UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Klamath River Renewal Corporation	**Project Nos. 14803-001;**
PacifiCorp	**2082-063**

AMENDED APPLICATION FOR SURRENDER OF LICENSE FOR MAJOR PROJECT AND REMOVAL OF PROJECT WORKS

EXHIBIT K (2 of 2)
Reservoir Drawdown and Diversion Plan

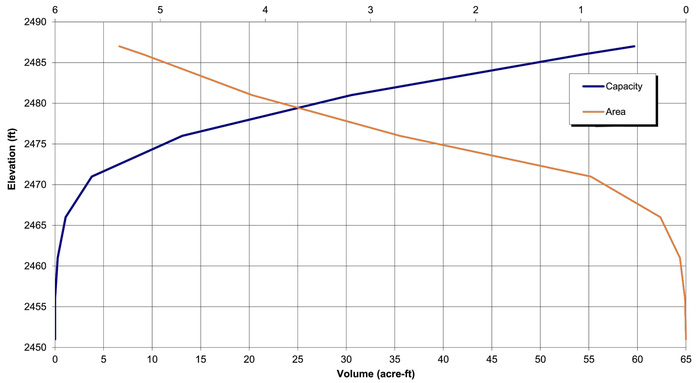

FIGURE 1 – RESERVOIR DEPTH AREA CAPACITY CURVE

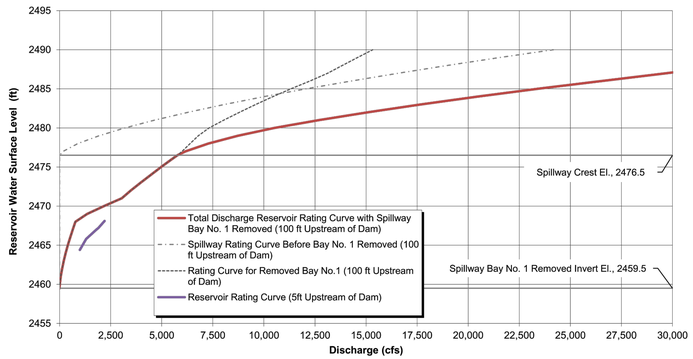

FIGURE 2 – RESERVOIR DISCHARGE RATING CURVE

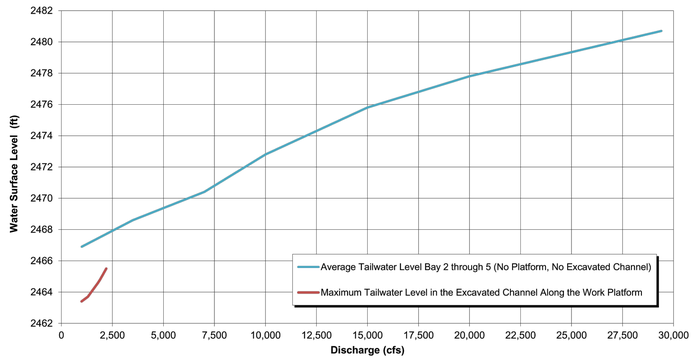

FIGURE 3 – TAILWATER DISCHARGE RATING CURVE

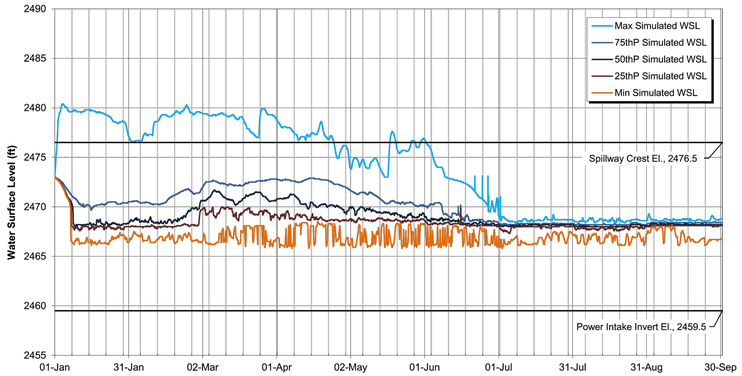

FIGURE 4 – DRAWDOWN PERCENTILES OF WATER SURFACE LEVEL

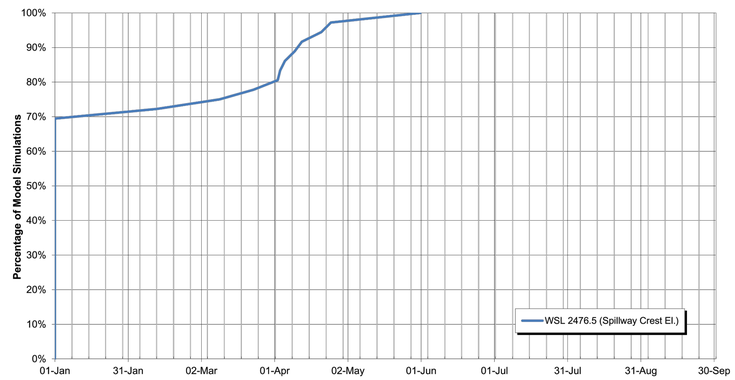

FIGURE 5 – SUSTAINED RESERVOIR DRAWDOWN AT SELECTED ELEVATIONS OVER PERIOD OF RECORD MODEL RUNS BY DATE

Flow Condition		Discharge (cfs)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 - 15	Jul 16 - 31	Aug	Sep 1-15	Sep 16-30	Oct 1-15	Oct 16-31	Nov 1-15	Nov 16-30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	23,400	23,400	20,500	17,000	11,000	8,200	4,400	3,200	2,000	2,000	2,200	2,500	6,900	8,100	10,300	12,000	28,200
	5% Probable Flood	11,800	11,800	13,000	11,100	7,400	4,500	2,900	2,000	1,600	1,600	1,900	2,100	6,300	6,000	6,600	7,800	15,900
	20% Probable Flood	5,800	5,800	8,500	6,900	4,500	2,900	1,900	1,300	1,300	1,300	1,600	1,600	6,100	6,300	6,400	6,300	8,000
	50% Probable Flood	3,000	3,000	6,500	4,600	2,900	1,900	1,400	1,100	1,200	1,200	1,300	1,300	5,200	5,200	5,600	5,900	6,400
Monthly Flow Duration 25% of Time Equaled or Exceeded		2,280	2,920	4,430	3,920	2,700	1,840	1,230	1,080	1,060	1,050	1,100	1,110	1,100	1,190	1,260	1,080	1,600
Mean Monthly Flow		1,910	2,360	3,230	2,790	2,110	1,620	1,210	990	990	980	1,030	1,030	1,050	1,140	1,230	1,240	1,490
Monthly Flow Duration 75% of Time Equaled or Exceeded		900	940	1,630	1,410	1,290	1,080	970	860	870	850	940	940	960	990	1,040	940	900

Flow Condition		Reservoir Water Surface Levels (ft) - Drawdown Phase (Spillway Bay No. 1 Removed)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 - 15	Jul 16 - 31	Aug	Sep 1-15	Sep 16-30	Oct 1-15	Oct 16-31	Nov 1-15	Nov 16-30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	2485.0	2485.0	2484.0	2482.7	2480.2	2478.6	2473.9	2471.3	2469.8	2469.8	2470.0	2470.4	2477.7	2478.6	2479.9	2480.7	2486.5
	5% Probable Flood	2480.6	2480.6	2481.1	2480.3	2478.1	2474.1	2470.0	2467.5	2466.5	2466.5	2467.2	2467.8	2477.1	2476.8	2477.4	2478.4	2482.3
	20% Probable Flood	2476.5	2476.5	2478.8	2477.7	2474.1	2470.8	2467.2	2465.8	2465.8	2465.8	2466.5	2466.5	2476.9	2477.1	2477.2	2477.1	2478.5
	50% Probable Flood	2470.9	2470.9	2477.3	2474.3	2470.8	2469.7	2466.0	2464.9	2465.3	2465.3	2465.8	2465.8	2475.4	2475.4	2476.2	2476.7	2477.2
Monthly Flow Duration 25% of Time Equaled or Exceeded		2470.1	2470.9	2473.9	2472.9	2470.6	2469.6	2465.5	2464.8	2464.7	2464.7	2464.9	2464.9	2468.6	2468.7	2468.9	2468.5	2469.3
Mean Monthly Flow		2469.7	2470.2	2471.4	2470.7	2469.9	2469.3	2465.4	2464.4	2464.4	2464.4	2464.6	2464.6	2468.5	2468.6	2468.8	2468.8	2469.2
Monthly Flow Duration 75% of Time Equaled or Exceeded		2468.2	2468.3	2469.3	2469.1	2468.9	2468.5	2464.3	2464.0	2464.1	2464.0	2464.3	2464.3	2468.3	2468.4	2468.5	2468.3	2468.2

Flow Condition		Tailwater Surface Levels (ft) - Drawdown Phase (Spillway Bay No. 1 Removed)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 - 15	Jul 16 - 31	Aug	Sep 1-15	Sep 16-30	Oct 1-15	Oct 16-31	Nov 1-15	Nov 16-30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	2478.8	2478.8	2478.0	2476.6	2473.4	2471.4	2469.1	2468.4	2467.6	2467.6	2467.7	2467.9	2470.3	2471.3	2473.0	2474.0	2480.3
	5% Probable Flood	2473.9	2473.9	2474.6	2473.5	2470.7	2469.1	2466.6	2465.0	2464.2	2464.2	2464.8	2465.3	2470.0	2469.9	2470.2	2471.0	2476.2
	20% Probable Flood	2469.8	2469.8	2471.6	2470.3	2469.1	2468.2	2464.8	2463.7	2463.7	2463.7	2464.2	2464.2	2469.9	2470.0	2470.1	2470.0	2471.2
	50% Probable Flood	2468.3	2468.3	2470.1	2469.2	2468.2	2467.5	2463.9	2463.5	2463.6	2463.6	2463.7	2463.7	2469.5	2469.5	2469.7	2469.8	2470.1
Monthly Flow Duration 25% of Time Equaled or Exceeded		2467.8	2468.2	2469.1	2468.8	2468.1	2467.5	2463.6	2463.5	2463.5	2463.5	2463.5	2463.5	2467.0	2467.0	2467.1	2467.0	2467.3
Mean Monthly Flow		2467.5	2467.8	2468.4	2468.1	2467.7	2467.3	2463.6	2463.4	2463.4	2463.4	2463.4	2463.4	2466.9	2467.0	2467.1	2467.1	2467.2
Monthly Flow Duration 75% of Time Equaled or Exceeded		2466.8	2466.9	2467.3	2467.2	2467.1	2467.0	2463.4	2463.2	2463.2	2463.1	2463.3	2463.3	2466.9	2466.9	2466.9	2466.9	2466.8

TABLE 1 – MONTHLY INFLOWS AND STEADY–STATE WATER SURFACE LEVELS

NOTES:

1. FOR RESERVOIR DRAWDOWN OPERATIONS NOTES SEE DRAWING C3056.
2. RESERVOIR STORAGE AREA CAPACITY CURVE (FIGURE 1) IS BASED ON THE 2018 BATHYMETRIC SURVEY.
3. DISCHARGE CAPACITY OF THE SPILLWAY AND OF THE REMOVED SPILLWAY BAY NO. 1 ON FIGURE 2 ARE FOR FREE DISCHARGE CONDITIONS. THE DISCHARGE CAPACITY FOR THE SPILLWAY IS FOR ALL 5 SPILLWAY GATES FULLY OPENED.
4. DISCHARGE RATING CURVES ON FIGURE 2 ARE FOR RESERVOIR WATER SURFACE LEVELS APPROXIMATELY 100 ft UPSTREAM OF THE DAM FACE, EXCEPT AS NOTED FOR THE RESERVOIR RATING CURVE DURING LOW FLOWS (<2,200 cfs), WHICH INDICATES CONDITIONS 5 ft UPSTREAM OF THE DAM FACE.
5. THE TAILWATER RATING CURVE ON FIGURE 3 INDICATES THE AVERAGE TAILWATER LEVELS ACROSS SPILLWAY BAYS 2 THROUGH 5 APPROXIMATELY 34 ft DOWNSTREAM OF THE DAM FACE FOR THE FULL RANGE OF FLOWS. THE SECOND RATING CURVE IDENTIFIES WATER LEVELS IN THE EXCAVATED CHANNEL THROUGH BAY 1 ALONG THE WORK PLATFORM DURING LOW FLOWS (<2,200 cfs).
6. RESERVOIR WATER LEVELS SHOWN IN FIGURE 4 ARE THE RESERVOIR WATER SURFACE LEVEL MODEL RUN RESULTING PERCENTILES IMMEDIATELY UPSTREAM OF THE DAM USING THE DRAWDOWN MODEL. THE PERCENTILES ARE CALCULATED BASED ON THE ENTIRE 36 YEAR RECORD OF 2019 JOINT BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. WATER LEVELS CAN BE OUTSIDE OF THESE VALUES DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR.
7. THE CURVE SHOWN ON FIGURE 5 REPRESENT THE PERCENTAGE OF MODEL SIMULATIONS AT WHICH RESERVOIR DRAWDOWN WATER SURFACE LEVELS ARE SUSTAINED BELOW SELECTED ELEVATIONS BASED ON THE DRAWDOWN MODEL USING THE ENTIRE 36 YEAR RECORD OF 2019 JOINT BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. THE ACTUAL DATE A WATER SURFACE LEVEL IS SUSTAINED AT A CERTAIN ELEVATION CAN BE DIFFERENT THAN SHOWN DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR AND THE DRAWDOWN SEQUENCING SHOWN ON DRAWING C3056.
8. RESERVOIR WATER SURFACE LEVELS IN TABLE 1 ARE DETERMINED USING THE STEADY–STATE INFLOWS SHOWN IN TABLE 1 AND THE DISCHARGE RATING CURVES ON FIGURE 2.
9. THE PROBABLE FLOOD DISCHARGES SHOWN IN TABLE 1 ASSUME THAT THE J.C. BOYLE AND COPCO NO. 1 FACILITIES PROVIDE FLOW ATTENUATION FROM JANUARY TO JUNE 15TH. ONCE RIVER DIVERSION HAS BEEN ACHIEVED AT THESE FACILITIES; THE FLOOD FLOWS WILL NO LONGER BE ATTENUATED. NO FLOW ATTENUATION IS ASSUMED FOR THE PROBABLE FLOOD DISCHARGES IN TABLE 1 BETWEEN JUNE 16TH AND DECEMBER.
10. GREY SHADED VALUES IN TABLE 1 REPRESENT RESERVOIR WATER SURFACE LEVELS WITH SPILLWAY FLOWS 100 ft UPSTREAM OF THE DAM. VALUES WITH NO SHADING REPRESENT RESERVOIR WATER SURFACE LEVELS 100 ft UPSTREAM OF THE DAM OR TAILWATER LEVELS 34 ft DOWNSTREAM OF THE DAM.
11. GREEN SHADED VALUES IN TABLE 1 REPRESENT WATER SURFACE LEVELS CALCULATED USING THE RATING CURVES DEVELOPED WITH THE WORK PLATFORM AND THE TEMPORARY CHANNEL EXCAVATION IN PLACE DURING LOWER FLOWS (<2,200 cfs). THESE INCLUDE RESERVOIR LEVELS 5 ft UPSTREAM OF THE DAM FACE AND TAILWATER LEVELS ALONG THE WORK PLATFORM.
12. RESERVOIR WATER SURFACE LEVELS DO NOT INCLUDE THE RECOMMENDED 3 ft FREEBOARD.
13. TAILWATER SURFACE LEVELS IN TABLE 1 ARE DETERMINED USING THE STEADY–STATE INFLOWS SHOWN IN TABLE 1 AND THE DISCHARGE RATING CURVES ON FIGURE 3.

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
C	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	HE	SRM	11/13/20
B	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	HE	SRM	10/07/20
A	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. VOS
DRAWN	R. PENG
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT	KLAMATH RIVER RENEWAL PROJECT
PROJ #	VA103-640/1
DATE	11/13/2020
SHEET TITLE	COPCO NO. 2 FACILITY HYDROLOGIC AND HYDRAULIC INFORMATION RESERVOIR AND TAILWATER SURFACE ELEVATIONS FIGURES AND TABLE
DWG	C3057

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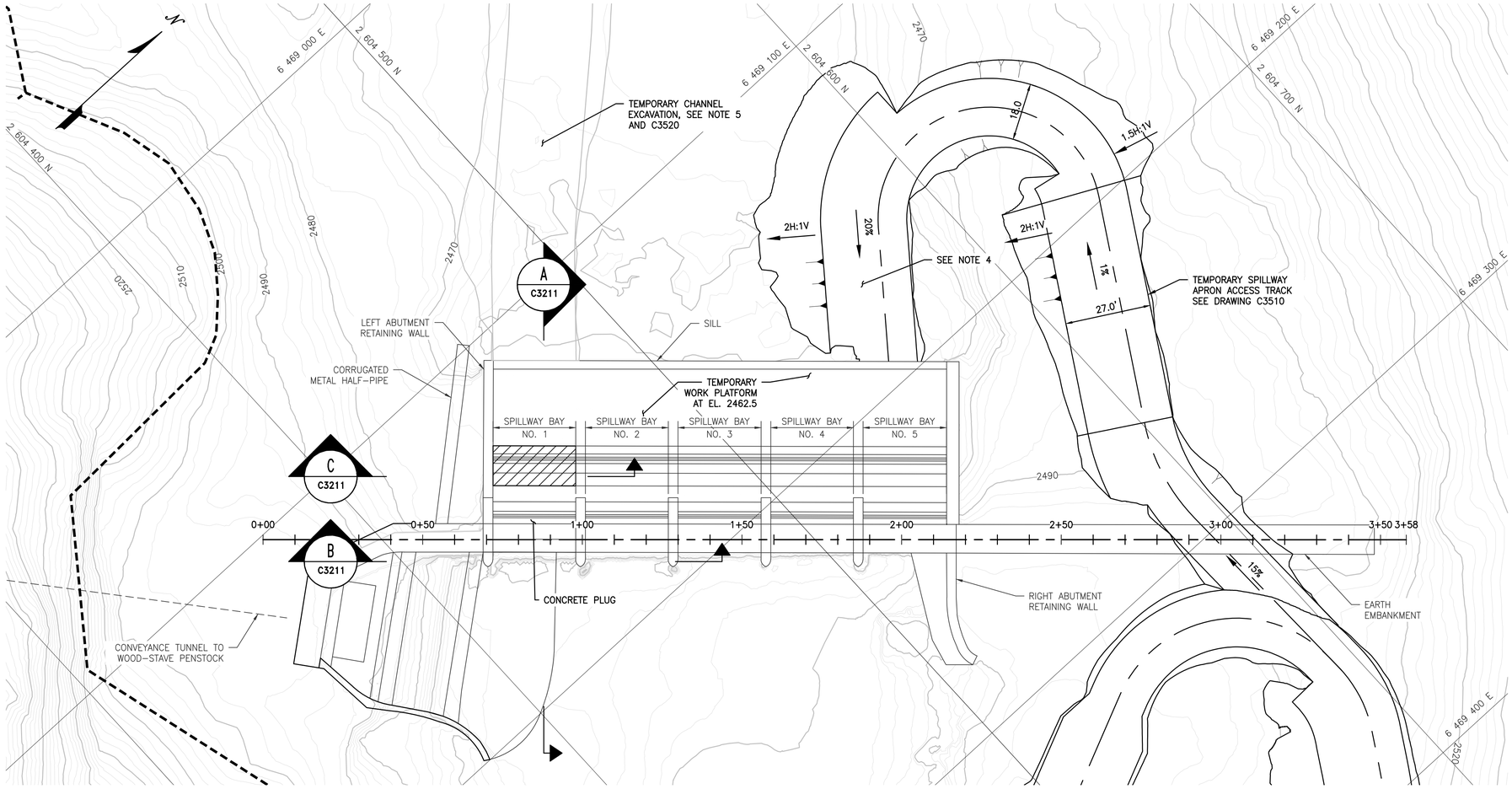
PUBLIC VERSION

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION

(CEII)

REDACTED

DESIGN SHEET CC3200: COPCO NO. 2 DIVERSION DAM INTAKE REMOVAL



PLAN

SCALE 1" = 20'

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. DAM OUTLINE BASED ON THE CALIFORNIA OREGON POWER COMPANY COPCO NO. 2 DEVELOPMENT HISTORIC DRAWING F-3930 (DATED 05/25/1925).
3. TEMPORARY WORK PLATFORM TO BE REMOVED UPON COMPLETION OF PRE-DRAWDOWN WORKS.
4. LOWER PORTION OF THE TEMPORARY SPILLWAY APRON ACCESS TRACK THAT IS WITHIN THE RIVER CHANNEL SHALL BE REMOVED UPON COMPLETION OF PRE-DRAWDOWN WORKS. SEE DRAWING C3216.
5. TEMPORARY CHANNEL EXCAVATION TO BE COMPLETED AT CONTRACTORS DISCRETION. EXCAVATION IS NOT REQUIRED FOR PRE-DRAWDOWN WORKS AND MAY BE COMPLETED DURING THE DRAWDOWN YEAR.
6. CONTRACTOR MAY OPTION TO REMOVE ENTIRE DAM DURING THE PRE-DRAWDOWN WORKS TO THE LIMITS SHOWN IN DRAWING C3221 PROVIDED COPCO NO. 1 CAN BE UTILIZED TO TEMPORARILY ARREST ALL RIVER FLOW. APPROACH DEPENDENT ON RELEVANT AGENCY APPROVALS. TEMPORARY CHANNEL EXCAVATION NOT REQUIRED IF THIS OPTION IS SELECTED.

LEGEND:

DEMOLITION / REMOVAL

LIMITS OF WORK

DEMOLITION/REMOVAL NOTES:

1. THE DIVERSION DAM WILL BE REMOVED IN THE FOLLOWING SEQUENCE:
   - 1.1. DIVERSION DAM MODIFICATIONS (C3210) – DURING THE PRE-DRAWDOWN YEAR REMOVE DOWNSTREAM PORTION OF SPILLWAY BAY NO. 1 TO EL. 2459.5 ft AND PREPARE REMAINDER OF CONCRETE PLUG FOR REMOVAL. CONSTRUCT TEMPORARY WORK PLATFORM AND SPILLWAY APRON ACCESS TRACK TO FACILITATE ACCESS TO AREA.
   - 1.2. SPILLWAY BAY NO. 1 REMOVAL (C3216) – REMOVE REMAINDER OF SPILLWAY BAY NO. 1 DOWN TO EL. 2459.5 ft DURING THE DRAWDOWN YEAR. DRAIN RESERVOIR TO LOWEST POSSIBLE LEVEL THROUGH THE WATER CONVEYANCE SYSTEM PRIOR TO REMOVING CONCRETE PLUG.
   - 1.3. DIVERSION DAM REMOVAL (C3220) – REMOVE ENTIRE CONCRETE DAM TO LIMITS SHOWN. CONSTRUCT WORK PLATFORM AND TEMPORARY CHANNEL EXCAVATION TO PROVIDE A DRY WORKING SURFACE.

0 20 40 60

1" = 20'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
G	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
F	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
E	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
D	ISSUED WITH 60% DESIGN REPORT	CAV	NB	SRM	02/07/20
C	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

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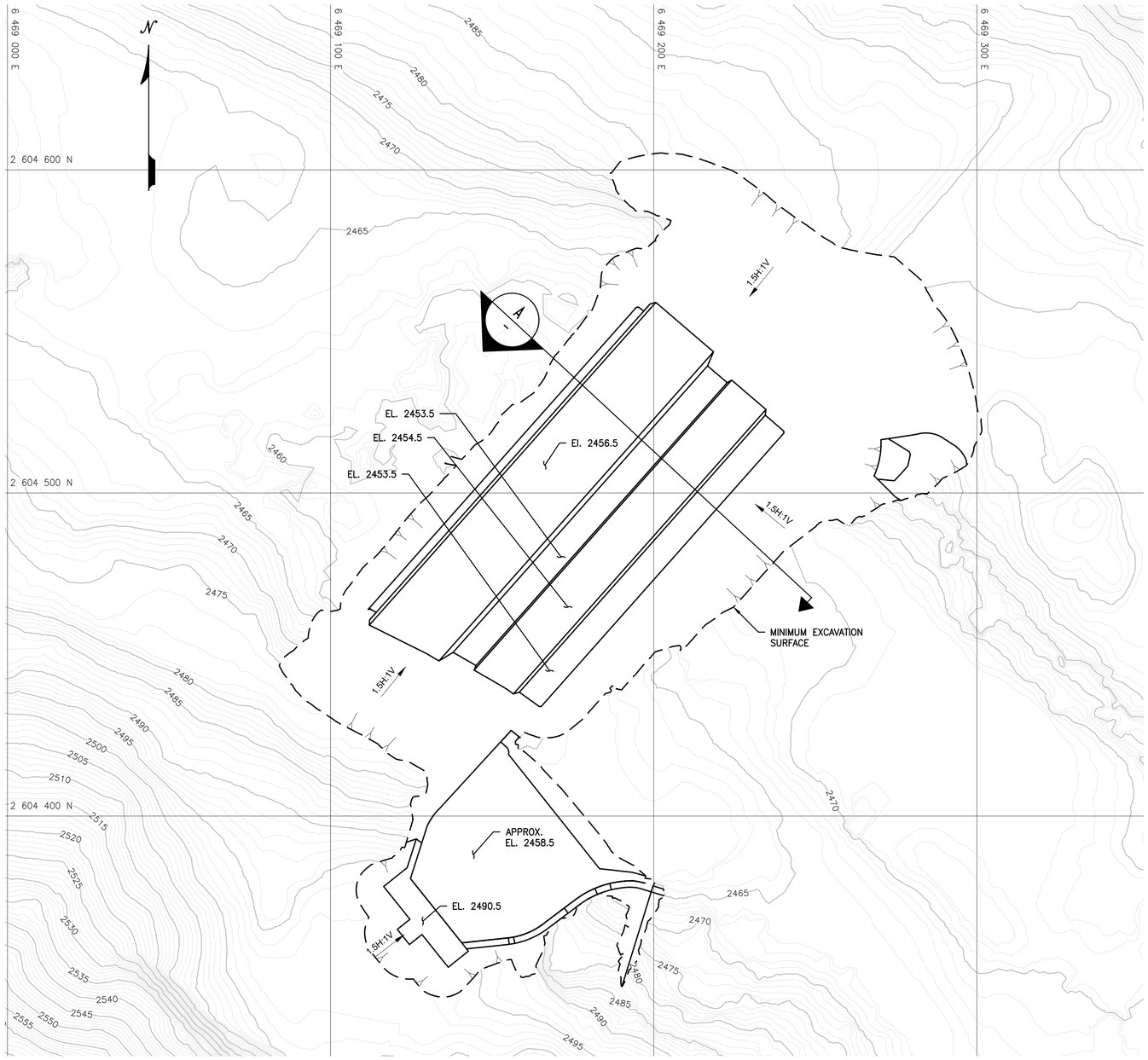
DRAWN	R. PENG
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

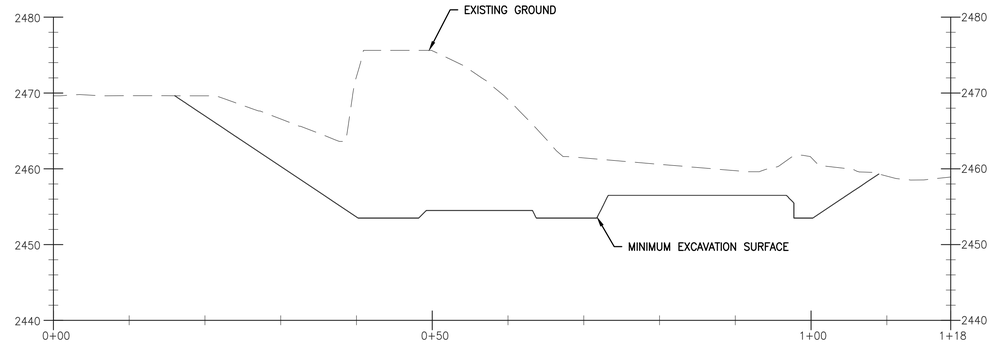
PROJECT	KLAMATH RIVER RENEWAL PROJECT
PROJ #	VA103-640/1
DATE	11/13/2020
SHEET TITLE	COPCO NO. 2 FACILITY PRE-DRAWDOWN WORKS DIVERSION DAM MODIFICATIONS - PLAN
DWG	C3210



PLAN
1" = 20'

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. CONCRETE RUBBLE TO BE DISPOSED OF IN COPCO NO. 1 DISPOSAL SITE OR COPCO NO. 2 INTAKE STRUCTURE. NATIVE RIVER MATERIAL REMOVED THROUGH EXCAVATION OF DAM TO BE USED FOR BACKFILLING RIVER CHANNEL, SEE DRAWING C3234 FOR SPECIFICATIONS.
3. DIVERSION DAM LOCATION IS APPROXIMATE AND MAY VARY. CONTRACTOR SHALL LOCATE STRUCTURE EXTENTS PRIOR TO REMOVAL.
4. EXCAVATION SLOPES TO BE VERIFIED BY THE ENGINEER. EXCAVATION IN AREAS WITH SATURATED SOILS OR WITH SIGNIFICANT SEEPAGE MAY REQUIRE REDUCED SLOPE ANGLES AND/OR DEWATERING.



A
–
SECTION
1" = 10'

0 20 40 60
1" = 20'

0 10 20 30
1" = 10'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
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A	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
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PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

PROJ # VA103-640/1
DATE 11/13/2020

SHEET TITLE
COPCO NO. 2 FACILITY
DIVERSION DAM REMOVAL
EXCAVATION PLAN

DWG C3221

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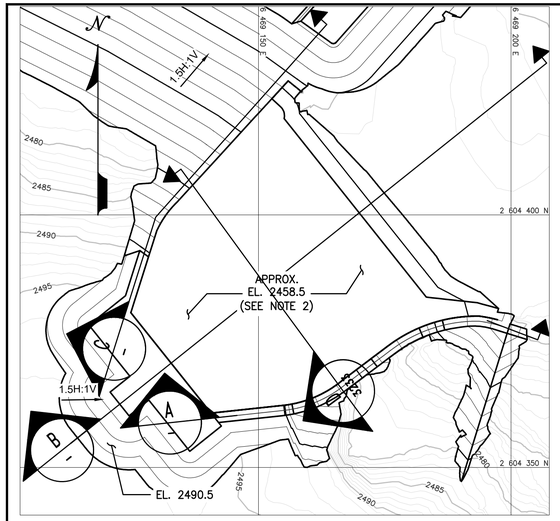
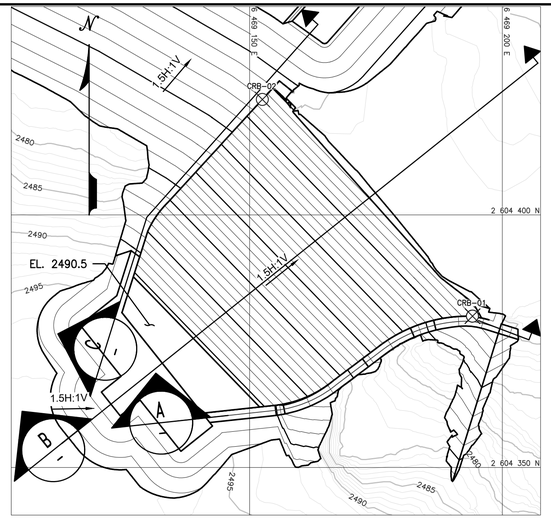
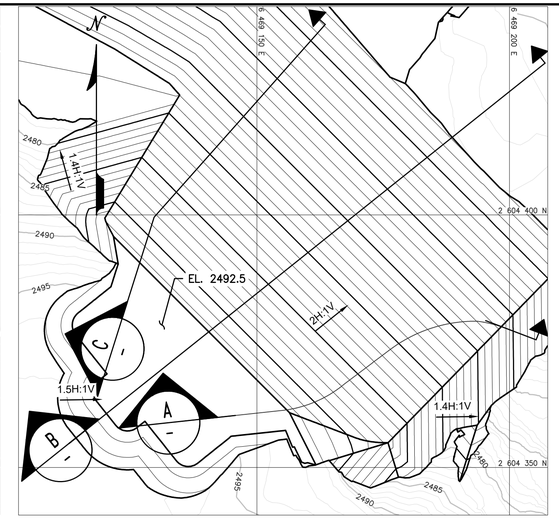


PLAN – INTAKE EXCAVATION



PLAN – CONCRETE RUBBLE BACKFILL

1" = 15'



PLAN – FINAL BACKFILL

1" = 15'

WORK POINTS TABLE			
WORK POINTS	EASTING	NORTHING	ELEVATION
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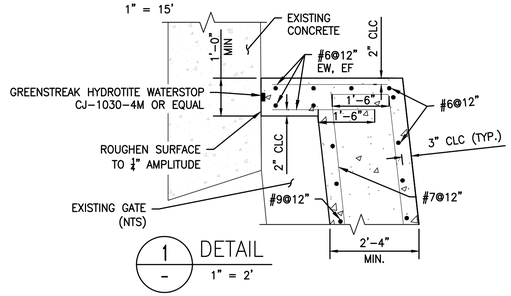
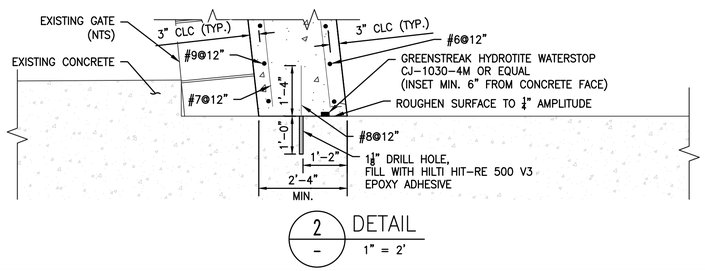


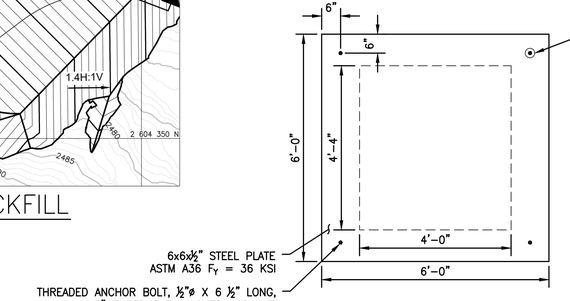
1 – DETAIL

1" = 2'



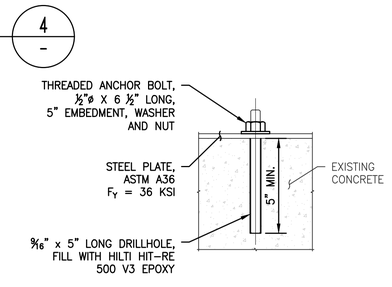
2 – DETAIL

1" = 2'



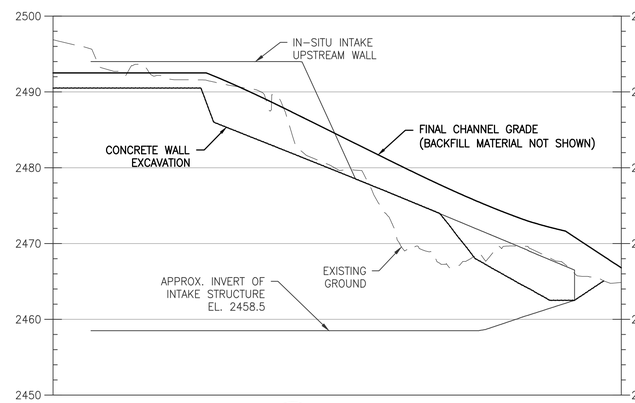
3 – PLAN – STEEL PLATE

NTS



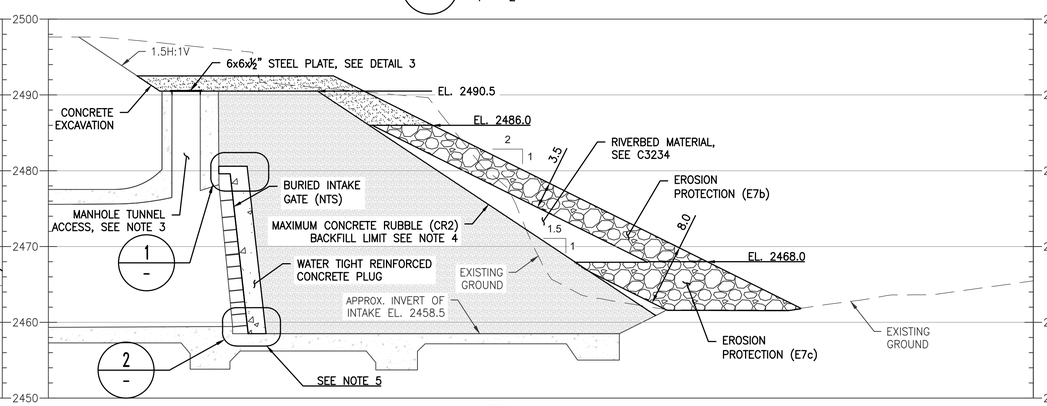
4 – DETAIL – ANCHOR BOLT

NTS



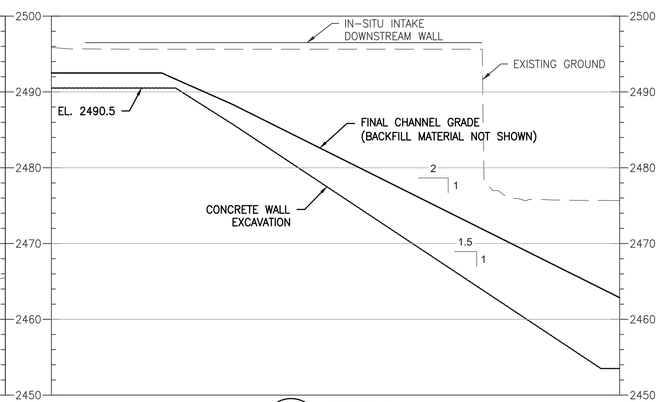
A – SECTION

1" = 10'



B – SECTION

1" = 10'



C – SECTION

1" = 10'

0 15 30 45
1" = 15'

0 10 20 30
1" = 10'

0 2 4 6
1" = 2'

LEGEND:

- (E) CONCRETE
- EROSION PROTECTION (E7b/E7c)
- GENERAL (E9)
- (P) CONCRETE
- CONCRETE RUBBLE (CR2)

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. REMOVE CONCRETE TOP SLAB, TRASH RACK, AND CONCRETE TRASH RACK FRAME. SEE HISTORIC DRAWINGS F-3728, F-3730, F-3853. ELEVATION OF INTAKE STRUCTURE INVERT VARIES.
3. CONTRACTOR SHALL SEAL TUNNEL MANHOLE ACCESS SHAFT FROM SURFACE WITH A STEEL PLATE AS SHOWN IN THE DETAILS PRIOR TO BACKFILLING INTAKE. CONTRACTOR MAY OPT TO USE A LARGE ROCK IN LIEU OF THE STEEL PLATE WITH THE APPROVAL OF THE ENGINEER. ALL STEEL BOLTS AND FASTENERS SHALL BE CARBON STEEL PER ASTM A36.
4. INTAKE BACKFILL MATERIAL SHALL COMPRISE CONCRETE RUBBLE (CR2) OR RIVERBED MATERIAL UP TO THE MAXIMUM CONCRETE RUBBLE BACKFILL LIMIT. SEE DRAWING C3234 FOR RIVERBED MATERIAL DESCRIPTION AND FOR EROSION PROTECTION DETAIL.
5. REBAR ANCHORS AND WATERSTOP SHOWN IN DETAIL 2 SHALL CONTINUE ALONG SIDE WALLS OF THE PLUG, SEE DRAWING C3233.
6. CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 psi.

