H&H modeling and a summary table of the analysis are presented in Attachment B.

Geotechnical Investigation

A series of soil borings were taken at the dam on October 21, 2013. The purpose of the soil borings is to characterize the soils behind the concrete cutoff wall and identify the depth and extent of the foundation. A total of 2 soils borings and 2 auger probes were conducted on October 21, 2013. In the soil borings, samples were taken for laboratory testing. The auger probes were conducted to determine depth to the foundation elevation and/or bedrock location.

Bedrock was not encountered in any of the borings or probes. The overburden (soil above the foundation) was found to be brown fine sand to gray silt (glacial till). A glacial till foundation was found to be consistent between 14.5 and 15.5 feet below the ground surface. A core of the glacial till was conducted to determine the thickness of the layer. After 4 feet of coring bedrock was not encountered and the coring was terminated. Boring logs are included in Attachment C. Locations of each boring or probe are shown on the existing conditions site plan in Attachment A.

Alternatives Analysis

Existing Conditions

As a result of this evaluation the dam was found to be in poor condition with the following primary deficiencies that will require implementation of remedial measures:

- Inadequate spillway hydraulic capacity: Due to the hydraulic capacity of the spillway overtopping occurs prior to the required spillway design flood (SDF of the ½ PMF. Furthermore, overtopping of the embankment was found to occur during the 50-year storm event, which is a much smaller storm event.
- Due to previous overtopping the embankment is significantly eroded on each side of the spillway. The erosion extends along the spillway training walls and is over-steepened at the discharge end of the spillway apron. Continued overtopping could exacerbate this condition resulting in a breach of the embankment.
- In general, the condition of the spillway concrete is poor. There is significant spalling and deterioration of the training walls and apron. The edges and corners of the cutoff wall are also deteriorated, however due to its mass and being buried against earth the overall condition of the cutoff wall concrete is fair.

Alternatives

To address these identified deficiencies several conceptual remediation measures were identified. Through an alternatives analysis, two (2) alternatives were developed and are presented for consideration. Those alternatives include:

Alternative 1 ~ Overflow Spillway

This alternative involves removing and replacing the current overflow weir and making the following modification to the dam:

- New labyrinth (v-shaped) overflow weir that would increase the span 9 feet currently to 20 feet.
- Construct a parapet wall atop the existing concrete cutoff wall. The top elevation will be 18 inches higher than the predicted peak water level during the spillway design flood (1/2 PMF).
- Regrading of the recreation/beach area to allow for shallow overtopping during extreme flood events.
- New, longer access bridge. A request by the owner was made for a bridge that would allow access of light vehicle traffic for park maintenance.
- Anticipated construction cost of \$510,000 to \$530,000.

Alternative 2 ~ Drop Inlet Spillway

This involves removing and replacing the current overflow weir and making the following modification to the dam:

- New 10 foot diameter drop-inlet (vertical riser) and 5 foot diameter outlet barrel system. Discharge from the lake spills into the drop inlet and flows through the outlet barrel into the downstream channel.
- Construct a parapet wall atop the existing concrete cutoff wall. The top elevation will be 12 inches higher than the predicted peak water level during the spillway design flood (1/2 PMF).
- Regrading of the recreation/beach area to allow for shallow overtopping during extreme flood events.
- The existing bridge and spillway will be removed. The excavated area will be filled with earth embankment allow access to the beach area across the embankment without a bridge.
- Anticipated construction cost of \$230,000 to \$250,00

An engineering sketch and estimate of probable construction costs are presented in Attachment D.

Conclusion and Recommendations

The results of this evaluation concur with previous studies and inspections of the Star Lake Dam. The dam is in poor condition and requires implementation of remedial measures. Through an alternatives analysis two (2) viable alternatives are identified. Both alternatives achieve the objective of safely passing the spillway design flood (1/2 PMF) while protecting the dam from overtopping. These alternatives, both, address the natural deterioration of the dam's elements, including the concrete and embankment. Furthermore, the alternatives allow continued use and maintenance of the recreation area without significant encumbrance.

Alternative 1 replaces the existing spillway in an "in-kind" manner by employing an overflow spillway design. Alternative 2 changes the design to a drop inlet system while extending the earth embankment. Both alternatives call for regrading to raise the topography on the dam, constructing a parapet wall on top of the existing cutoff wall, and protecting an area near the beach to allow overtopping in a controlled manner. The cost difference between the alternatives is significant due to the extent of the design and construction materials used, for that reason DuBois & King recommends implementing Alternative 2.

Once you have a chance to review this summary report and discuss the findings and recommendations with the stakeholders, D&K is prepared to conduct a public meeting to further discuss the details of our work, outline next steps and answer any questions that may arise.

We appreciate the opportunity to assist you with this project. Please call me at (802) 728-3376 if you have any questions or need any additional information.

Very truly yours,

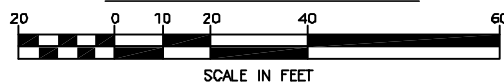
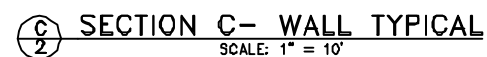
DuBOIS & KING, INC.



Shawn R. Patenaude, P.E.
Project Manager

Attachments:

- A – Existing Conditions & Photos
- B – Hydrology & Hydraulics
- C – Geotechnical Data
- D – Alternatives (Exhibits/Costs)



PHOTOGRAPH B
October 8, 2013

PHOTOGRAPH C
October 8, 2013

**NOT FOR
CONSTRUCTION
PRELIMINARY
PLANS**

[illegible]

VERMONT
DEPARTMENT OF
ENVIRONMENTAL
CONSERVATION

STAR LAKE DAM
VT 135.02
TOWN OF MOUNT
HOLLY, VERMONT
RUTLAND COUNTY

SHEET TITLE
EXISTING CONDITIONS

DRAWN BY RDL	DATE OCT 2013
CHECKED BY SRP	D&K PROJECT # 922052
PROJ. ENG. RDL	D&K ARCHIVE #

SHEET NUMBER

C1

SHEET 1 OF 3

PHOTOGRAPHS



Photograph 01 ~ *Upstream view of Star Lake Dam from beyond the left abutment.*



Photograph 02 ~ *View of the spillway from the dam embankment behind the right abutment.*

PHOTOGRAPHS



Photograph 03 ~ *View of the outlet channel from behind the right abutment, next to the spillway.*



Photograph 04 ~ *View of the spillway from the outlet channel.*

PHOTOGRAPHS

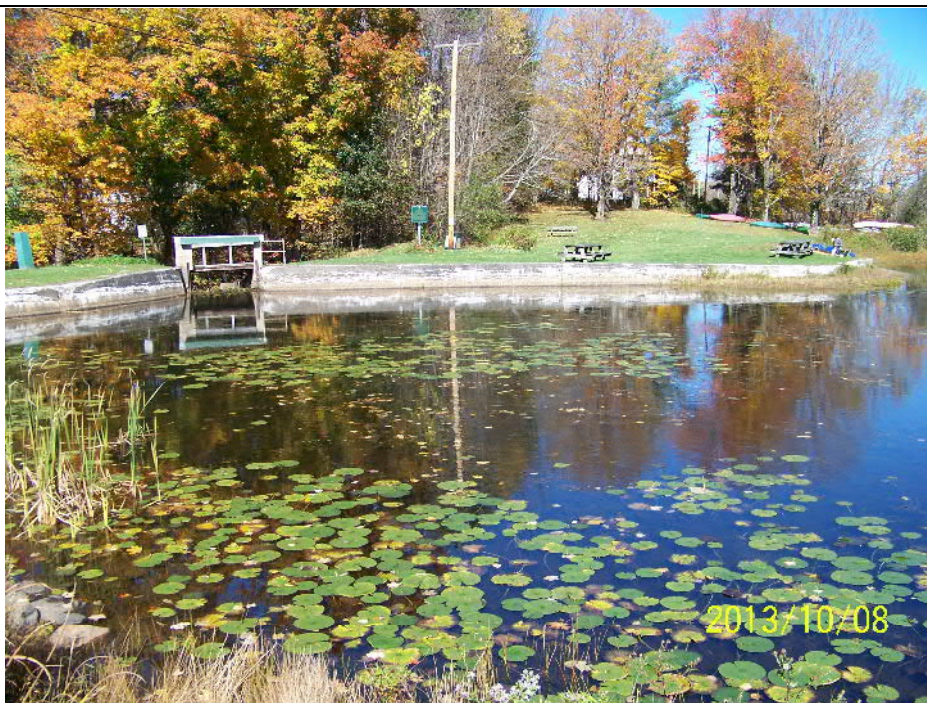


Photograph 05 ~ *A view looking upstream of the outlet channel from a position further downstream on the outlet channel.*



Photograph 06 ~ *A view of the low level outlet located underneath the spillway.*

PHOTOGRAPHS



Photograph 07 ~ *A view of the spillway and right abutment from beyond the left abutment.*



Photograph 08 ~ *A view of the spillway and left abutment from the right abutment.*

PHOTOGRAPHS



Photograph 09 ~ *A view of the Star Lake Recreation Area and right abutment from the left abutment.*



Photograph 10 ~ *View of the spillway from the left abutment.*



☐ Randolph, VT 05060 (802) 728-3376
☐
☐

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY: _____ DATE: _____

CHECKED BY: _____ DATE: _____

SCALE: _____

Engineering • Planning • Development • Management

(PRELIMINARY DESIGN)

HYDRAULIC PERFORMANCE SUMMARY

EXISTING CONDITIONS

Key Elevations

Key Data

Existing Top of Dam El.	1848.00	-	1848.62	ft.	Drainage Area:	1.1	sm
Proposed Top of Dam	1851.00	ft.	(Parapet Wall)				
Historic Pool El.	1846.65	ft.			Saddle El.	1849.65	ft.
Proposed Pool El.	1846.65	ft.					

Hydraulic Performance

Storm Event

Peak Inflow

Outflow through Spillway

Outflow through Saddle

Outflow over Abutment

Total Outflow

WSEL

Freeboard

cfs

cfs

cfs

cfs

cfs

ft

ft

100-yr (6.33 in/24hrs)

1072.6

53.0

0.0

117.31

170.34

1848.34

-0.34

Historic Conditions

500-yr (9.14 in/24hrs)

1836.8

84.9

0.0

666.00

750.87

1848.95

-0.95

Historic Conditions

1/2 PMF (14.5 in/24hrs)

3449.32

140.1

5.6

2239.19

2384.94

1849.83

-1.83

Historic Conditions

100-yr (6.33 in/24hrs)

1072.6

218.1

0.0

11.78

229.84

1848.13

2.87

Labyrinth Weir

500-yr (9.14 in/24hrs)

1836.8

408.4

0.0

293.25

701.61

1848.87

2.13

Labyrinth Weir

1/2 PMF (14.5 in/24hrs)

3449.32

742.5

6.3

1451.27

2199.97

1849.88

1.12

Labyrinth Weir

100-yr (6.33 in/24hrs)

1072.6

193.3

0.0

15.42

208.70

1848.17

2.83

Drop-Inlet Spillway

500-yr (9.14 in/24hrs)

1836.8

349.8

0.0

333.57

683.36

1848.91

2.09

Drop-Inlet Spillway

1/2 PMF (14.5 in/24hrs)

3449.32

609.3

8.3

2587.36

1520.57

1849.92

1.08

Drop-Inlet Spillway

Print Date: 11/7/2013

Star Lake Dam

Prepared by DuBois & King, Inc.