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	CAV	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. VOS
DRAWN	A. NASIRI
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE: COPCO NO. 2 FACILITY
INTAKE CONCRETE REMOVAL AND BACKFILL LIMITS
PLANS AND SECTIONS

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C3232

scammayo Nov 12, 2020 - 3:10pm
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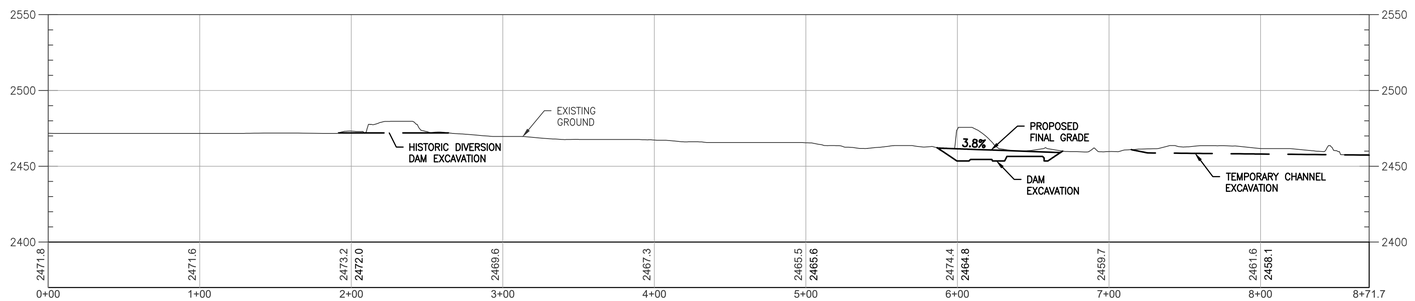
PLAN

1" = 40'



PROFILE

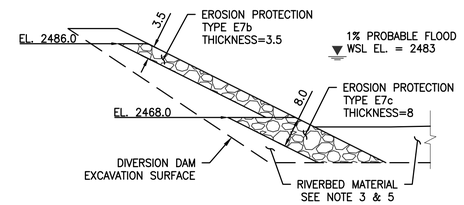
1" = 50'

FOR INFORMATION ONLY

NOTES:

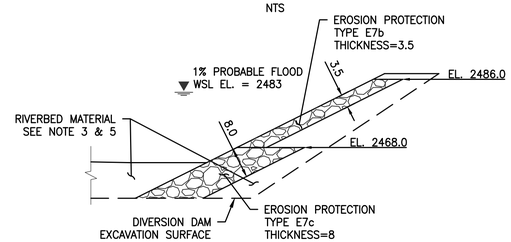
1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. THE RIVER CHANNEL SHALL BE BACKFILLED TO THE EXTENTS SHOWN WITH RIVERBED MATERIAL, EXCEPT FOR AREAS THAT ARE SPECIFIED AS EROSION PROTECTION. RIVERBED MATERIAL MAY BE INTERMIXED WITH THE CONCRETE RUBBLE STORED IN THE INTAKE STRUCTURE AT THE DISCRETION OF THE CONTRACTOR, SEE DRAWING C3232.
3. MATERIAL STOCKPILED ON THE RIGHT BANK UPSTREAM OF THE COPCO NO. 1 DAM ORIGINATES FROM THE HISTORIC COPCO NO. 1 DAM EXCAVATION AND IS ASSUMED TO BE SUITABLE FOR DIRECT PLACEMENT AS RIVERBED MATERIAL. RIVERBED MATERIAL NOT SOURCED FROM THIS AREA MUST BE WELL GRADED MATERIAL WITH AN UPPER PARTICLE SIZE OF APPROXIMATELY 36 in, AND A 15% MAXIMUM OF MATERIAL SMALLER THAN 6 in (BY VOLUME).
4. CHANNEL BACKFILL TO BE BLENDED WITH NATURAL RIVER BED AT FILL EXTENTS.
5. PRIOR TO PLACEMENT OF EROSION PROTECTION THE EXCAVATION OR PLACED SUBGRADE SURFACE SHALL BE VISUALLY FREE OF FINES TO ALLOW FOR DIRECT EROSION PROTECTION PLACEMENT.
6. EROSION PROTECTION MATERIAL SHALL BE TAMPED BY THE CONTRACTOR TO INCREASE INTERLOCK AFTER PLACEMENT.
7. SEE DRAWING C3620 FOR SURFACING REQUIREMENTS.

WORK POINTS TABLE			
WORK POINTS	EASTING	NORTHING	ELEVATION
DDB-01	6469245.0	2604504.7	2462.0
DDB-02	6469188.3	2604546.9	2459.4
DDB-03	6469212.4	2604392.2	2461.6
DDB-04	6469153.7	2604453.4	2460.7
DDB-05	6469113.6	2604478.6	2459.0



TYPICAL LEFT BANK EROSION PROTECTION DETAIL

NTS



TYPICAL RIGHT BANK EROSION PROTECTION DETAIL

NTS

LEGEND:

EROSION PROTECTION (E7b/E7c)

0 50 100 150

1" = 50'

0 40 80 120

1" = 40'

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	CAV	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. VOS
DRAWN	R. PENG
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE: COPCO NO. 2 FACILITY
DIVERSION DAM REMOVAL
CHANNEL GRADING PLAN AND PROFILE

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C3234

scammayo Nov 12, 2020 - 4:30pm
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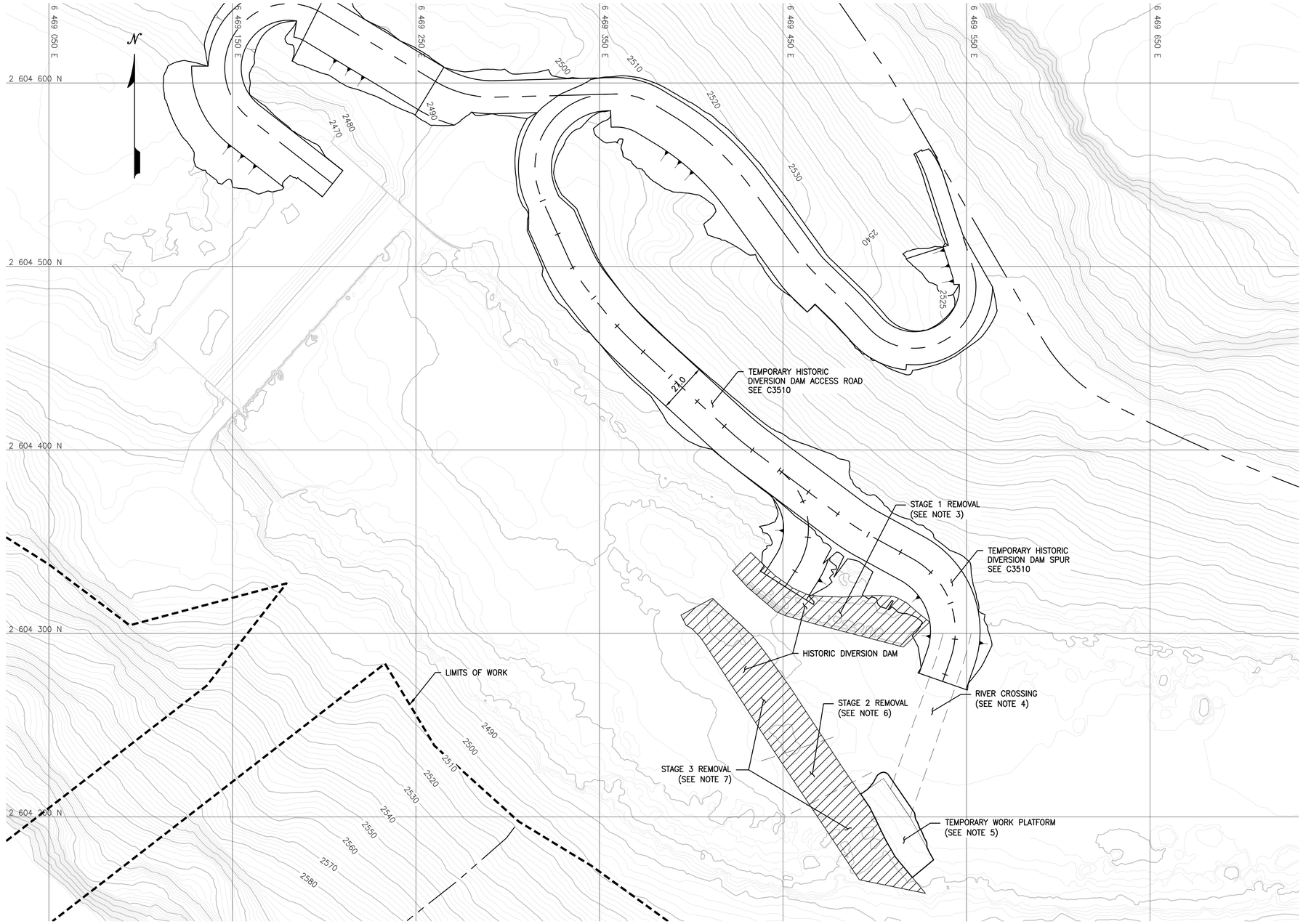

PLAN
1" = 30'

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. REMOVE HISTORIC DIVERSION DAM TO SURROUNDING NATURAL RIVER GRADE.
3. STAGE 1 – REMOVE RIGHT BANK PORTION OF HISTORIC DIVERSION DAM FIRST TO WIDEN THE HISTORIC DIVERSION DAM OPENING AND LOWER THE RIVER LEVEL.
4. CONTRACTOR TO CROSS RIVER DURING LOW FLOW MONTHS. SURROUNDING MATERIAL MAY BE USED TO CREATE A PATH THROUGH THE RIVER IF DEPTH OF WATER IS TOO DEEP TO OPERATE THROUGH.
5. A TEMPORARY WORK PLATFORM SHALL BE CREATED FROM SURROUNDING MATERIAL AS REQUIRED BY THE CONTRACTOR.
6. STAGE 2 – THE PORTION OF THE HISTORIC DIVERSION DAM THAT BLOCKS THE NATURAL LOW POINT IN THE RIVERBED SHALL BE REMOVED TO PROVIDE AN ALTERNATIVE FLOW PATH FOR THE RIVER.
7. STAGE 3 – THE REMAINDER OF THE HISTORIC DIVERSION DAM SHALL BE REMOVED USING THE CONTRACTORS PREFERRED SEQUENCE AND HANDLING METHODOLOGY.
8. SEE CALIFORNIA OREGON POWER COMPANY COPCO NO. 2 DEVELOPMENT HISTORIC DRAWING E-3290 (DATED 05/27/24) FOR HISTORIC DIVERSION DAM DETAILS.

LEGEND:

- DEMOLITION / REMOVAL
- LIMITS OF WORK

0 30 60 90
1" = 30'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	CAV	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. VOS
DRAWN	P. PETKOVIC
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APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: COPCO NO. 2 FACILITY HISTORIC DIVERSION DAM REMOVAL PLAN AND REMOVAL NOTES
DWG C3240

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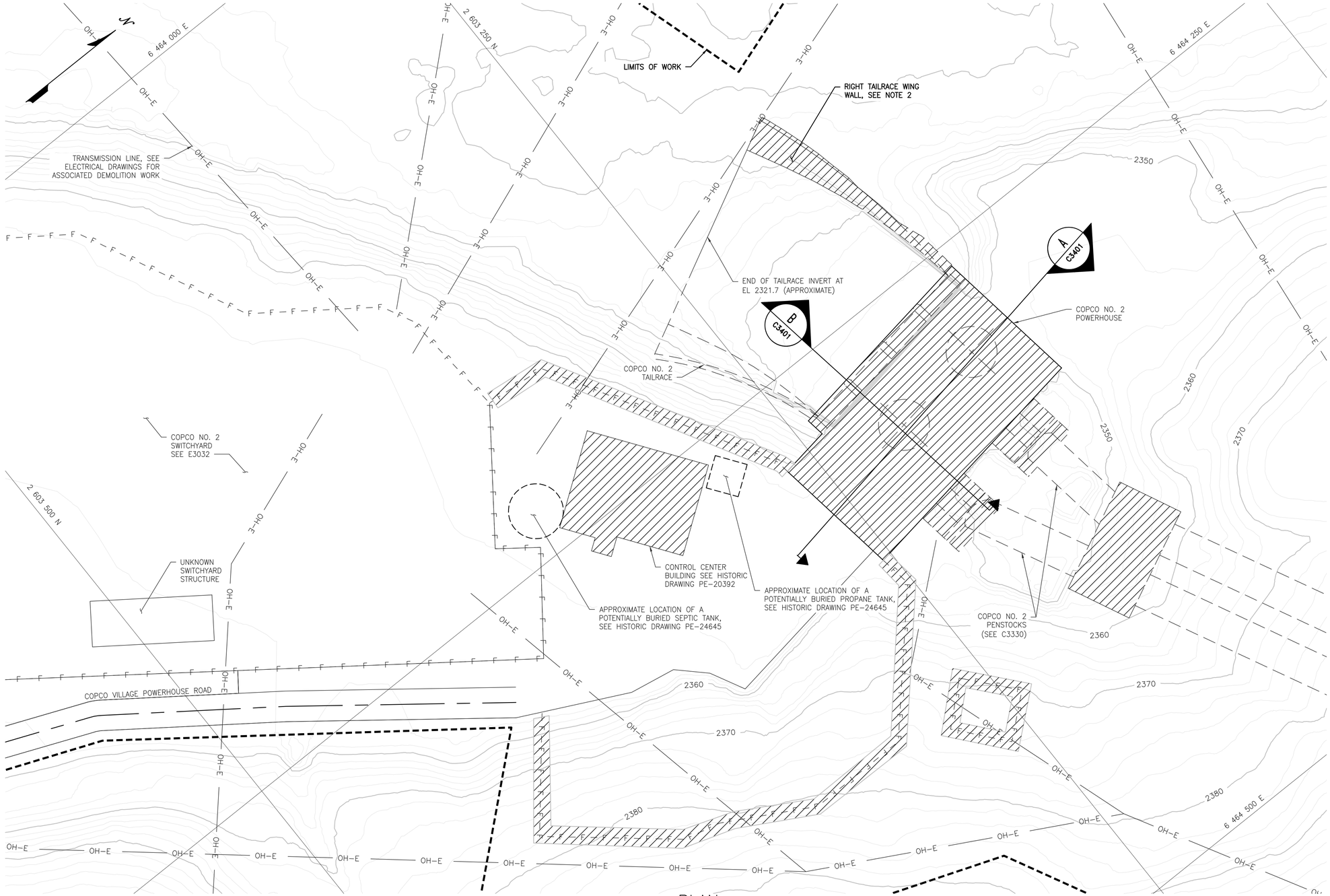

PLAN
1" = 20'

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. RIGHT TAILRACE WING WALL TO BE REMOVED AND PLACED INTO TAILRACE. SEE DRAWING C3332 FOR EXCAVATION DETAILS.
3. TRANSMISSION LINES AND PART OF THE COPCO NO. 2 SWITCHYARD WILL BE SELECTIVELY REMOVED. SEE ELECTRICAL DRAWINGS FOR ASSOCIATED DEMOLITION WORK.

LEGEND:

DEMOLITION / REMOVAL

LIMITS OF WORK

FOR INFORMATION ONLY

0 20 40 60
1" = 20'

REV	DESCRIPTION	BY	CHK	APP	DATE
G	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
F	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
E	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
D	ISSUED WITH 60% DESIGN REPORT	CAV	NB	SRM	02/17/20
C	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY
Knight Piésold CONSULTING
Kiewit

DESIGNED	C. VOS
DRAWN	R. PENG
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE
COPCO NO. 2 FACILITY
POWERHOUSE DEMOLITION
GENERAL ARRANGEMENT - PLAN

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C3400

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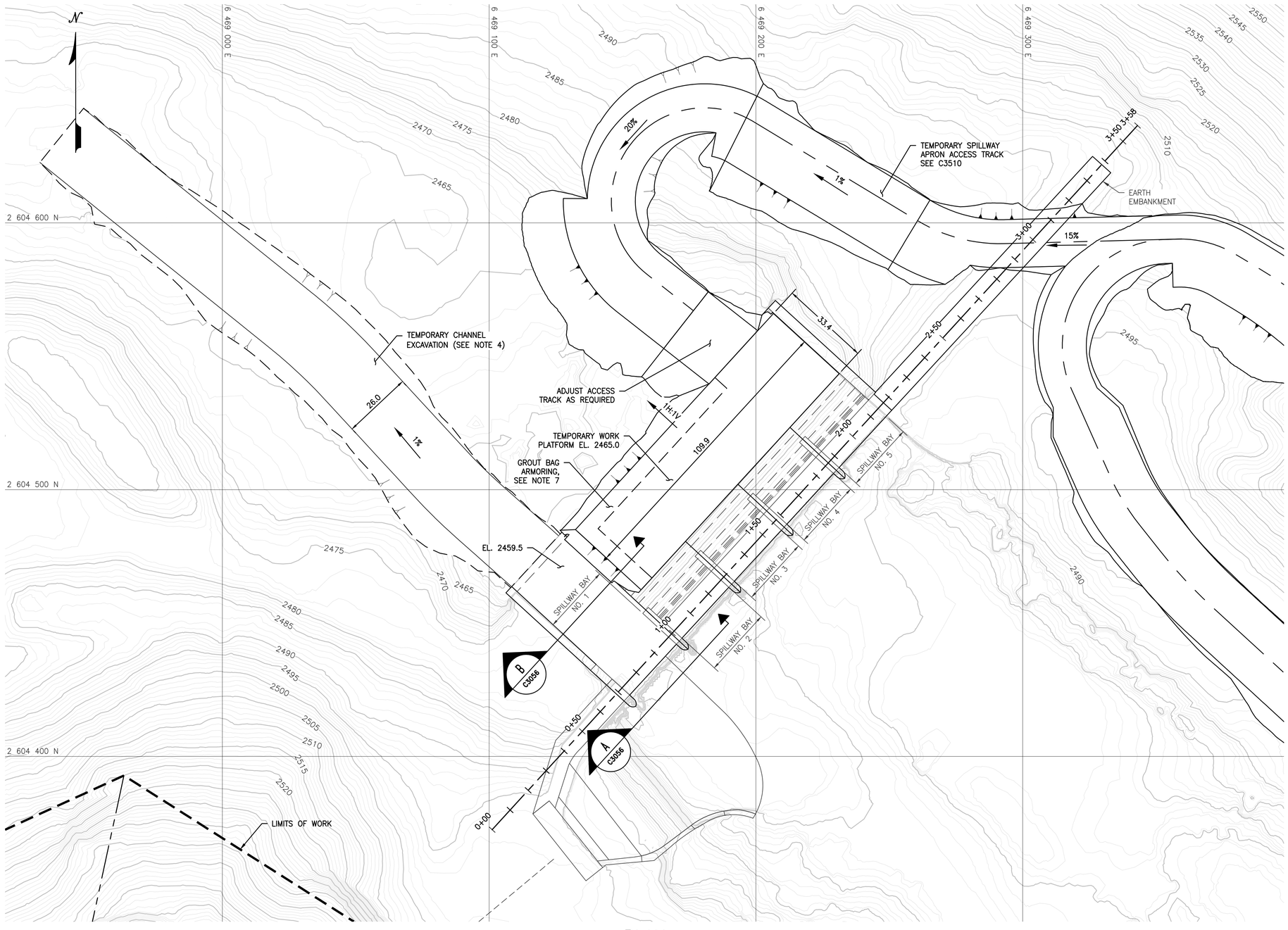

PLAN

SCALE 1" = 20'

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. LOCATION AND ELEVATION OF EXISTING STRUCTURES TO BE CONFIRMED PRIOR TO DEMOLITION.
3. DAM OUTLINE BASED ON THE CALIFORNIA OREGON POWER COMPANY COPCO 2 DEVELOPMENT HISTORIC DRAWING F-3930 (DATED 05/25/1925).
4. TEMPORARY CHANNEL EXCAVATION DESIGNED TO REDUCE THE RIVER ELEVATION ADJACENT TO THE WORK PLATFORM TO BE CONSTRUCTED AT THE CONTRACTOR'S DISCRETION. WORK PLATFORM MAY NEED TO BE RAISED TO PROVIDE A DRY WORKING SURFACE IN THE EVENT THE TEMPORARY CHANNEL EXCAVATION IS NOT CONSTRUCTED.
5. TEMPORARY CHANNEL EXCAVATION MUST BE BACKFILLED IF EXCAVATED.
6. TEMPORARY WORK PLATFORM TO BE EXCAVATED AS REQUIRED.
7. WORK PLATFORM TO BE ARMORED USING GROUT BAGS OR SIMILAR APPROVED BY ENGINEER.
8. SEE DRAWING C3056 FOR ANTICIPATED WATER LEVELS ALONG SPILLWAY BAY NO. 1 WITH THE TEMPORARY WORK PLATFORM AND TEMPORARY CHANNEL EXCAVATION IN PLACE.

LEGEND:

- - - - - - LIMITS OF WORK

FOR INFORMATION ONLY

0 20 40 60

1" = 20'

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
B	ISSUED WTIH 60% DESIGN REPORT	CAV	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. VOS
DRAWN	R. PENG
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE: COPCO NO. 2 FACILITY
CONSTRUCTION ACCESS - TEMPORARY SPILLWAY APRON ACCESS TRACK AND WORK PLATFORM

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C3520

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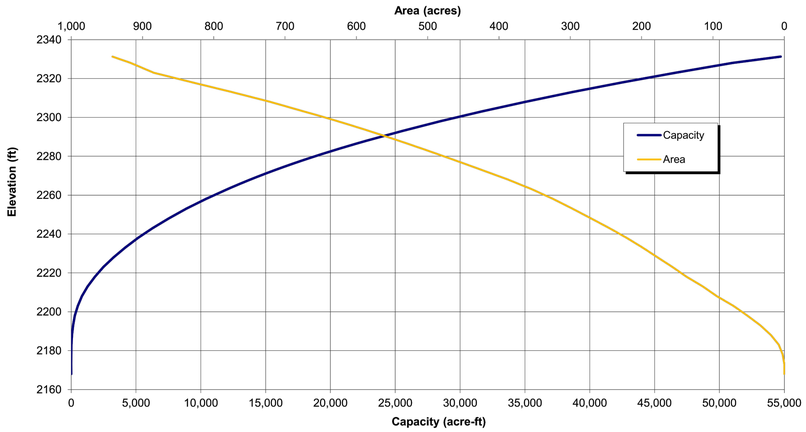

FIGURE 1 – RESERVOIR DEPTH AREA CAPACITY CURVE

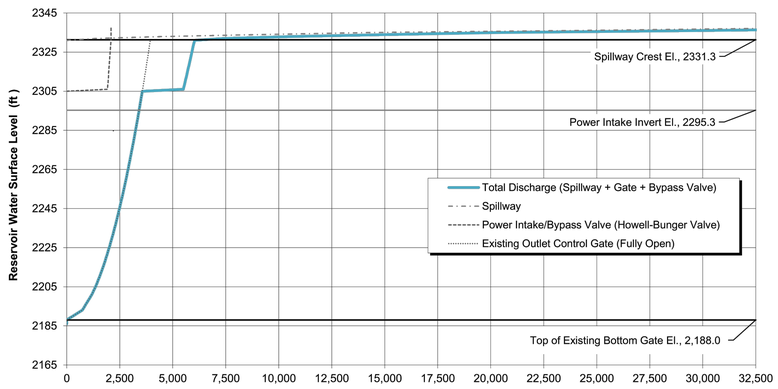

FIGURE 2 – RESERVOIR DRAWDOWN RATING CURVE

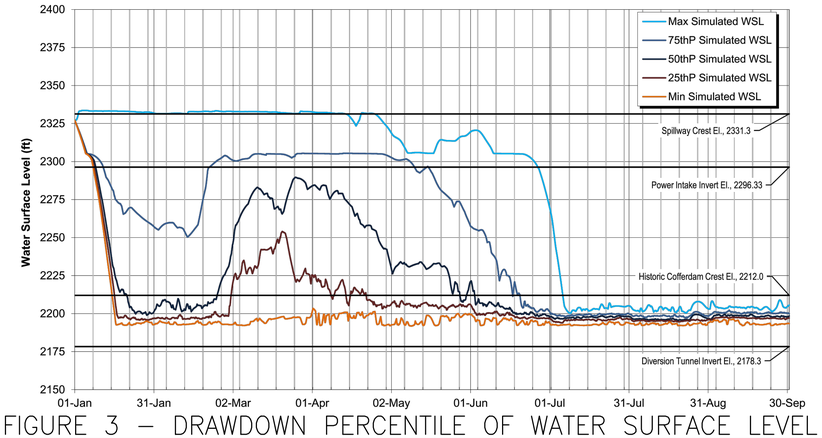

FIGURE 3 – DRAWDOWN PERCENTILE OF WATER SURFACE LEVEL

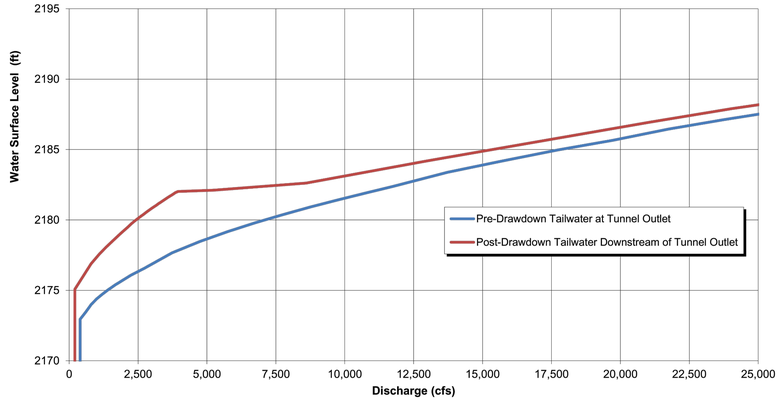

FIGURE 4 – TAILWATER RATING CURVE PRE–DRAWDOWN AND POST–DRAWDOWN

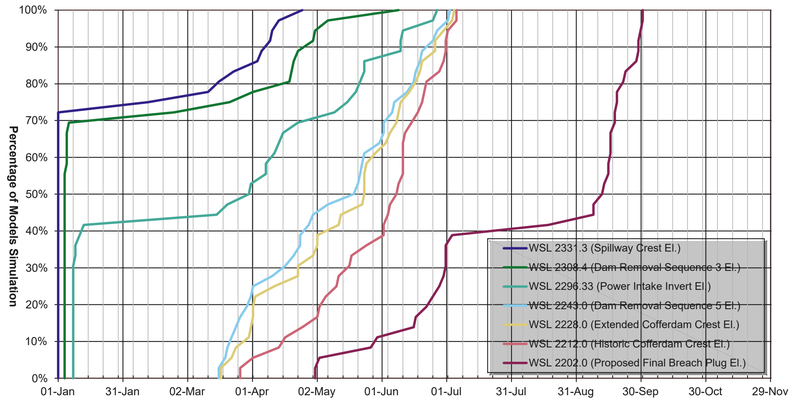

FIGURE 5 – SUSTAINED RESERVOIR DRAWDOWN AT SELECTED ELEVATIONS OVER PERIOD OF RECORD MODEL RUNS BY DATE

NOTES:

1. FOR RESERVOIR DRAWDOWN OPERATIONS NOTES SEE DRAWING C4200.
2. RESERVOIR STORAGE AREA CAPACITY CURVE (FIGURE 1) IS BASED ON THE 2018 BATHYMETRIC SURVEY.
3. DISCHARGE CAPACITIES OF THE SPILLWAY, POWER INTAKE/BY–PASS VALVE (HOWELL–BUNGER VALVE) AND THE EXISTING OUTLET CONTROL GATE ON FIGURE 2 ARE FOR FREE DISCHARGE CONDITIONS.
4. DISCHARGE RATING CURVES ON FIGURE 2 ARE FOR WATER LEVELS IMMEDIATELY UPSTREAM OF THE DAM.
5. PRE–DRAWDOWN TAILWATER SURFACE LEVELS ON FIGURE 3 ARE FOR WATER LEVELS AT THE TUNNEL ACCESS ROAD IMMEDIATELY DOWNSTREAM OF THE DIVERSION TUNNEL OUTLET.
6. POST–DRAWDOWN TAILWATER SURFACE LEVELS ON FIGURE 3 ARE FOR WATER LEVELS DOWNSTREAM OF THE DIVERSION TUNNEL OUTLET AT THE TOE PROTECTION BERM.
7. RESERVOIR WATER LEVELS SHOWN IN FIGURE 4 ARE THE RESERVOIR WATER SURFACE LEVEL MODEL RUN RESULTING PERCENTILES IMMEDIATELY UPSTREAM OF THE DAM USING THE DRAWDOWN MODEL. THE PERCENTILES ARE CALCULATED BASED ON THE ENTIRE 36 YEAR RECORD OF 2019 JOINT BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. THE RESERVOIR WATER LEVELS ARE SIMULATED USING THE RESERVOIR DRAWDOWN OPERATIONS ON DRAWING C4200. WATER LEVELS CAN BE OUTSIDE OF THESE VALUES DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR.
8. THE CURVES SHOWN ON FIGURE 5 REPRESENT THE PERCENTAGE OF MODEL SIMULATIONS AT WHICH RESERVOIR DRAWDOWN WATER SURFACE LEVELS ARE SUSTAINED BELOW SELECTED ELEVATIONS BASED ON THE DRAWDOWN MODEL USING THE ENTIRE 36 YEAR RECORD OF 2019 JOINT BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. THE ACTUAL DATE A WATER SURFACE LEVEL IS SUSTAINED AT A CERTAIN ELEVATION CAN BE DIFFERENT THAN SHOWN DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR AND THE DRAWDOWN SEQUENCING SHOWN ON DRAWINGS C4203 TO C4209.

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH 100% DESIGN REPORT	KTW	HE	SRM	11/13/20
D	ISSUED WITH 100% DESIGN REPORT	KTW	NB	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	KTW	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	KTW	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	KTW	NB	SRM	12/18/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	K. WECHSELBERGER
DRAWN	R. PENG
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
SHEET TITLE: IRON GATE FACILITY
HYDROLOGIC AND HYDRAULIC INFORMATION
DRAWDOWN - FIGURES

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C4050

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PLAN
1" = 150'

NOTES:

1. ALL COORDINATES ARE NAD83 HARN ZONE 1.
2. ALL DIMENSIONS AND ELEVATIONS ARE SHOWN IN FEET UNLESS NOTED OTHERWISE.
3. WATER SURFACE LEVELS SHOWN INDICATE THE STEADY-STATE WATER SURFACE LEVELS IN THE RESERVOIR SUBJECT TO A PROBABLE FLOOD AND CONSIDERING THE DISCHARGE CAPACITY OF THE DIVERSION TUNNEL WITH THE EXISTING UPPER GATE FULLY OPEN.
4. HYDROLOGIC DATA ARE PRESENTED IN DETAIL FOR ALL MONTHS IN TABLE 1 ON DRAWING C4055.

FOR INFORMATION ONLY

0 150 300 450
1" = 150'

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH 100% DESIGN REPORT	KTW	HE	SRM	11/13/20
D	ISSUED WITH 100% DESIGN REPORT	KTW	NB	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	KTW	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	KTW	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	KTW	NB	SRM	12/18/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY
Knight Piésold CONSULTING
Kiewit

DESIGNED	K. WECHSELBERGER
DRAWN	E. GUEVARRA
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

PROJ # VA103-640/1
DATE 11/13/2020

SHEET TITLE
IRON GATE FACILITY
HYDROLOGIC AND HYDRAULIC INFORMATION - DRAWDOWN WATER SURFACE FLOOD LEVELS - RESERVOIR PLAN

DWG C4051

sammiyo Nov 13, 2020 - 9:38am
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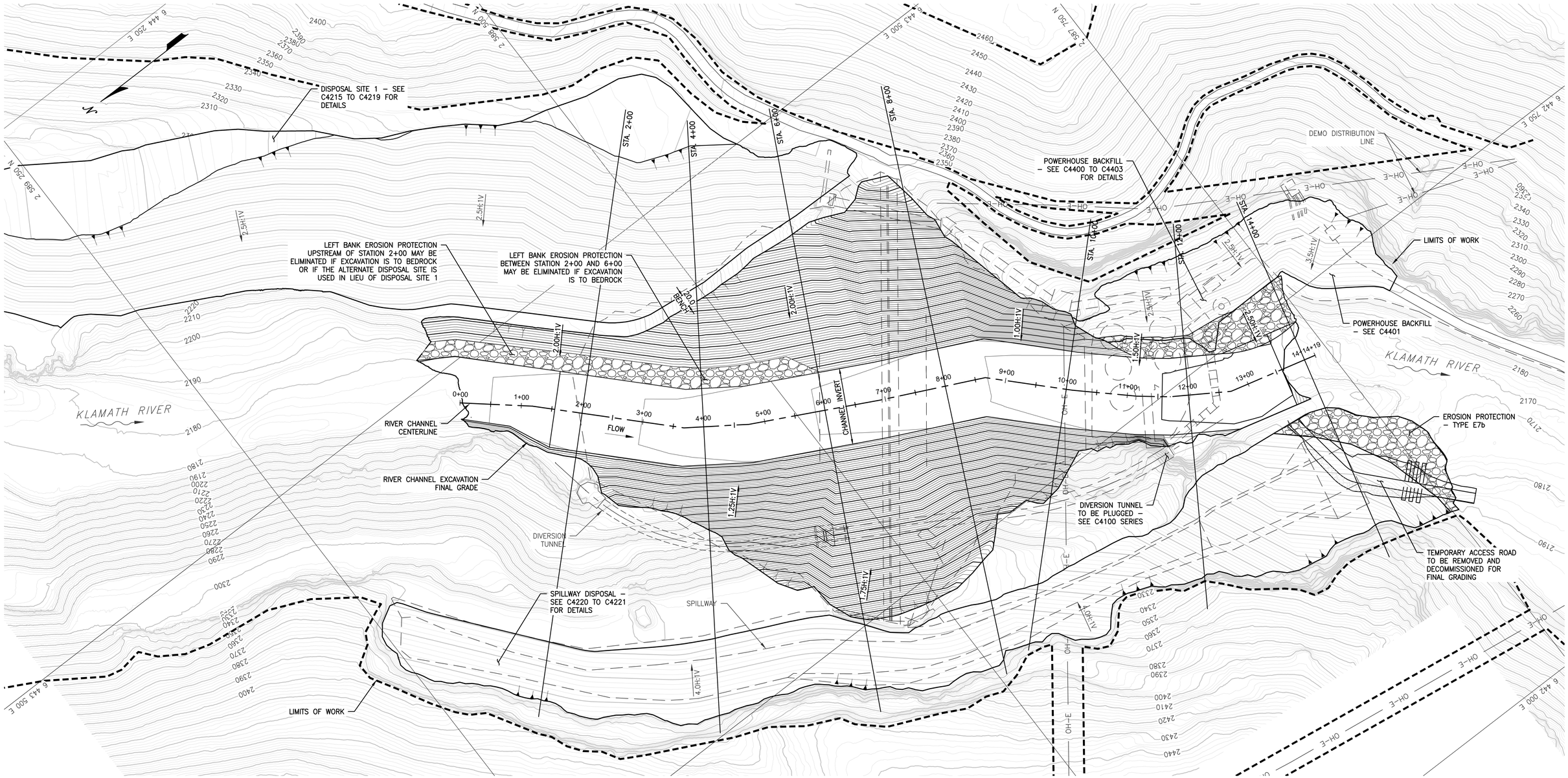
PUBLIC VERSION

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION

(CEII)

REDACTED

DESIGN SHEET C4203-C4209: COPCO NO. 1 EMBANKMENT REMOVAL



PLAN
1" = 80'

NOTES:

1. REFER TO GENERAL NOTES ON G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. CONTOUR INTERVALS ARE 2 ft.
3. ALL CORE ZONE MATERIAL (ZONE III) SHALL BE EXCAVATED TO BEDROCK. ALL OTHER EXCAVATED SURFACE SHALL BE TO BEDROCK OR EXCAVATION EXTENTS SHOWN HERE.
4. FOR FINAL GRADE SURFACE TREATMENT, SEE DRAWING SERIES C4600.
5. NO EROSION PROTECTION REQUIRED WHERE EXCAVATION IS TO BEDROCK.

0 80 160 320
1" = 80'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH 100% DESIGN REPORT	KTW	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	KTW	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	KTW	SY	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	KTW	SY	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	KTW	SY	SRM	12/18/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY
Knight Piésold CONSULTING
Kiewit

DESIGNED	K. WECHSELBERGER
DRAWN	A. TSENG
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

PROJ # VA103-640/1
DATE 11/13/2020

SHEET TITLE
IRON GATE FACILITY
EMBANKMENT REMOVAL
GRADING GENERAL ARRANGEMENT PLAN

DWG C4210

atseng Nov 12, 2020 - 10:48am
\\KPL\VA-Prj\B1103\00940\01\A\cad\DWGS\4000\C4210-C4211\C4210-C4211.dwg

DISPOSAL SITE 1 – SEQUENCE 3 AT EL. 2275 – SEE C4218

BOUNDARY OF FINAL CHANNEL EXCAVATION – SEE FINAL GRADE DRAWINGS ON C4210 SERIES (FINAL FOOTPRINT)

DISPOSAL SITE 1 BACKFILL (FINAL FOOTPRINT) – SEE C4215 TO C4219 FOR DETAILS

EXTENDED COFFERDAM EL. 2231.7

HISTORICAL COFFERDAM

RIVER CHANNEL CENTERLINE

FLOW

KLAMATH RIVER

BREACH PLUG CREST AT EL. 2202

BREACH CHANNEL (THROUGH EMBANKMENT)

EXCAVATE RIGHT BANK OF FINAL BREACH CHANNEL TO BEDROCK

1 / C4255

DIVERSION TUNNEL

SPILLWAY

FOR POWERHOUSE SITE FINAL GRADING AND BACKFILL – SEE DRAWING SERIES C4400

LIMITS OF WORK

20.0

70.0

2.00H:1V

5.00H:1V

1.43H:1V

20.0

20.0

0+00 1+00 2+00 3+00 4+00 5+00 6+00 6+83 7+00 8+00 9+00 10+00 11+00 12+00

20+00 21+00 22+22+10

2 588 500 N

2 587 750 N

6 442 750 E

2390 2380 2370 2360 2350 2340 2330 2320 2310 2300 2290 2280 2270 2260 2250 2240 2230 2220 2210 2200

NOTES:

1. REFER TO GENERAL NOTES ON G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. CONTOUR INTERVALS ARE 2 ft.
3. EMBANKMENT REMOVAL STAGES ARE DEFINED AS THE MAXIMUM EXTENT OF WORK AND ASSOCIATED CUT VOLUME PRIOR TO RELEVANT DATE.
4. EXISTING EMBANKMENT ZONE EXTENTS ARE APPROXIMATE AND SHOWN TO ASSIST CONSTRUCTION PLANNING ONLY. REFER TO HISTORICAL DRAWINGS FOR MORE DETAIL.

LEGEND:

- DEMOLITION / REMOVAL
- (E) EARTHFILL
- (E) RIPRAP
- CORE MATERIAL (ZONE III)
- EROSION PROTECTION (E7b)
- EROSION PROTECTION (E7c)

PLAN
1" = 50'

0 80 160 240
1" = 80'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
C	ISSUED WITH 100% DESIGN REPORT	KTW	HE	SRM	11/13/20
B	ISSUED WITH DRAFT 100% DESIGN REPORT	KTW	HE	SRM	10/07/20
A	ISSUED WITH 90% DESIGN REPORT	KTW	HE	SRM	08/05/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY
Knight Piésold CONSULTING
Kiewit

DESIGNED	K. WECHSELBERGER
DRAWN	A. TSENG
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE
IRON GATE FACILITY
EMBANKMENT REMOVAL
FINAL BREACH PLAN

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C4250

atseng Nov 12, 2020 - 11:05am
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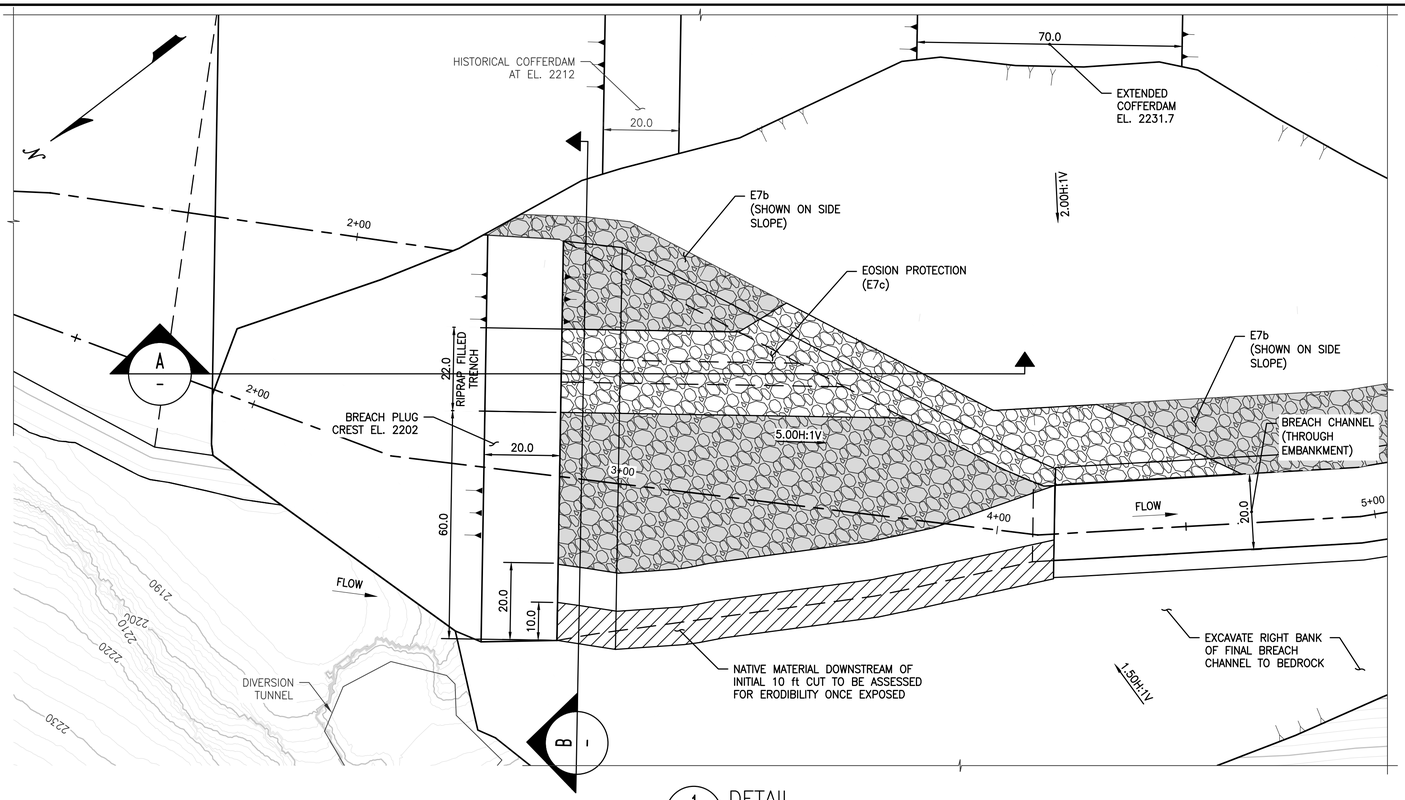
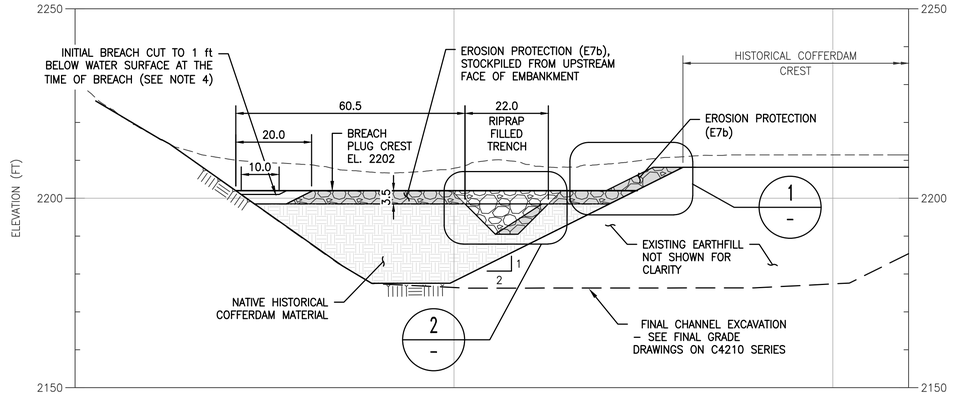
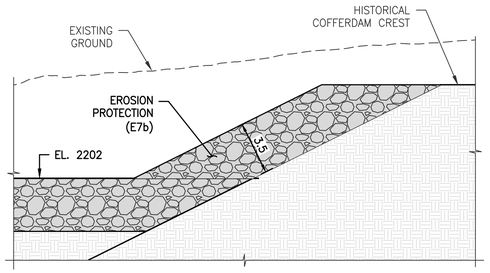


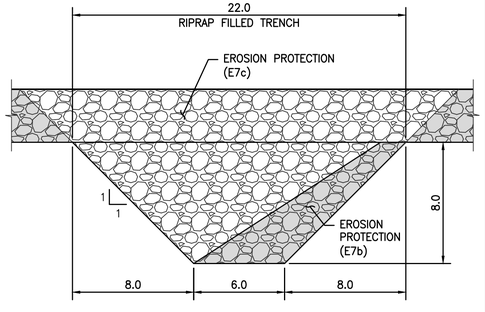
1 / C4250 DETAIL
1" = 20'



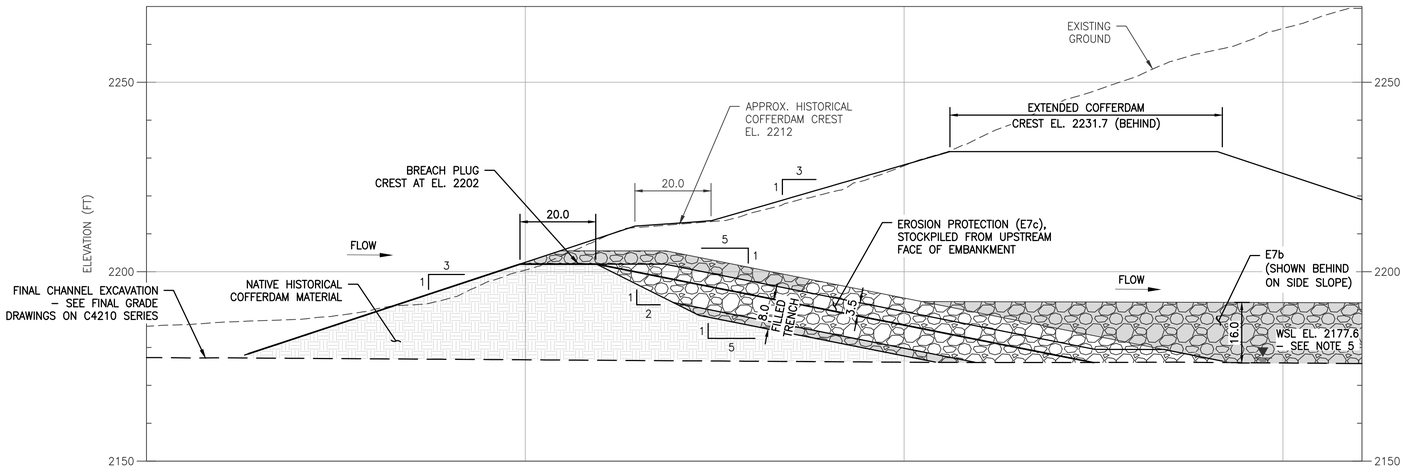
B / – SECTION
1" = 20'



1 / – DETAIL
1" = 5'



2 / – DETAIL
1" = 5'



A / – SECTION
1" = 20'

LEGEND:

- (E) EARTHFILL
- EROSION PROTECTION (E7c)
- EROSION PROTECTION (E7b)
- DEMOLITION / REMOVAL
- BEDDING (E8)

NOTES:

1. REFER TO GENERAL NOTES ON G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. CONTOUR INTERVALS ARE 2 ft.
3. LIFTS SHALL BE EXCAVATED FROM RIGHT BANK TO LEFT BANK.
4. THE INITIAL BREACH CUT SHALL BE 1ft BELOW THE WATER SURFACE AT THE TIME OF BREACH. FOLLOWING THE INITIAL CUT, FURTHER MECHANICAL BREACH FACILITATION, IF REQUIRED SHALL BE ACHIEVED FROM A HISTORICAL ROCK BENCH ON THE RIGHT ABUTMENT.
5. FOLLOWING THE REMOVAL OF THE TOE PROTECTION BERM UPSTREAM OF THE POWERHOUSE IMMEDIATELY PRIOR TO BREACH THE MEAN MONTHLY TAILWATER LEVEL CONSISTENT WITH INFLOWS DURING THE BREACH WINDOW IS ESTIMATED AT EL. 2177.6 ft. FOR TAILWATER LEVELS ASSOCIATED WITH OTHER RETURN PERIOD INTERVALS SEE SHEET C4055.

0 20 40 60
1" = 20'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
B	ISSUED WITH 100% DESIGN REPORT	KTW	HE	SRM	11/13/20
A	ISSUED WITH DRAFT 100% DESIGN REPORT	KTW	HE	SRM	10/07/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING / Kiewit

DESIGNED	K. WECHSELBERGER
DRAWN	A. TSENG
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: IRON GATE FACILITY EMBANKMENT REMOVAL FINAL BREACH - BREACH PLUG DETAILS
DWG C4255

atseng Nov 12, 2020 - 12:17hm
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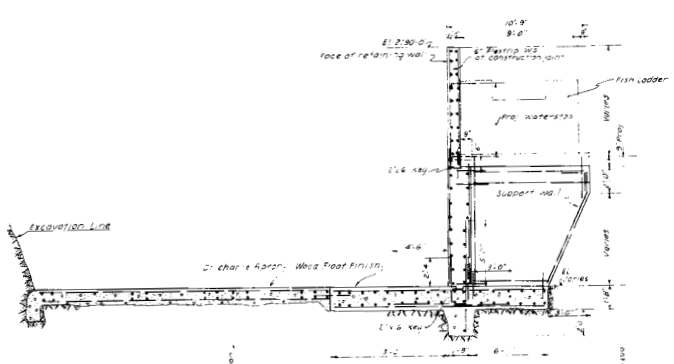
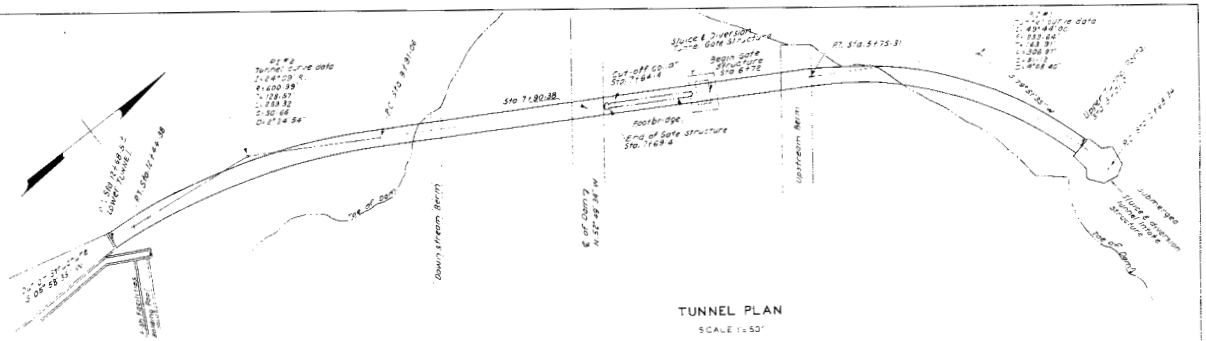
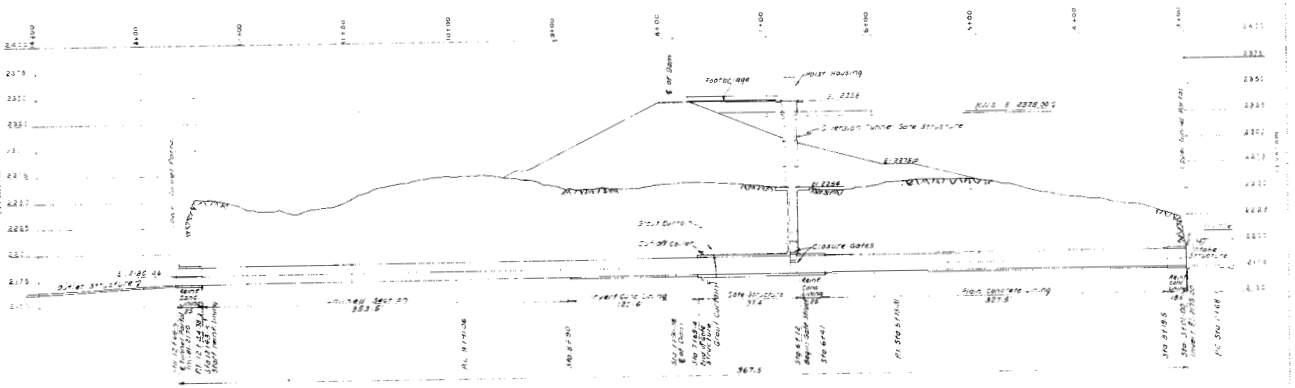


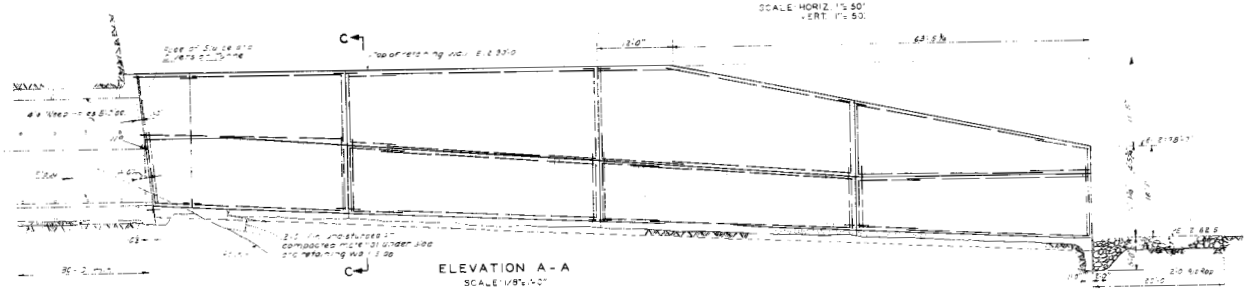
SECTION C-C
SCALE 1/4" = 1'-0"



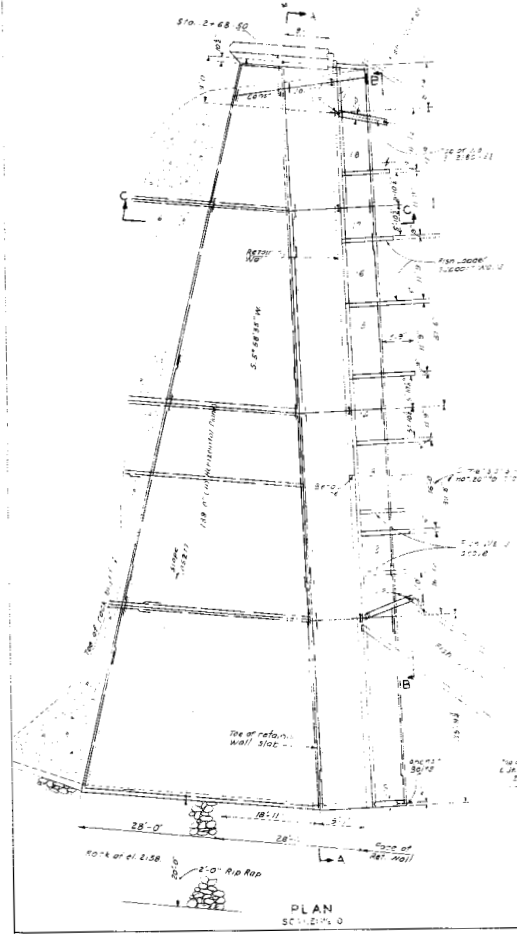
TUNNEL PLAN
SCALE 1" = 50'



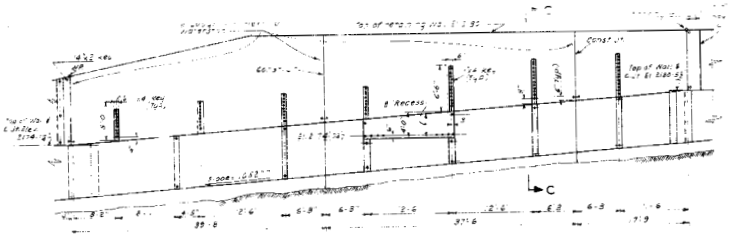
PROFILE ALONG ℄ OF TUNNEL
SCALE: HORIZ. 1" = 50'
VERT. 1" = 50'



ELEVATION A - A
SCALE 1/8" = 1'-0"



PLAN
SCALE 1/8" = 1'-0"



ELEVATION B - B
SCALE: 1/8" = 1'-0"

ELEVATIONS ARE REFERRED TO U.S.G.S. DATUM

THIS MAP IS A PART OF THE APPLICATION FOR AN AMENDMENT OF LICENSE MADE BY THE UNDERSIGNED THIS 25TH DAY OF MAY, 1962.

PACIFIC POWER & LIGHT COMPANY

BY _____
VICE PRESIDENT

PACIFIC POWER & LIGHT COMPANY PORTLAND, OREGON

APPLICATION FOR AMENDMENT OF LICENSE
PROJECT NO. 2082

KLAMATH BASIN PROJECT
IRON GATE DEVELOPMENT

SLUICE & DIVERSION TUNNEL - PLAN & PROFILE
OUTLET STRUCTURE PLAN, ELEVATIONS & SECTION

SCALE: AS NOTED

G-8862 SH. 1

Source: Northwest Hydraulic Consultants Drawdown Model Report for the Klamath River Renewal Project in Appendix G of the 100% Design Report (Knight Piésold, 2020b).