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Existing Conditions
Type II 24-hr 100-yr Rainfall=6.33"

Printed 11/7/2013

Page 1

Summary for Pond 1P: Star Lake Dam

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 3.57" for 100-yr event
 Inflow = 1,072.60 cfs @ 12.91 hrs, Volume= 211.228 af
 Outflow = 87.53 cfs @ 17.52 hrs, Volume= 143.042 af, Atten= 92%, Lag= 276.5 min
 Primary = 84.52 cfs @ 17.52 hrs, Volume= 140.947 af
 Secondary = 3.01 cfs @ 17.52 hrs, Volume= 2.095 af
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,845.15' Surf.Area= 50.000 ac Storage= 146.250 af
 Peak Elev= 1,847.44' @ 17.52 hrs Surf.Area= 70.168 ac Storage= 291.513 af (145.263 af above start)
 Flood Elev= 1,852.00' Surf.Area= 99.110 ac Storage= 742.400 af (596.150 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= 580.5 min (1,471.8 - 891.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Primary	1,845.15'	9.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Secondary	1,846.96'	BC Weir - right abutment, C= 2.63 Offset (feet) 381.47 381.47 382.25 397.20 404.40 451.53 452.89 487.67 501.69 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,846.96 1,846.96 1,848.26 1,848.22 1,848.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#3	Secondary	1,847.60'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 181.37 213.50 284.89 285.01 304.54 314.80 326.94 353.52 371.85 372.19 372.97 372.97 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,847.60 1,848.41 1,848.23 1,847.99 1,848.04 1,848.62 1,848.41 1,848.41 1,870.00
#4	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.63 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00

Star Lake Dam

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Existing Conditions
Type II 24-hr 100-yr Rainfall=6.33"

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Primary OutFlow Max=84.34 cfs @ 17.52 hrs HW=1,847.44' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 84.34 cfs @ 4.09 fps)

Secondary OutFlow Max=2.62 cfs @ 17.52 hrs HW=1,847.44' (Free Discharge)

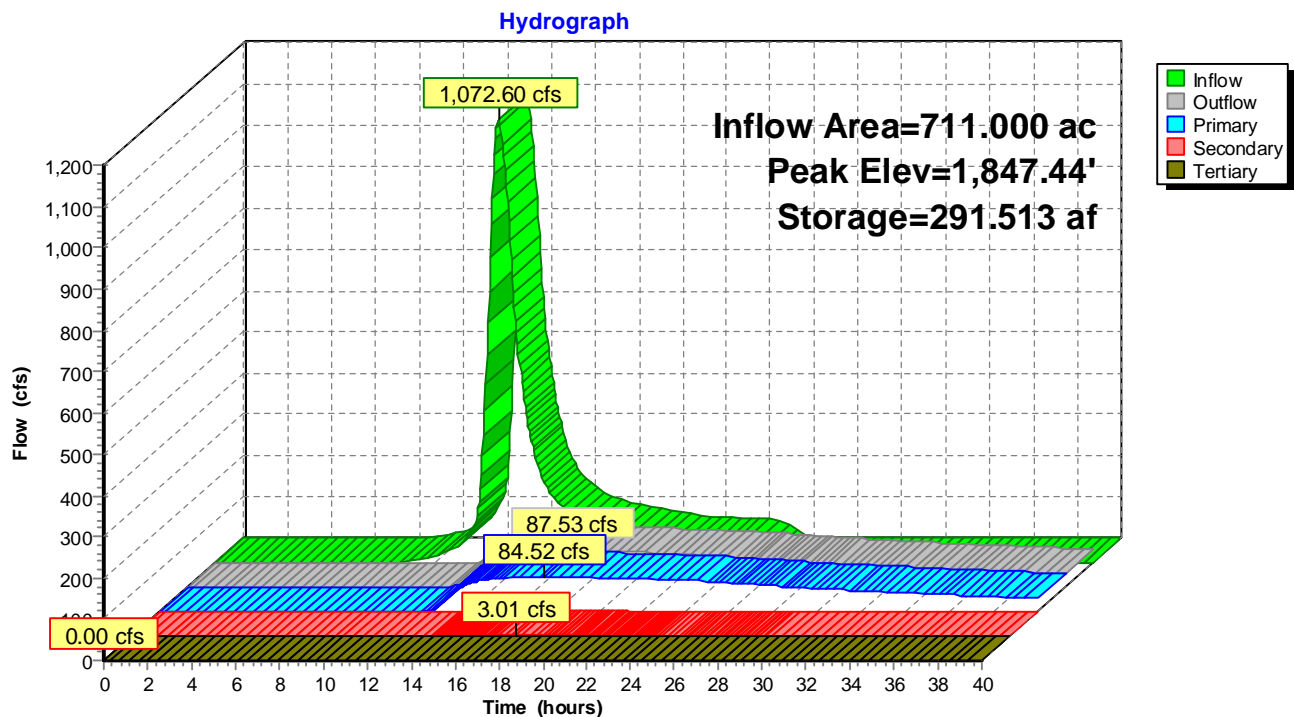
↑ **2=BC Weir - right abutment** (Weir Controls 2.62 cfs @ 0.86 fps)

↑ **3=BC Weir - left abutment** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,845.15' (Free Discharge)

↑ **4=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 1P: Star Lake Dam



Star Lake Dam

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Existing Conditions
Type II 24-hr 500-yr Rainfall=9.14"

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Summary for Pond 1P: Star Lake Dam

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 6.08" for 500-yr event
 Inflow = 1,836.80 cfs @ 12.89 hrs, Volume= 360.304 af
 Outflow = 317.83 cfs @ 14.96 hrs, Volume= 274.795 af, Atten= 83%, Lag= 124.0 min
 Primary = 149.16 cfs @ 14.96 hrs, Volume= 212.691 af
 Secondary = 168.67 cfs @ 14.96 hrs, Volume= 62.104 af
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,845.15' Surf.Area= 50.000 ac Storage= 146.250 af
 Peak Elev= 1,848.46' @ 14.96 hrs Surf.Area= 80.719 ac Storage= 370.643 af (224.393 af above start)
 Flood Elev= 1,852.00' Surf.Area= 99.110 ac Storage= 742.400 af (596.150 af above start)

Plug-Flow detention time= 985.1 min calculated for 128.385 af (36% of inflow)
 Center-of-Mass det. time= 462.2 min (1,338.3 - 876.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Primary	1,845.15'	9.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Secondary	1,846.96'	BC Weir - right abutment, C= 2.63 Offset (feet) 381.47 381.47 382.25 397.20 404.40 451.53 452.89 487.67 501.69 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,846.96 1,846.96 1,848.26 1,848.22 1,848.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#3	Secondary	1,847.60'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 181.37 213.50 284.89 285.01 304.54 314.80 326.94 353.52 371.85 372.19 372.97 372.97 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,847.60 1,848.41 1,848.23 1,847.99 1,848.04 1,848.62 1,848.41 1,848.41 1,870.00
#4	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.63 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00

Star Lake Dam

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Existing Conditions

Type II 24-hr 500-yr Rainfall=9.14"

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Primary OutFlow Max=149.07 cfs @ 14.96 hrs HW=1,848.46' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 149.07 cfs @ 5.00 fps)

Secondary OutFlow Max=161.16 cfs @ 14.96 hrs HW=1,848.46' (Free Discharge)

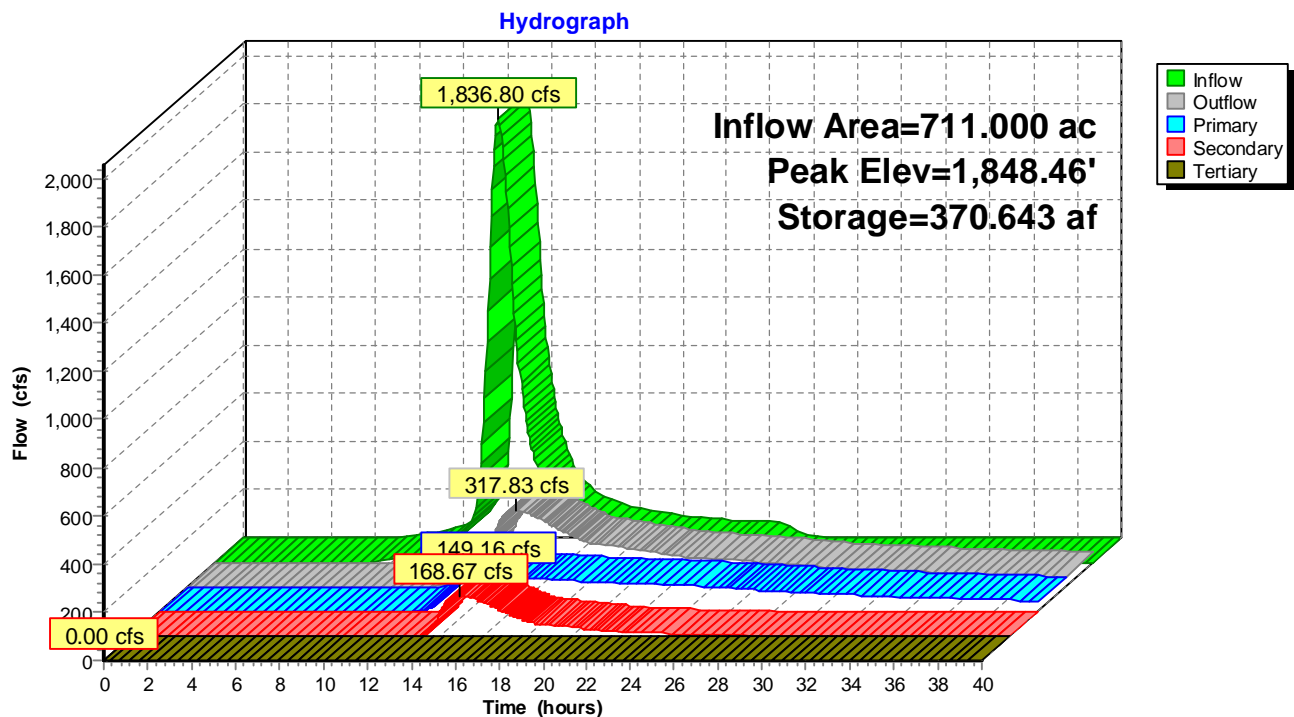
↑ **2=BC Weir - right abutment** (Weir Controls 110.62 cfs @ 1.45 fps)

↑ **3=BC Weir - left abutment** (Weir Controls 50.54 cfs @ 1.17 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,845.15' (Free Discharge)

↑ **4=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 1P: Star Lake Dam



Star Lake Dam

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Existing Conditions

D&K S-VT PMP 24-hr Half PMF Rainfall=14.50"

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Summary for Pond 1P: Star Lake Dam

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 11.15" for Half PMF event
 Inflow = 3,449.32 cfs @ 13.27 hrs, Volume= 660.475 af
 Outflow = 2,006.38 cfs @ 14.00 hrs, Volume= 571.682 af, Atten= 42%, Lag= 43.6 min
 Primary = 243.15 cfs @ 14.00 hrs, Volume= 243.906 af
 Secondary = 1,763.22 cfs @ 14.00 hrs, Volume= 327.776 af
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,845.15' Surf.Area= 50.000 ac Storage= 146.250 af
 Peak Elev= 1,849.61' @ 14.00 hrs Surf.Area= 92.538 ac Storage= 459.289 af (313.039 af above start)
 Flood Elev= 1,852.00' Surf.Area= 99.110 ac Storage= 742.400 af (596.150 af above start)

Plug-Flow detention time= 442.2 min calculated for 424.901 af (64% of inflow)
 Center-of-Mass det. time= 258.3 min (1,121.7 - 863.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Primary	1,845.15'	9.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Secondary	1,846.96'	BC Weir - right abutment, C= 2.63 Offset (feet) 381.47 381.47 382.25 397.20 404.40 451.53 452.89 487.67 501.69 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,846.96 1,846.96 1,848.26 1,848.22 1,848.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#3	Secondary	1,847.60'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 181.37 213.50 284.89 285.01 304.54 314.80 326.94 353.52 371.85 372.19 372.97 372.97 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,847.60 1,848.41 1,848.23 1,847.99 1,848.04 1,848.62 1,848.41 1,848.41 1,870.00
#4	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.63 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00

Star Lake Dam

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Existing Conditions
D&K S-VT PMP 24-hr Half PMF Rainfall=14.50"

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Primary OutFlow Max=243.07 cfs @ 14.00 hrs HW=1,849.61' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 243.07 cfs @ 6.06 fps)

Secondary OutFlow Max=1,759.69 cfs @ 14.00 hrs HW=1,849.61' (Free Discharge)

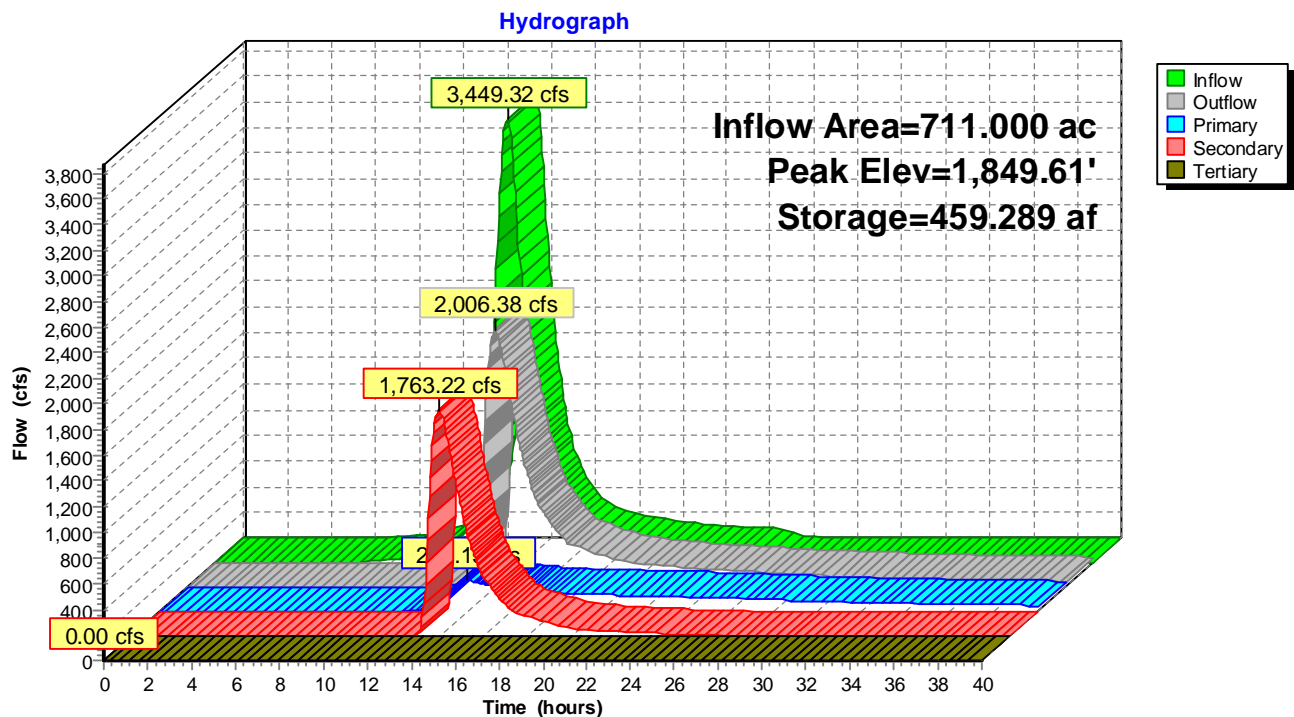
↑ **2=BC Weir - right abutment** (Weir Controls 740.44 cfs @ 2.66 fps)