Drawdown Plots for J.C. Boyle Reservoir

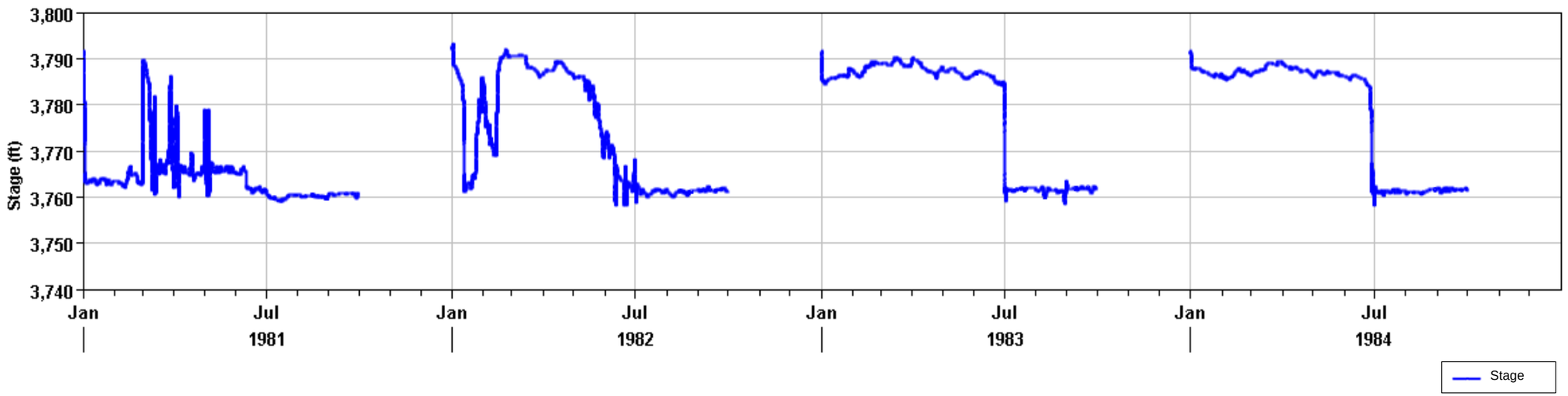


Figure 1: J.C. Boyle Drawdown Stage for years 1981 through 1984

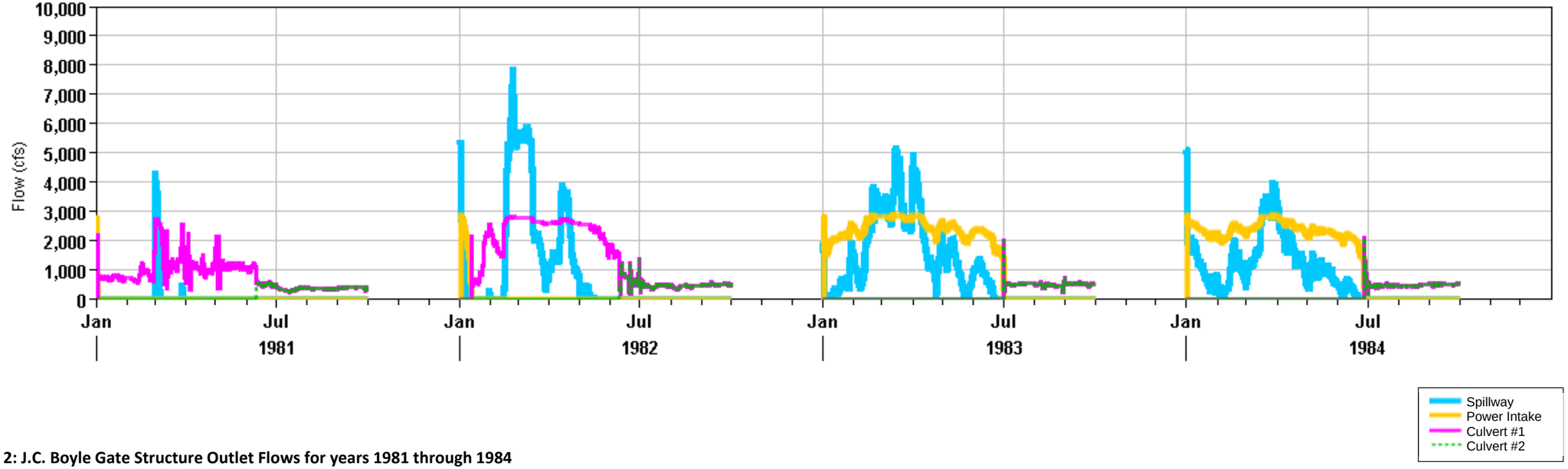


Figure 2: J.C. Boyle Gate Structure Outlet Flows for years 1981 through 1984

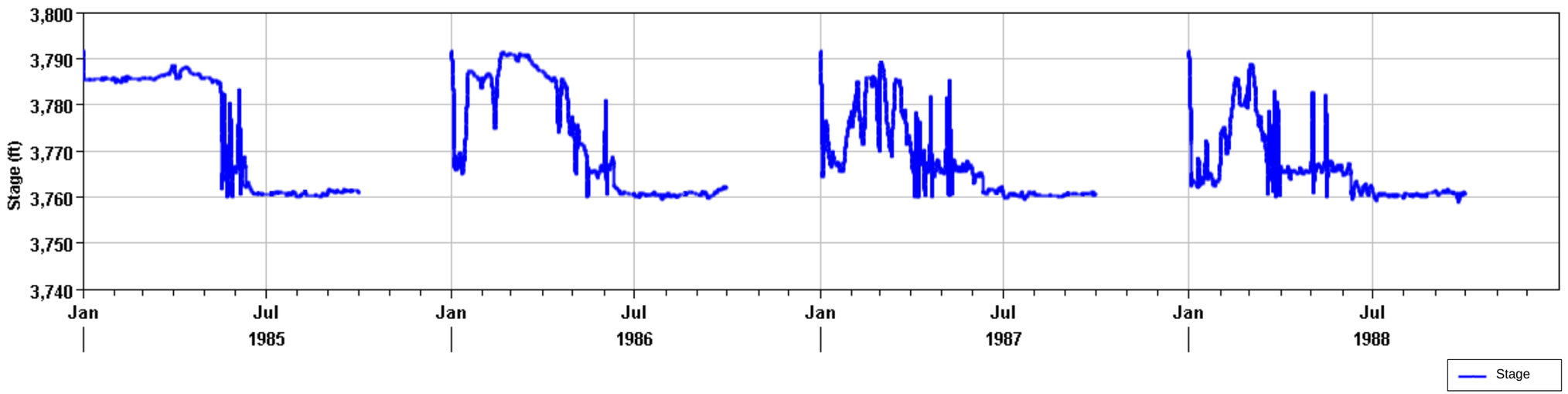


Figure 3: J.C. Boyle Drawdown Stage for years 1985 through 1988

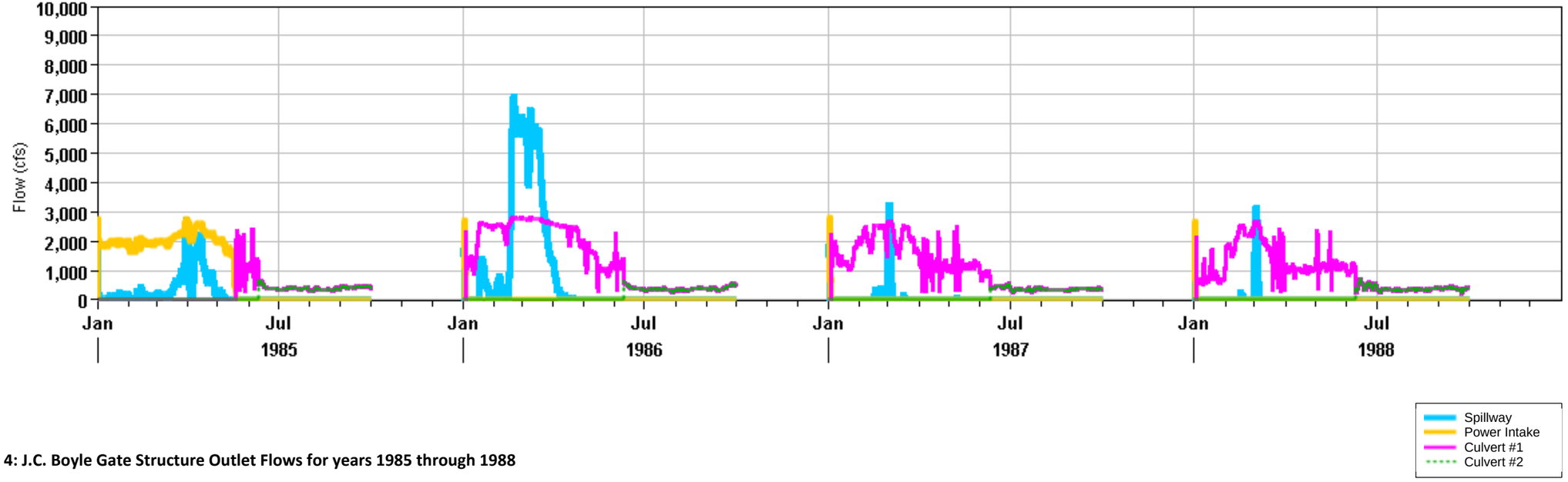


Figure 4: J.C. Boyle Gate Structure Outlet Flows for years 1985 through 1988

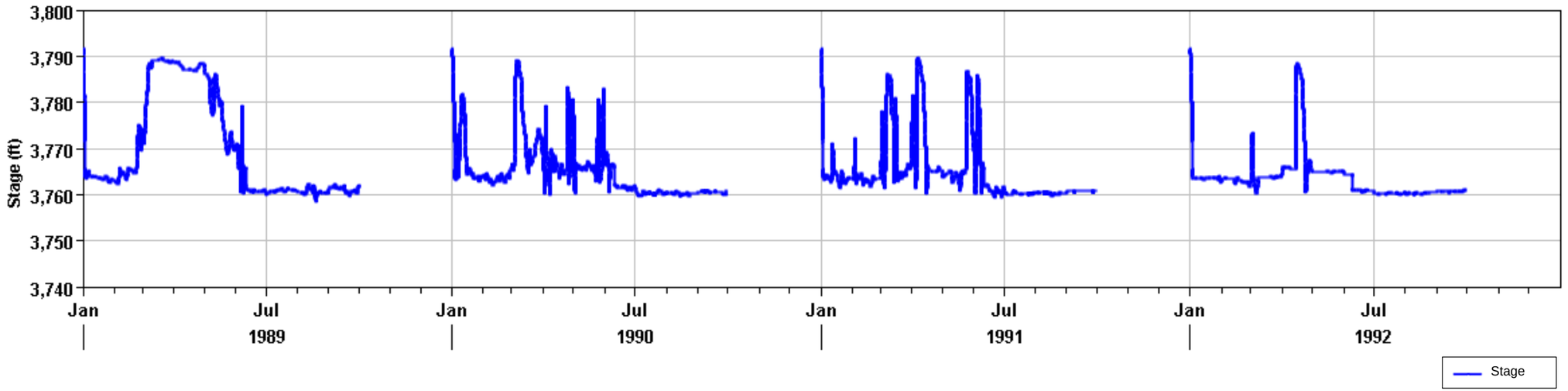


Figure 5: J.C. Boyle Drawdown Stage for years 1989 through 1992

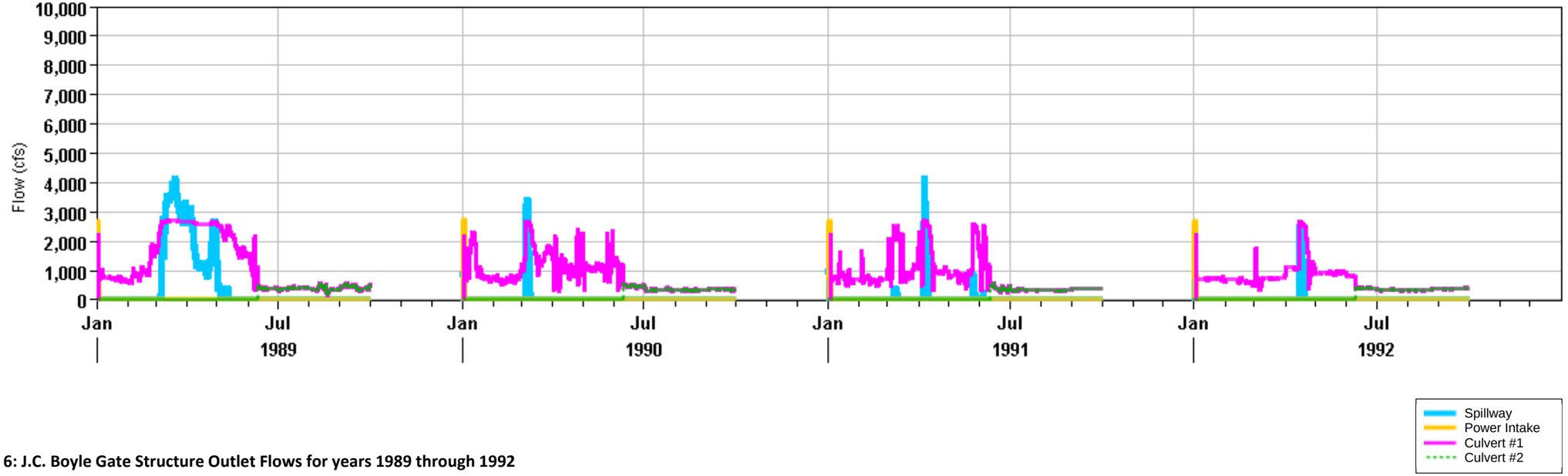


Figure 6: J.C. Boyle Gate Structure Outlet Flows for years 1989 through 1992

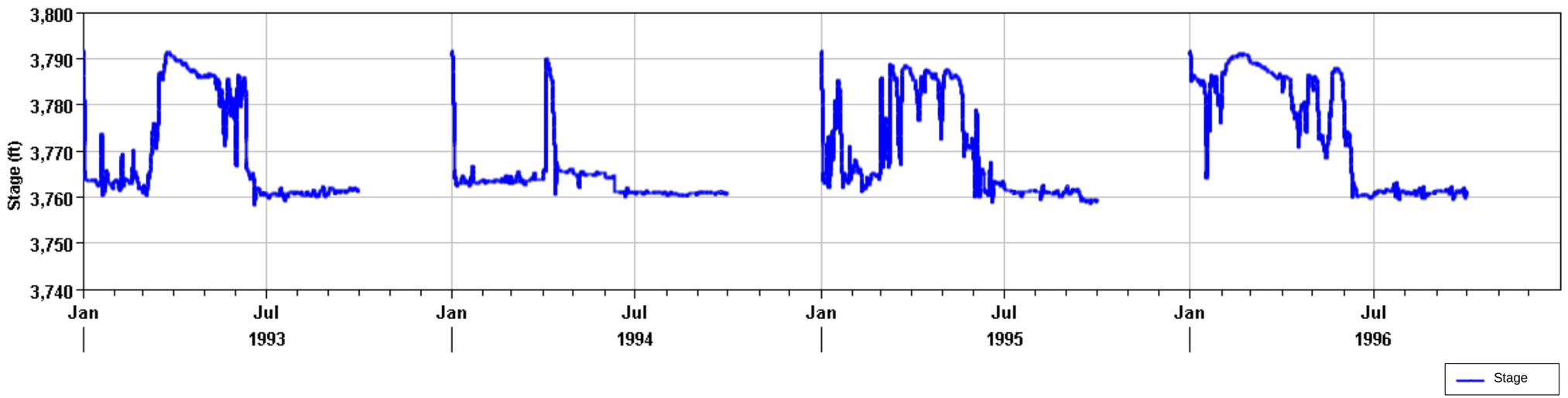


Figure 7: J.C. Boyle Drawdown Stage for years 1993 through 1996

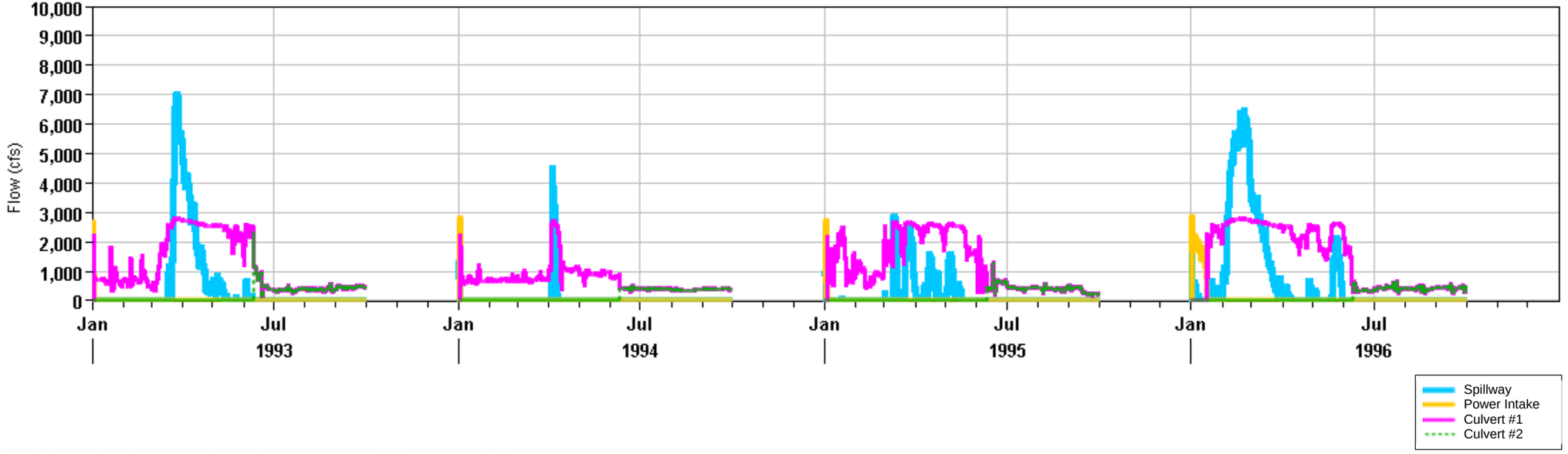


Figure 8: J.C. Boyle Gate Structure Outlet Flows for years 1993 through 1996

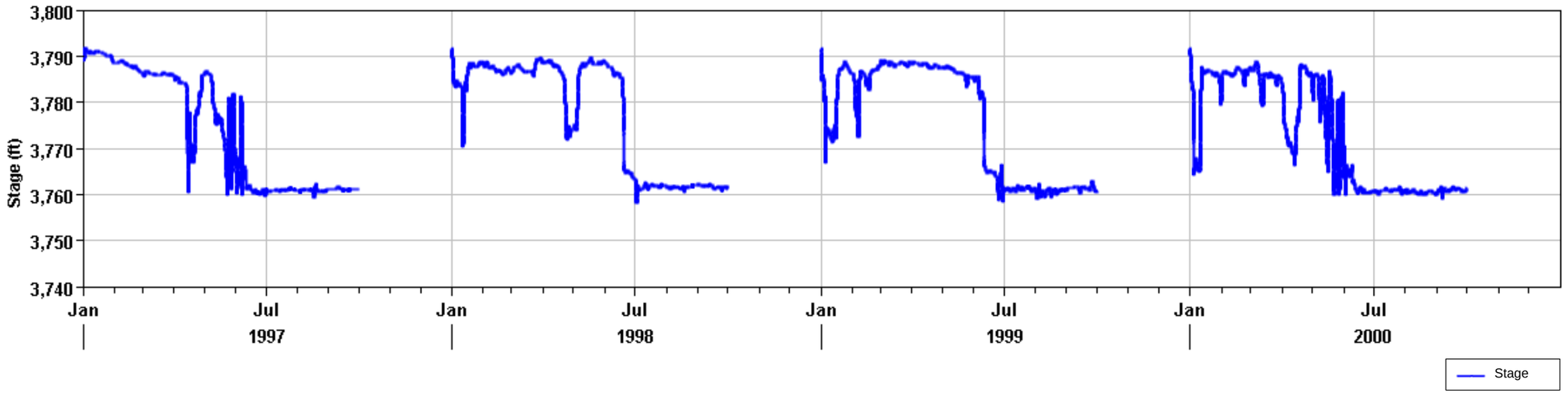


Figure 9: J.C. Boyle Drawdown Stage for years 1997 through 2000

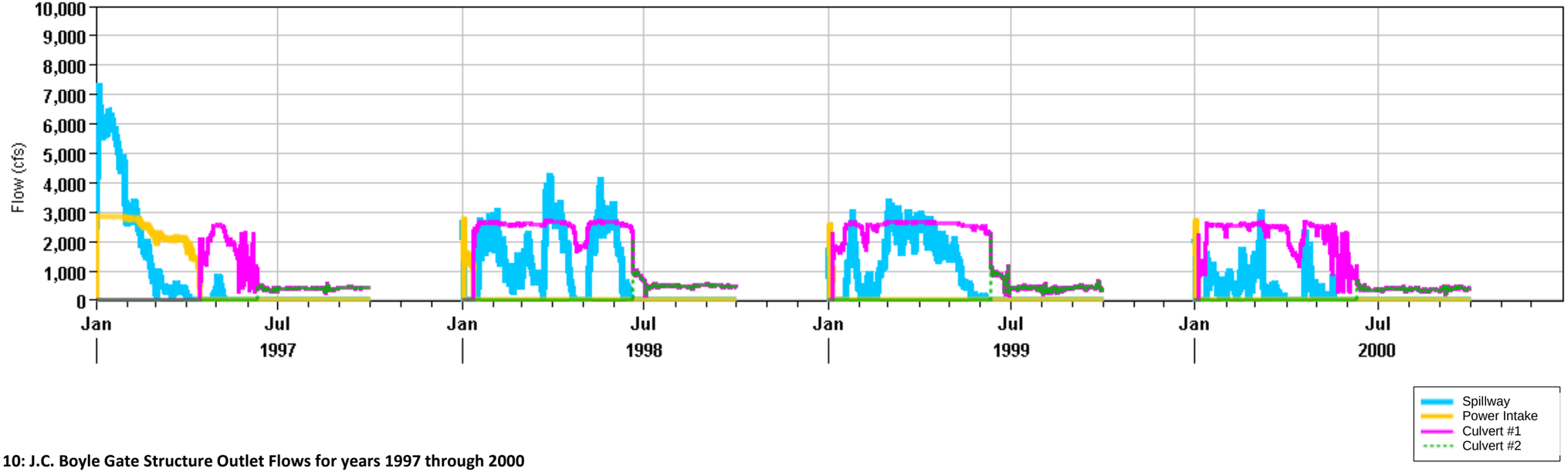


Figure 10: J.C. Boyle Gate Structure Outlet Flows for years 1997 through 2000

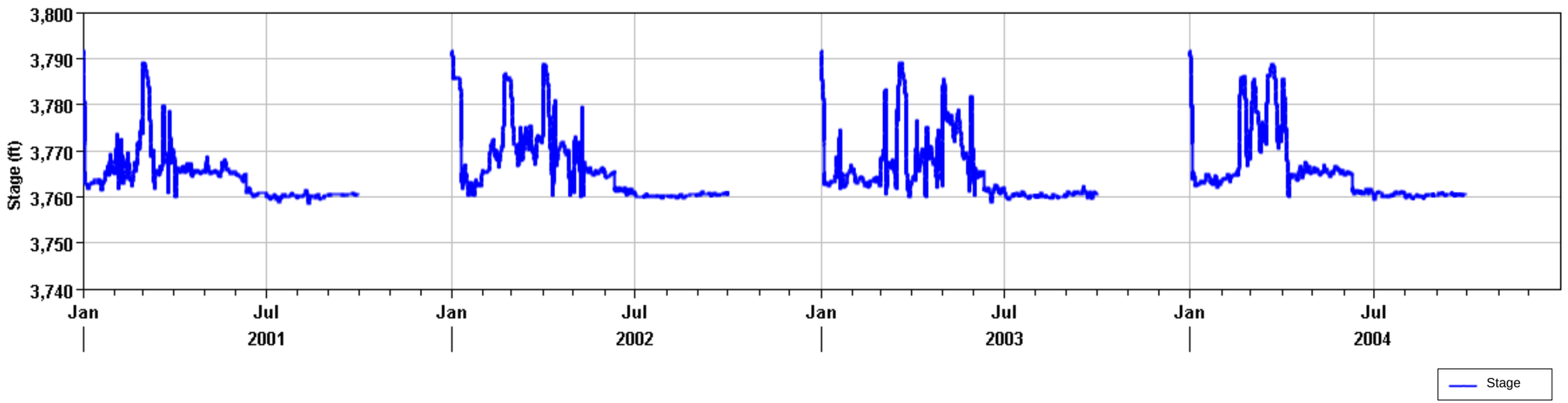


Figure 11: J.C. Boyle Drawdown Stage for years 2001 through 2004

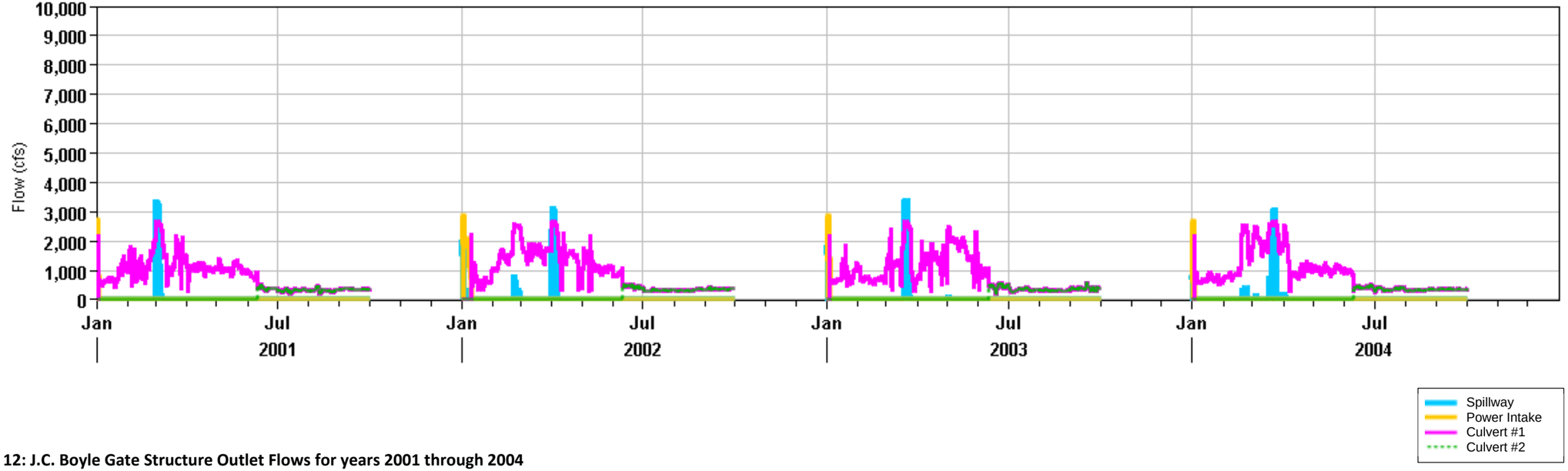


Figure 12: J.C. Boyle Gate Structure Outlet Flows for years 2001 through 2004

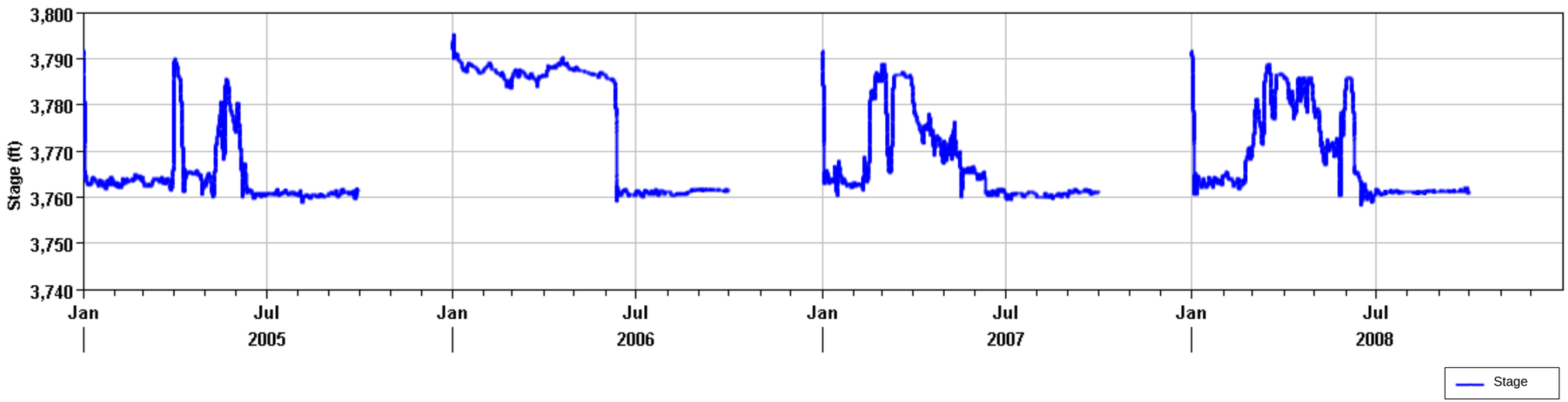


Figure 13: J.C. Boyle Drawdown Stage for years 2005 through 2008

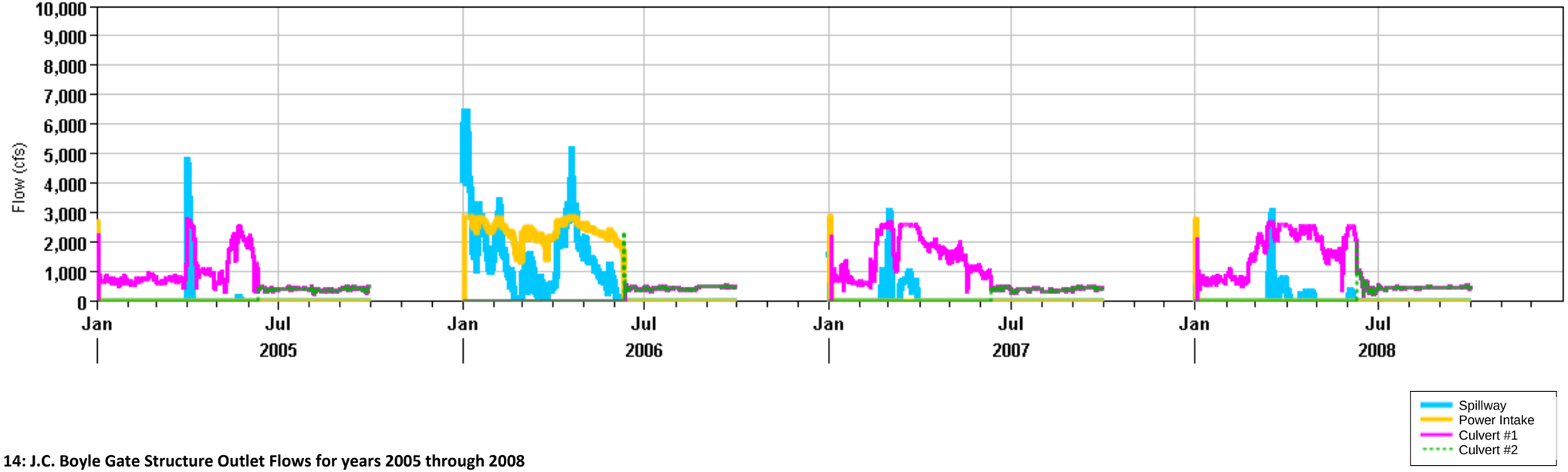


Figure 14: J.C. Boyle Gate Structure Outlet Flows for years 2005 through 2008

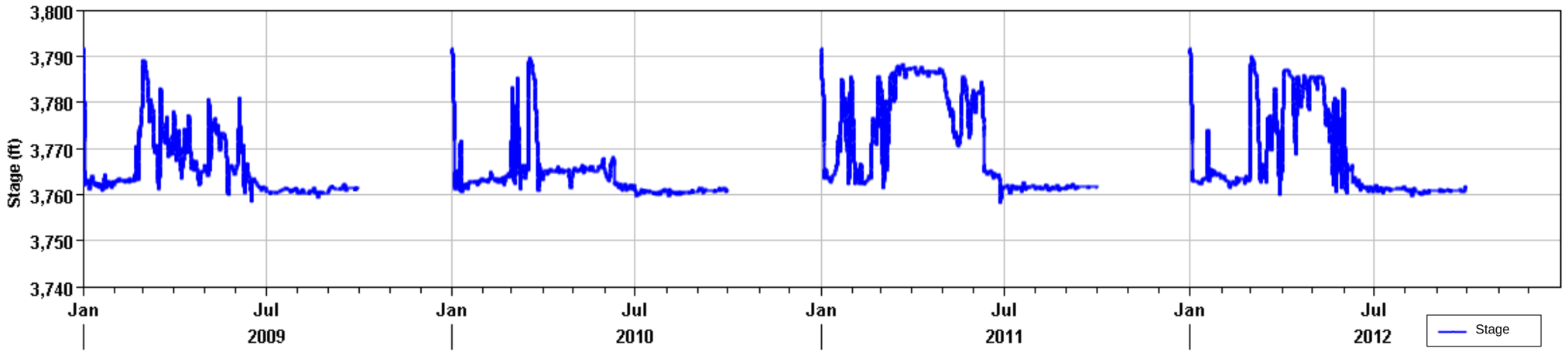


Figure 15: J.C. Boyle Drawdown Stage for years 2009 through 2012

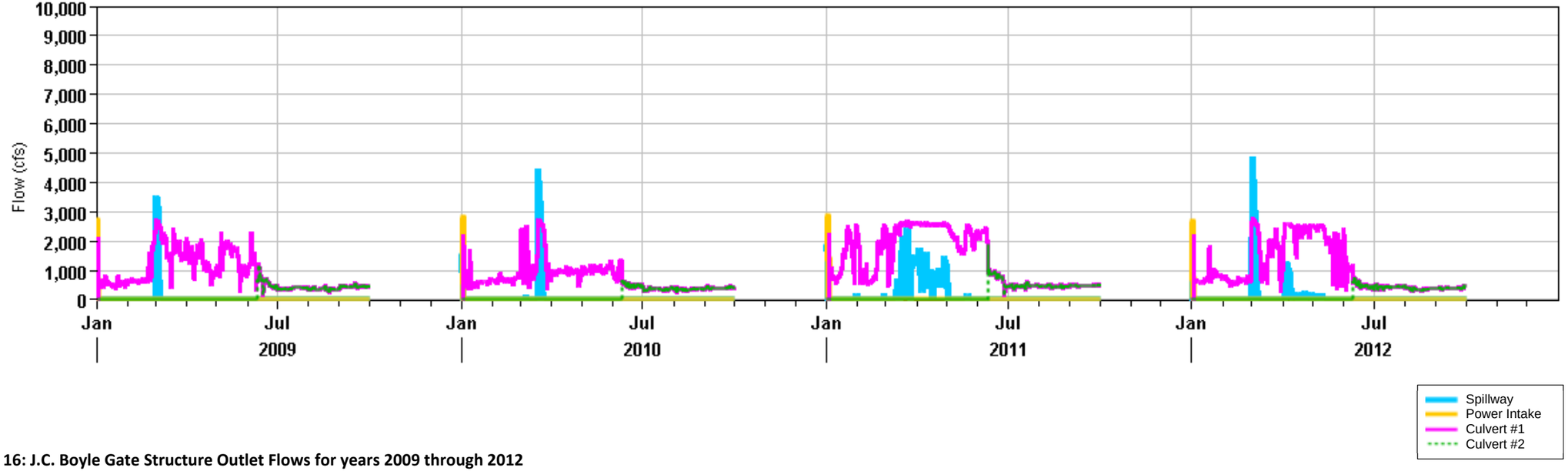


Figure 16: J.C. Boyle Gate Structure Outlet Flows for years 2009 through 2012

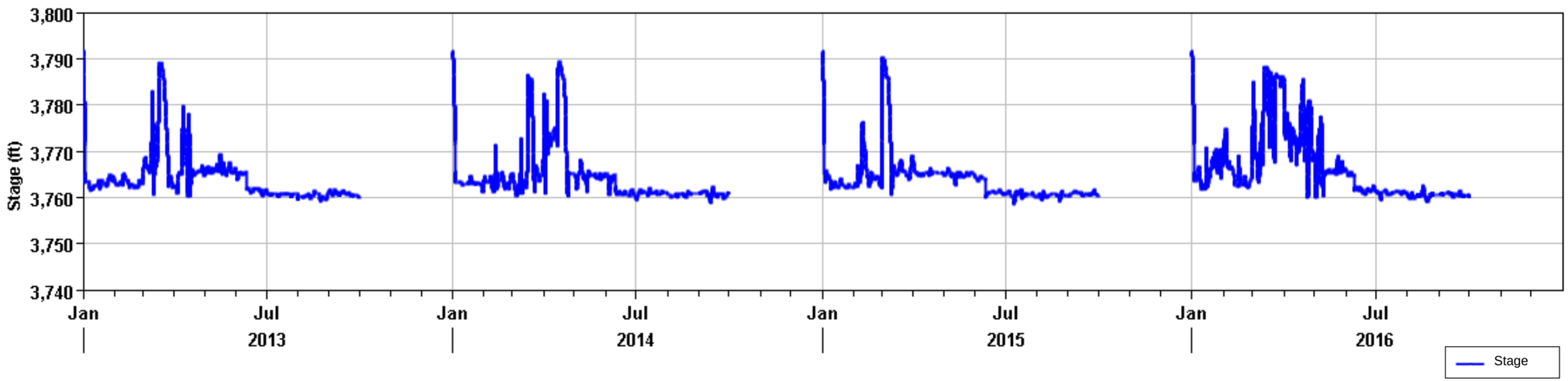


Figure 17: J.C. Boyle Drawdown Stage for years 2013 through 2016

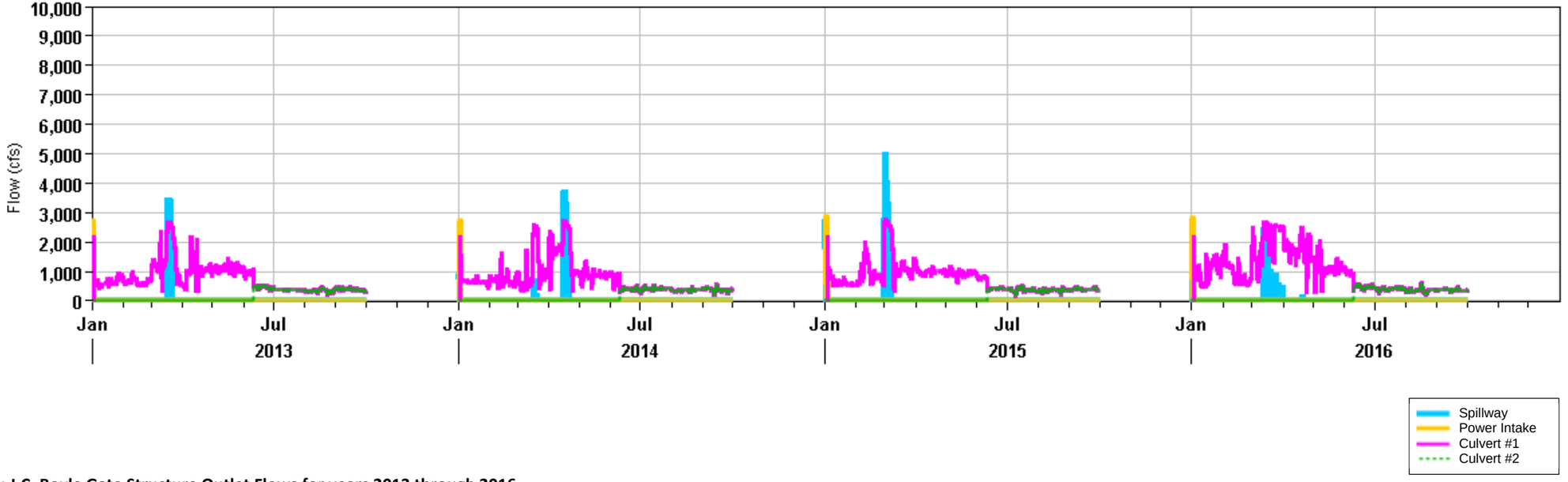


Figure 18: J.C. Boyle Gate Structure Outlet Flows for years 2013 through 2016

Drawdown Plots for Copco No. 1 Reservoir

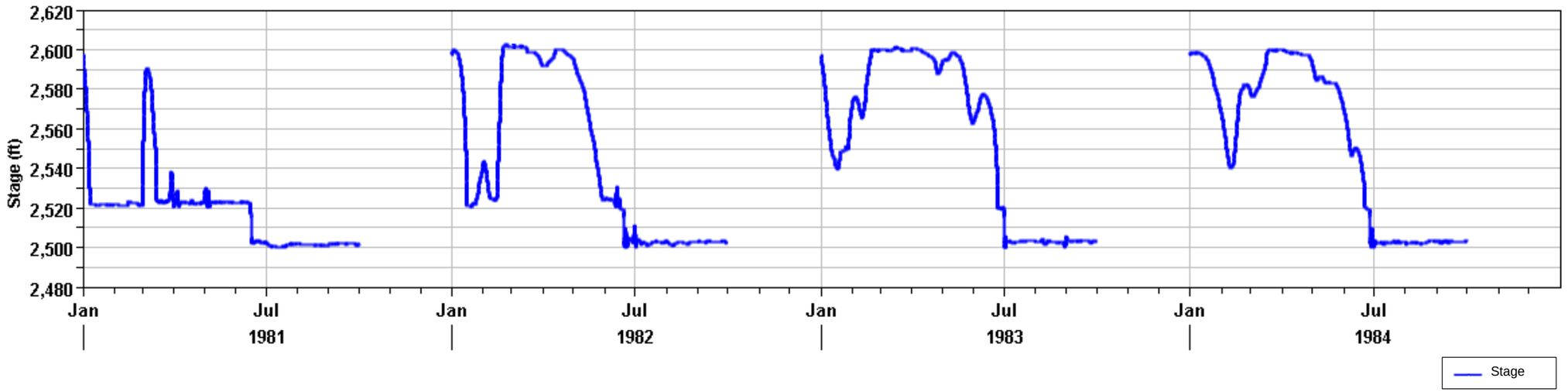


Figure 19: Copco No. 1 Drawdown Stage for years 1981 through 1984

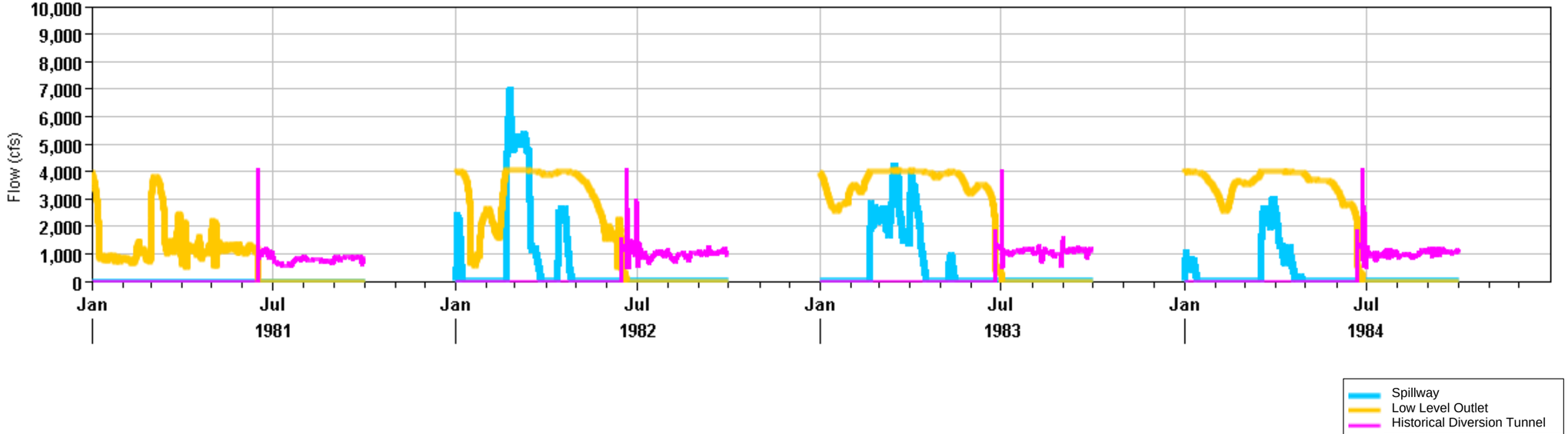


Figure 20: Copco No. 1 Gate Structure Outlet Flows for years 1981 through 1984

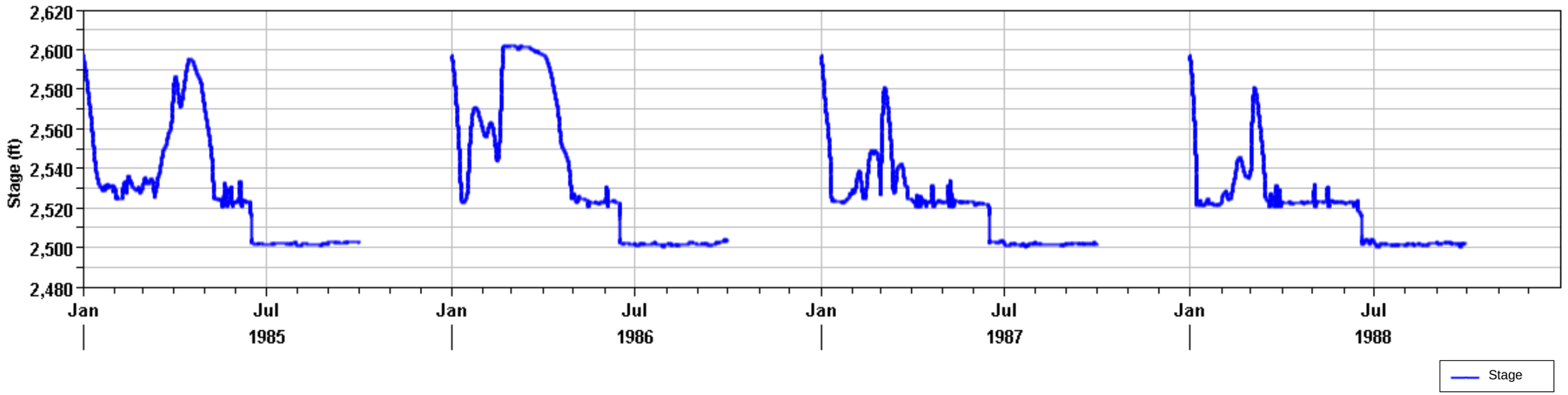


Figure 21: Copco No. 1 Drawdown Stage for years 1985 through 1988

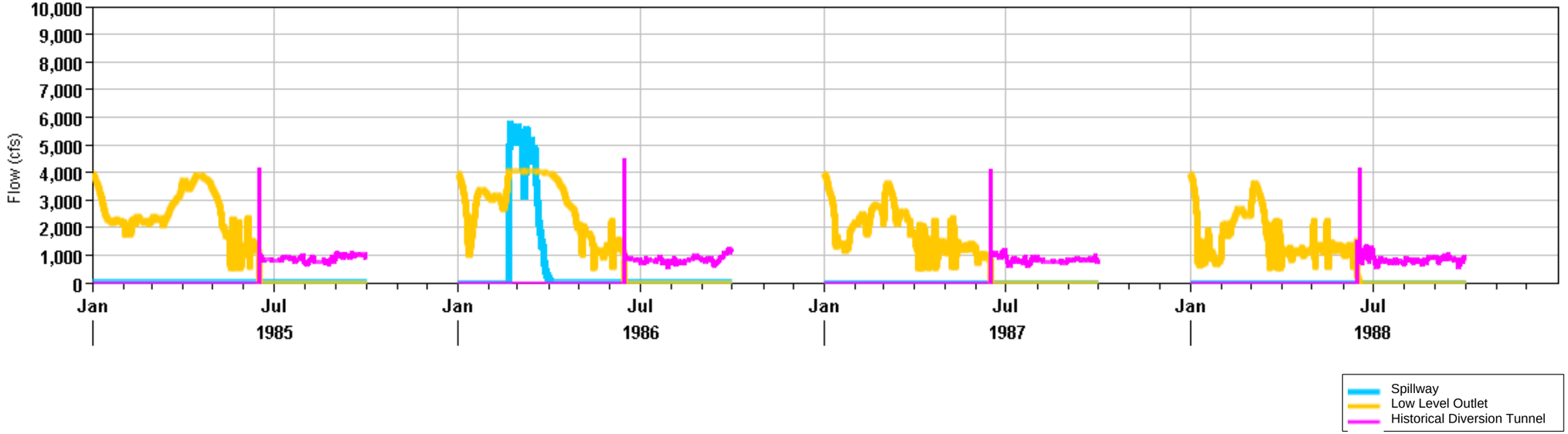


Figure 22: Copco No. 1 Gate Structure Outlet Flows for years 1985 through 1988

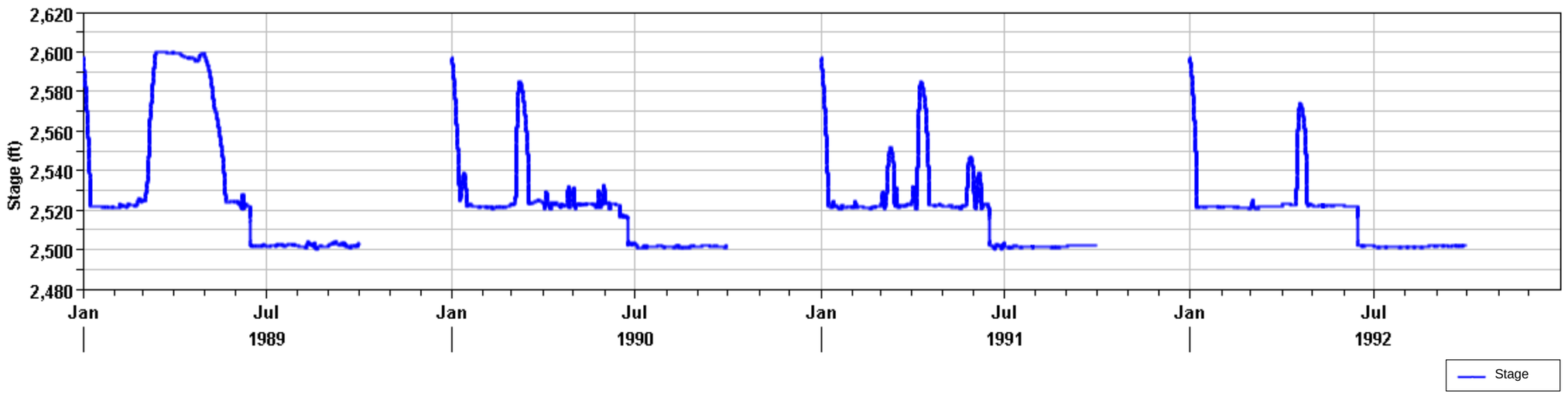


Figure 23: Copco No. 1 Drawdown Stage for years 1989 through 1992

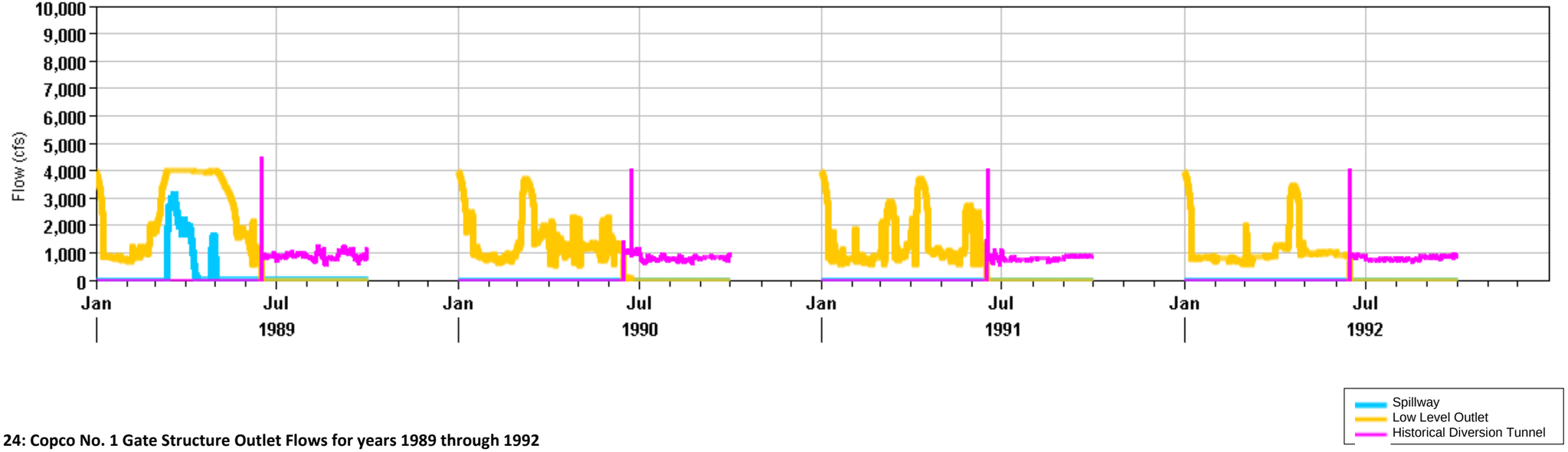


Figure 24: Copco No. 1 Gate Structure Outlet Flows for years 1989 through 1992

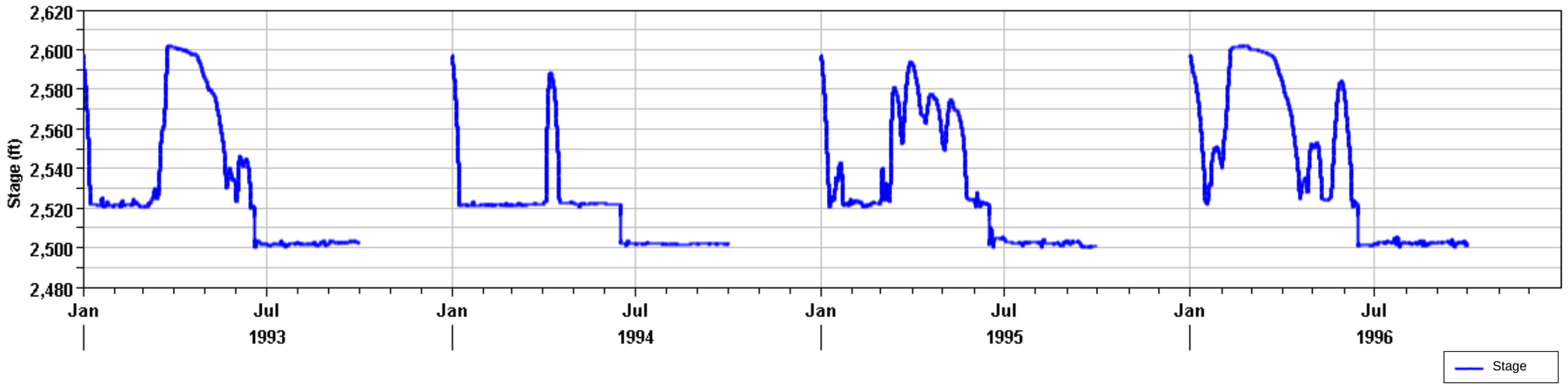


Figure 25: Copco No. 1 Drawdown Stage for years 1993 through 1996

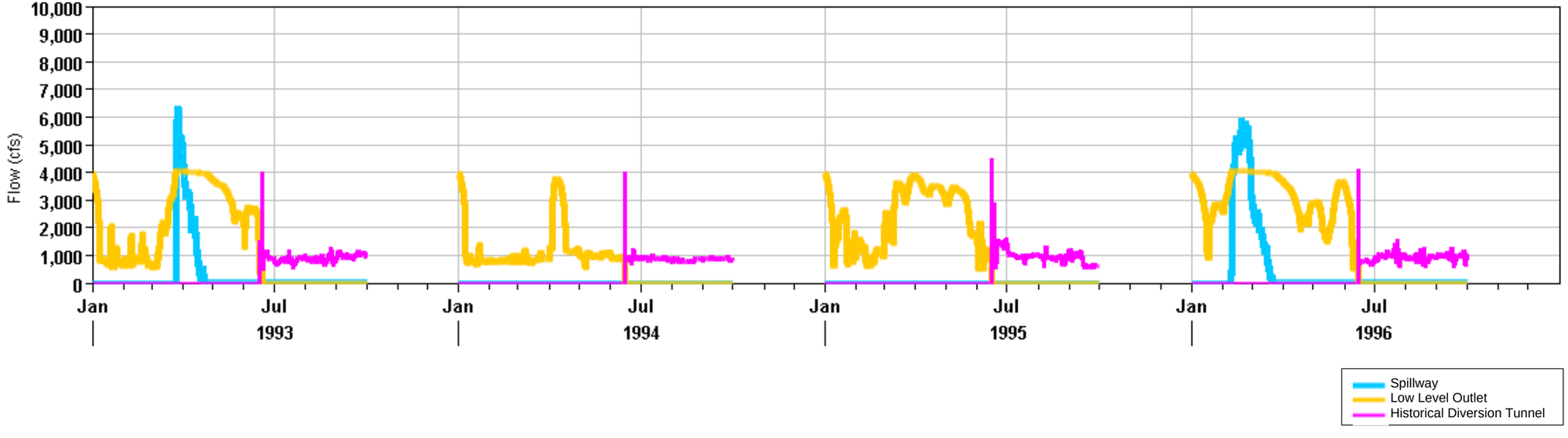


Figure 26: Copco No. 1 Gate Structure Outlet Flows for years 1993 through 1996

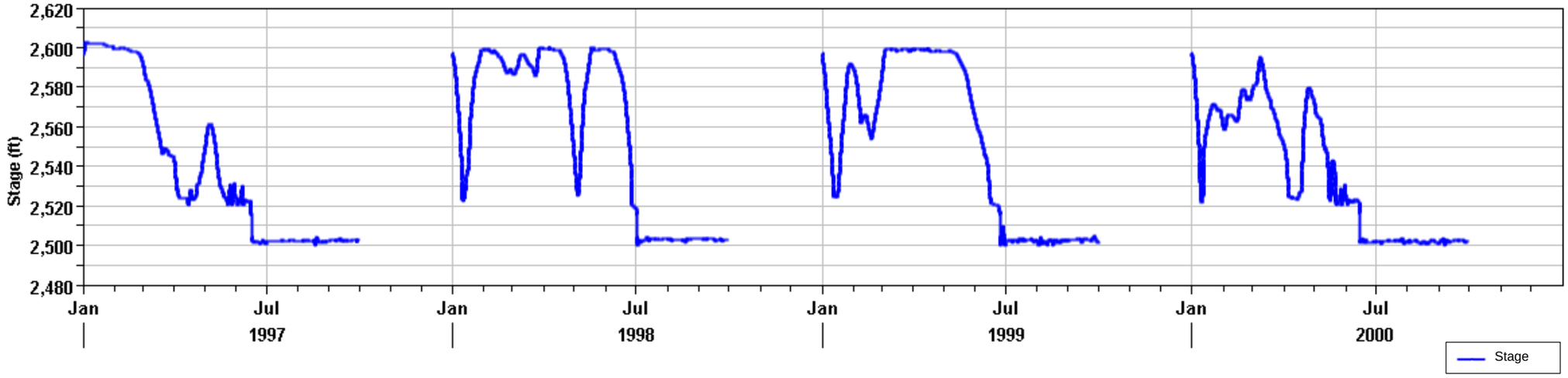


Figure 27: Copco No. 1 Drawdown Stage for years 1997 through 2000

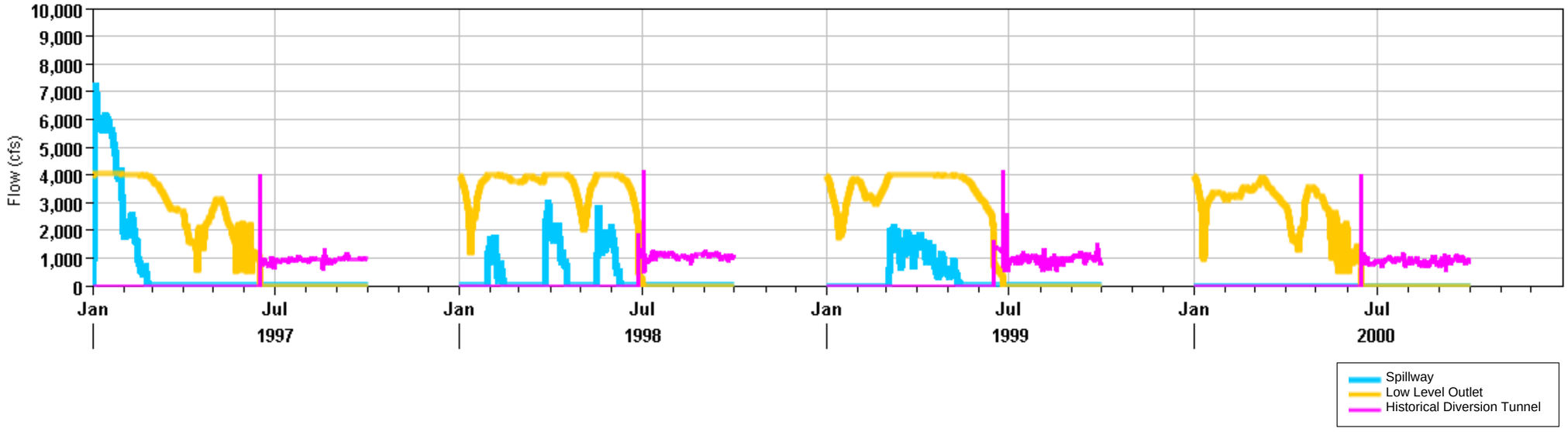


Figure 28: Copco No. 1 Gate Structure Outlet Flows for years 1997 through 2000

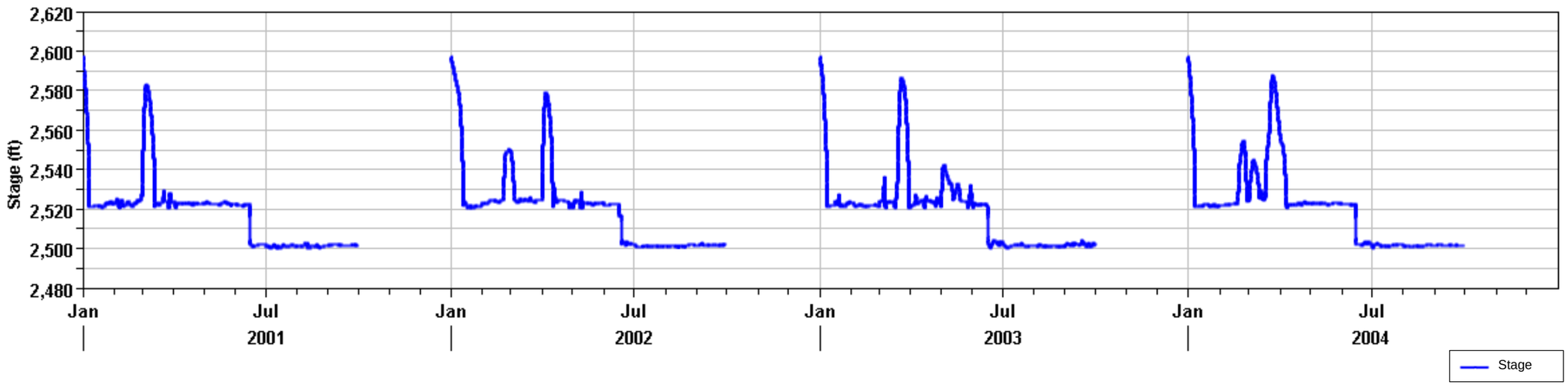


Figure 29: Copco No. 1 Drawdown Stage for years 2001 through 2004

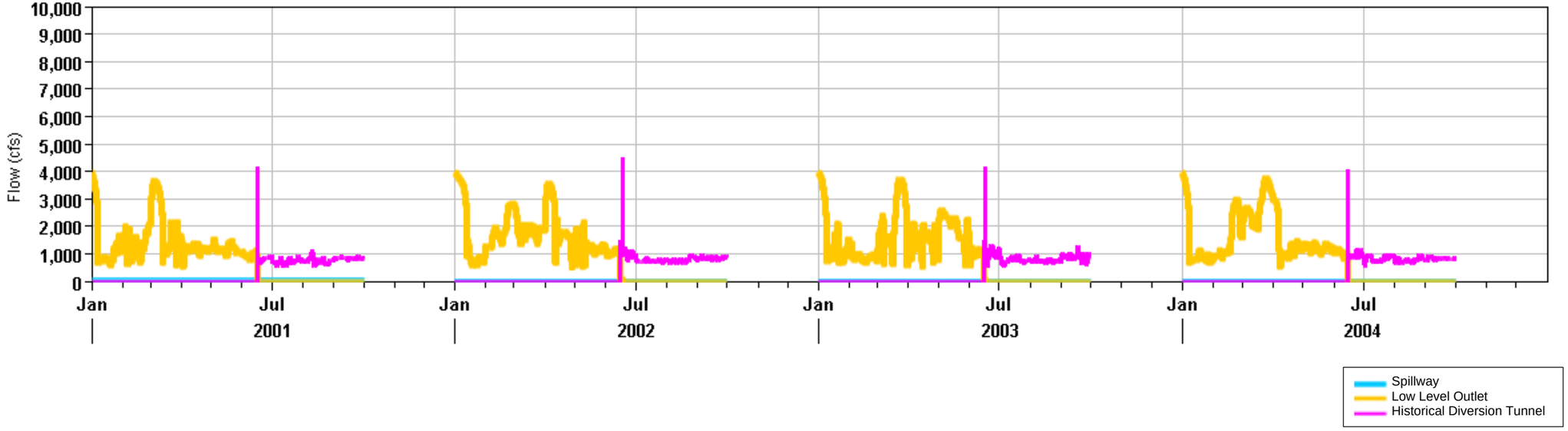


Figure 30: Copco No. 1 Gate Structure Outlet Flows for years 2001 through 2004

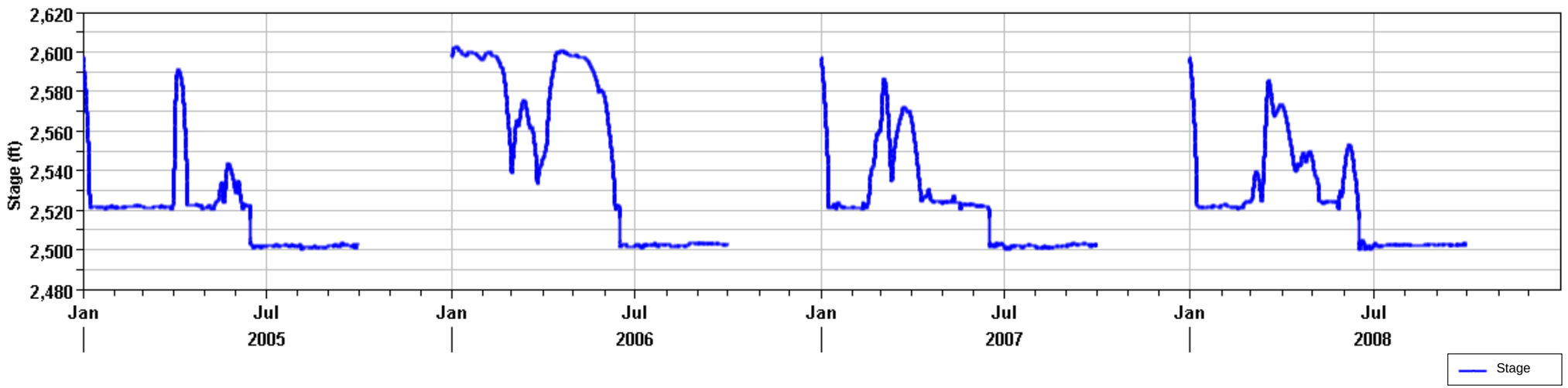


Figure 31: Copco No. 1 Drawdown Stage for years 2005 through 2008

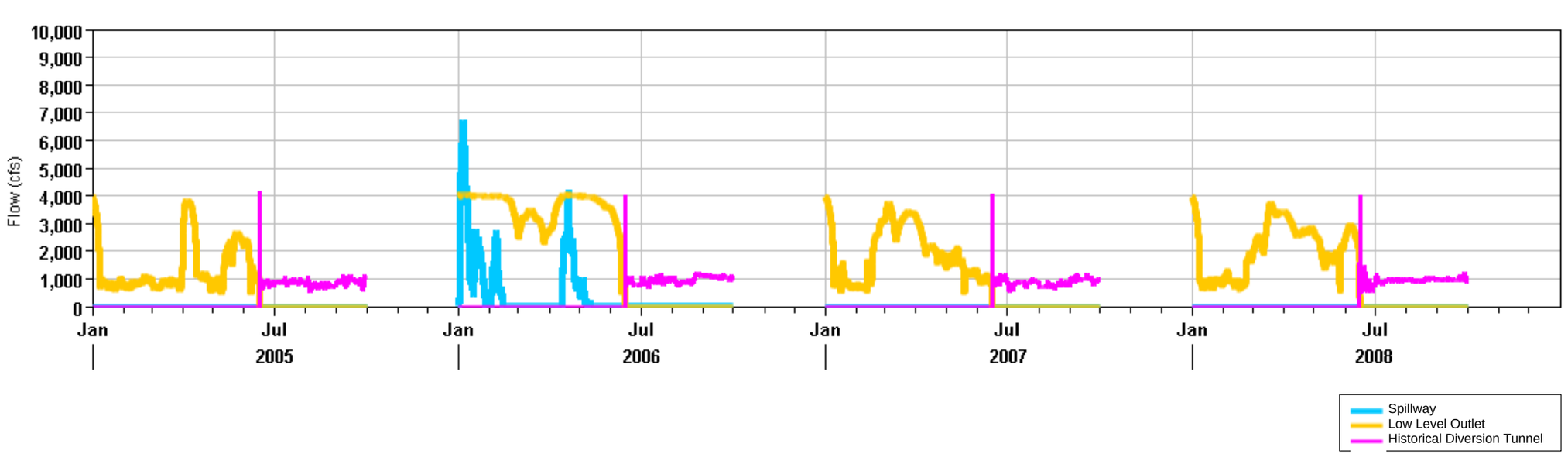


Figure 32: Copco No. 1 Gate Structure Outlet Flows for years 2005 through 2008

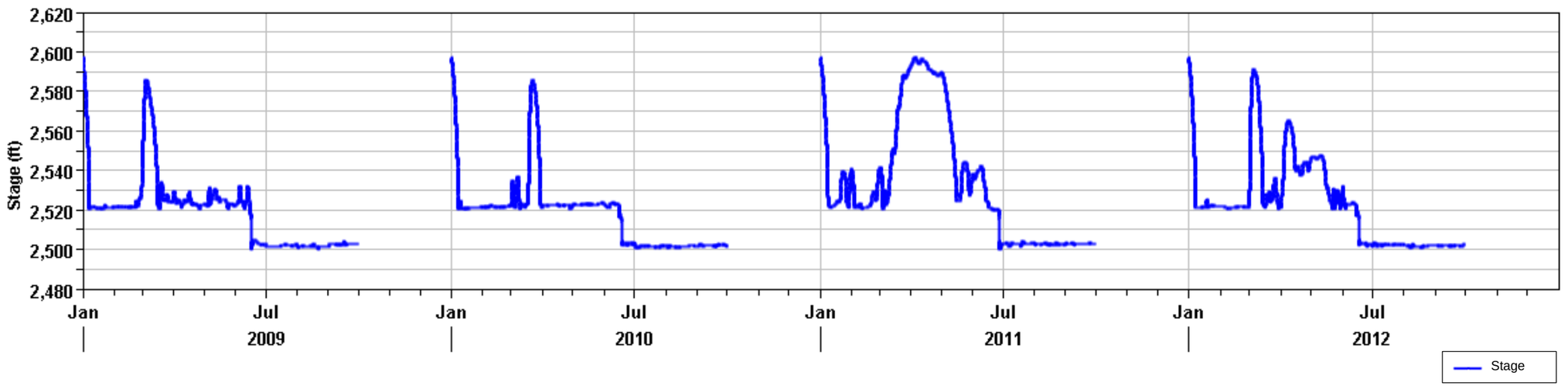


Figure 33: Copco No. 1 Drawdown Stage for years 2009 through 2012

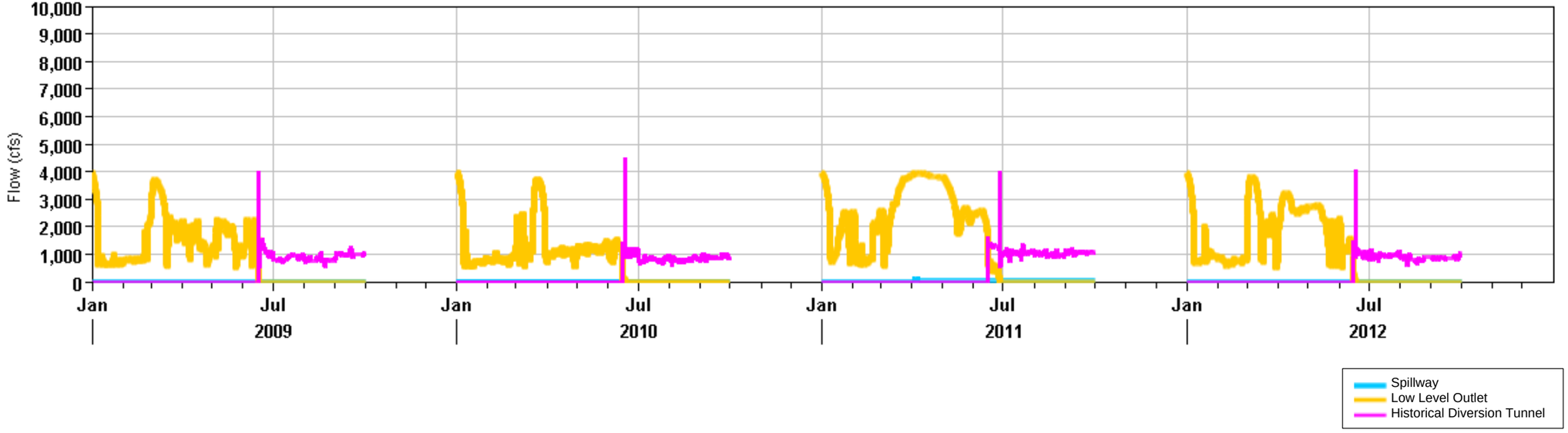


Figure 34: Copco No. 1 Gate Structure Outlet Flows for years 2009 through 2012

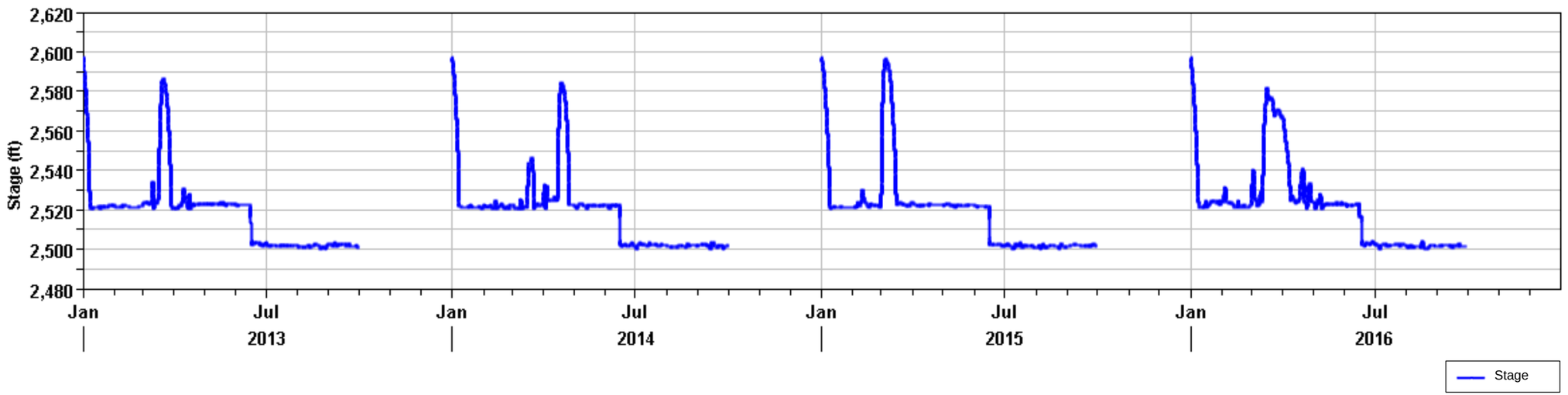


Figure 35: Copco No. 1 Drawdown Stage for years 2013 through 2016

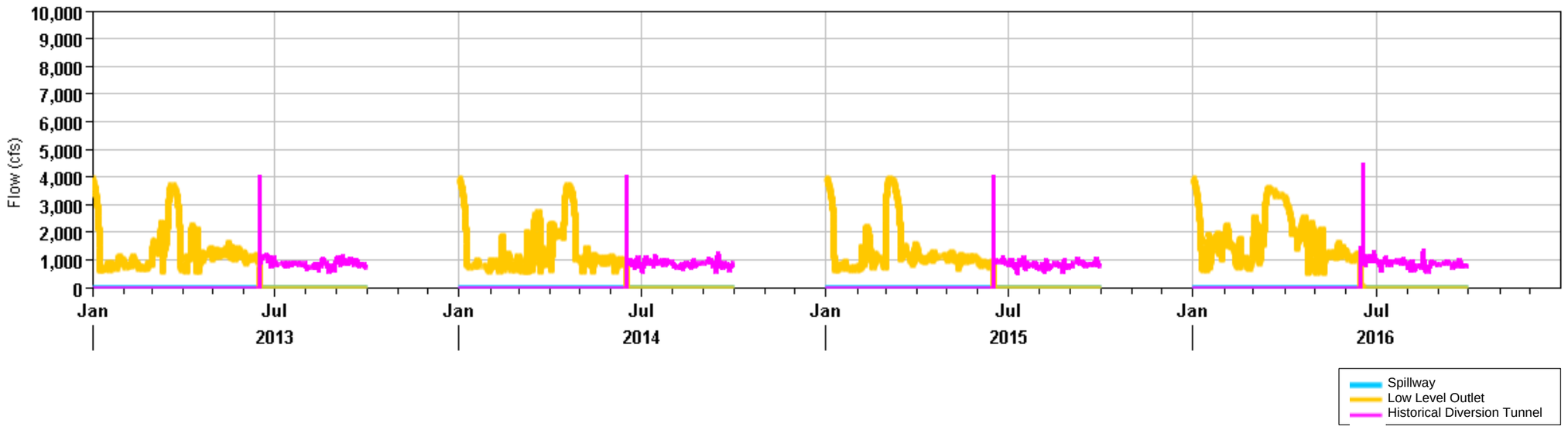


Figure 36: Copco No. 1 Gate Structure Outlet Flows for years 2013 through 2016

Drawdown Plots for Copco No. 2 Reservoir

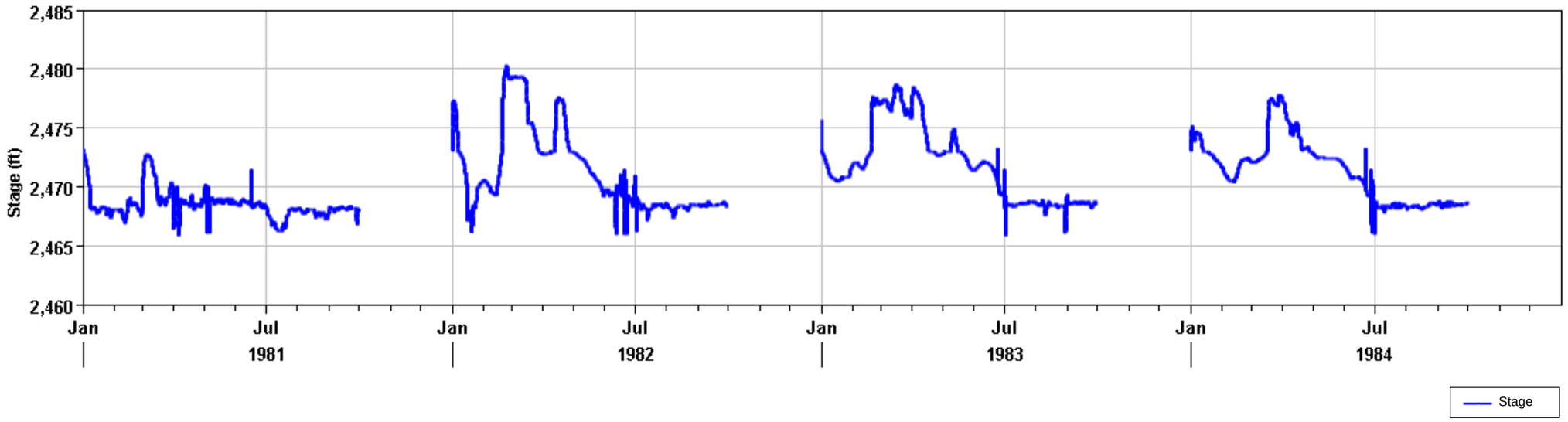


Figure 37: Copco No. 2 Drawdown Stage for years 1981 through 1984

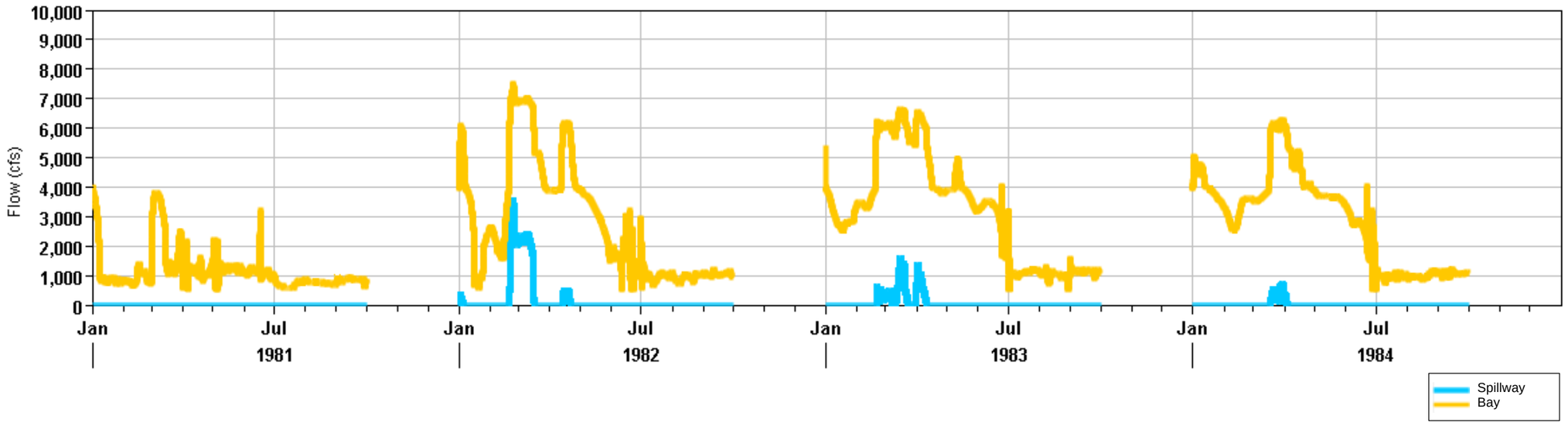


Figure 38: Copco No. 2 Gate Structure Outlet Flows for years 1981 through 1984

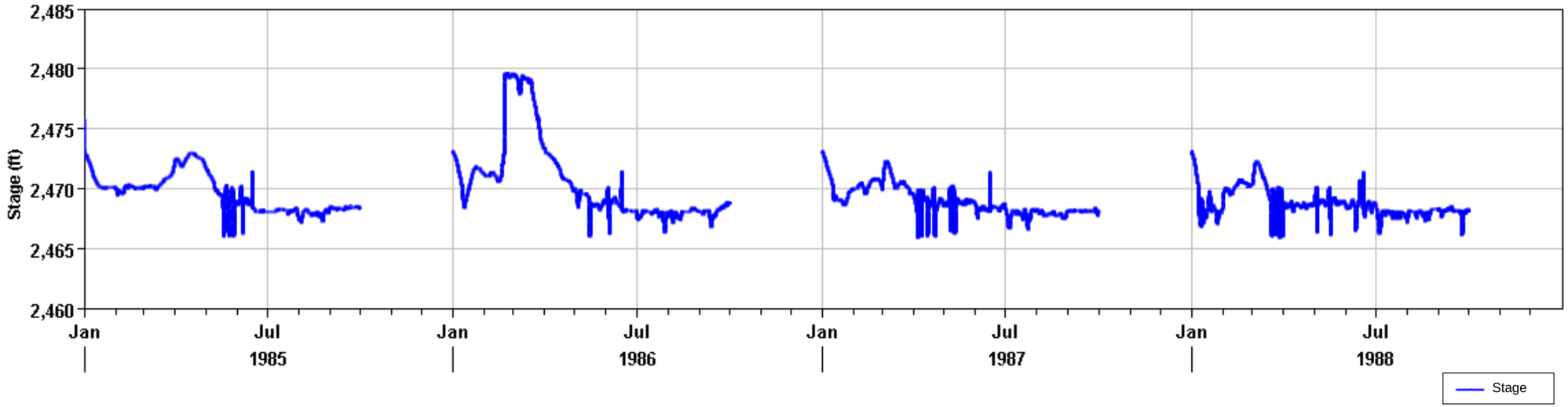