↑ **3=BC Weir - left abutment** (Weir Controls 1,019.25 cfs @ 2.74 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,845.15' (Free Discharge)

↑ **4=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 1P: Star Lake Dam



Star Lake Dam

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Existing Conditions

Type II 24-hr TS Irene Rainfall=8.00"

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Summary for Pond 1P: Star Lake Dam

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 5.04" for TS Irene event
 Inflow = 1,523.20 cfs @ 12.90 hrs, Volume= 298.719 af
 Outflow = 169.40 cfs @ 16.03 hrs, Volume= 216.728 af, Atten= 89%, Lag= 188.4 min
 Primary = 125.87 cfs @ 16.03 hrs, Volume= 193.759 af
 Secondary = 43.53 cfs @ 16.03 hrs, Volume= 22.969 af
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,845.15' Surf.Area= 50.000 ac Storage= 146.250 af
 Peak Elev= 1,848.12' @ 16.03 hrs Surf.Area= 77.183 ac Storage= 344.121 af (197.871 af above start)
 Flood Elev= 1,852.00' Surf.Area= 99.110 ac Storage= 742.400 af (596.150 af above start)

Plug-Flow detention time= 1,217.1 min calculated for 70.478 af (24% of inflow)
 Center-of-Mass det. time= 529.1 min (1,410.5 - 881.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Primary	1,845.15'	9.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Secondary	1,846.96'	BC Weir - right abutment, C= 2.63 Offset (feet) 381.47 381.47 382.25 397.20 404.40 451.53 452.89 487.67 501.69 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,846.96 1,846.96 1,848.26 1,848.22 1,848.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#3	Secondary	1,847.60'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 181.37 213.50 284.89 285.01 304.54 314.80 326.94 353.52 371.85 372.19 372.97 372.97 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,847.60 1,848.41 1,848.23 1,847.99 1,848.04 1,848.62 1,848.41 1,848.41 1,870.00
#4	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.63 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00

Star Lake Dam

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Existing Conditions

Type II 24-hr TS Irene Rainfall=8.00"

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Primary OutFlow Max=125.69 cfs @ 16.03 hrs HW=1,848.12' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 125.69 cfs @ 4.70 fps)

Secondary OutFlow Max=34.46 cfs @ 16.03 hrs HW=1,848.12' (Free Discharge)

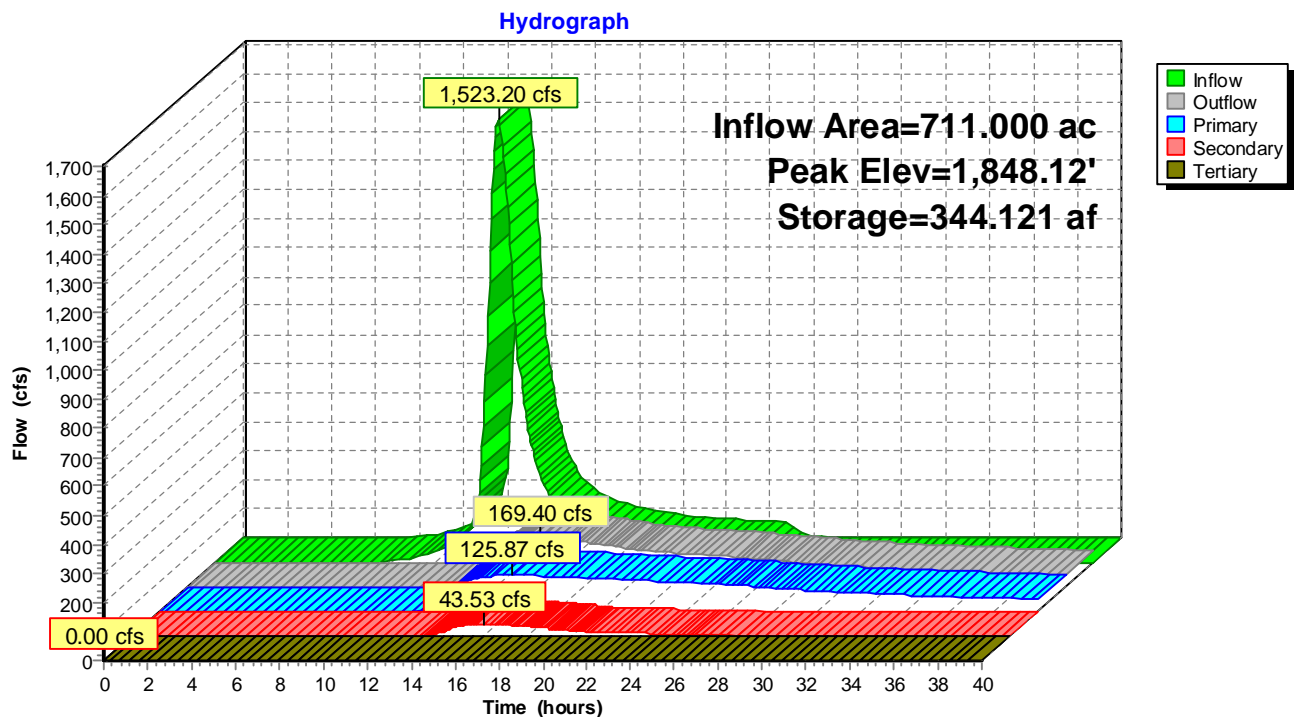
↑ **2=BC Weir - right abutment** (Weir Controls 26.75 cfs @ 1.04 fps)

↑ **3=BC Weir - left abutment** (Weir Controls 7.71 cfs @ 0.70 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,845.15' (Free Discharge)

↑ **4=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 1P: Star Lake Dam



Star Lake Dam- Historic

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Historic Conditions

Type II 24-hr 100-yr Rainfall=6.33"

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Page 1

Summary for Pond 1P: Star Lake Dam

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 3.57" for 100-yr event
 Inflow = 1,072.60 cfs @ 12.91 hrs, Volume= 211.228 af
 Outflow = 170.33 cfs @ 15.25 hrs, Volume= 148.078 af, Atten= 84%, Lag= 140.2 min
 Primary = 53.03 cfs @ 15.25 hrs, Volume= 77.205 af
 Secondary = 117.31 cfs @ 15.25 hrs, Volume= 70.873 af
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,846.65' Surf.Area= 62.000 ac Storage= 230.250 af
 Peak Elev= 1,848.34' @ 15.25 hrs Surf.Area= 79.514 ac Storage= 361.601 af (131.351 af above start)
 Flood Elev= 1,852.00' Surf.Area= 99.110 ac Storage= 742.400 af (512.150 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= 432.9 min (1,324.1 - 891.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Primary	1,846.65'	9.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Secondary	1,846.96'	BC Weir - right abutment, C= 2.63 Offset (feet) 381.47 381.47 382.25 397.20 404.40 451.53 452.89 487.67 501.69 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,846.96 1,846.96 1,848.26 1,848.22 1,848.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#3	Secondary	1,847.60'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 181.37 213.50 284.89 285.01 304.54 314.80 326.94 353.52 371.85 372.19 372.97 372.97 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,847.60 1,848.41 1,848.23 1,847.99 1,848.04 1,848.62 1,848.41 1,848.41 1,870.00
#4	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.63 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00

Star Lake Dam- Historic

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Historic Conditions

Type II 24-hr 100-yr Rainfall=6.33"

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Primary OutFlow Max=52.82 cfs @ 15.25 hrs HW=1,848.34' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 52.82 cfs @ 3.46 fps)

Secondary OutFlow Max=105.68 cfs @ 15.25 hrs HW=1,848.34' (Free Discharge)

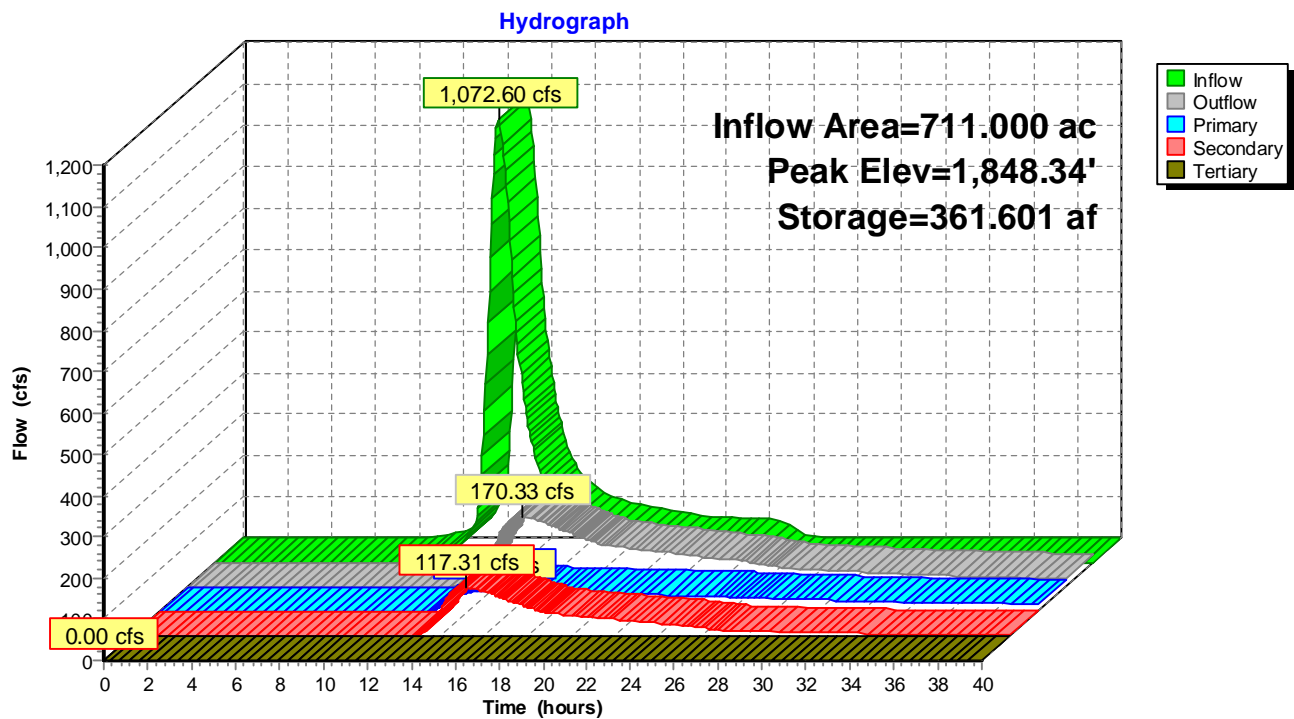
↑ **2=BC Weir - right abutment** (Weir Controls 74.49 cfs @ 1.25 fps)

↑ **3=BC Weir - left abutment** (Weir Controls 31.19 cfs @ 1.01 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,846.65' (Free Discharge)

↑ **4=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 1P: Star Lake Dam



Star Lake Dam- Historic

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Historic Conditions

Type II 24-hr 500-yr Rainfall=9.14"

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Summary for Pond 1P: Star Lake Dam

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 6.08" for 500-yr event
 Inflow = 1,836.80 cfs @ 12.89 hrs, Volume= 360.304 af
 Outflow = 750.86 cfs @ 13.90 hrs, Volume= 294.370 af, Atten= 59%, Lag= 60.9 min
 Primary = 84.87 cfs @ 13.90 hrs, Volume= 93.029 af
 Secondary = 666.00 cfs @ 13.90 hrs, Volume= 201.341 af
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,846.65' Surf.Area= 62.000 ac Storage= 230.250 af
 Peak Elev= 1,848.95' @ 13.90 hrs Surf.Area= 85.732 ac Storage= 408.238 af (177.988 af above start)
 Flood Elev= 1,852.00' Surf.Area= 99.110 ac Storage= 742.400 af (512.150 af above start)

Plug-Flow detention time= 1,061.5 min calculated for 64.040 af (18% of inflow)
 Center-of-Mass det. time= 272.7 min (1,148.7 - 876.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Primary	1,846.65'	9.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Secondary	1,846.96'	BC Weir - right abutment, C= 2.63 Offset (feet) 381.47 381.47 382.25 397.20 404.40 451.53 452.89 487.67 501.69 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,846.96 1,846.96 1,848.26 1,848.22 1,848.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#3	Secondary	1,847.60'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 181.37 213.50 284.89 285.01 304.54 314.80 326.94 353.52 371.85 372.19 372.97 372.97 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,847.60 1,848.41 1,848.23 1,847.99 1,848.04 1,848.62 1,848.41 1,848.41 1,870.00
#4	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.63 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00

Star Lake Dam- Historic

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Historic Conditions

Type II 24-hr 500-yr Rainfall=9.14"

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Primary OutFlow Max=84.69 cfs @ 13.90 hrs HW=1,848.95' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 84.69 cfs @ 4.10 fps)

Secondary OutFlow Max=653.08 cfs @ 13.90 hrs HW=1,848.95' (Free Discharge)

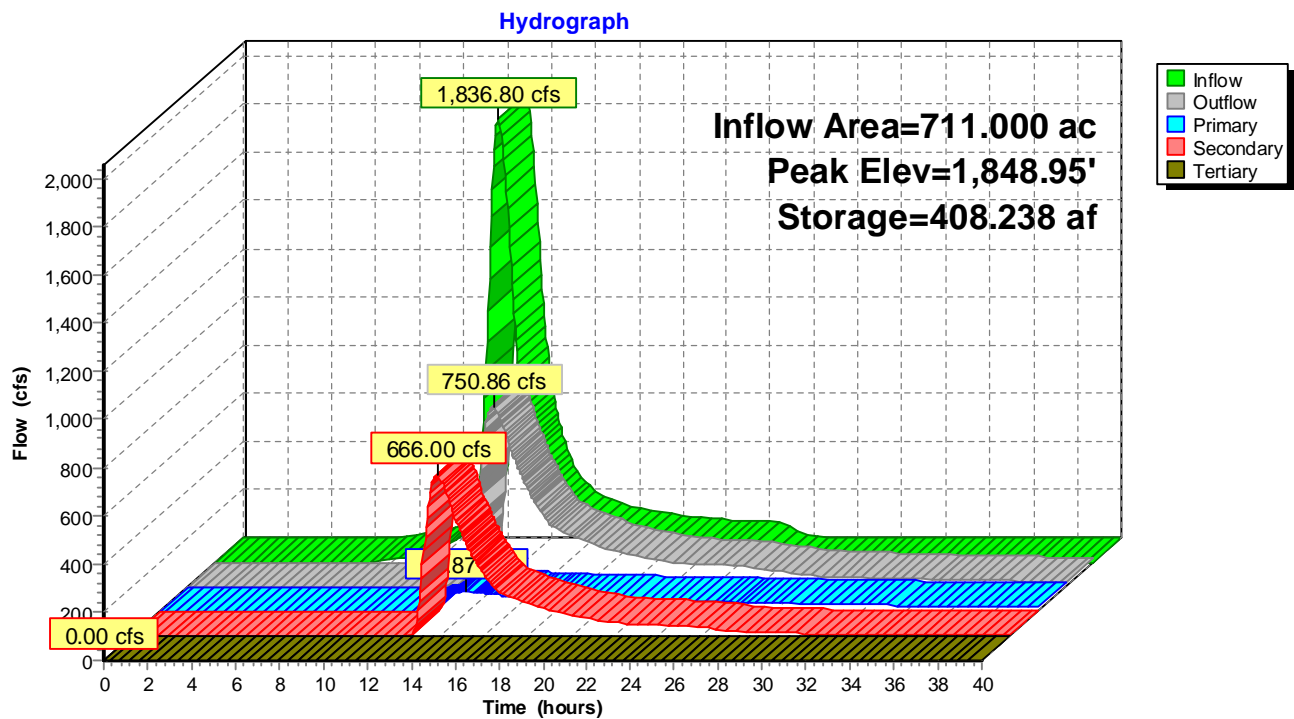
↑ **2=BC Weir - right abutment** (Weir Controls 321.19 cfs @ 2.10 fps)

↑ **3=BC Weir - left abutment** (Weir Controls 331.89 cfs @ 1.87 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,846.65' (Free Discharge)

↑ **4=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 1P: Star Lake Dam



Star Lake Dam- Historic

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Historic Conditions

D&K S-VT PMP 24-hr Half PMF Rainfall=14.50"

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Summary for Pond 1P: Star Lake Dam

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 11.15" for Half PMF event
 Inflow = 3,449.32 cfs @ 13.27 hrs, Volume= 660.475 af
 Outflow = 2,384.93 cfs @ 13.84 hrs, Volume= 593.598 af, Atten= 31%, Lag= 34.2 min
 Primary = 140.12 cfs @ 13.84 hrs, Volume= 108.191 af
 Secondary = 2,239.19 cfs @ 13.84 hrs, Volume= 485.189 af
 Tertiary = 5.63 cfs @ 13.84 hrs, Volume= 0.218 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,846.65' Surf.Area= 62.000 ac Storage= 230.250 af
 Peak Elev= 1,849.83' @ 13.84 hrs Surf.Area= 93.472 ac Storage= 484.345 af (254.095 af above start)
 Flood Elev= 1,852.00' Surf.Area= 99.110 ac Storage= 742.400 af (512.150 af above start)

Plug-Flow detention time= 380.8 min calculated for 363.348 af (55% of inflow)
 Center-of-Mass det. time= 160.9 min (1,024.3 - 863.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Primary	1,846.65'	9.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Secondary	1,846.96'	BC Weir - right abutment, C= 2.63 Offset (feet) 381.47 381.47 382.25 397.20 404.40 451.53 452.89 487.67 501.69 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,846.96 1,846.96 1,848.26 1,848.22 1,848.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#3	Secondary	1,847.60'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 181.37 213.50 284.89 285.01 304.54 314.80 326.94 353.52 371.85 372.19 372.97 372.97 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,847.60 1,848.41 1,848.23 1,847.99 1,848.04 1,848.62 1,848.41 1,848.41 1,870.00
#4	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.63 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00

Star Lake Dam- Historic

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Historic Conditions

D&K S-VT PMP 24-hr Half PMF Rainfall=14.50"

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Primary OutFlow Max=139.96 cfs @ 13.84 hrs HW=1,849.83' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 139.96 cfs @ 4.89 fps)

Secondary OutFlow Max=2,230.25 cfs @ 13.84 hrs HW=1,849.83' (Free Discharge)

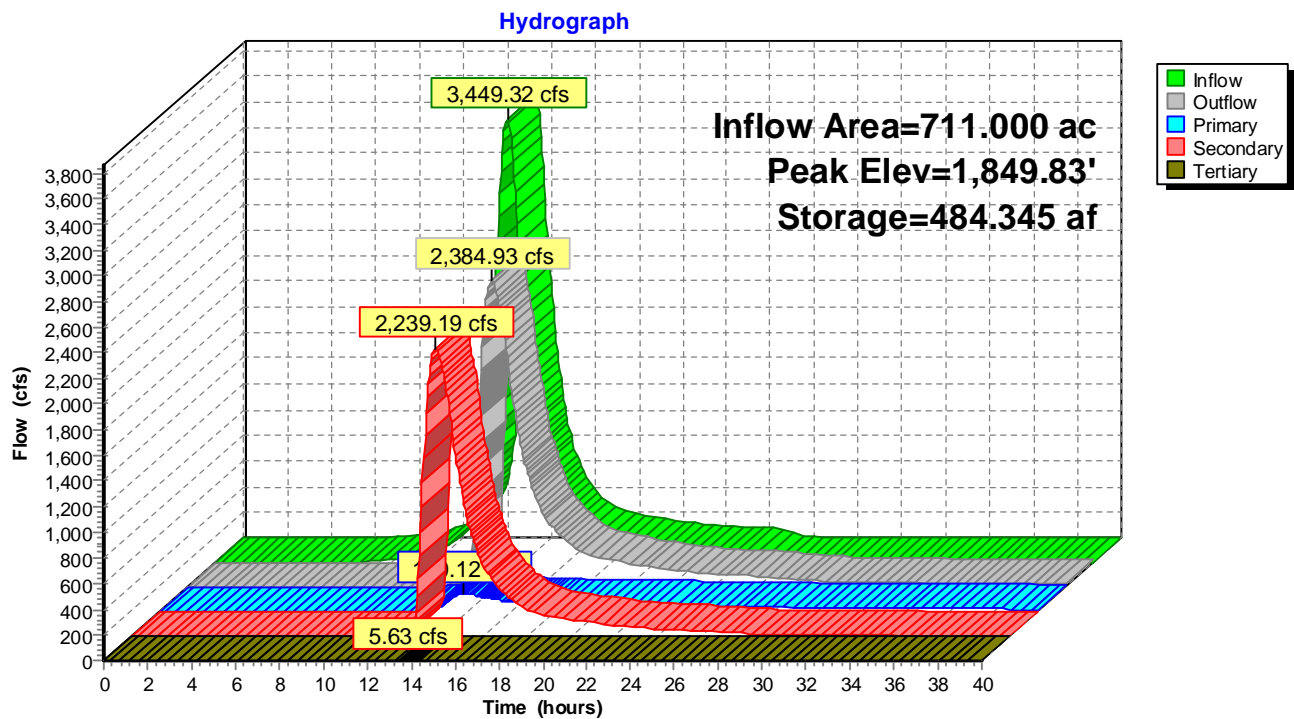
↑ **2=BC Weir - right abutment** (Weir Controls 917.12 cfs @ 2.81 fps)

↑ **3=BC Weir - left abutment** (Weir Controls 1,313.13 cfs @ 2.97 fps)

Tertiary OutFlow Max=2.50 cfs @ 13.84 hrs HW=1,849.83' (Free Discharge)

↑ **4=Exit Out Far Side of Lake** (Weir Controls 2.50 cfs @ 0.45 fps)

Pond 1P: Star Lake Dam



Star Lake Dam Proposed

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Proposed Conditions- Labyrinth
Type II 24-hr 100-yr Rainfall=6.33"

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Summary for Pond 20P: Star Lake Dam- 20' Lab.

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 3.57" for 100-yr event
Inflow = 1,072.60 cfs @ 12.91 hrs, Volume= 211.228 af
Outflow = 229.84 cfs @ 14.73 hrs, Volume= 191.957 af, Atten= 79%, Lag= 109.0 min
Primary = 218.06 cfs @ 14.73 hrs, Volume= 190.167 af
Secondary = 11.78 cfs @ 14.73 hrs, Volume= 1.790 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Starting Elev= 1,846.65' Surf.Area= 62.000 ac Storage= 230.250 af
Peak Elev= 1,848.13' @ 14.73 hrs Surf.Area= 77.317 ac Storage= 345.125 af (114.875 af above start)
Flood Elev= 1,850.00' Surf.Area= 93.910 ac Storage= 504.400 af (274.150 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 356.4 min (1,247.7 - 891.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,848.00'	BC Weir - right abutment, C= 2.63 Offset (feet) 387.22 387.22 392.22 397.20 404.40 451.53 451.53 524.99 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#2	Secondary	1,848.48'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 165.53 215.01 284.89 285.01 285.01 304.54 314.80 326.94 353.52 367.22 367.22 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,848.48 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,870.00
#3	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.00 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00
#4	Primary	1,846.65'	Special & User-Defined Head (feet) 0.00 0.44 0.87 1.31 1.74 2.18 2.61 3.05 3.48 3.91 4.35 Disch. (cfs) 0.000 29.000 90.000 176.000 281.000 398.000 522.000 651.000 872.000 915.000 1,052.000

Star Lake Dam Proposed

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Proposed Conditions- Labyrinth
Type II 24-hr 100-yr Rainfall=6.33"

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Primary OutFlow Max=218.05 cfs @ 14.73 hrs HW=1,848.13' (Free Discharge)

↑ **4=Special & User-Defined** (Custom Controls 218.05 cfs)

Secondary OutFlow Max=9.43 cfs @ 14.73 hrs HW=1,848.13' (Free Discharge)

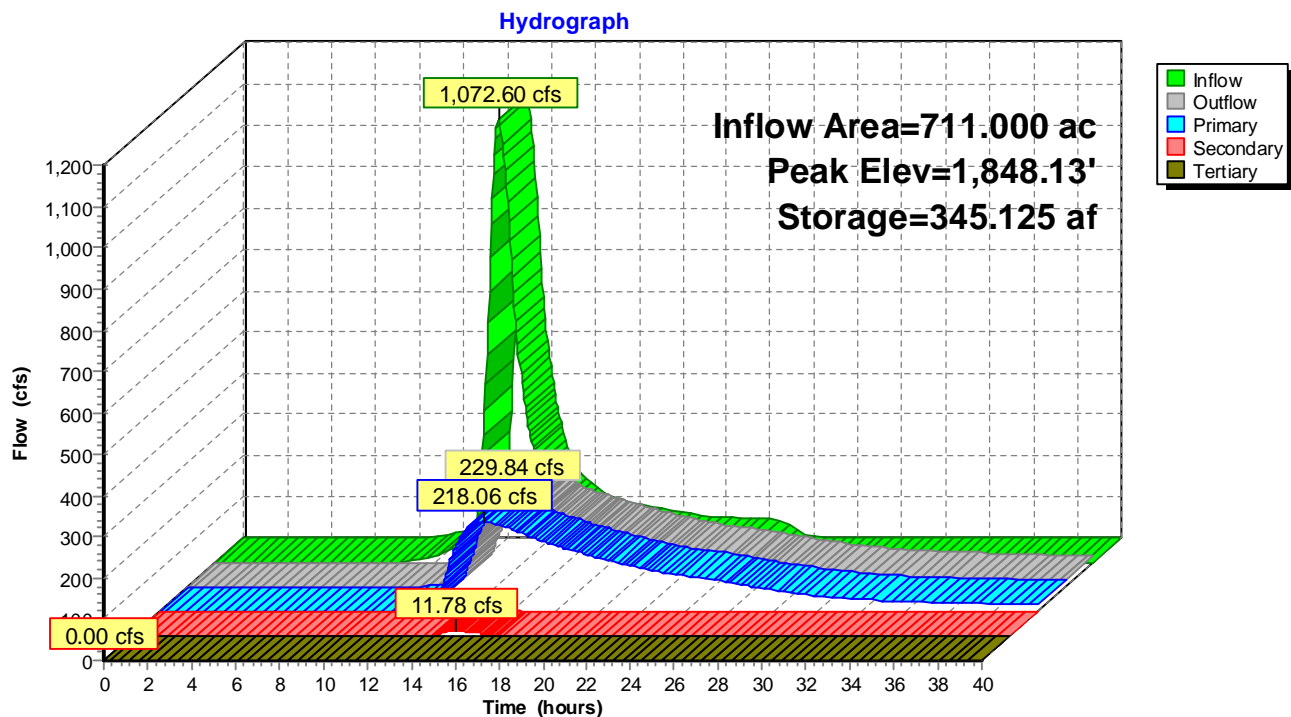
↑ **1=BC Weir - right abutment** (Weir Controls 9.43 cfs @ 0.94 fps)

↑ **2=BC Weir - left abutment** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,846.65' (Free Discharge)

↑ **3=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 20P: Star Lake Dam- 20' Lab.