Figure 39: Copco No. 2 Drawdown Stage for years 1985 through 1988

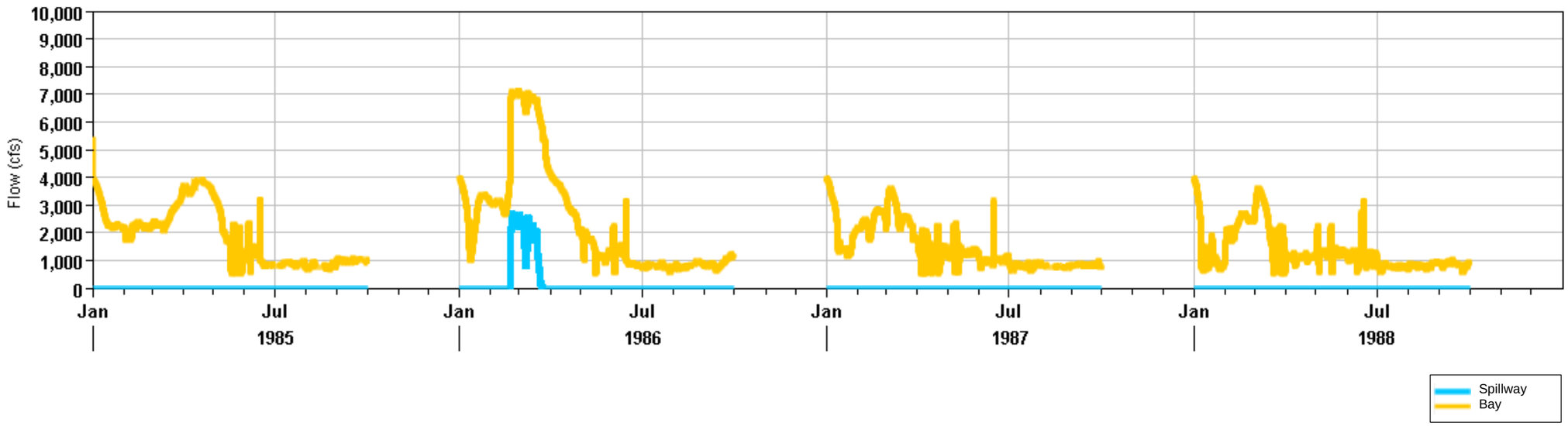


Figure 40: Copco No. 2 Gate Structure Outlet Flows for years 1985 through 1988

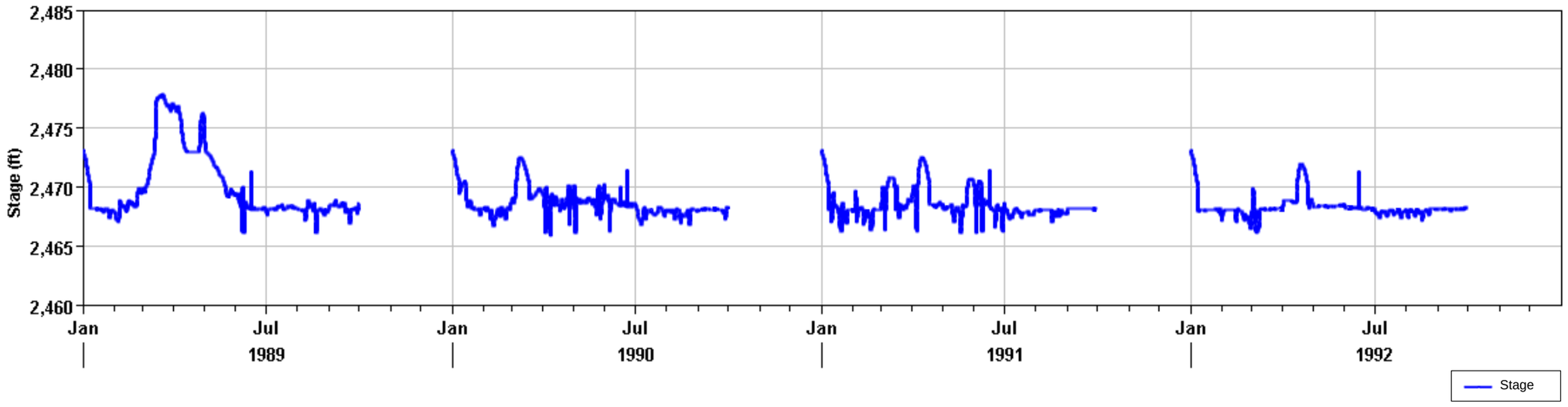


Figure 41: Copco No. 2 Drawdown Stage for years 1989 through 1992

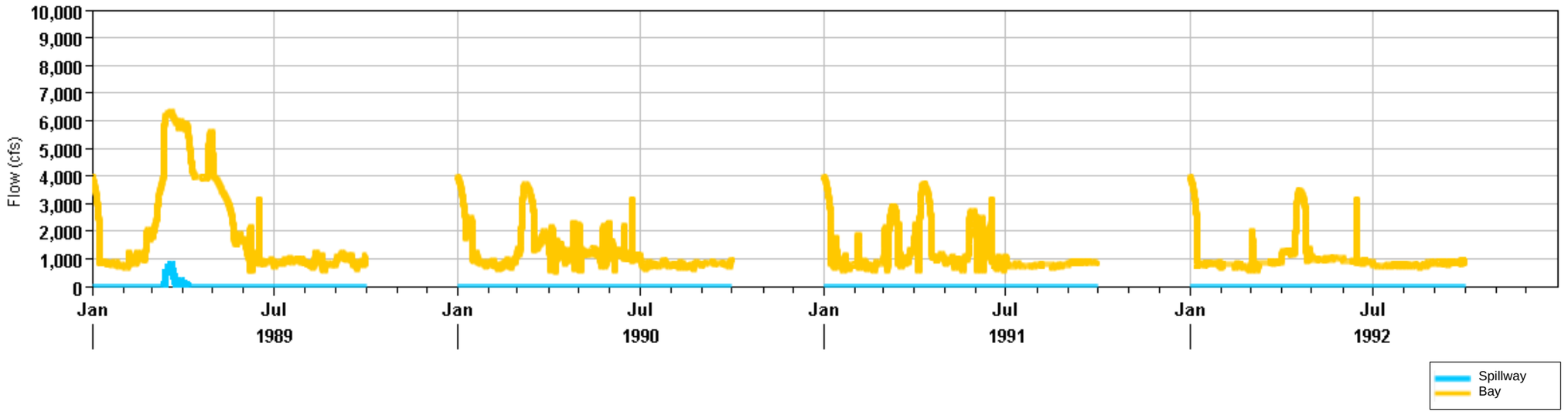


Figure 42: Copco No. 2 Gate Structure Outlet Flows for years 1989 through 1992

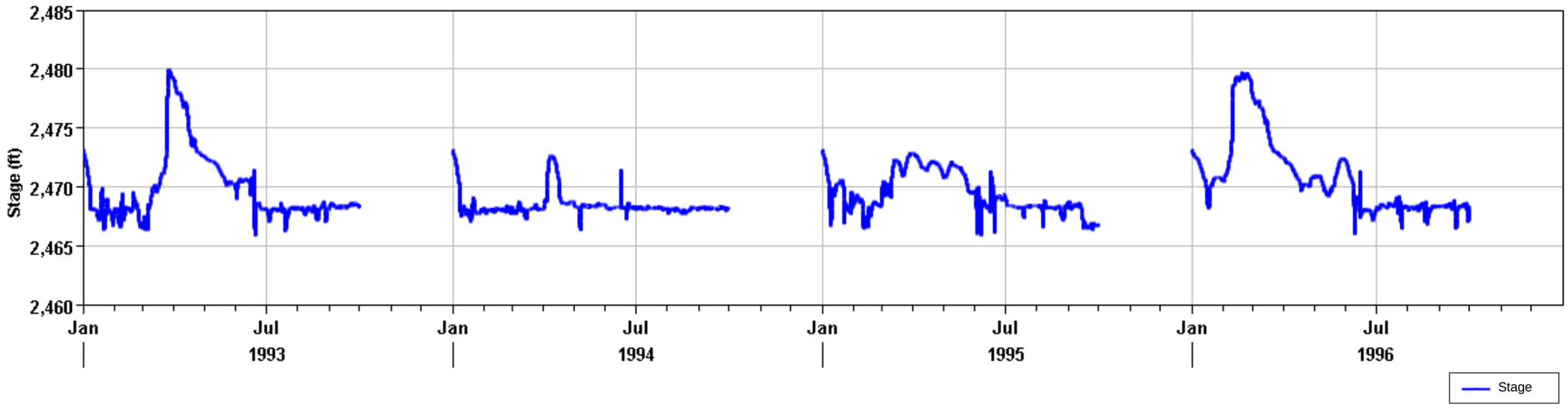


Figure 43: Copco No. 2 Drawdown Stage for years 1993 through 1996

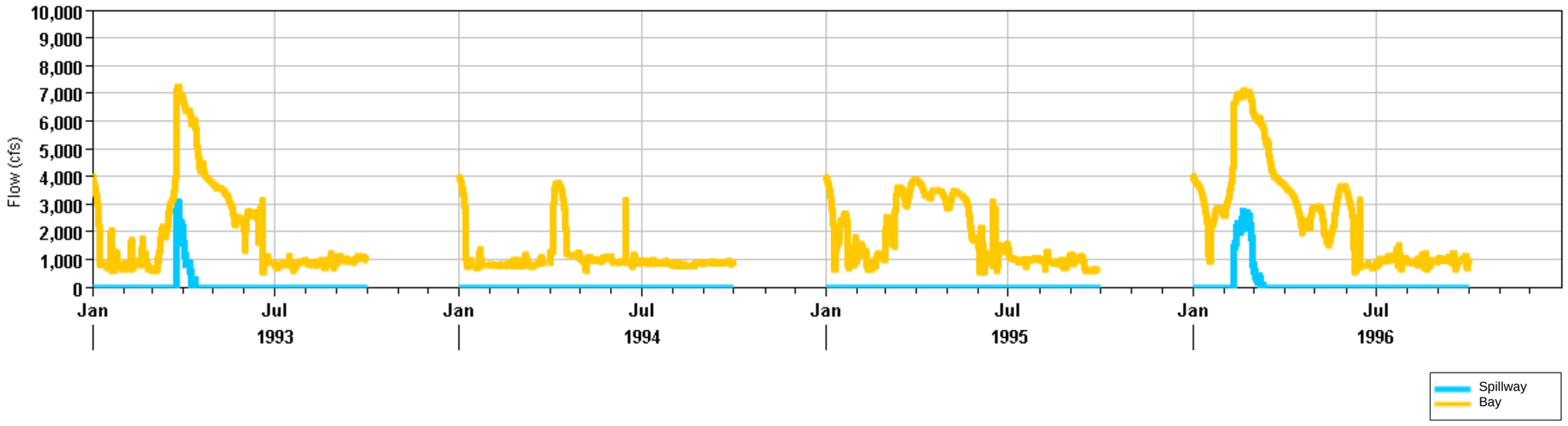


Figure 44: Copco No. 2 Gate Structure Outlet Flows for years 1993 through 1996

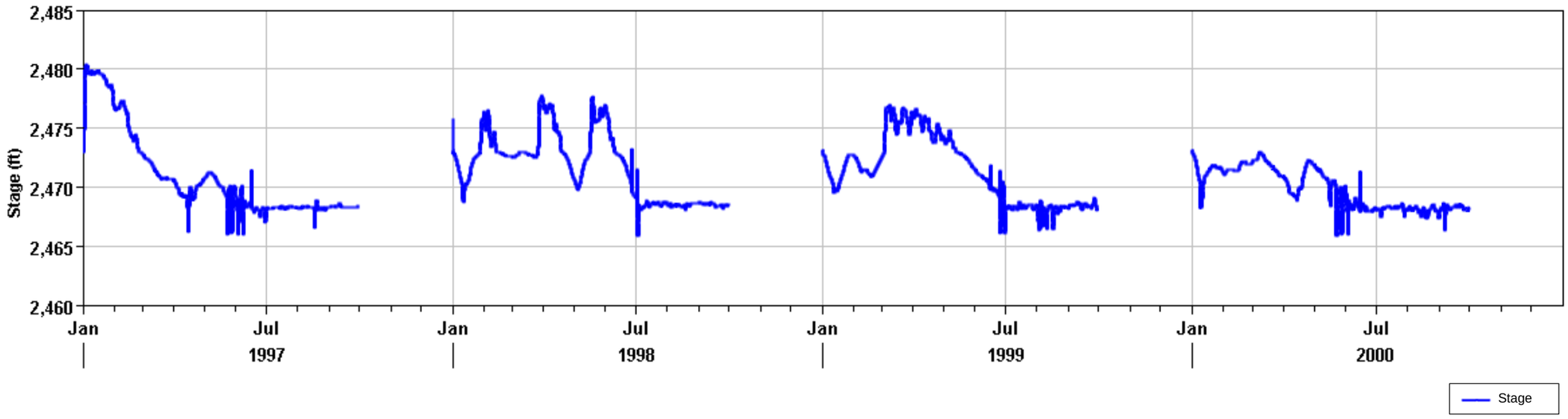


Figure 45: Copco No. 2 Drawdown Stage for years 1997 through 2000

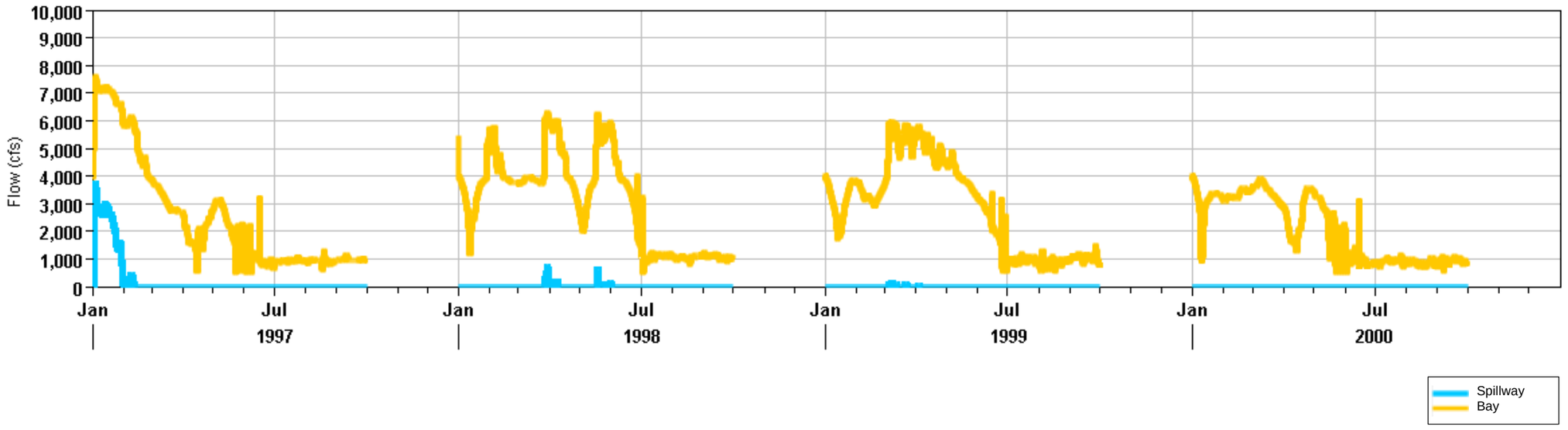


Figure 46: Copco No. 2 Gate Structure Outlet Flows for years 1997 through 2000

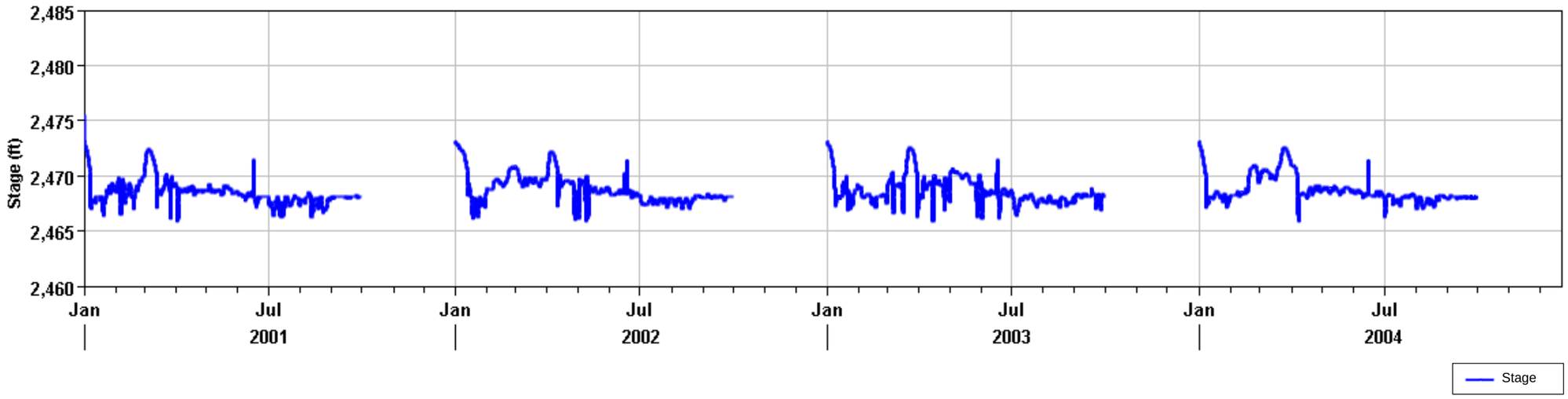


Figure 47: Copco No. 2 Drawdown Stage for years 2001 through 2004

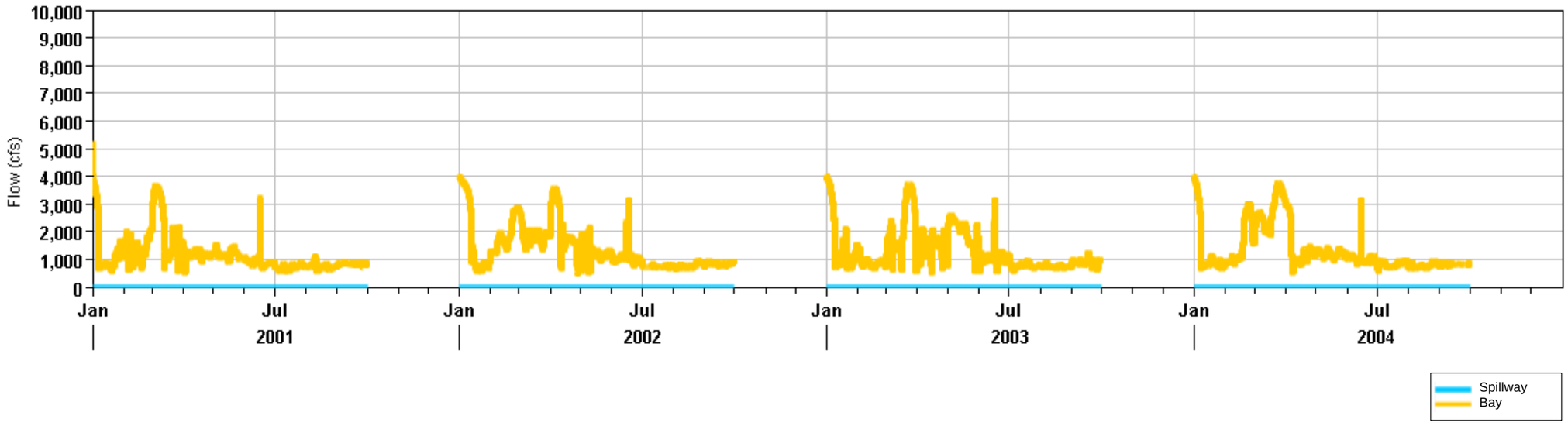


Figure 48: Copco No. 2 Gate Structure Outlet Flows for years 2001 through 2004

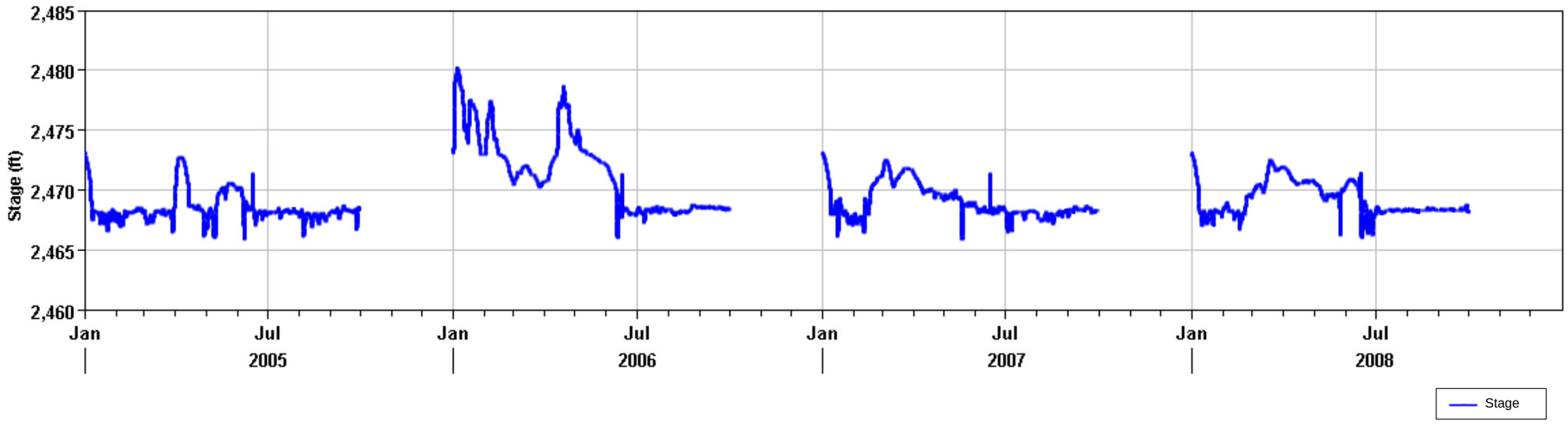


Figure 49: Copco No. 2 Drawdown Stage for years 2005 through 2008

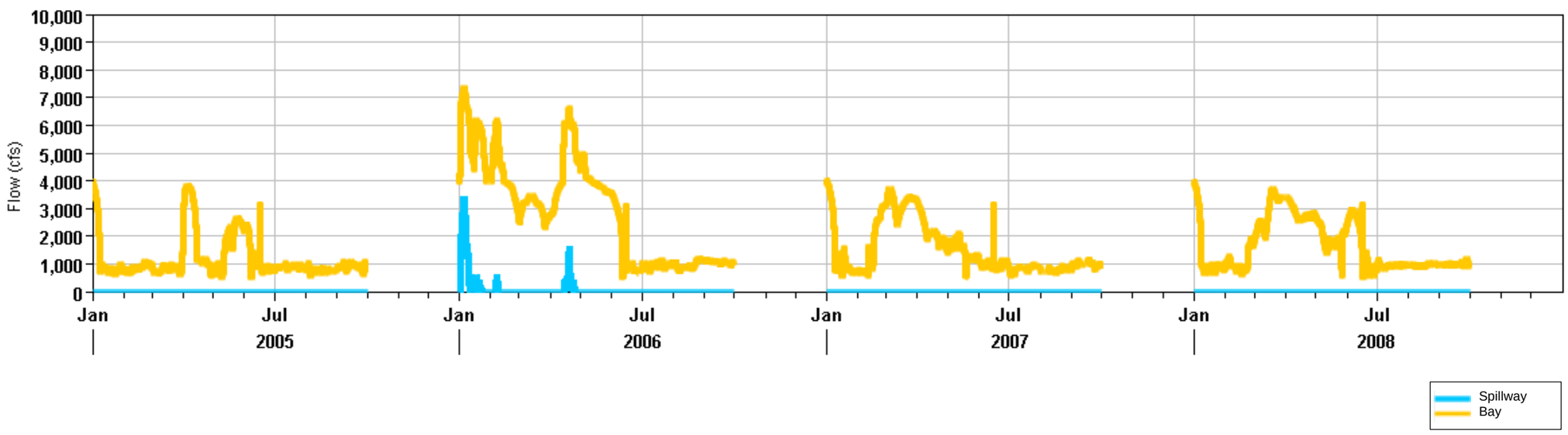


Figure 50: Copco No. 2 Gate Structure Outlet Flows for years 2005 through 2008

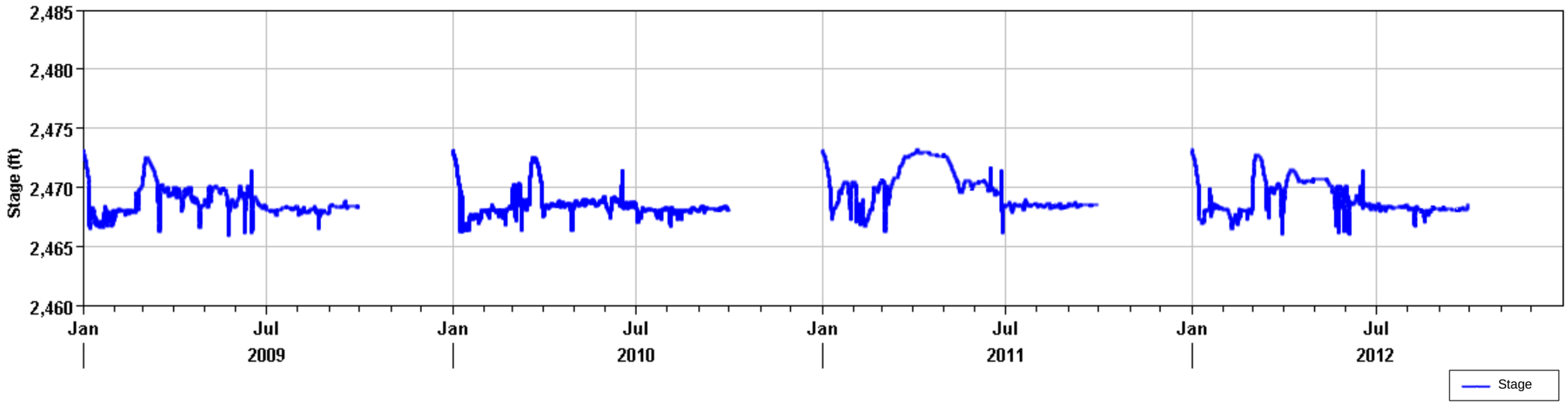


Figure 51: Copco No. 2 Drawdown Stage for years 2009 through 2012

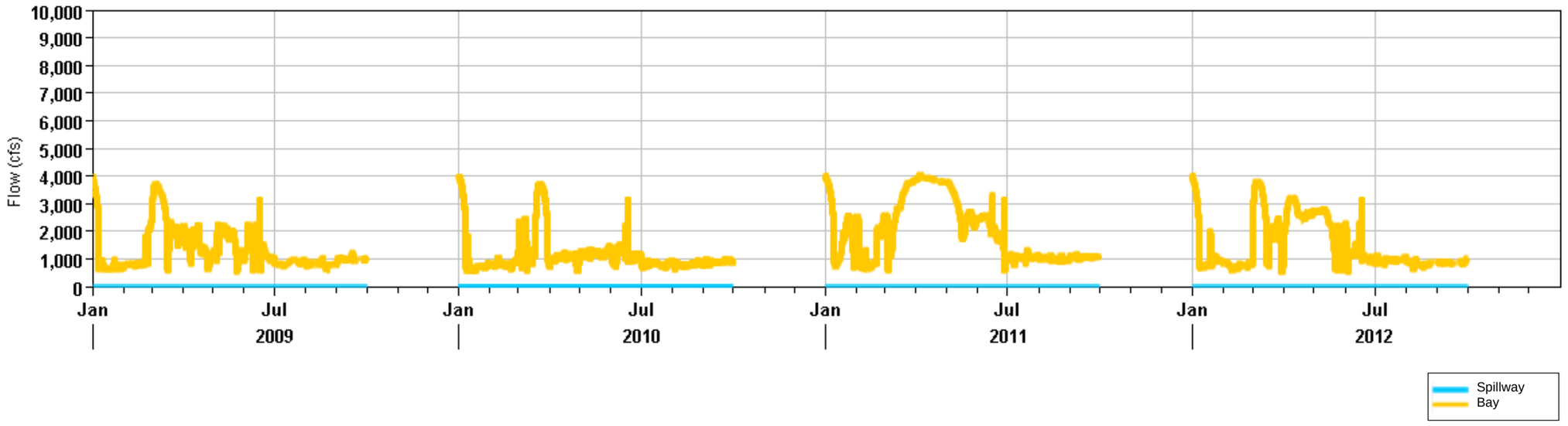


Figure 52: Copco No. 2 Gate Structure Outlet Flows for years 2009 through 2012

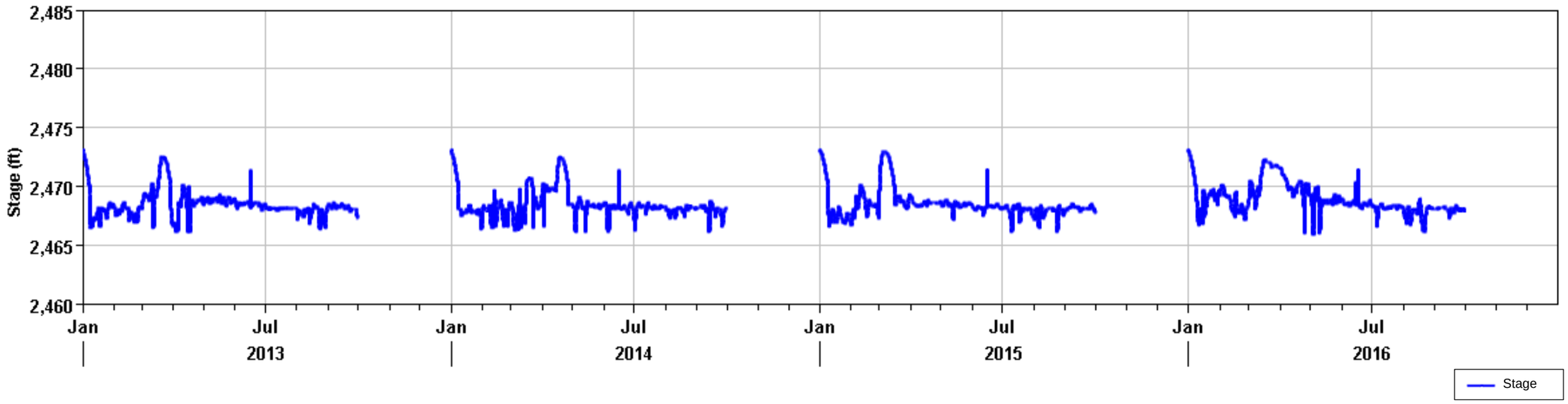


Figure 53: Copco No. 2 Drawdown Stage for years 2013 through 2016

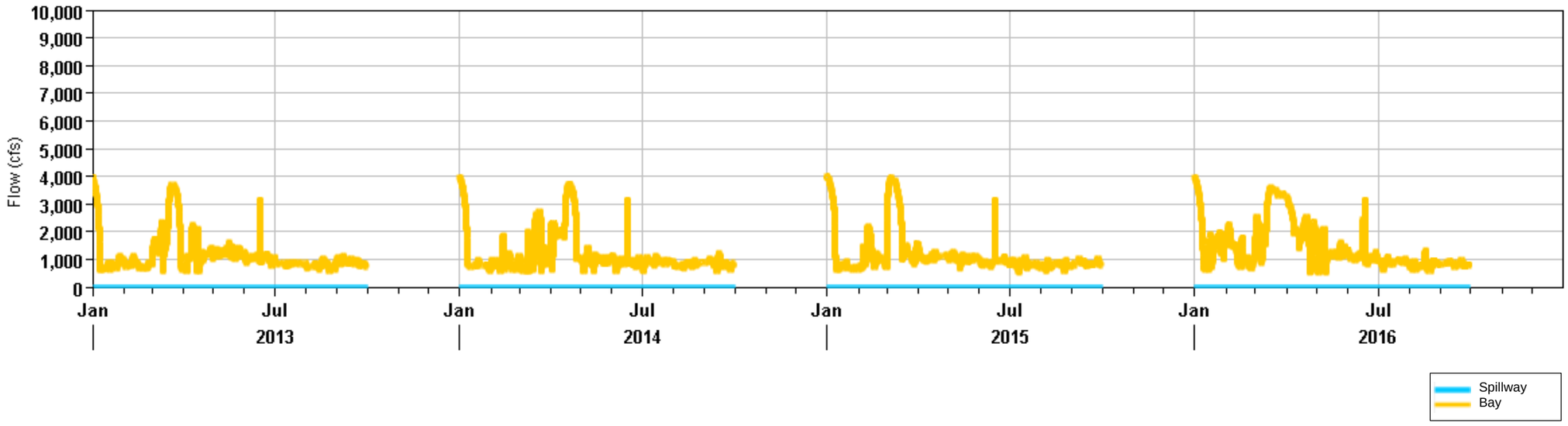


Figure 54: Copco No. 2 Gate Structure Outlet Flows for years 2013 through 2016

Drawdown Plots for Iron Gate Reservoir

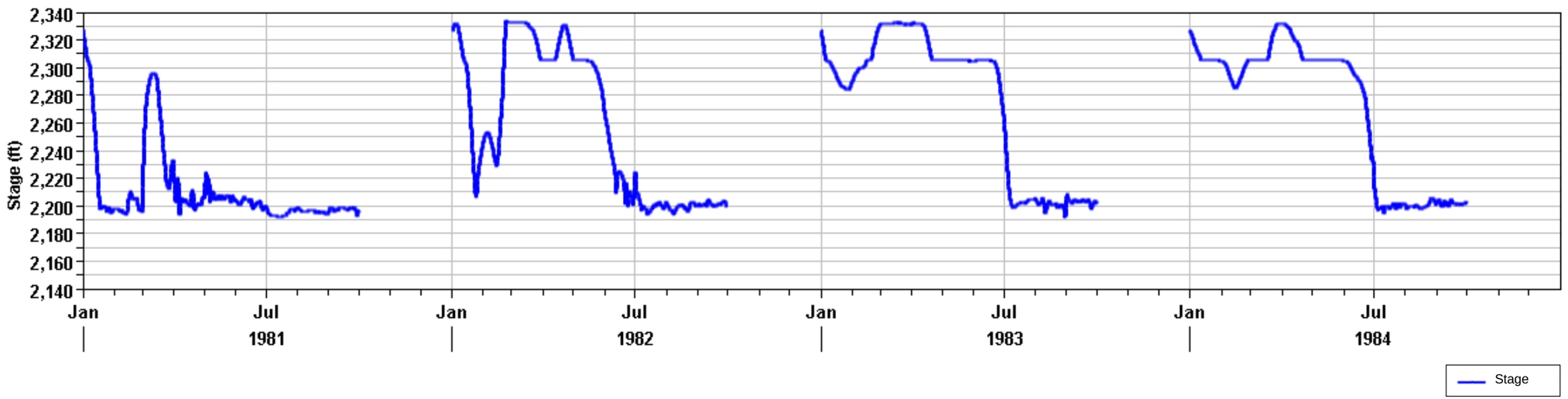


Figure 55: Iron Gate Drawdown Stage for years 1981 through 1984

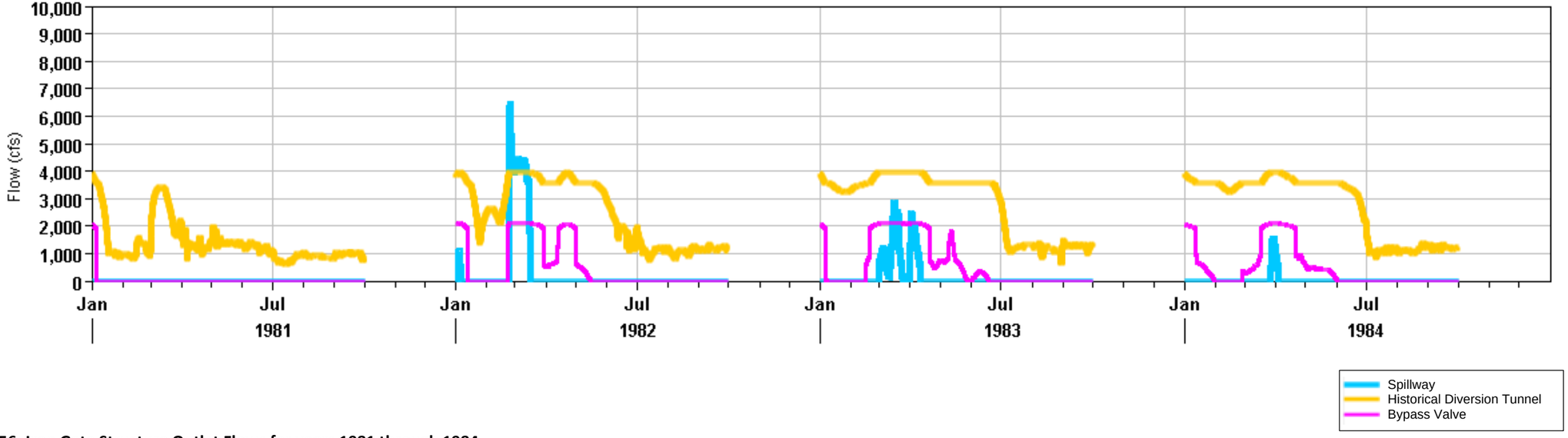


Figure 56: Iron Gate Structure Outlet Flows for years 1981 through 1984

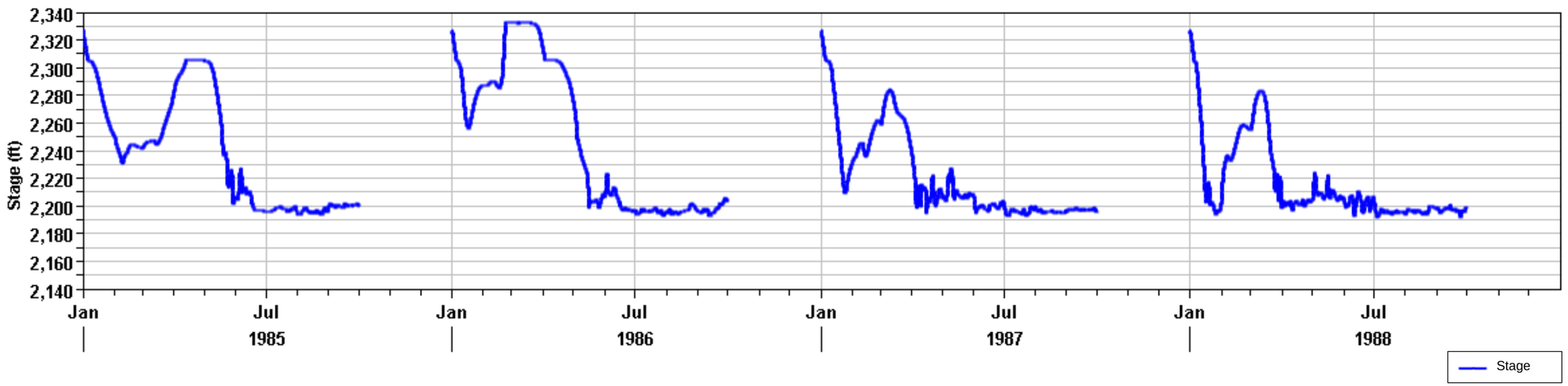


Figure 57: Iron Gate Drawdown Stage for years 1985 through 1988

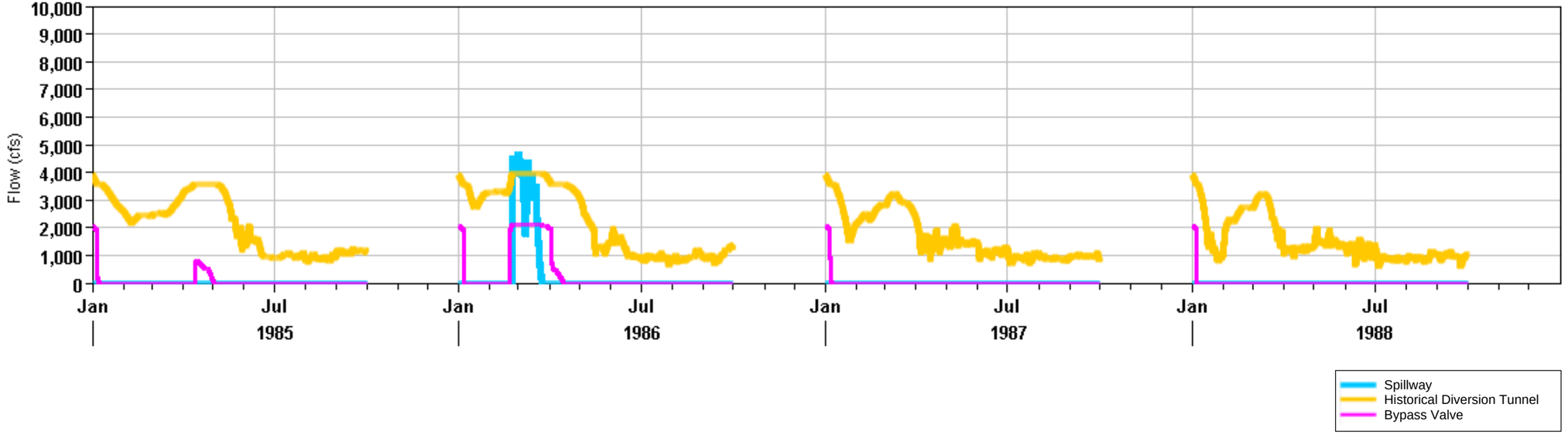


Figure 58: Iron Gate Structure Outlet Flows for years 1985 through 1988

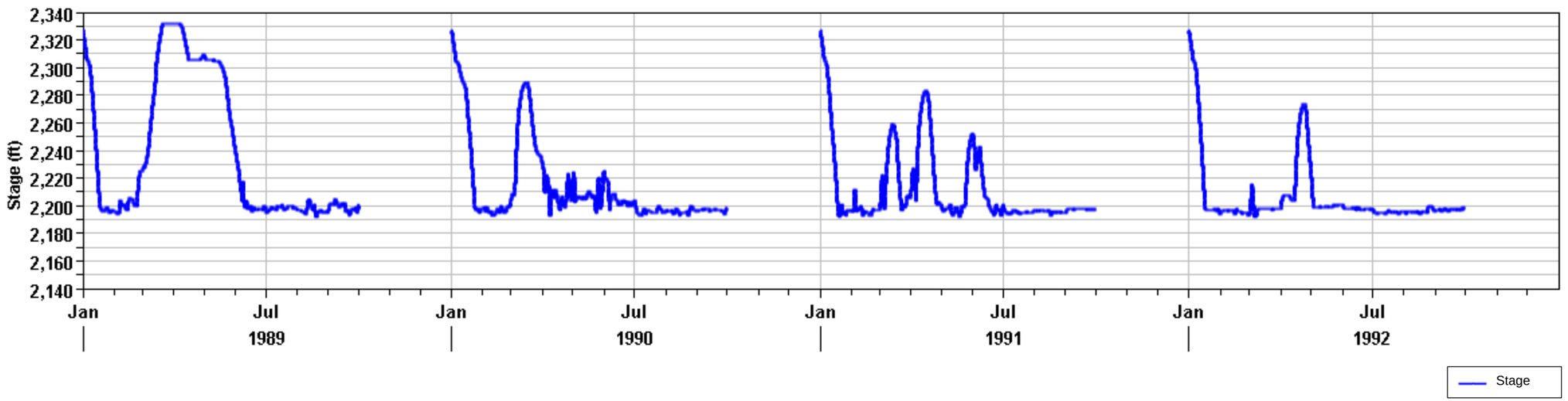


Figure 59: Iron Gate Drawdown Stage for years 1989 through 1992

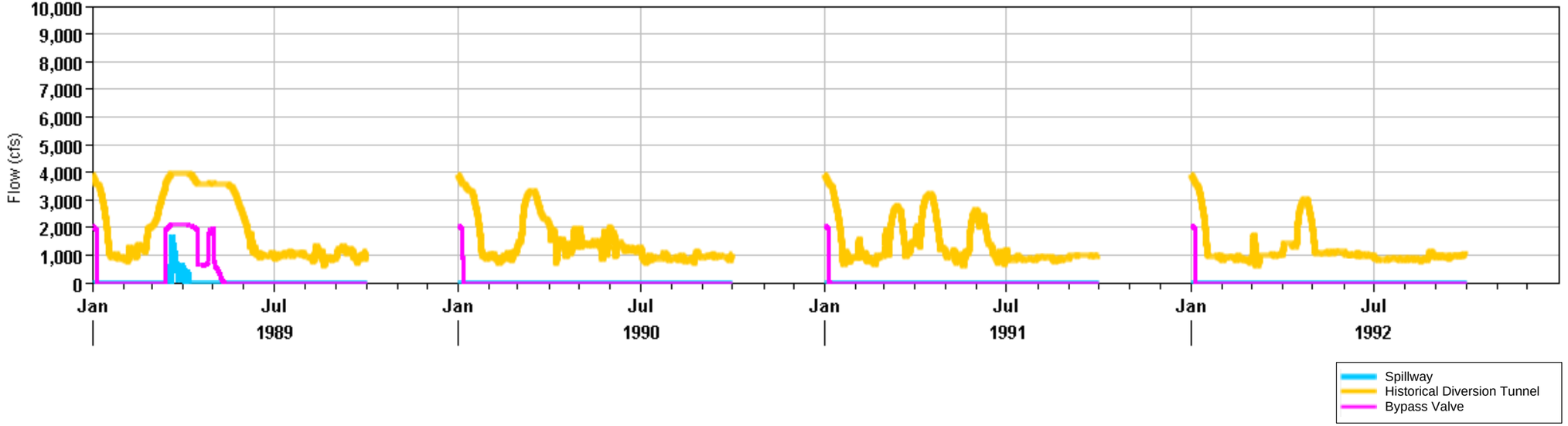


Figure 60 Iron Gate Structure Outlet Flows for years 1989 through 1992

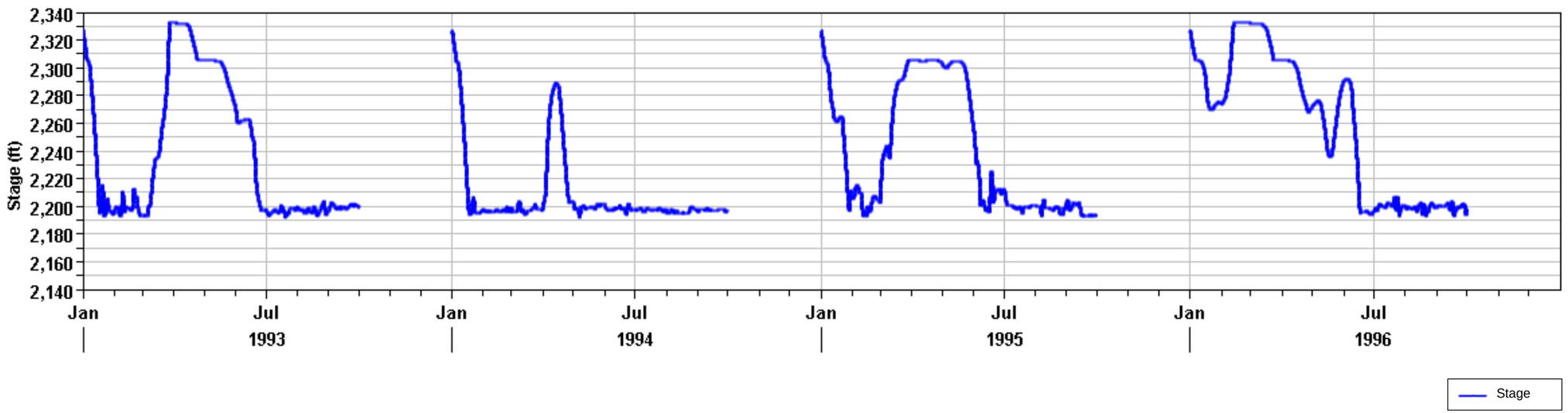


Figure 61: Iron Gate Drawdown Stage for years 1993 through 1996

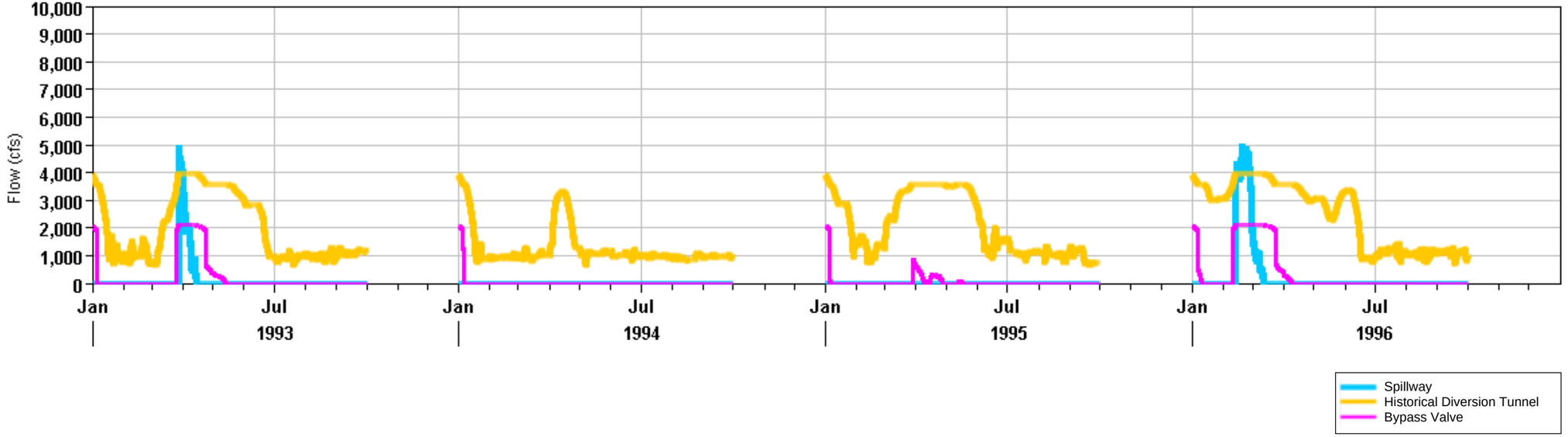


Figure 62: Iron Gate Structure Outlet Flows for years1993 through 1996

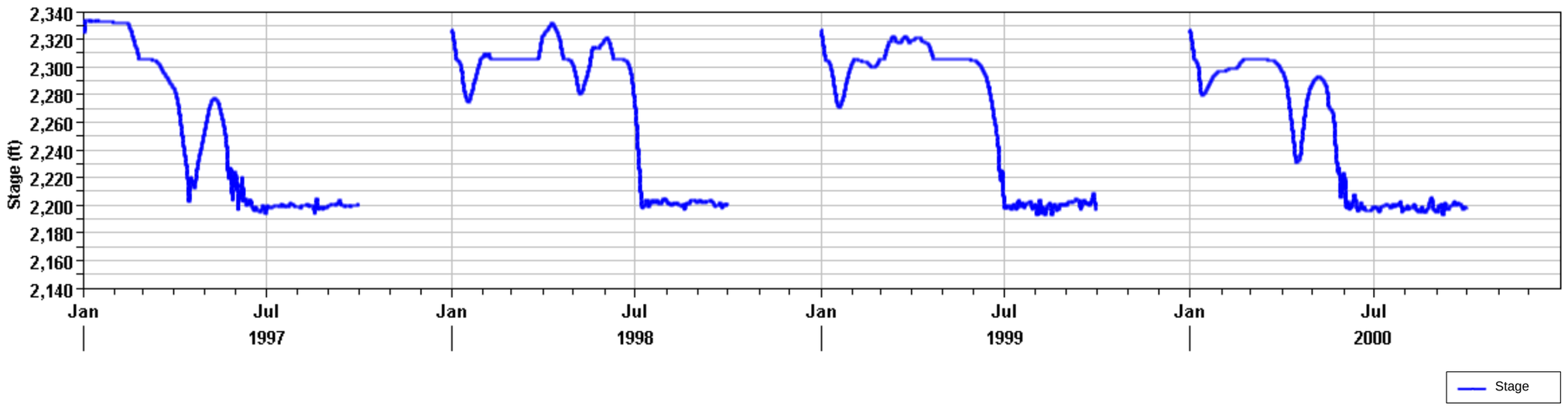


Figure 63: Iron Gate Drawdown Stage for years 1997 through 2000

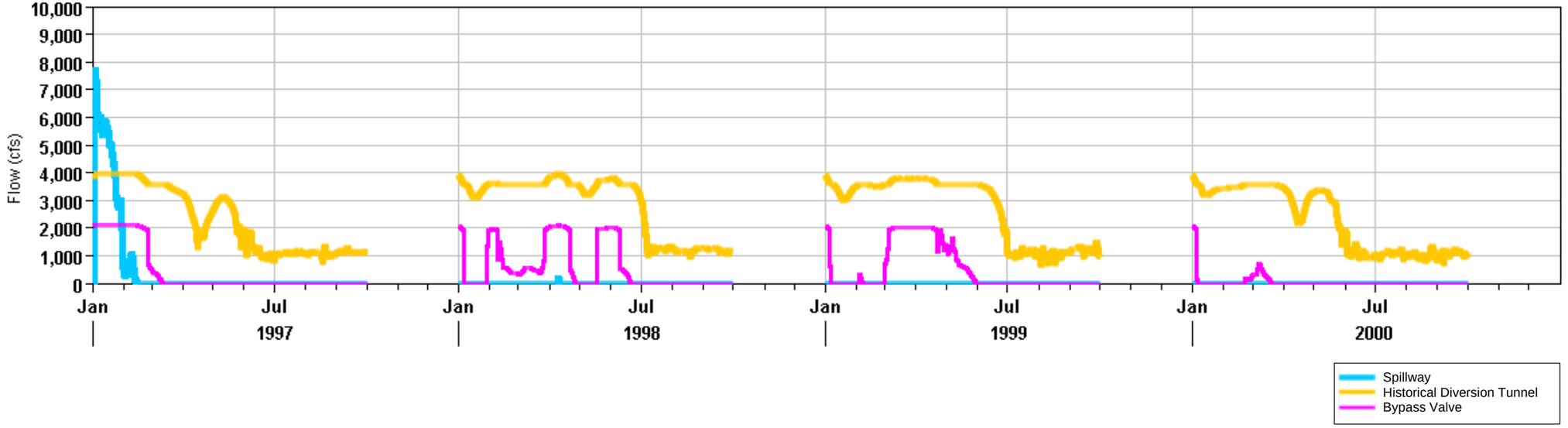


Figure 64: Iron Gate Structure Outlet Flows for years 1997 through 2000

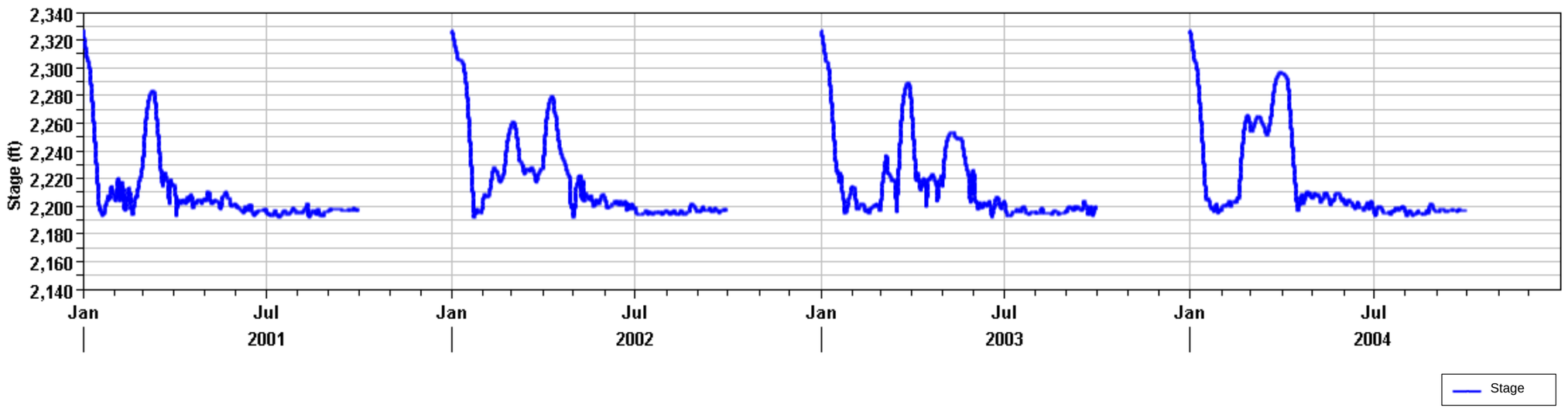


Figure 65: Iron Gate Drawdown Stage for years 2001 through 2004

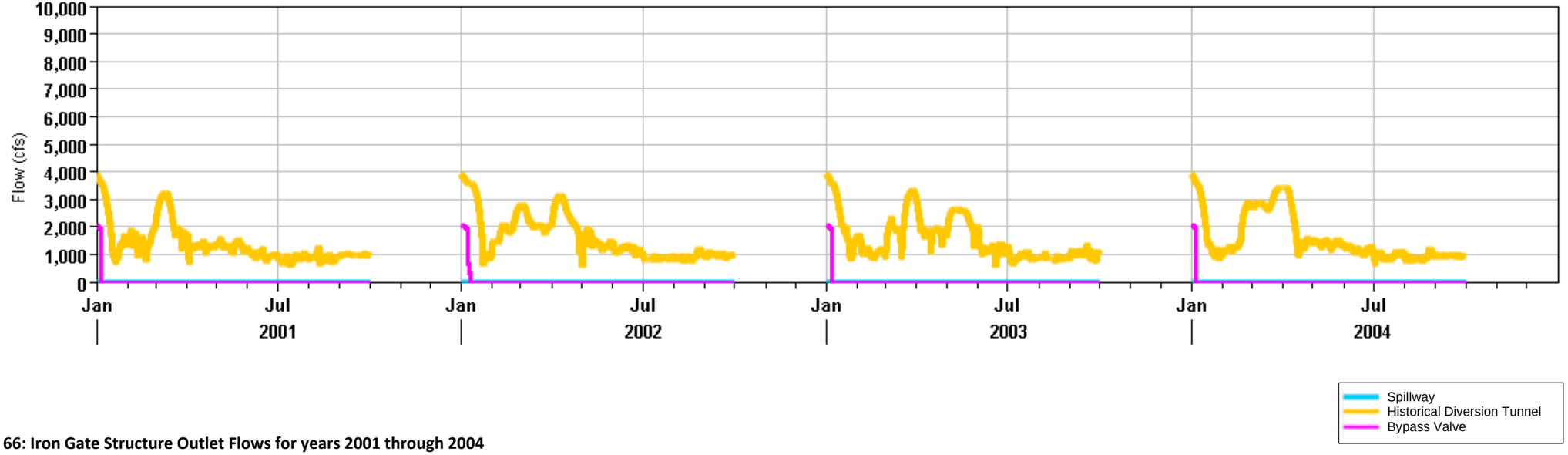


Figure 66: Iron Gate Structure Outlet Flows for years 2001 through 2004

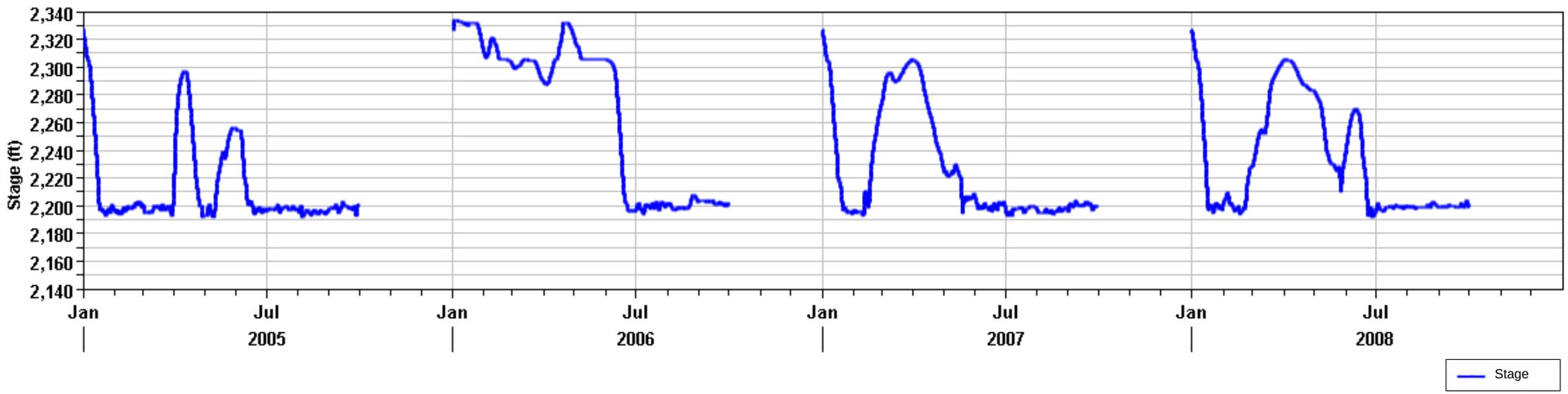


Figure 67: Iron Gate Drawdown Stage for years 2005 through 2008

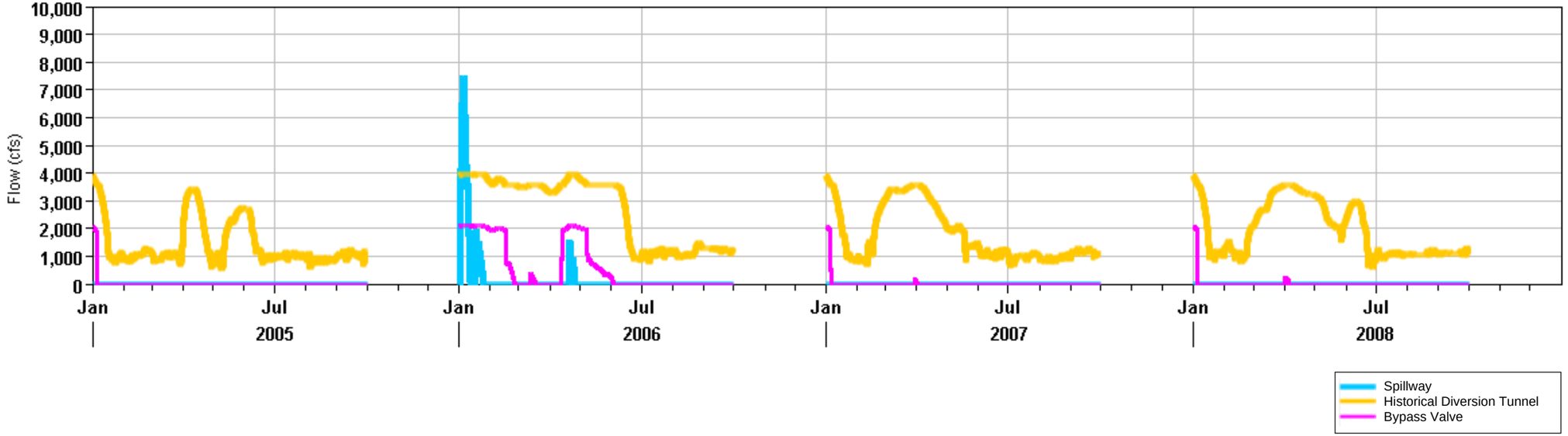


Figure 68: Iron Gate Structure Outlet Flows for years 2005 through 2008

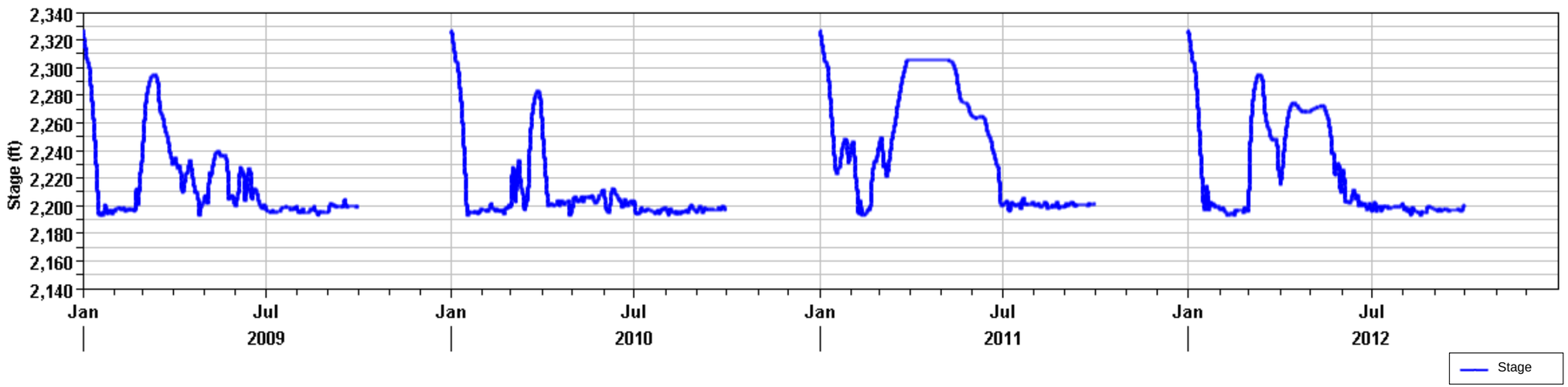


Figure 69: Iron Gate Drawdown Stage for years 2009 through 2012

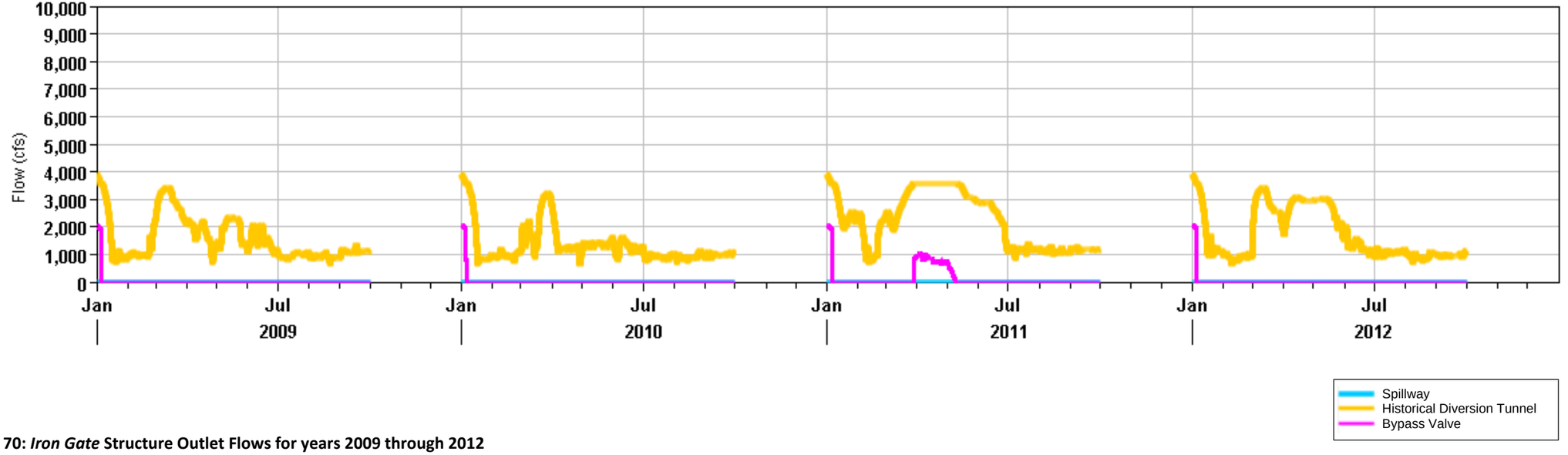


Figure 70: *Iron Gate* Structure Outlet Flows for years 2009 through 2012

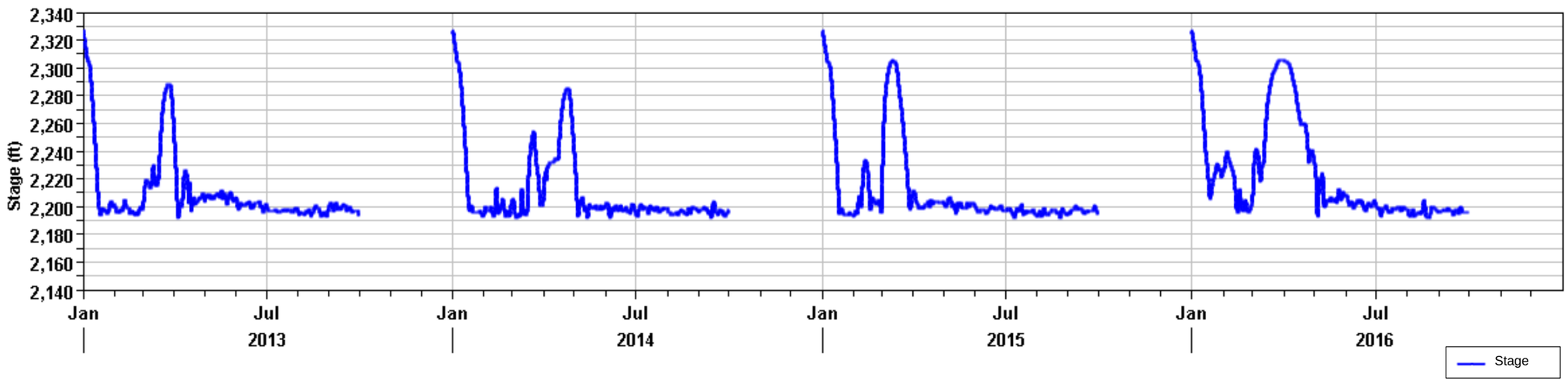


Figure 71: Iron Gate Drawdown Stage for years 2013 through 2016

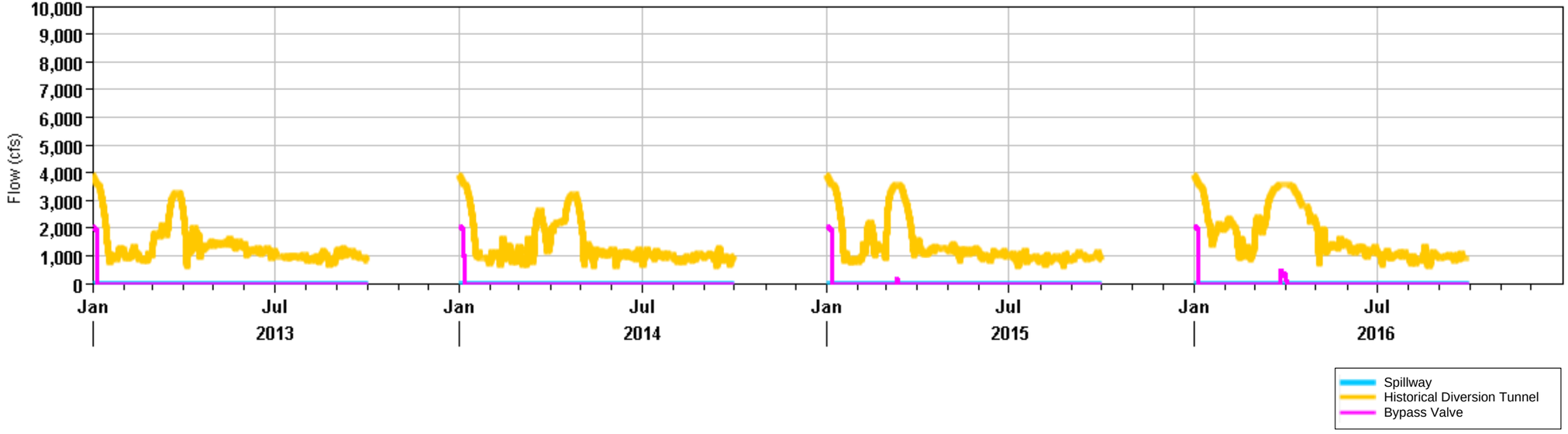
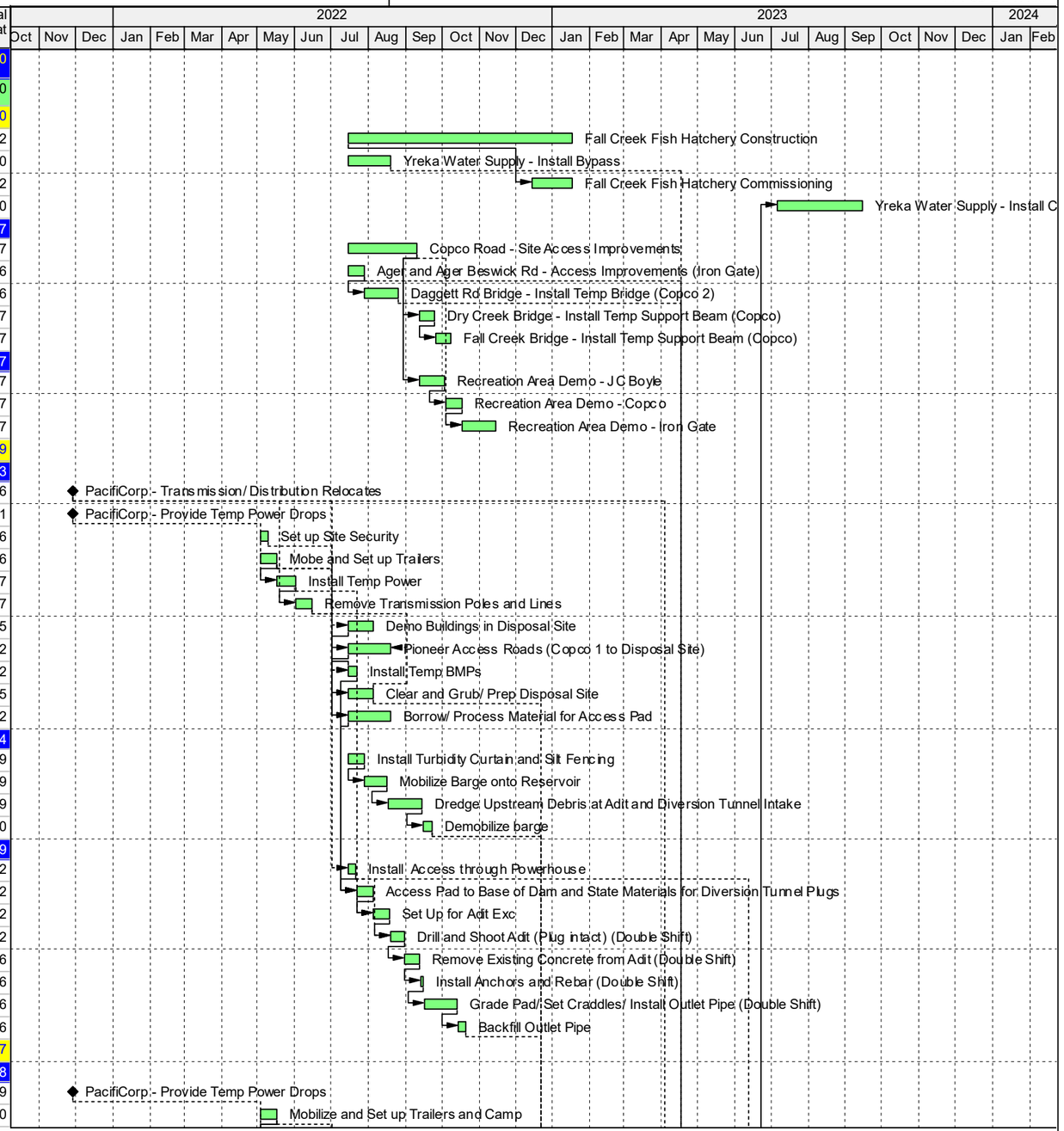


Figure 72: Iron Gate Structure Outlet Flows for years 2013 through 2016

Appendix B

Implementation Schedule

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Klamath River Reconstruction Project - Implementation Work Sc		356	29-Nov-21	16-Nov-23	0
PRE-DRAWDOWN YEAR		316	29-Nov-21	14-Sep-23	40
Project Wide		230	15-Jul-22	14-Sep-23	40
PW1104	Fall Creek Fish Hatchery Construction	153	15-Jul-22	16-Jan-23	152
PW1010	Yreka Water Supply - Install Bypass	30	15-Jul-22	19-Aug-22	250
PW1114	Fall Creek Fish Hatchery Commissioning	25	15-Dec-22	16-Jan-23	152
PW1184	Yreka Water Supply - Install Cut and Cover	60	06-Jul-23	14-Sep-23	40
Roads and Bridges		73	15-Jul-22	08-Oct-22	197
PW0044	Copco Road - Site Access Improvements	49	15-Jul-22	10-Sep-22	37