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Proposed Conditions- Labyrinth
Type II 24-hr 500-yr Rainfall=9.14"

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Summary for Pond 20P: Star Lake Dam- 20' Lab.

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 6.08" for 500-yr event
Inflow = 1,836.80 cfs @ 12.89 hrs, Volume= 360.304 af
Outflow = 701.60 cfs @ 13.97 hrs, Volume= 338.487 af, Atten= 62%, Lag= 65.0 min
Primary = 408.36 cfs @ 13.97 hrs, Volume= 287.113 af
Secondary = 293.25 cfs @ 13.97 hrs, Volume= 51.374 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Starting Elev= 1,846.65' Surf.Area= 62.000 ac Storage= 230.250 af
Peak Elev= 1,848.87' @ 13.97 hrs Surf.Area= 84.898 ac Storage= 401.983 af (171.733 af above start)
Flood Elev= 1,850.00' Surf.Area= 93.910 ac Storage= 504.400 af (274.150 af above start)

Plug-Flow detention time= 858.6 min calculated for 108.102 af (30% of inflow)
Center-of-Mass det. time= 271.8 min (1,147.8 - 876.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,848.00'	BC Weir - right abutment, C= 2.63 Offset (feet) 387.22 387.22 392.22 397.20 404.40 451.53 451.53 524.99 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#2	Secondary	1,848.48'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 165.53 215.01 284.89 285.01 285.01 304.54 314.80 326.94 353.52 367.22 367.22 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,848.48 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,870.00
#3	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.00 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00
#4	Primary	1,846.65'	Special & User-Defined Head (feet) 0.00 0.44 0.87 1.31 1.74 2.18 2.61 3.05 3.48 3.91 4.35 Disch. (cfs) 0.000 29.000 90.000 176.000 281.000 398.000 522.000 651.000 872.000 915.000 1,052.000

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Proposed Conditions- Labyrinth
Type II 24-hr 500-yr Rainfall=9.14"

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Primary OutFlow Max=408.29 cfs @ 13.97 hrs HW=1,848.87' (Free Discharge)

↑ **4=Special & User-Defined** (Custom Controls 408.29 cfs)

Secondary OutFlow Max=289.31 cfs @ 13.97 hrs HW=1,848.87' (Free Discharge)

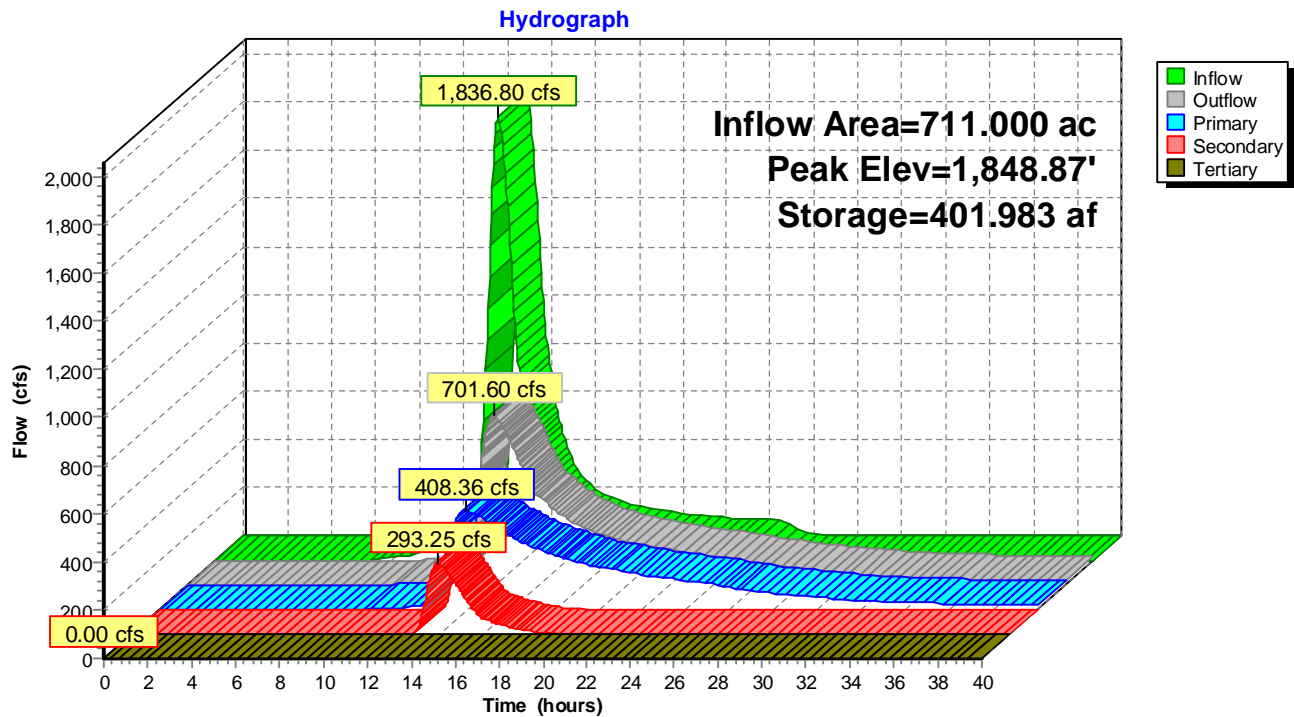
↑ **1=BC Weir - right abutment** (Weir Controls 170.94 cfs @ 2.16 fps)

↑ **2=BC Weir - left abutment** (Weir Controls 118.37 cfs @ 1.61 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,846.65' (Free Discharge)

↑ **3=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 20P: Star Lake Dam- 20' Lab.



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Proposed Conditions- Labyrinth

D&K S-VT PMP 24-hr Half PMF Rainfall=14.50"

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Summary for Pond 20P: Star Lake Dam- 20' Lab.

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 11.15" for Half PMF event
Inflow = 3,449.32 cfs @ 13.27 hrs, Volume= 660.475 af
Outflow = 2,199.97 cfs @ 13.91 hrs, Volume= 637.425 af, Atten= 36%, Lag= 38.6 min
Primary = 742.45 cfs @ 13.91 hrs, Volume= 386.714 af
Secondary = 1,451.27 cfs @ 13.91 hrs, Volume= 250.410 af
Tertiary = 6.25 cfs @ 13.91 hrs, Volume= 0.301 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Starting Elev= 1,846.65' Surf.Area= 62.000 ac Storage= 230.250 af
Peak Elev= 1,849.88' @ 13.91 hrs Surf.Area= 93.593 ac Storage= 489.873 af (259.623 af above start)
Flood Elev= 1,850.00' Surf.Area= 93.910 ac Storage= 504.400 af (274.150 af above start)

Plug-Flow detention time= 387.4 min calculated for 406.667 af (62% of inflow)
Center-of-Mass det. time= 178.5 min (1,041.9 - 863.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,848.00'	BC Weir - right abutment, C= 2.63 Offset (feet) 387.22 387.22 392.22 397.20 404.40 451.53 451.53 524.99 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#2	Secondary	1,848.48'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 165.53 215.01 284.89 285.01 285.01 304.54 314.80 326.94 353.52 367.22 367.22 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,848.48 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,870.00
#3	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.00 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00
#4	Primary	1,846.65'	Special & User-Defined Head (feet) 0.00 0.44 0.87 1.31 1.74 2.18 2.61 3.05 3.48 3.91 4.35 Disch. (cfs) 0.000 29.000 90.000 176.000 281.000 398.000 522.000 651.000 872.000 915.000 1,052.000

Star Lake Dam Proposed

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Proposed Conditions- Labyrinth

D&K S-VT PMP 24-hr Half PMF Rainfall=14.50"

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Primary OutFlow Max=742.21 cfs @ 13.91 hrs HW=1,849.88' (Free Discharge)

↑ **4=Special & User-Defined** (Custom Controls 742.21 cfs)

Secondary OutFlow Max=1,443.68 cfs @ 13.91 hrs HW=1,849.88' (Free Discharge)

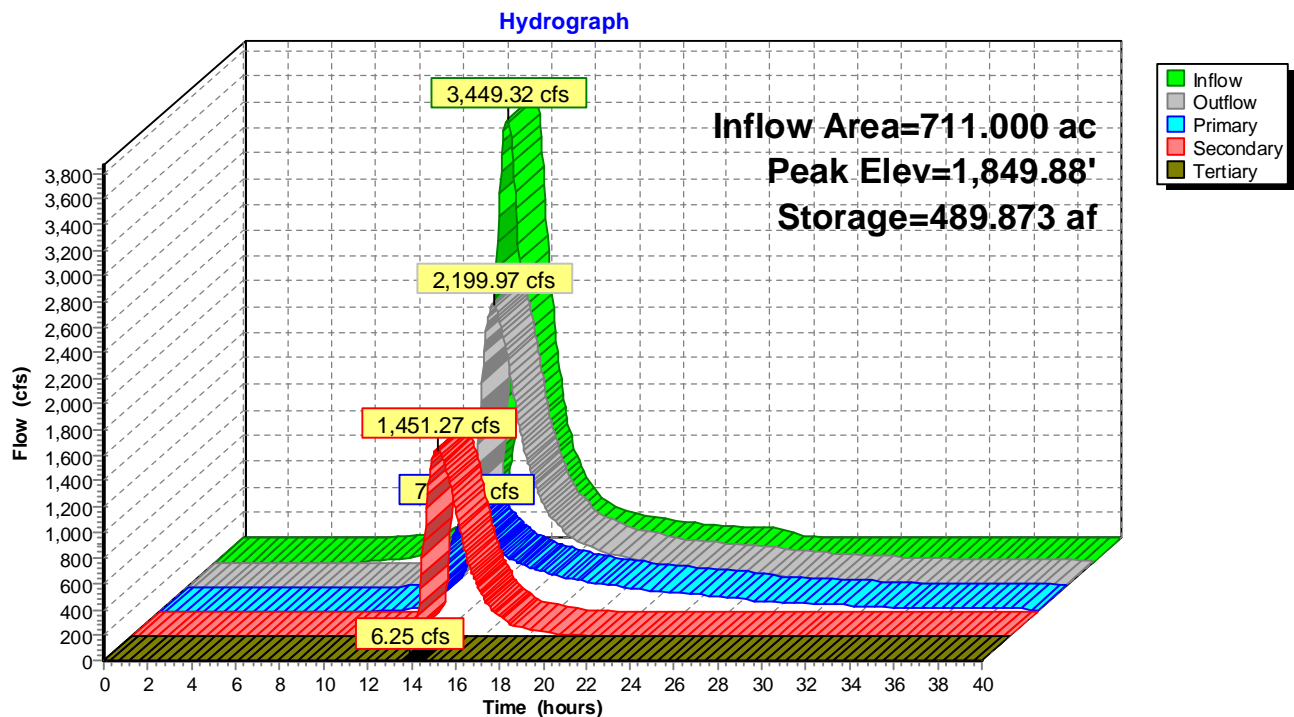
↑ **1=BC Weir - right abutment** (Weir Controls 603.19 cfs @ 2.85 fps)

↑ **2=BC Weir - left abutment** (Weir Controls 840.50 cfs @ 2.93 fps)

Tertiary OutFlow Max=3.36 cfs @ 13.91 hrs HW=1,849.88' (Free Discharge)

↑ **3=Exit Out Far Side of Lake** (Weir Controls 3.36 cfs @ 0.38 fps)

Pond 20P: Star Lake Dam- 20' Lab.



Star Lake Dam Proposed

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Proposed Conditions- Drop Inlet
Type II 24-hr 100-yr Rainfall=6.33"

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Summary for Pond 22P: Star Lake Dam- 10' D.I.

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 3.57" for 100-yr event
Inflow = 1,072.60 cfs @ 12.91 hrs, Volume= 211.228 af
Outflow = 208.71 cfs @ 14.87 hrs, Volume= 189.901 af, Atten= 81%, Lag= 117.9 min
Primary = 193.28 cfs @ 14.87 hrs, Volume= 186.889 af
Secondary = 15.42 cfs @ 14.87 hrs, Volume= 3.012 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Starting Elev= 1,846.65' Surf.Area= 62.000 ac Storage= 230.250 af
Peak Elev= 1,848.17' @ 14.87 hrs Surf.Area= 77.740 ac Storage= 348.297 af (118.047 af above start)
Flood Elev= 1,850.00' Surf.Area= 93.910 ac Storage= 504.400 af (274.150 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 378.6 min (1,269.9 - 891.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,848.00'	BC Weir - right abutment, C= 2.63 Offset (feet) 362.22 362.22 392.22 397.20 404.40 451.53 451.53 452.89 524.99 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#2	Secondary	1,848.48'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 165.53 213.50 284.89 285.01 285.01 304.54 314.80 326.94 353.52 362.22 362.22 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,848.48 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,870.00
#3	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.00 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00
#4	Primary	1,846.65'	120.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Star Lake Dam Proposed

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Proposed Conditions- Drop Inlet
Type II 24-hr 100-yr Rainfall=6.33"

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Primary OutFlow Max=193.11 cfs @ 14.87 hrs HW=1,848.17' (Free Discharge)

↑ **4=Orifice/Grate** (Weir Controls 193.11 cfs @ 4.04 fps)

Secondary OutFlow Max=14.19 cfs @ 14.87 hrs HW=1,848.17' (Free Discharge)

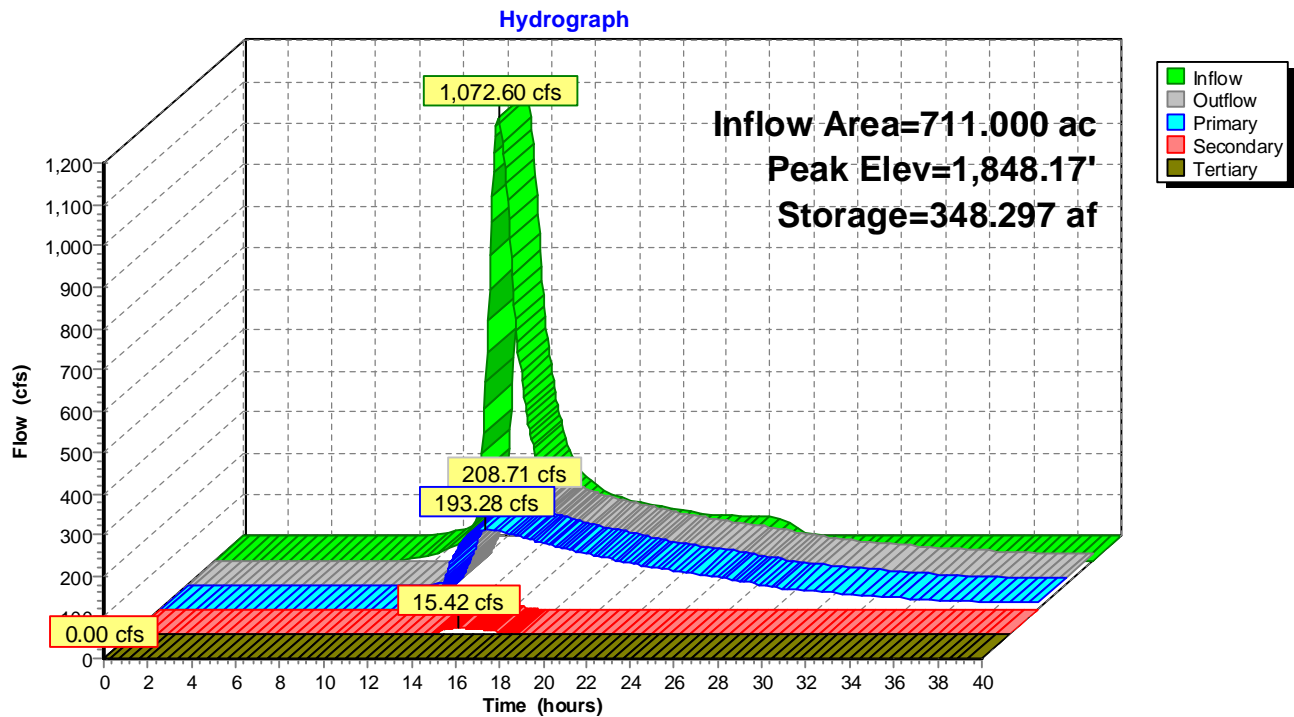
↑ **1=BC Weir - right abutment** (Weir Controls 14.19 cfs @ 1.06 fps)

↑ **2=BC Weir - left abutment** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,846.65' (Free Discharge)

↑ **3=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 22P: Star Lake Dam- 10' D.I.



Star Lake Dam Proposed

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Proposed Conditions- Drop Inlet
Type II 24-hr 500-yr Rainfall=9.14"

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Summary for Pond 22P: Star Lake Dam- 10' D.I.

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 6.08" for 500-yr event
Inflow = 1,836.80 cfs @ 12.89 hrs, Volume= 360.304 af
Outflow = 683.37 cfs @ 14.00 hrs, Volume= 336.292 af, Atten= 63%, Lag= 66.7 min
Primary = 349.79 cfs @ 14.00 hrs, Volume= 272.769 af
Secondary = 333.57 cfs @ 14.00 hrs, Volume= 63.523 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Starting Elev= 1,846.65' Surf.Area= 62.000 ac Storage= 230.250 af
Peak Elev= 1,848.91' @ 14.00 hrs Surf.Area= 85.365 ac Storage= 405.486 af (175.236 af above start)
Flood Elev= 1,850.00' Surf.Area= 93.910 ac Storage= 504.400 af (274.150 af above start)

Plug-Flow detention time= 897.2 min calculated for 106.042 af (29% of inflow)
Center-of-Mass det. time= 288.3 min (1,164.3 - 876.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,848.00'	BC Weir - right abutment, C= 2.63 Offset (feet) 362.22 362.22 392.22 397.20 404.40 451.53 451.53 452.89 524.99 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#2	Secondary	1,848.48'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 165.53 213.50 284.89 285.01 285.01 304.54 314.80 326.94 353.52 362.22 362.22 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,848.48 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,870.00
#3	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.00 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00
#4	Primary	1,846.65'	120.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Star Lake Dam Proposed

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Proposed Conditions- Drop Inlet
Type II 24-hr 500-yr Rainfall=9.14"

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Primary OutFlow Max=349.28 cfs @ 14.00 hrs HW=1,848.91' (Free Discharge)

↑ **4=Orifice/Grate** (Weir Controls 349.28 cfs @ 4.92 fps)

Secondary OutFlow Max=325.51 cfs @ 14.00 hrs HW=1,848.91' (Free Discharge)

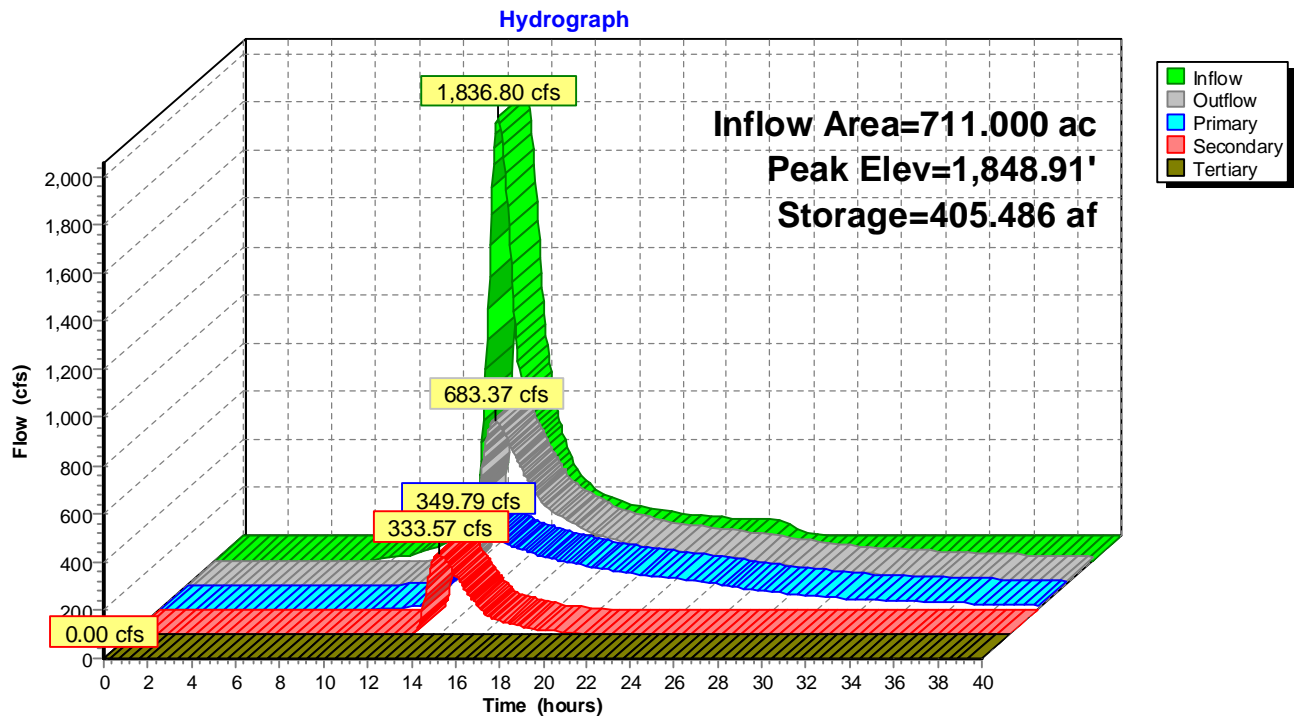
↑ **1=BC Weir - right abutment** (Weir Controls 185.44 cfs @ 2.20 fps)

↑ **2=BC Weir - left abutment** (Weir Controls 140.07 cfs @ 1.69 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,846.65' (Free Discharge)

↑ **3=Exit Out Far Side of Lake** (Controls 0.00 cfs)

Pond 22P: Star Lake Dam- 10' D.I.



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Proposed Conditions- Drop Inlet

D&K S-VT PMP 24-hr Half PMF Rainfall=14.50"

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Summary for Pond 22P: Star Lake Dam- 10' D.I.

Inflow Area = 711.000 ac, 0.90% Impervious, Inflow Depth = 11.15" for Half PMF event
Inflow = 3,449.32 cfs @ 13.27 hrs, Volume= 660.475 af
Outflow = 2,138.15 cfs @ 13.94 hrs, Volume= 635.209 af, Atten= 38%, Lag= 40.1 min
Primary = 609.33 cfs @ 13.94 hrs, Volume= 356.797 af
Secondary = 1,520.57 cfs @ 13.94 hrs, Volume= 277.946 af
Tertiary = 8.25 cfs @ 13.94 hrs, Volume= 0.466 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Starting Elev= 1,846.65' Surf.Area= 62.000 ac Storage= 230.250 af
Peak Elev= 1,849.92' @ 13.94 hrs Surf.Area= 93.715 ac Storage= 495.474 af (265.224 af above start)
Flood Elev= 1,850.00' Surf.Area= 93.910 ac Storage= 504.400 af (274.150 af above start)

Plug-Flow detention time= 401.5 min calculated for 404.453 af (61% of inflow)
Center-of-Mass det. time= 187.6 min (1,051.1 - 863.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,839.30'	2,842.750 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,839.30	0.000	0.000	0.000
1,845.15	50.000	146.250	146.250
1,846.65	62.000	84.000	230.250
1,849.65	93.000	232.500	462.750
1,869.65	145.000	2,380.000	2,842.750

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,848.00'	BC Weir - right abutment, C= 2.63 Offset (feet) 362.22 362.22 392.22 397.20 404.40 451.53 451.53 452.89 524.99 600.22 655.85 655.85 Elev. (feet) 1,870.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,848.00 1,848.00 1,848.00 1,851.60 1,855.76 1,870.00
#2	Secondary	1,848.48'	BC Weir - left abutment, C= 2.63 Offset (feet) 0.00 0.00 99.21 165.53 213.50 284.89 285.01 285.01 304.54 314.80 326.94 353.52 362.22 362.22 Elev. (feet) 1,870.00 1,855.73 1,848.48 1,848.48 1,848.48 1,848.48 1,848.48 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,851.00 1,870.00
#3	Tertiary	1,849.65'	Exit Out Far Side of Lake, C= 2.00 Offset (feet) 1,000.00 1,000.00 1,330.81 1,362.81 1,447.81 1,532.81 1,564.81 1,895.61 1,895.61 Elev. (feet) 1,870.00 1,869.65 1,851.65 1,850.65 1,849.65 1,850.65 1,851.65 1,869.65 1,870.00
#4	Primary	1,846.65'	120.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

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Proposed Conditions- Drop Inlet

D&K S-VT PMP 24-hr Half PMF Rainfall=14.50"

Printed 11/7/2013

Page 6

Primary OutFlow Max=608.77 cfs @ 13.94 hrs HW=1,849.92' (Free Discharge)

↑ **4=Orifice/Grate** (Weir Controls 608.77 cfs @ 5.92 fps)

Secondary OutFlow Max=1,513.49 cfs @ 13.94 hrs HW=1,849.92' (Free Discharge)