PW1003	Ager and Ager Beswick Rd - Access Improvements (Iron Gate)	12	15-Jul-22	28-Jul-22	56
PW1004	Daggett Rd Bridge - Install Temp Bridge (Copco 2)	24	29-Jul-22	25-Aug-22	56
PW1001	Dry Creek Bridge - Install Temp Support Beam (Copco)	12	12-Sep-22	24-Sep-22	197
PW1002	Fall Creek Bridge - Install Temp Support Beam (Copco)	12	26-Sep-22	08-Oct-22	197
Demo Recreation Sites		55	12-Sep-22	14-Nov-22	37
PW1008	Recreation Area Demo - J C Boyle	19	12-Sep-22	03-Oct-22	37
PW1020	Recreation Area Demo - Copco	12	04-Oct-22	17-Oct-22	37
PW1030	Recreation Area Demo - Iron Gate	24	18-Oct-22	14-Nov-22	37
Copco 1		169	29-Nov-21	20-Oct-22	9
Site Prep		116	29-Nov-21	19-Aug-22	53
CO12222	PacifiCorp - Transmission/ Distribution Relocates	0		29-Nov-21*	86
CO12240	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	181
CO10290	Set up Site Security	6	03-May-22	10-May-22	106
CO10062	Mobe and Set up Trailers	12	03-May-22	17-May-22	76
CO10600	Install Temp Power	12	17-May-22	01-Jun-22	77
CO10620	Remove Transmission Poles and Lines	12	01-Jun-22	15-Jun-22	77
CO10800	Demo Buildings in Disposal Site	18	15-Jul-22	05-Aug-22	65
CO10021	Pioneer Access Roads (Copco 1 to Disposal Site)	30	15-Jul-22	19-Aug-22	52
CO10040	Install Temp BMPs	6	15-Jul-22	22-Jul-22	52
CO10031	Clear and Grub/ Prep Disposal Site	18	15-Jul-22	05-Aug-22	65
CO10700	Borrow/ Process Material for Access Pad	30	15-Jul-22	19-Aug-22	52
Upstream Work		58	15-Jul-22	22-Sep-22	34
CO10030	Install Turbidity Curtain and Silt Fencing	12	15-Jul-22	28-Jul-22	39
CO10010	Mobilize Barge onto Reservoir	16	29-Jul-22	16-Aug-22	39
CO10210	Dredge Upstream Debris at Adit and Diversion Tunnel Intake	24	17-Aug-22	14-Sep-22	39
CO10052	Demobilize barge	6	15-Sep-22	22-Sep-22	120
Downstream Work		83	15-Jul-22	20-Oct-22	9
CO10034	Install Access through Powerhouse	6	15-Jul-22	21-Jul-22	52
CO16010	Access Pad to Base of Dam and State Materials for Diversion Tunnel Plugs	12	22-Jul-22	04-Aug-22	52
CO10380	Set Up for Adit Exc	12	05-Aug-22	18-Aug-22	52
CO10071	Drill and Shoot Adit (Plug intact) (Double Shift)	10	19-Aug-22	30-Aug-22	52
CO10340	Remove Existing Concrete from Adit (Double Shift)	10	31-Aug-22	12-Sep-22	96
CO10360	Install Anchors and Rebar (Double Shift)	3	13-Sep-22	15-Sep-22	96
CO10451	Grade Pad/ Set Craddles/ Install Outlet Pipe (Double Shift)	23	16-Sep-22	13-Oct-22	96
CO11010	Backfill Outlet Pipe	6	14-Oct-22	20-Oct-22	96
Copco 2		159	29-Nov-21	08-Oct-22	197
Access/Site Work		106	29-Nov-21	08-Aug-22	168
CO20521	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	409
CO20491	Mobilize and Set up Trailers and Camp	12	03-May-22	17-May-22	110



Klamath River Reconstruction Project - Implementation Work Schedule - 100% DCD 2022 Start

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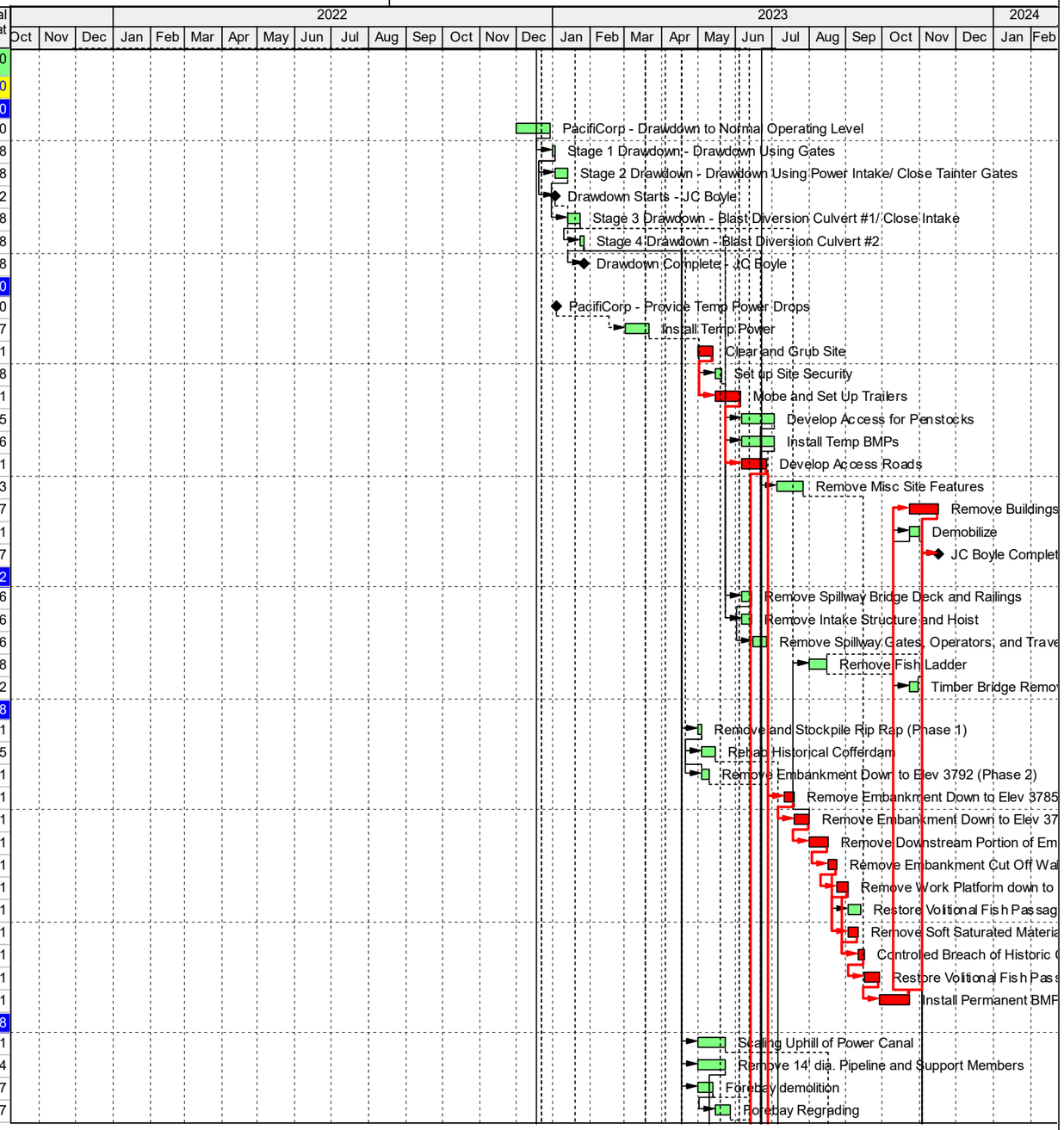
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
CO20011	Install Temp BMPs	10	17-May-22	28-May-22	110
CO20501	Install Temp Power	10	17-May-22	28-May-22	226
CO20013	Prep Site and Clear and Grub	10	15-Jul-22	27-Jul-22	72
CO20012	Set Up Staging Areas	18	15-Jul-22	05-Aug-22	145
CO20014	Pioneer Access Roads	10	27-Jul-22	08-Aug-22	72
Dam Removal		53	08-Aug-22	08-Oct-22	197
Dry Period #1		25	08-Aug-22	06-Sep-22	203
CO2001	Dry Up Reservoir	1	08-Aug-22	08-Aug-22	79
CO2008	Remove Right Retaining Wall (Double Shift)	2	08-Aug-22	10-Aug-22	147
CO2026	Remove Existing Cofferdam (Double Shift)	5	08-Aug-22	13-Aug-22	223
CO2007	Remove Tainter Gates, Bridge Deck, Hoists (Double Shift)	6	09-Aug-22	15-Aug-22	142
CO2011	Demo Concrete Spillway (Double Shift)	6	09-Aug-22	15-Aug-22	142
CO20541	Refill Reservoir	18	16-Aug-22	06-Sep-22	142
Dry Period #2		28	07-Sep-22	08-Oct-22	197
CO20481	Dry Up Reservoir	1	07-Sep-22	07-Sep-22	79
CO20401	Close Caterpillar Gate	1	08-Sep-22	08-Sep-22	142
CO2004	CIP Plug for Caterpillar Gate (Double Shift)	1	09-Sep-22	09-Sep-22	197
CO20411	Demo and Remove Intake Structure (Double Shift)	3	10-Sep-22	13-Sep-22	197
CO2013	Regrade Right Bank, Remove Access Road, and Grade Area (Double Shift)	6	10-Sep-22	16-Sep-22	216
CO2002	Backfill Intake Structure with Rip Rap (Double Shift)	2	14-Sep-22	15-Sep-22	217
CO20391	Restore Volitional Fish Channel (Downstream of Dam) (Double Shift)	4	14-Sep-22	17-Sep-22	197
CO20551	Refill Reservoir	18	19-Sep-22	08-Oct-22	197
Iron Gate		178	29-Nov-21	25-Nov-22	151
Access/ Site Work		111	29-Nov-21	12-Aug-22	218
IG4000	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	182
IG2130	Set Up Site Security	6	03-May-22	10-May-22	287
IG0067	Mobe and Setup Trailers	19	03-May-22	24-May-22	68
IG0064	Install Temp BMPs	16	25-May-22	13-Jun-22	268
IG3280	Install Temp Power	16	25-May-22	13-Jun-22	70