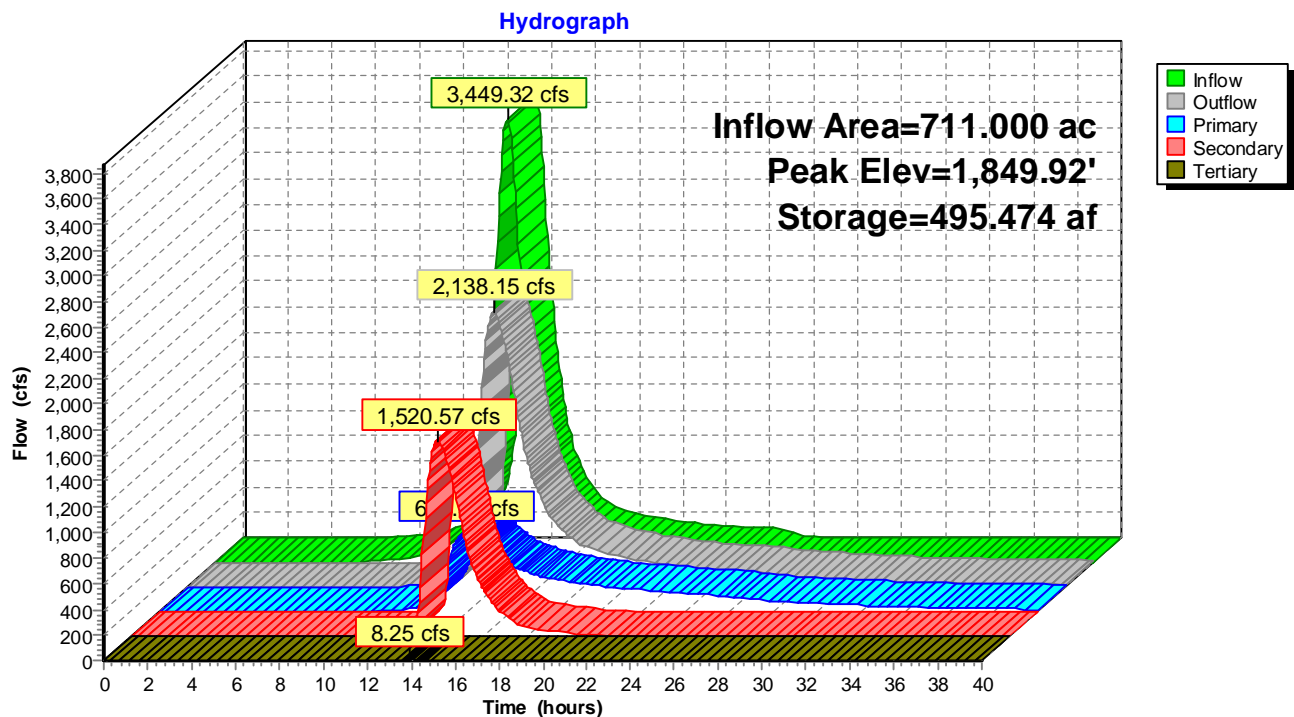
↑ **1=BC Weir - right abutment** (Weir Controls 628.86 cfs @ 2.87 fps)

↑ **2=BC Weir - left abutment** (Weir Controls 884.63 cfs @ 2.98 fps)

Tertiary OutFlow Max=5.38 cfs @ 13.94 hrs HW=1,849.92' (Free Discharge)

↑ **3=Exit Out Far Side of Lake** (Weir Controls 5.38 cfs @ 0.42 fps)

Pond 22P: Star Lake Dam- 10' D.I.



BORING LOG										
PROJECT: Star Lake Dam						JOB NO. 922052 HOLE NO. SB-101 A GRND ELEV. 1848.2' START DATE 10/18/13 FINISH DATE 10/18/13 DRILLER Mike McGinley HELPER Shawn Bijolle INSPECTOR RDL				
LOCATION: Mount Holly, VT										
CONTRACTOR: Mike's Boring & Coring										
	CASING	SAMPLE	CORE	GROUNDWATER		DEPTH TO				
TYPE	HSA			DATE	TIME	WATER	BOT. OF CASING	BOT OF HOLE		
SIZE ID	4.25"									
HAMMER WT.	140 lb.									
HAMMER FALL	30"									
DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLE			SAMPLE BLOWS PER 6" ON SAMPLER				SOIL DESCRIPTION	
		No.	Depth	Recovery	0-6	6-12	12-18	18-24		
1		S1	0'- 2'	14"	3	3	13	83	Organics on top, brown sand w/ rock on the bottom, hitting rock Auger Refusal 2'- 4"	
2										
3										
4										
5										
10										
15										
20										
25										
30										
35										
NOTES:										

BORING LOG									
PROJECT: Star Lake Dam						JOB NO. 922052 HOLE NO. SB-101 B GRND ELEV. 1848.2' START DATE 10/18/13 FINISH DATE 10/18/13 DRILLER Mike McGinley HELPER Shawn Bijolle INSPECTOR RDL			
LOCATION: Mount Holly, VT									
CONTRACTOR: Mike's Boring & Coring									
	CASING	SAMPLE	CORE	GROUNDWATER		DEPTH TO			
TYPE	HSA			DATE	TIME	WATER	BOT. OF CASING	BOT OF HOLE	
SIZE ID	4.25"								
HAMMER WT.	140 lb.								
HAMMER FALL	30"								
DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLE			SAMPLE BLOWS PER 6" ON SAMPLER				SOIL DESCRIPTION
		No.	Depth	Recovery	0-6	6-12	12-18	18-24	
1		S2	0'- 2'	18"					Brown silty sand
2									
3									
4									
5		S3	4'- 6'	16"	2	1	2	1	Brown silty sand w/ gravel particles
10		S4	6'- 8'	12"	2	2	3	2	Moist to wet brown silty sand w/ gravels
		S5	8'- 10'	13"	1	1	4	4	Fine brown sand to dark grey fine silt- wet
15		S6	10'- 12'	16"	7	10	9	4	Brown sand on top 3", glacial till/stone- wet
		S7	12'- 14'	21"	6	10	21	34	Very wet brown sand, log at bottom
	S8	14'- 16'	2"	100/5.5"				Grey silt	
20									Refusal 14'- 5.5" Elevation at Refusal 1833.75'
25									
30									
35									
NOTES:									

BORING LOG												
PROJECT: Star Lake Dam						JOB NO. 922052						
LOCATION: Mount Holly, VT						HOLE NO. AP-102						
CONTRACTOR: Mike's Boring & Coring						GRND ELEV. 1848.2'						
	CASING	SAMPLE	CORE	GROUNDWATER		DEPTH TO			START DATE 10/18/13			
TYPE	HSA			DATE	TIME	WATER	BOT. OF CASING	BOT OF HOLE		FINISH DATE 10/18/13		
SIZE ID	4.25"										DRILLER Mike McGinley	
HAMMER WT.	140 lb.											HELPER Shawn Bijolle
HAMMER FALL	30"											
DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLE			SAMPLE BLOWS PER 6" ON SAMPLER				SOIL DESCRIPTION			
		No.	Depth	Recovery	0-6	6-12	12-18	18-24				
1												
2												
3												
4												
5												
10									Auger refusal 5'- 6" Elevation at Refusal 1842.7'			
15												
20												
25												
30												
35												
NOTES: Done with a solid 4.5" auger. The probe was taken 4'- 3" from the upstream face of the left abutment wall. Refusal was thought to be found upon stone, rather than concrete.												

BORING LOG											
PROJECT:		Star Lake Dam						JOB NO. 922052			
LOCATION:		Mount Holly, VT						HOLE NO. SB-103			
CONTRACTOR:		Mike's Boring & Coring						GRND ELEV. 1848.2'			
	CASING	SAMPLE	CORE	GROUNDWATER		DEPTH TO					
TYPE	HSA			DATE	TIME	WATER	BOT. OF CASING	BOT OF HOLE	START DATE 10/18/13		
SIZE ID	4.25"								FINISH DATE 10/18/13		
HAMMER WT.	140 lb.								DRILLER Mike McGinley		
HAMMER FALL	30"								HELPER Shawn Bijolle		
									INSPECTOR RDL		
DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLE			SAMPLE BLOWS PER 6" ON SAMPLER				SOIL DESCRIPTION		
		No.	Depth	Recovery	0-6	6-12	12-18	18-24			
1		S1	0'- 2'	16"	3	3	9	8	Light to brown sand w/ gravel at the bottom		
2		S1	0'- 2'	16"					Hitting rock (augered through)		
3											
4											
5		S2	4'- 6'	6"	17	13	14	12	Damp brown sand, rock at bottom		
10		S3	6'- 8'	12"	2	2	2	2	Damp brown sand w/ gravels, dark wet sand at top		
	S4				8'- 10'	16"	2	2	2	2	Dark brown sand to wet to grey silt/brown sand mix
15		S5	10'- 12'	20"	10	9	7	8	Brown sand on top to dark brown silt/organic		
		S6	12'- 14'	12"	5	6	8	25	Dark brown sand/grey silt- very wet		
		S7	14'- 16'	22"	42	42	100/5"		Dark brown sand w/ gravel, glacial till on bottom		
20									Refusal 15'- 5"		
											Elevation at Refusal 1832.75'
25											
30											
35											
NOTES:											

ROCK CORE LOG

[illegible][illegible]

ROCK CORE CALCULATIONS

[illegible]

Core Recovery, CR	=	$\frac{\text{Total Length of Core Recovered (in.)}}{\text{Total Core Run Length (in.)}}$	RQD VALUE	DESCRIPTION OF ROCK QUALITY
Core Recovery, CR	=	$\frac{X}{48} = \text{\#VALUE!}$		
RQD	=	$\frac{\Sigma \text{ Length of Sound Pieces}}{\text{Total Core Run Length (in.)}}$	0-25%	Very Poor
			25-50%	Poor
			50-75%	Fair
			75-90%	Good
RQD	=	$\frac{0}{48} = 0.00\%$	90-100%	Excellent

ADDITIONAL NOTES: The core sample was into glacial till. Few rock fragments were recovered. Since the core was not into bedrock, no rock quality can be determined.

BORING LOG												
PROJECT: Star Lake Dam						JOB NO. 922052						
LOCATION: Mount Holly, VT						HOLE NO. AP-104						
CONTRACTOR: Mike's Boring & Coring						GRND ELEV. 1848.2'						
	CASING	SAMPLE	CORE	GROUNDWATER		DEPTH TO			START DATE 10/18/13			
TYPE	HSA			DATE	TIME	WATER	BOT. OF CASING	BOT OF HOLE		FINISH DATE 10/18/13		
SIZE ID	4.25"										DRILLER Mike McGinley	
HAMMER WT.	140 lb.											HELPER Shawn Bijolle
HAMMER FALL	30"											
DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLE			SAMPLE BLOWS PER 6" ON SAMPLER				SOIL DESCRIPTION			
		No.	Depth	Recovery	0-6	6-12	12-18	18-24				
1												
2												
3												
4												
5												
10												
15									Auger refusal 14'- 0"			
20									Elevation at Refusal 1834.2'			
25												
30												
35												
NOTES: Done with a solid 4.5" auger.												

APPENDIX D ~ PHOTOGRAPHS



Photograph A.01 ~ *View of Auger Probe 102 being drilled near the left abutment wall by Mike's Boring*

APPENDIX D ~ PHOTOGRAPHS



Auger Probe 104 being drilled by Mike's Boring & Coring

[illegible]

STAR LAKE DAM
VT 135.02
TOWN OF MOUNT
HOLLY, VERMONT
RUTLAND COUNTY

SHEET TITLE

ALTERNATIVE 1-
LABYRINTH WIER

DRAWN BY RDL	DATE OCT 2013
CHECKED BY SRP	D&K PROJECT # 922052
PROJ. ENG. RDL	D&K ARCHIVE #

SHEET NUMBER

C2

SHEET 2 OF 3



**Star Lake Dam
Mount Holly, Vermont
Alternative 1- Labyrinth Weir**

Probable Cost

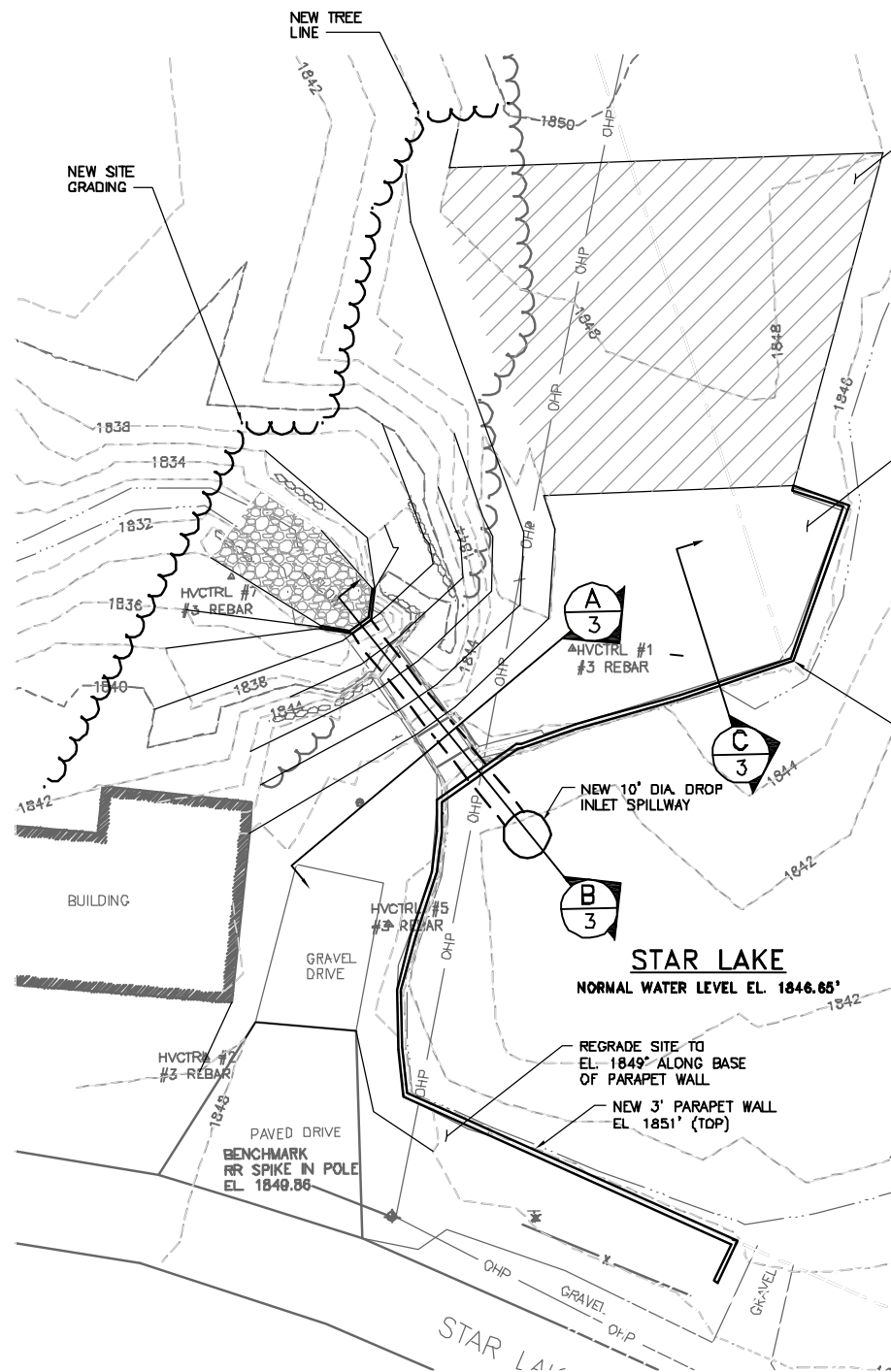
Item #	Item Description	Quantity	Unit	Unit Cost	Total
1	Mobilization/EPSC/Control of Water (15% of subtotal)	1	LS	\$52,800	\$52,800
2	Labyrinth Weir- Concrete	7	CY	\$1,000	\$7,000
3	Training Wall- Concrete	50	CY	\$750	\$37,500
4	Footing/Slab- Concrete	186	CY	\$750	\$139,500
5	Parapet Wall- Concrete	84	CY	\$750	\$63,000
6	Bridge	1	LS	\$60,000	\$60,000
7	Site Grading and Restoration	0.5	ACRE	\$20,000	\$10,000
8	Low Level Valve/Pipe	1	LS	\$17,400	\$17,400
9	Excavation	723	CY	\$15	\$10,845
10	Common Fill/Compaction	334	CY	\$20	\$6,680

Note:

In providing opinions of probable construction cost, the Client understands that D&K has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that our Opinion of Probable Construction Costs are made on the basis of our professional judgment and experience. D&K makes no warranty, express or implied, that the bids or negotiated costs of the Work will not vary from the Opinion of Probable Construction Cost provided herein.

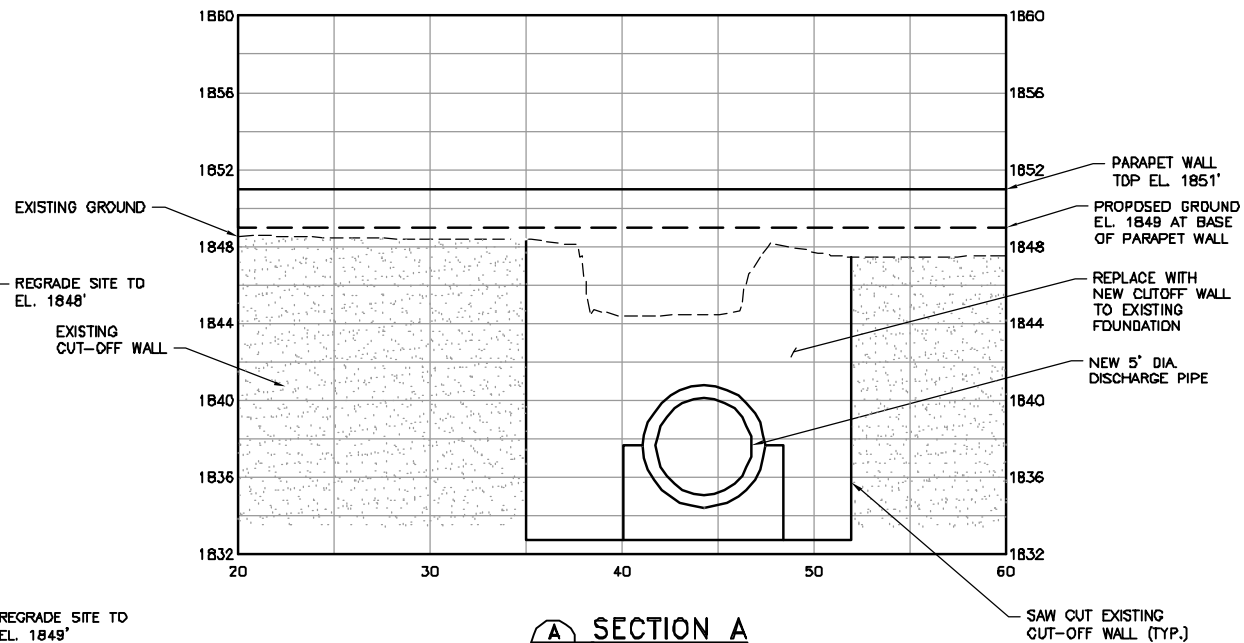
	Sub-Total	\$404,725
25%	Contingency	\$101,181
	Total Estimated Construction Cost	\$505,906
	Estimate Preparation Date:	10/14/2013
	Spreadsheet Print Date:	10/14/2013
	Prepared by:	RDL
	Checked by:	

I:\922053 Star Lake Dam\CADD\dwg\922053-Alt 2-XSIC- red.dwg 11/4/2013 8:48 AM

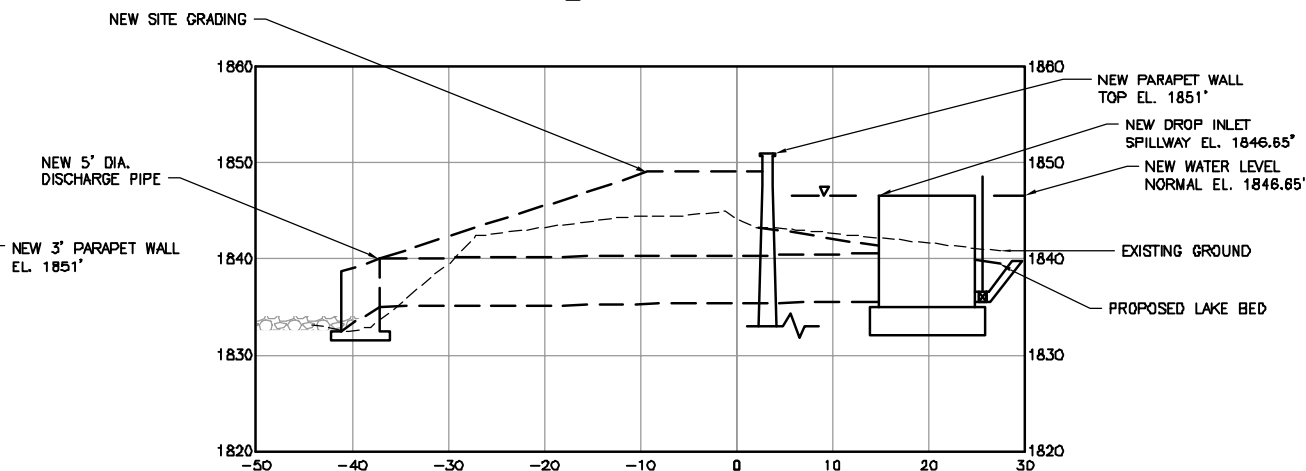


PROPOSED CONDITIONS
ALTERNATIVE 2- DROP INLET SPILLWAY

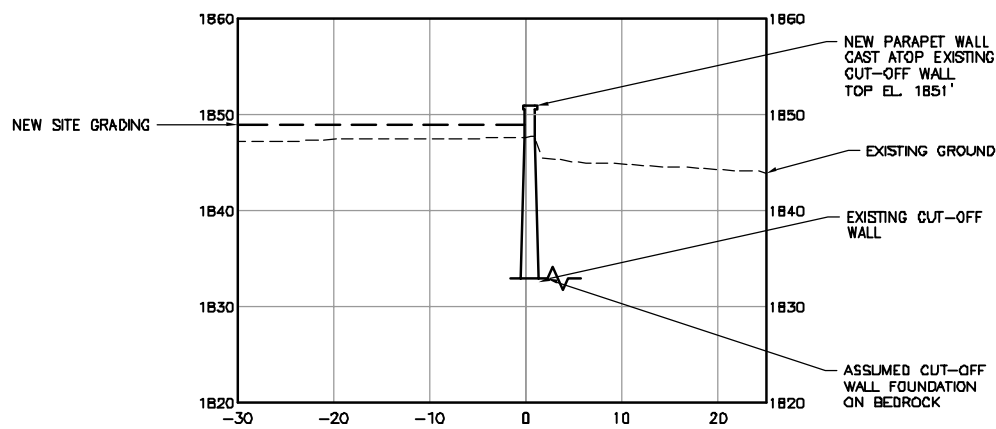
20 0 10 20 40 60
SCALE IN FEET



SECTION A
SCALE: 1" = 5'



SECTION B
SCALE: 1" = 10'



SECTION C
SCALE: 1" = 10'

LEGEND

EXISTING

- EDGE OF GRAVEL
- EDGE OF PAVEMENT
- EDGE OF WATER
- FENCE (WOVEN WIRE)
- TREE LINE
- BUILDINGS
- DECIDUOUS TREE
- TEMPORARY BENCH MARK
- SURVEY CONTROL POINT
- SIGN
- UTILITY POLE
- GUY WIRE
- PHOTO LOCATION

PROPOSED

- NEW STRUCTURE
- UNDERGROUND STRUCTURE
- CONTOURS

BASIS OF ALTERNATIVE

1. RAISE WATER LEVEL TO HISTORIC ELEVATION
2. NEW 10" DIAMETER DROP INLET WITH 60" DISCHARGE PIPE
3. CONSTRUCT PARAPET WALL ATOP EXISTING CUT-OFF WALL
4. REGRADE SITE AND RECHARGE TO ALLOW STORM FLOW DISCHARGE
5. FILL/REGRADE SPILLWAY ARE WITH EMBANKMENT AND ELIMINATE ACCESS BRIDGE

DuBois & King Inc.

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MANAGEMENT • DEVELOPMENT
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WILLISTON, VT
SPRINGFIELD, VT
BEDFORD, NH

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PROFESSIONAL SEAL

**NOT FOR
CONSTRUCTION
PRELIMINARY
PLANS**

NO.	DATE	BY	CHK'D	DESCRIPTION

VERMONT
DEPARTMENT OF
ENVIRONMENTAL
CONSERVATION

STAR LAKE DAM
VT 135.02
TOWN OF MOUNT
HOLLY, VERMONT
RUTLAND COUNTY

SHEET TITLE

ALTERNATIVE 2-
DROP INLET
SPILLWAY

DRAWN BY	DATE
RDL	OCT 2013
CHECKED BY	D&K PROJECT #
SRP	922052
PROJ. ENL	D&K ARCHIVE #
RDL	

SHEET NUMBER

C3

SHEET 3 OF 3

**Star Lake Dam
Mount Holly, Vermont
Alternative 2- Drop Inlet Structure**

Probable Cost

Item #	Item Description	Quantity	Unit	Unit Cost	Total
1	Mobilization/EPSC/Control of Water (15% of subtotal)	1	LS	\$24,100	\$24,100
2	Drop Inlet (10' Dia.)	1	EA	\$8,720	\$8,720
3	Discharge Pipe (5' Dia. RCP)	40	LF	\$220	\$8,800
4	Footing/Slab- Concrete	8	CY	\$750	\$6,000
5	Parapet Wall- Concrete	118	CY	\$750	\$88,500
6	Site Grading and Restoration	0.5	ACRE	\$20,000	\$10,000
7	Low Level Valve/Pipe	1	LS	\$17,400	\$17,400
8	Excavation	385	CY	\$15	\$5,775
9	Common Fill/Compaction	249	CY	\$20	\$4,980
10	Trash Rack and Walkway	1	LS	\$10,000	\$10,000

Note:

In providing opinions of probable construction cost, the Client understands that D&K has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that our Opinion of Probable Construction Costs are made on the basis of our professional judgment and experience. D&K makes no warranty, express or implied, that the bids or negotiated costs of the Work will not vary from the Opinion of Probable Construction Cost provided herein.

	Sub-Total	\$184,275
25%	Contingency	\$46,069
	Total Estimated Construction Cost	\$230,344
	Estimate Preparation Date:	9/27/2013
	Spreadsheet Print Date:	9/27/2013
	Prepared by:	RDL
	Checked by:	