IG2140	Install Piping at Fish Facilities	25	15-Jul-22	12-Aug-22	155
IG0051	Build Access Road to Diversion Tunnel and Holding Tanks	18	15-Jul-22	04-Aug-22	27
IG0065	Prep Site and Set Up Staging Areas	16	15-Jul-22	03-Aug-22	227
IG3290	Decommission Holding Ponds	12	15-Jul-22	28-Jul-22	33
Pre-Drawdown Modifications		74	05-Aug-22	25-Nov-22	0
Tunnel Linning		74	05-Aug-22	25-Nov-22	0
IG3050	Mobe Equipment and Set-up	10	05-Aug-22	16-Aug-22	27
IG0001	Close and Secure Hinged Blind Flange	5	17-Aug-22	22-Aug-22	27
IG3060	Demo Weir and Stop Logs/ Water Pump Down (Double Shift)	2	23-Aug-22	24-Aug-22	27
IG3070	Tunnel Inspection Scaling/ Vent/ Utilities/ Temp Support (Double Shift)	10	25-Aug-22	06-Sep-22	27
IG3080	Demo Existing Invert Concrete (double shift)	4	07-Sep-22	10-Sep-22	27
IG3090	Install Anchors for Walls/ invert (double shift)	4	12-Sep-22	15-Sep-22	27
IG3100	Mud Mat (Double Shift)	2	16-Sep-22	17-Sep-22	27
IG3110	Invert Rebar (Double Shift)	2	19-Sep-22	20-Sep-22	27
IG3120	Invert Concrete (Double Shift)	5	21-Sep-22	26-Sep-22	27
IG3130	Wall Rebar (Double Shift)	4	30-Sep-22	04-Oct-22	30
IG0013	Wall Concrete (Double Shift)	14	05-Oct-22	21-Oct-22	30
IG0028	Install Vent Lines (Double Shift)	22	22-Oct-22	17-Nov-22	30
IG3260	Remove Blind Flange (Double Shift)	6	18-Nov-22	25-Nov-22	30

Actual Work
Remaining Work
Critical Remaining Work
Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

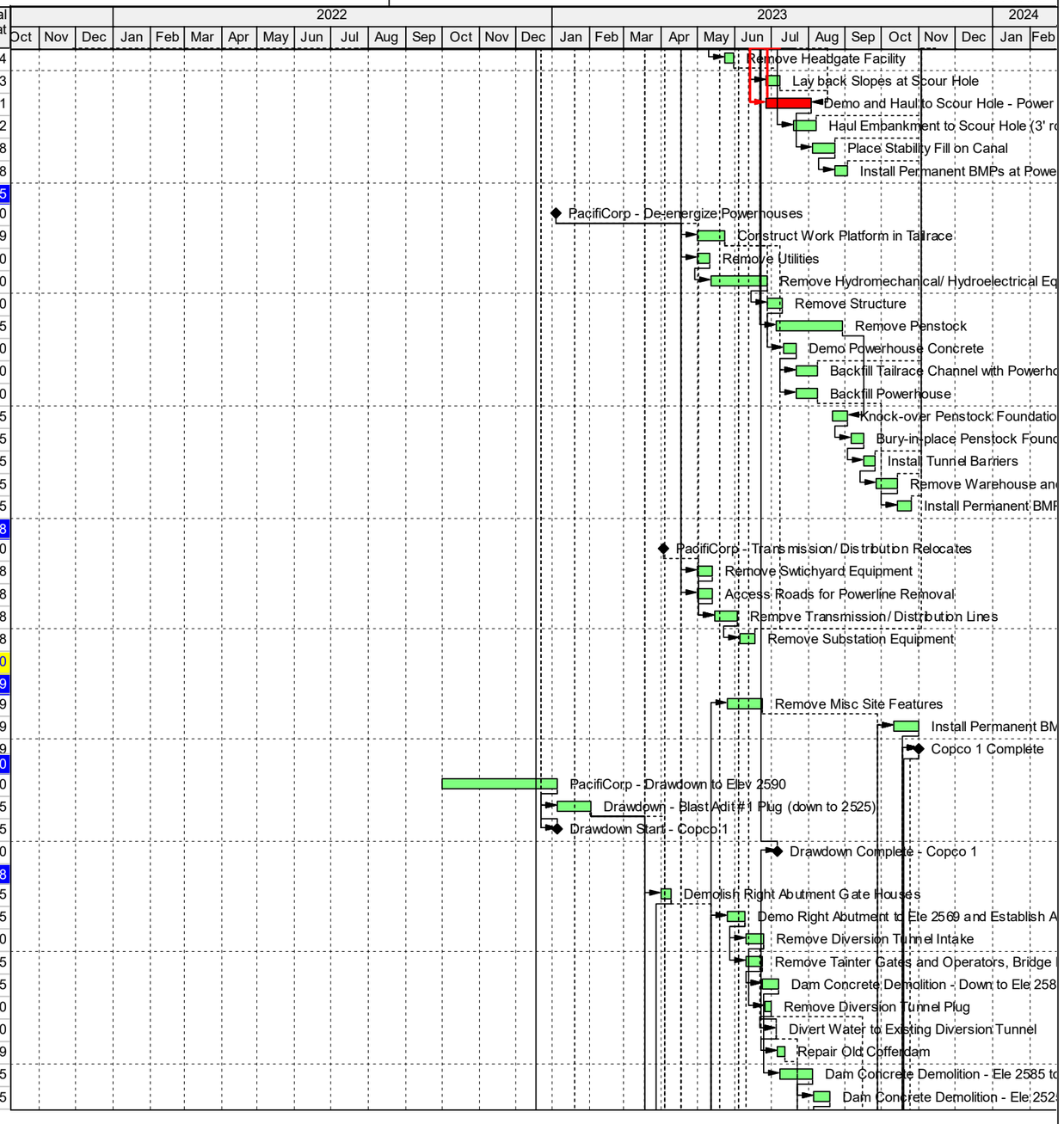
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
DRAWDOWN YEAR		204	01-Oct-22	16-Nov-23	0
JC Boyle		178	01-Dec-22	16-Nov-23	0
Drawdown		0	01-Dec-22	27-Jan-23	0
JCB1180	PacifiCorp - Drawdown to Normal Operating Level	20	01-Dec-22*	29-Dec-22	0
JCB0017	Stage 1 Drawdown - Drawdown Using Gates	2	01-Jan-23	03-Jan-23	48
JCB1220	Stage 2 Drawdown - Drawdown Using Power Intake/ Close Tainter Gates	10	03-Jan-23	13-Jan-23	48
JCB0082	Drawdown Starts - JC Boyle	0	03-Jan-23		72
JCB1230	Stage 3 Drawdown - Blast Diversion Culvert #1/ Close Intake	10	13-Jan-23	23-Jan-23	48
JCB0019	Stage 4 Drawdown - Blast Diversion Culvert #2	4	23-Jan-23	27-Jan-23	48
JCB1050	Drawdown Complete - JC Boyle	0		27-Jan-23	48
Access/ Site Work		178	03-Jan-23	16-Nov-23	0
JCB1270	PacifiCorp - Provide Temp Power Drops	0		03-Jan-23*	0
JCB1260	Install Temp Power	18	01-Mar-23*	21-Mar-23	47
JCB0057	Clear and Grub Site	12	01-May-23*	13-May-23	1
JCB1060	Set up Site Security	6	15-May-23	20-May-23	18
JCB0056	Mobe and Set Up Trailers	18	15-May-23	05-Jun-23	1
JCB1070	Develop Access for Penstocks	24	06-Jun-23	03-Jul-23	5
JCB0051	Install Temp BMPs	24	06-Jun-23	03-Jul-23	6
JCB0052	Develop Access Roads	18	06-Jun-23	26-Jun-23	1
JCB1190	Remove Misc Site Features	20	05-Jul-23	27-Jul-23	53
JCB1200	Remove Buildings and Storage Sheds at Dam	20	23-Oct-23	16-Nov-23	37
JCB0059	Demobilize	7	23-Oct-23	31-Oct-23	1
JCB0081	JC Boyle Complete	0		16-Nov-23	37
Dam/Intake/Spillway Removal		122	06-Jun-23	30-Oct-23	2
JCB0014	Remove Spillway Bridge Deck and Railings	8	06-Jun-23	14-Jun-23	106
JCB0012	Remove Intake Structure and Hoist	8	06-Jun-23	14-Jun-23	116
JCB0015	Remove Spillway Gates, Operators, and Traveling Hoist	10	15-Jun-23	26-Jun-23	106
JCB0005	Remove Fish Ladder	13	01-Aug-23	16-Aug-23	58
JCB0013	Timber Bridge Removal	6	23-Oct-23	30-Oct-23	2
Embankment Removal		146	01-May-23	23-Oct-23	8
JCB0006	Remove and Stockpile Rip Rap (Phase 1)	3	01-May-23*	03-May-23	51
JCB0003	Rehab Historical Cofferdam	10	04-May-23*	15-May-23	55
JCB1240	Remove Embankment Down to Elev 3792 (Phase 2)	6	04-May-23*	10-May-23	51
JCB0020	Remove Embankment Down to Elev 3785 (Phase 3)	8	11-Jul-23	20-Jul-23	1
JCB1120	Remove Embankment Down to Elev 3775.7 (Phase 4)	10	20-Jul-23*	01-Aug-23	1
JCB1130	Remove Downstream Portion of Embankment down to Bedrock Elev 3738 (Phase	14	01-Aug-23	17-Aug-23	1
JCB0007	Remove Embankment Cut Off Wall	6	17-Aug-23	24-Aug-23	1
JCB1170	Remove Work Platform down to Bedrock (Phase 7)	8	24-Aug-23	02-Sep-23	1
JCB1000	Restore Volitional Fish Passage (Downstream of Historic Cofferdam)	8	02-Sep-23	13-Sep-23	41
JCB1140	Remove Soft Saturated Material	6	02-Sep-23	11-Sep-23	1
JCB0009	Controlled Breach of Historic Cofferdam (down to 3740.7)	5	11-Sep-23	16-Sep-23	1
JCB1150	Restore Volitional Fish Passage (Upstream of Embamkment)	10	16-Sep-23	28-Sep-23	1
JCB1210	Install Permanent BMPs	20	28-Sep-23	23-Oct-23	1
Power Canal Removal		106	01-May-23	02-Sep-23	48
JCB1090	Scaling Uphill of Power Canal	20	01-May-23	23-May-23	61
JCB0024	Remove 14' dia. Pipeline and Support Members	20	01-May-23	23-May-23	114
JCB0029	Forebay demolition	12	01-May-23	13-May-23	37
JCB1010	Forebay Regrading	12	15-May-23	27-May-23	47



Actual Work
Remaining Work
Critical Remaining Work
Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

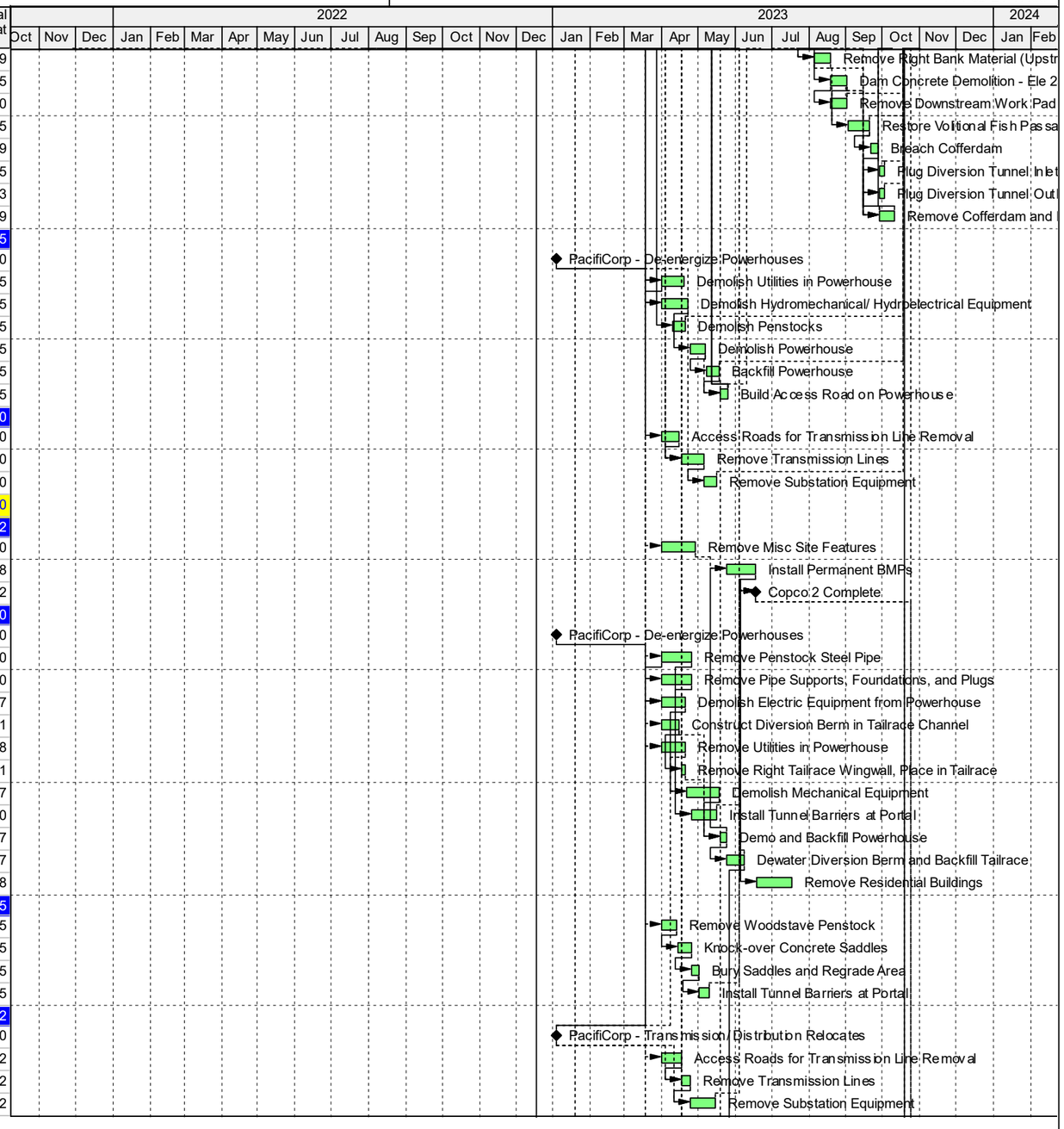
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
JCB0026	Remove Headgate Facility	5	24-May-23	30-May-23	114
JCB0040	Lay back Slopes at Scour Hole	10	27-Jun-23	08-Jul-23	23
JCB0027	Demo and Haul to Scour Hole - Power Canal Downhill Wall	32	27-Jun-23	03-Aug-23	1
JCB0031	Haul Embankment to Scour Hole (3' rock cover)	15	20-Jul-23	07-Aug-23	72
JCB0028	Place Stability Fill on Canal	16	04-Aug-23	22-Aug-23	48
JCB1100	Install Permanent BMPs at Power Canal and Scour Hole	10	23-Aug-23	02-Sep-23	48
Powerhouse and Penstock Removal		173	03-Jan-23	25-Oct-23	5
JCB1040	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
JCB0034	Construct Work Platform in Tailrace	20	01-May-23	23-May-23	99
JCB0043	Remove Utilities	10	01-May-23*	11-May-23	60
JCB0044	Remove Hydromechanical/ Hydroelectrical Equipment	39	12-May-23	27-Jun-23	60
JCB1020	Remove Structure	10	28-Jun-23	10-Jul-23	60
JCB0022	Remove Penstock	48	05-Jul-23	29-Aug-23	5
JCB0041	Demo Powerhouse Concrete	10	11-Jul-23	21-Jul-23	60
JCB0038	Backfill Tailrace Channel with Powerhouse Concrete and Excavated Alluvial Materi	15	22-Jul-23	08-Aug-23	70
JCB0025	Backfill Powerhouse	15	22-Jul-23	08-Aug-23	60
JCB0023	Knock-over Penstock Foundations	12	21-Aug-23	02-Sep-23	5
JCB0032	Bury-in-place Penstock Foundations	10	05-Sep-23	15-Sep-23	5
JCB0033	Install Tunnel Barriers	8	16-Sep-23	25-Sep-23	5
JCB1030	Remove Warehouse and Buildings	15	26-Sep-23	13-Oct-23	5
JCB1250	Install Permanent BMP	10	14-Oct-23	25-Oct-23	5
Transmission/Distribution		64	03-Apr-23	17-Jun-23	98
JCB1110	PacifiCorp - Transmission/ Distribution Relocates	0		03-Apr-23*	0
JCB0036	Remove Swtichyard Equipment	12	01-May-23*	13-May-23	98
JCB0100	Access Roads for Powerline Removal	12	01-May-23*	13-May-23	98
JCB0042	Remove Transmission/ Distribution Lines	17	15-May-23	03-Jun-23	98
JCB0045	Remove Substation Equipment	12	05-Jun-23	17-Jun-23	98
Copco 1		204	01-Oct-22	31-Oct-23	0
Access/Site Work		132	26-May-23	31-Oct-23	39
CO11000	Remove Misc Site Features	24	26-May-23	23-Jun-23	129
CO11020	Install Permanent BMPs	18	11-Oct-23	31-Oct-23	39
CO10064	Copco 1 Complete	0		31-Oct-23	39
Drawdown		104	01-Oct-22	06-Jul-23	40
CO10018	PacifiCorp - Drawdown to Elev 2590	32	01-Oct-22*	04-Jan-23	0
CO10003	Drawdown - Blast Adit #1 Plug (down to 2525)	10	04-Jan-23	01-Feb-23	15
CO10063	Drawdown Start - Copco 1	0	04-Jan-23		15
CO10260	Drawdown Complete - Copco 1	0	06-Jul-23		40
Dam Removal		160	01-Apr-23	10-Oct-23	18
CO10005	Demolish Right Abutment Gate Houses	6	01-Apr-23	08-Apr-23	65
CO10004	Demo Right Abutment to Ele 2569 and Establish Access	12	26-May-23	09-Jun-23	35
CO10072	Remove Diversion Tunnel Intake	13	10-Jun-23	24-Jun-23	40
CO10002	Remove Tainter Gates and Operators, Bridge Deck and Piers	12	10-Jun-23	23-Jun-23	35
CO10250	Dam Concrete Demolition - Down to Ele 2585	10	24-Jun-23	07-Jul-23	35
CO10240	Remove Diversion Tunnel Plug	6	26-Jun-23	01-Jul-23	40
CO10331	Divert Water to Existing Diversion Tunnel	1	05-Jul-23	05-Jul-23	40
CO10400	Repair Old Cofferdam	6	06-Jul-23	12-Jul-23	79
CO11300	Dam Concrete Demolition - Ele 2585 to Elev 2525	24	08-Jul-23	04-Aug-23	35
CO10300	Dam Concrete Demolition - Ele 2525 to Elev 2511	12	05-Aug-23	18-Aug-23	35



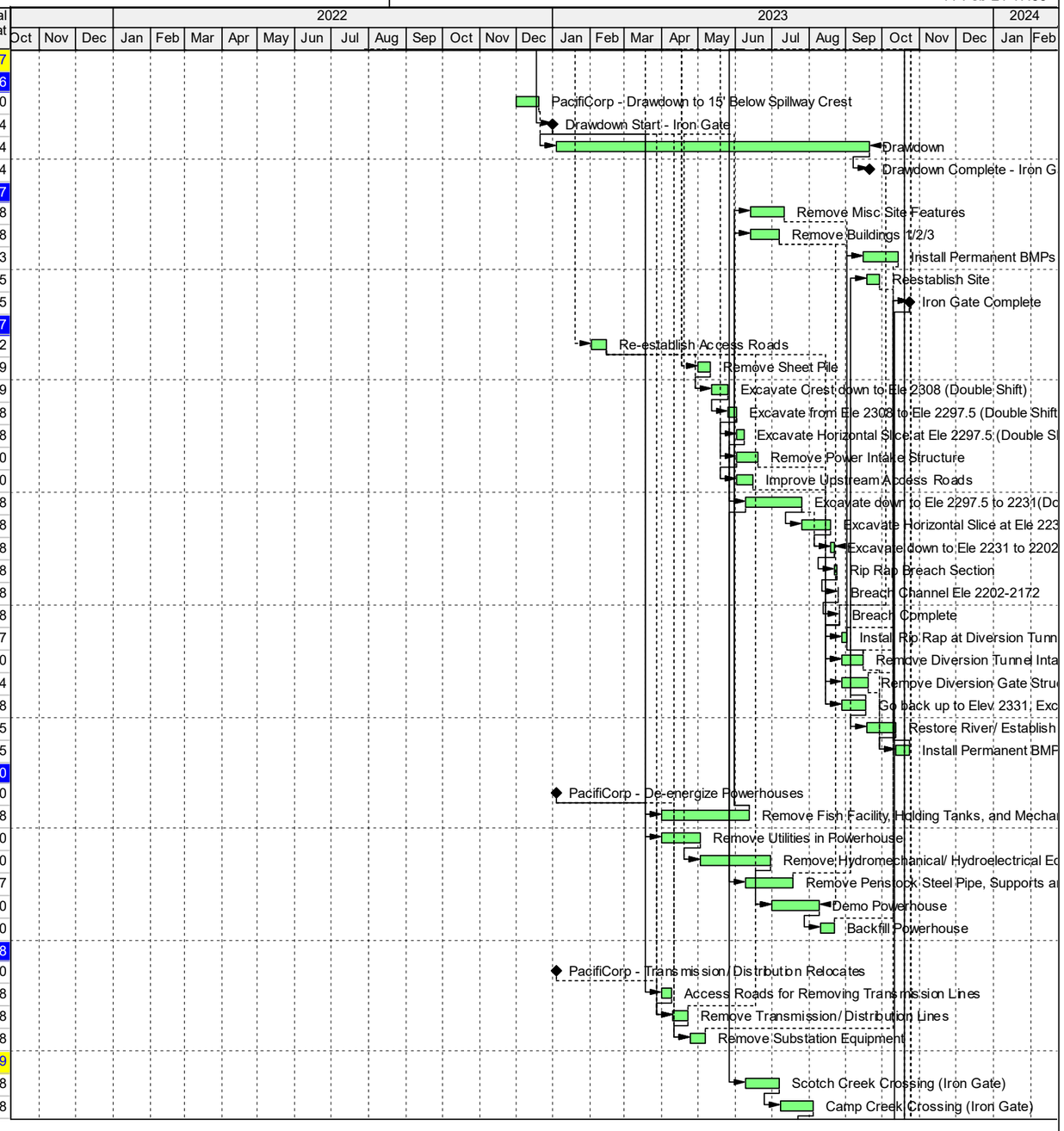
Actual Work
Remaining Work
Critical Remaining Work
◆ Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

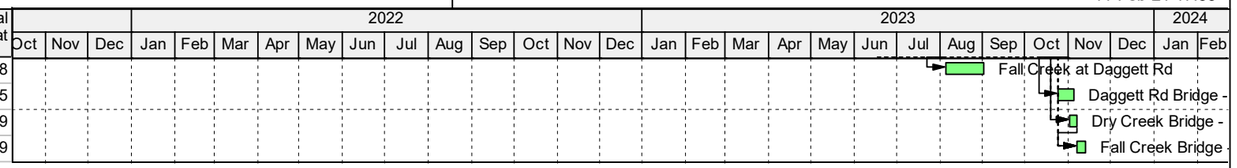
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
CO10341	Remove Right Bank Material (Upstream of Dam)	12	05-Aug-23	18-Aug-23	59
CO11200	Dam Concrete Demolition - Ele 2511 to Ele 2472	12	19-Aug-23	01-Sep-23	35
CO10017	Remove Downstream Work Pad and Pipe	12	19-Aug-23	01-Sep-23	70
CO10371	Restore Volitional Fish Passage Channel (Downstream of Historical Cofferdam)	15	02-Sep-23	20-Sep-23	35
CO11800	Breach Cofferdam	6	21-Sep-23	27-Sep-23	39
CO11030	Plug Diversion Tunnel Inlet	4	28-Sep-23	02-Oct-23	45
CO10019	Plug Diversion Tunnel Outlet	4	28-Sep-23	02-Oct-23	63
CO10351	Remove Cofferdam and Historical Construction, Volitional Fish Passage Upstream	10	28-Sep-23	10-Oct-23	39
Powerhouse and Penstock Removal		46	03-Jan-23	25-May-23	35
CO12230	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
CO10051	Demolish Utilities in Powerhouse	15	01-Apr-23	19-Apr-23	35
CO10053	Demolish Hydromechanical/ Hydroelectrical Equipment	18	01-Apr-23	22-Apr-23	35
CO10006	Demolish Penstocks	10	10-Apr-23	20-Apr-23	65
CO10007	Demolish Powerhouse	12	24-Apr-23	06-May-23	35
CO10022	Backfill Powerhouse	10	08-May-23	18-May-23	35
CO10390	Build Access Road on Powerhouse	6	19-May-23	25-May-23	35
Transmission/Distribution		38	01-Apr-23	16-May-23	140
CO10220	Access Roads for Transmission Line Removal	12	01-Apr-23	15-Apr-23	140
CO10054	Remove Transmission Lines	17	17-Apr-23	05-May-23	140
CO10055	Remove Substation Equipment	9	06-May-23	16-May-23	140
Copco 2 (Could Happen as Early as Pre-Drawdown Year)		88	03-Jan-23	17-Jul-23	90
Site		66	01-Apr-23	17-Jun-23	152
CO20421	Remove Misc Site Features	24	01-Apr-23*	28-Apr-23	160
CO20441	Install Permanent BMPs	20	25-May-23	17-Jun-23	138
CO2081	Copco 2 Complete	0		17-Jun-23	152
Powerhouse and Penstock Removal		88	03-Jan-23	17-Jul-23	90
CO20531	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
CO20190	Remove Penstock Steel Pipe	20	01-Apr-23*	25-Apr-23	140
CO20110	Remove Pipe Supports, Foundations, and Plugs	20	01-Apr-23	25-Apr-23	140
CO20051	Demolish Electric Equipment from Powerhouse	16	01-Apr-23*	20-Apr-23	97
CO20112	Construct Diversion Berm in Tailrace Channel	12	01-Apr-23*	15-Apr-23	121
CO20471	Remove Utilities in Powerhouse	15	01-Apr-23*	20-Apr-23	98
CO20010	Remove Right Tailrace Wingwall, Place in Tailrace	4	17-Apr-23	20-Apr-23	121
CO20053	Demolish Mechanical Equipment	24	21-Apr-23	18-May-23	97
CO20111	Install Tunnel Barriers at Portal	18	26-Apr-23	16-May-23	140
CO20113	Demo and Backfill Powerhouse	5	19-May-23	24-May-23	97
CO20114	Dewater Diversion Berm and Backfill Tailrace	12	25-May-23	08-Jun-23	97
CO20431	Remove Residential Buildings	24	19-Jun-23	17-Jul-23	138
Wood Stave Penstock Removal		33	01-Apr-23	10-May-23	145
CO2014	Remove Woodstave Penstock	10	01-Apr-23*	13-Apr-23	145
CO2016	Knock-over Concrete Saddles	10	14-Apr-23	25-Apr-23	145
CO2017	Bury Saddles and Regrade Area	5	26-Apr-23	01-May-23	145
CO2018	Install Tunnel Barriers at Portal	8	02-May-23	10-May-23	145
Transmission/Distribution		36	03-Jan-23	15-May-23	142
CO20511	PacifiCorp - Transmission/ Distribution Relocates	0		03-Jan-23*	0
CO20230	Access Roads for Transmission Line Removal	12	01-Apr-23*	17-Apr-23	142
CO20052	Remove Transmission Lines	6	17-Apr-23	24-Apr-23	142
CO20054	Remove Substation Equipment	18	24-Apr-23	15-May-23	142



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Iron Gate		171	01-Dec-22	23-Oct-23	7
Drawdown		142	01-Dec-22	19-Sep-23	36
IG2000	PacifiCorp - Drawdown to 15' Below Spillway Crest	16	01-Dec-22*	20-Dec-22	0
IG0040	Drawdown Start - Iron Gate	0	01-Jan-23		14
IG0003	Drawdown	218	03-Jan-23	19-Sep-23	84
IG2110	Drawdown Complete - Iron Gate	0		19-Sep-23	84
Access/Site Work		111	13-Jun-23	23-Oct-23	7
IG1000	Remove Misc Site Features	24	13-Jun-23	11-Jul-23	108
IG0050	Remove Buildings 1/2/3	20	13-Jun-23	07-Jul-23	88
IG1020	Install Permanent BMPs	24	15-Sep-23	13-Oct-23	53
IG3160	Reestablish Site	10	18-Sep-23	28-Sep-23	65
IG0070	Iron Gate Complete	0		23-Oct-23	45
Embankment Removal		171	01-Feb-23	23-Oct-23	7
IG0033	Re-establish Access Roads	12	01-Feb-23*	14-Feb-23	112
IG0021	Remove Sheet Pile	10	01-May-23*	11-May-23	39
IG4030	Excavate Crest down to Ele 2308 (Double Shift)	12	12-May-23*	25-May-23	39
IG0022	Excavate from Ele 2308 to Ele 2297.5 (Double Shift)	5	26-May-23*	01-Jun-23	38
IG4040	Excavate Horizontal Slice at Ele 2297.5 (Double Shift)	6	02-Jun-23	08-Jun-23	38
IG3230	Remove Power Intake Structure	15	02-Jun-23	19-Jun-23	100
IG2150	Improve Upstream Access Roads	12	02-Jun-23	15-Jun-23	100
IG0024	Excavate down to Ele 2297.5 to 2231(Double Shift)	38	09-Jun-23*	25-Jul-23	38
IG4050	Excavate Horizontal Slice at Ele 2231(Double Shift)	21	26-Jul-23*	18-Aug-23	38
IG0025	Excavate down to Ele 2231 to 2202 (Double Shift)	2	19-Aug-23*	21-Aug-23	38
IG3190	Rip Rap Breach Section	3	22-Aug-23	24-Aug-23	38
IG4010	Breach Channel Ele 2202-2172	1	25-Aug-23	25-Aug-23	38
IG4020	Breach Complete	1	26-Aug-23	26-Aug-23	38
IG0080	Install Rip Rap at Diversion Tunnel Intake Structure	5	28-Aug-23	01-Sep-23	87
IG0004	Remove Diversion Tunnel Intake Structure	15	28-Aug-23	14-Sep-23	40
IG0020	Remove Diversion Gate Structure	18	28-Aug-23	18-Sep-23	64
IG3270	Go back up to Elev 2331, Exc Elev 2331 to 2164 (Remaining Embankment)	17	28-Aug-23	16-Sep-23	38
IG3210	Restore River/ Establish Volitional Fish Passage	20	18-Sep-23	11-Oct-23	45
IG3200	Install Permanent BMPs	10	12-Oct-23	23-Oct-23	45
Powerhouse/ Fish Facility Removal (Could Happen as Early as January Drawdown Year)		118	03-Jan-23	21-Aug-23	60
IG3020	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
IG0007	Remove Fish Facility, Holding Tanks, and Mechanical	60	01-Apr-23	12-Jun-23	88
IG0061	Remove Utilities in Powerhouse	26	01-Apr-23	02-May-23	60
IG0062	Remove Hydromechanical/ Hydroelectrical Equipment	50	03-May-23	30-Jun-23	60
IG0031	Remove Penstock Steel Pipe, Supports and Foundations	32	09-Jun-23	18-Jul-23	67
IG0032	Demo Powerhouse	32	01-Jul-23	09-Aug-23	60
IG0036	Backfill Powerhouse	10	10-Aug-23	21-Aug-23	60
Transmission/Distribution		30	03-Jan-23	06-May-23	148
IG3010	PacifiCorp - Transmission/ Distribution Relocates	0		03-Jan-23*	0
IG0210	Access Roads for Removing Transmission Lines	6	01-Apr-23	08-Apr-23	118
IG0054	Remove Transmission/ Distribution Lines	12	10-Apr-23	22-Apr-23	118
IG0063	Remove Substation Equipment	12	24-Apr-23	06-May-23	148
Project Wide		131	09-Jun-23	13-Nov-23	39
PW0042	Scotch Creek Crossing (Iron Gate)	24	09-Jun-23	07-Jul-23	98
PW1074	Camp Creek Crossing (Iron Gate)	24	08-Jul-23	04-Aug-23	98



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
PW1174	Fall Creek at Daggett Rd	24	05-Aug-23	01-Sep-23	98
PW1051	Daggett Rd Bridge - Remove Temp Bridge (Copco 2)	11	24-Oct-23	04-Nov-23	45
PW1054	Dry Creek Bridge - Remove Temp Bridge Support (Copco 1)	5	01-Nov-23	06-Nov-23	39
PW1053	Fall Creek Bridge - Remove Temp Bridge Support (Copco 1)	5	07-Nov-23	13-Nov-23	39



Appendix C

Terrain Stability Maps

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION (CEII)

REDACTED

APPENDIX C: TERRAIN STABILITY MAPS

Appendix B

California Slope Stability and Monitoring Plan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

California Slope Stability Monitoring Plan

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February 2021

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Appendices

1.0 Introduction

1.1 Purpose of Management Plan

This California Slope Stability Monitoring Plan is a subplan of the Reservoir Drawdown and Diversion Plan that will be implemented as part of the Proposed Action for the Lower Klamath Project (Project).

The California Slope Stability Monitoring Plan describes the Renewal Corporation's monitoring and evaluates practices related to slope stability. The California Slope Stability Monitoring Plan identifies reservoir slopes and other areas within the limits of work prone to instability and describes the Renewal Corporation's monitoring measures for instability during drawdown and dam removal under the Proposed Action. The subplan also describes the Renewal Corporation's measures to address instability and discharges that violate water quality standards. The Renewal Corporation's measures are also intended to protect private property, structures, and cultural sites.

The Renewal Corporation will implement the following measures through this California Slope Stability Monitoring Plan (or by reference to other management plans):

- Describe slope stability monitoring, including locations and schedule.
- Coordinate with reservoir drawdown to address potential modification of drawdown implementation to control slope instability if necessary, to protect infrastructure, property, or resources.
- Provide a list of measures to be implemented to address erosion and maintain soil stability.
- Visually monitor and inspect for evidence of potential slumping, cracking, and other signs of slope instability during drawdown and dam removal and after storm events, and implement necessary repairs, replacements, and/or additional measures to minimize potential slope instability effects on water quality based on inspection information.
- Provide contingency and notification procedures to respond to confirmed or suspected issues for slope instability or loss of erosion protection.
- Submit monthly and annual reports.

The Renewal Corporation and PacifiCorp have entered into an Operations and Maintenance Agreement. Upon acceptance of the License transfer order and subsequently acceptance of the License Surrender Order, PacifiCorp will continue to operate the Project as the Renewal Corporation assignee, until such time operation is no longer required under decommissioning.

1.2 Relationship to Other Plans

The California Slope Stability Monitoring Plan is supported by elements of the following management plans for effective implementation: Erosion and Sediment Control Plan, Water Quality Monitoring and Protection Plans, and Reservoir Drawdown and Diversion Plan.

1.3 California 401 Water Quality Certificate Condition 18

The California State Water Board Section 401 Water Quality Certificate (CA CWA 401) identifies 11 elements for consideration in the Slope Stability Monitoring Plan. These elements have been addressed throughout this plan, with the exception of identifying the number and location of piezometers and inclinometers. The current Supporting Technical Information Documents (STIDs) for the Project facilities do not include piezometer or inclinometer instrumentation (PacifiCorp, 2007, 2015, and 2016). This instrumentation was not necessary in the past for dam safety or monitoring. Modeling for the design (Knight Piésold, 2020b) showed that dam stability increases during reservoir drawdown and the proposed dam removal for each of the facilities. Therefore, this subplan does not include the number and location of piezometer wells and inclinometers proposed for installation by the CA CWA 401 Condition 18, sub items (3) and (4). Such instrumentation equipment was also determined infeasible to install near private dwellings as land access was not permitted on private lands based on initial landowner outreach. The Renewal Corporation will continue outreach to the private landowners but is not proposing instrumentation installation at this time. As a secondary option, the Renewal Corporation will perform monitoring of drainage and visual observations of the dam faces and private property by during drawdown and dam removal.

2.0 Supporting Information

2.1 Reservoir Rim

Section 2 is informational and includes excerpts from the Reservoir Rim Stability Report (Knight Piésold 2020a). The section does not contain specific measures to be implemented by the Renewal Corporation as part of the Proposed Action.

The Reservoir Rim Stability Report summarizes the findings of an evaluation of the reservoir rim stability during and following drawdown. The Reservoir Rim is defined as the terrain that lies within the normal operating levels of the reservoir. The terrain downslope and upslope of the rim are defined as submarine slopes and upslope areas, respectively. The evaluation focused on the potential instabilities that could affect residences and other resources adjacent to the rim, such as transportation infrastructure. This concise analysis is consistent with previous evaluations completed by the Renewal Corporation (2019) and PanGeo (2008).

The approach utilized for Knight Piésold's stability analyses (Knight Piésold, 2020a) commenced with a review of the Renewal Corporation's analyses and conclusions (2019). Knight Piésold's stability models were developed based on the interpretation of data and observations collected by the Renewal Corporation as influenced by the challenges of gaining site access. Terrain analyses, identifying and characterizing terrain hazards, were completed for each of the four reservoir sites and guided the development of slope models for analyses. The locations of the features/hazards identified from the terrain analysis are shown in Figures 2-1 and 2-2. Completion of Limit Equilibrium (LE) analyses also allowed for identification of influential factors that govern slope stability due to drawdown of the reservoir.

Each stability model evaluated existing conditions to identify the possible extent of instability during drawdown for the current surveyed ground surface (topography and bathymetry), the assumed geological model, and an established piezometric low (assuming that the minimum operating reservoir level represents drawdown conditions). These results provide a framework for judging the results of the drawdown analyses.

2.1.1 Geological Setting

The limits of work are predominantly contained in the Western and High Cascades. The Klamath River predates the formation of the Cascade Mountain Range and maintained a relatively similar course through the mountain building events. The bedrock within the limits of work comprises volcanic rocks (up to 45 million years old) and includes basalt and andesite lava flows, tuffs, tuff-breccias, and volcaniclastic sandstone. The volcanic rocks are intruded by numerous dikes and plugs of andesite, rhyolite, and basalt. Many of the volcanoes associated with the Western Cascades have since eroded, but large shield volcanoes and vents of the High Cascades remain and are still active in present times.

Large deposits of coarse alluvium were deposited along the Klamath River during the period of the last glaciation when the river had a higher discharge. Lacustrine deposits were laid down in former temporary lakes that were created at the present-day site of the Copco No. 1 Reservoir when the Klamath River was temporarily ‘dammed’ by volcanic activity. Diatomite deposits surround much of the shoreline of Copco No. 1 Reservoir (PanGeo, 2008, as cited in SWRCB, 2020a). Diatomite is a very fine-grained sedimentary rock most often used as a filter aid in commercial applications (SWRCB, 2020a). The presence of diatomaceous deposits and associated fluvio-lacustrine terrace deposits along the rim and below the reservoir water level present the greatest potential for slope instability during drawdown.

2.1.2 Copco No. 1 Reservoir Rim

Residential properties occur locally around the Copco No. 1 Reservoir rim, primarily at the southwest and east sectors of the shoreline. Copco Road follows the north side of the Copco No. 1 Reservoir and Ager Beswick Road along the south side.

Steep shoreline slopes of weak, white diatomite are a prominent feature along the west part of the rim of the Copco No. 1 Reservoir. Shoreline slopes of diatomite are particularly prominent along the south shore in the west part of the reservoir. The shoreline slopes show indications of active erosion undercut by wind-induced reservoir waves, two possible debris slides, a tension crack, slope retrogression, and slumped toe debris.

A natural terrain landslide was identified upslope, with the toe located beneath the reservoir shoreline. Past rock falls occur close to Copco No. 1 Reservoir, and two rockslides were identified in a cliff upslope from Ager Beswick Road. Terrain analysis identified three possible debris slides on the downslope side of Copco Road and a possible debris flood deposit within the reservoir (Knight Piésold, 2020a). Landslides were identified within the cut slopes along Copco Road and Ager Beswick Road, and a rock cut slope alongside Ager Beswick Road

shows evidence of recent rock falls and rockslides. Minor sheet and gully erosion were identified on the natural slopes and south side of the reservoir.

The Klamath River previously followed a sinuous meandering path in the west part of the reservoir footprint. Debris slides were identified in the steep slope on the outside of these former meander bends. It is interpreted these landslides occurred in terrace slopes that comprise alluvium and diatomaceous lacustrine deposits. These locations may be possible sites of terrain instability in the post-drawdown condition once the course of the Klamath River is re-established. Possible relict rockslides were identified in submarine rock slopes close to the dam in the south part of the reservoir. Soft sediment that has accumulated on the floor of the reservoir will likely be susceptible to erosion upon drawdown.

For Copco No. 1, the LE stability analysis results indicate the potential of slope instability impacts from the proposed reservoir drawdown near the southwest shoreline of the reservoir (Knight Piésold, 2020a). This finding is consistent with the Renewal Corporation study (2019).

The drawdown is unlikely to adversely affect relict rockslides mapped on the steep slopes of the narrow canyon upstream of the reservoir. The absence of diatomite and presence of colluvium and weathered bedrock along this slope segment indicates there is a low likelihood the drawdown will adversely affect slope stability. Except for the southwest shoreline that could be impacted, other areas of slope instability at Copco No. 1 Reservoir are considered low risk.

2.1.3 Copco No. 2 Reservoir Rim

There are no residential properties adjacent to the reservoir rim. The access roads to the Copco No. 1 Powerhouse and Copco No. 2 Reservoir are located adjacent to the rim on the north side of the reservoir.

Two shallow debris slides were identified in a steep slope at the left bank of the rim of Copco No. 2 Reservoir. The columnar jointed basalt cliffs upslope of the reservoir have open sub-vertical discontinuities and are susceptible to toppling, causing rock falls. Talus slopes exist from past rock falls adjacent to the downstream portion of the reservoir. A previously constructed rock fall protection barrier was observed on the southwest side of the reservoir. The terrain analysis also identified a debris slide in the cut slope along the access road to the Copco No. 1 Powerhouse at a switch-back of the road alignment. The surficial geology at the site of this landslide comprises an unwelded pyroclastic deposit, which developed before 1991, and there appears to have been no significant change between 1991 and 2016.

The Copco No. 2 Reservoir is relatively shallow, with valley side slopes intersecting the gently sloping terrain of the former riverbed. The submarine slopes are gently inclined, and no submarine landslides have been identified. Soft sediment that has accumulated on the floor of the reservoir will likely be susceptible to erosion upon drawdown.

For Copco No. 2, terrain analysis indicates that although there are areas of potentially unstable terrain around the rim of the reservoir, any slope instability is be expected to be relatively small due to the interpreted shallow depth of the bedrock and the fact that the colluvium generally comprises coarse talus (Knight Piésold, 2020a). There is also a potential for local instability of the colluvial slopes in the upstream area at the left bank where the colluvium is finer grained and the two recent debris slides were identified. Based on the low risk of identified potential instability areas, drawdown of the reservoir is not expected to result in large-scale slope instability effecting adjacent infrastructure or properties.

2.1.4 Iron Gate Reservoir Rim

Copco Road follows the north side of the reservoir. Copco Road follows the north (right) side of the reservoir. No known residential properties were identified adjacent to the rim of the Iron Gate Reservoir in the Reservoir Rim Stability Report (Knight Piésold, 2020a). One structure was subsequently identified adjacent to the east side of the reservoir rim. The terrain hazard analysis completed by Knight Piésold (2020a) identified no slope hazards were present in this area. Additionally, the slopes below this property are relatively gentle; therefore, this property was not included in the stability analysis.

The terrain analysis confirmed the presence of slope instability at the rim of the Iron Gate Reservoir as previously identified in both the PanGeo (2008) and the Renewal Corporation (2019) reports. A debris slide was identified at a former meander bend of the Klamath River and, upslope of this, a possible relict debris slide. The terrain analysis also identified two recent debris slides in colluvium and/or weathered bedrock at the reservoir rim, as well as two additional debris slides that occurred at the site of a former meander bend of the Klamath River. It is possible that undercutting at the former meander bend was a contributory cause of slope instability. The presence of over-steepened bare soil slopes, slumped debris, and inclined trees along the reservoir rim provide evidence of active erosion by wind-generated reservoir waves.

The Klamath River followed a sinuous meandering path in the footprint area of the reservoir. Over-steepened slope segments are present on the outside of meander bends and are potential sites of terrain instability in the post-drawdown condition once the course of the Klamath River is re-established. Submarine talus slopes have accumulated from rock falls locally around the reservoir rim, in particular in the east part of the south shore of the reservoir. Soft sediment that has accumulated on the floor of the reservoir will likely be susceptible to erosion upon drawdown.

For Iron Gate, there is the potential for local instability to affect Copco Road, in particular where possible historic landslides were identified between the road and the reservoir rim and where existing cracks were identified on the road pavement (Knight Piésold, 2020a). Previous slope instability was identified at the reservoir rim down slope from Copco Road; however, it was relatively small-scale and did not affect the road. It is likely that any slope instability at these areas caused by the drawdown is similarly small-scale and not affect Copco Road. The terrain analysis identified previous slope instability at an area between the road and reservoir rim;

however, it is unlikely the drawdown will reactivate slope instability at the same location (Knight Piésold, 2020a).

3.0 Embankment and Reservoir Rim Stability

This California Slope Stability Monitoring Plan addresses embankment and reservoir rim stability during the pre-drawdown and active drawdown and dam removal phases. Section 3 describes the Renewal Corporation's proposed activities for the pre-drawdown phase and active drawdown and dam removal phase for each reservoir and identify potential slope stability areas of concern.

3.1 Copco No. 1

3.1.1 Pre-Drawdown

The Renewal Corporation will construct a new low-level outlet under spillway bay 3 through the dam, which will be used to drawdown the reservoir. The construction of the outlet will require temporary construction access from the right bank through the powerhouse to develop a work platform beside the spillway plunge pool and access to the historic diversion tunnel outlet. The proposed work includes dredging of the low-level outlet approach channel and the historic diversion tunnel approach channel.

During the pre-drawdown construction period, the Renewal Corporation will keep the Copco No. 1 Reservoir level at or below the spillway ogee crest level (elevation 2,597.1 ft), to as low as the minimum operating level (elevation 2,592 ft) during and after pre-drawdown construction. The Renewal Corporation will bypass reservoir inflows through the powerhouse turbine generator units 1 and 2, which provide a combined discharge capacity of 3,000 cfs (PacifiCorp, 2016).

3.1.2 Reservoir Drawdown

The Renewal Corporation will maintain the lowered Copco No. 1 Reservoir level implemented for pre-drawdown construction until drawdown begins on or around January 1 of the drawdown year, depending on the water year. The proposed drawdown operation at Copco No. 1 will be governed by two main events: opening the low-level outlet for primary reservoir lowering, and subsequently opening the historic diversion tunnel to divert flows around the dam and facilitate dam removal works.

The low-level outlet is an uncontrolled hydraulic structure and drawdown rates as well as the overall drawdown period will depend on the reservoir inflow rates during the drawdown period. Partial reservoir refilling can occur due to large inflow events that exceed outlet capacity.

3.1.2.1 Low-Level Outlet Opening

The Renewal Corporation will commence drawdown on or about January 1 of the drawdown year, depending on the water year, when the low-level outlet is opened to the reservoir. The

outlet will be opened through precision blasting of the concrete plug left in place during the pre-drawdown tunnel excavation works. The low-level outlet is designed to lower the reservoir without addition of power operations. A dam stability evaluation of the low-level outlet indicated that stresses due to the potential failure modes (PFMs) (PacifiCorp, 2015) loads and loading condition will be similarly low to those identified by the stability analysis with the current dam arrangement, and little or no damage to the dam is expected during PFM conditions.

The Renewal Corporation will install an earthfill apron to protect the outlet conduit, allowing access to the existing spillway face during drawdown and diversion. The earthfill apron is designed for the greater of the surface loads resulting from the impact of concrete rubble falling from the dam crest during dam demolition and the traffic load imposed by construction vehicles. The Renewal Corporation will install an erosion protection lining to protect the earthfill apron. This rigid apron is designed for the dynamic pressures caused by the resulting stresses from the high-velocity flow impacting the apron from the stepped chute and for uplift forces acting on the concrete apron caused by the high-velocity flow over the apron.

3.1.2.2 Historic Diversion Tunnel Opening

The Renewal Corporation will complete opening of the historic diversion tunnel when reservoir water surface elevations have subsided to 2,530 ft or lower. The initial step is to remove the concrete inlet structure, followed by removal of the concrete plug. Re-establishing flow in the historic diversion tunnel results in the lowering of water levels to at or below the historic cofferdam crest elevation (2,515 ft), thereby routing river flows around the dam site and facilitating dam demolition and removal. The additional diversion capacity will also reduce the risk of reservoir refilling during the dam removal period.

3.1.3 Dam Removal

The demolition and dam removal work at Copco No. 1 includes removal of the dam, water conveyance, powerhouse, and electrical infrastructure. It also involves establishing the final river channel for volitional fish passage through the former dam and reservoir inundation area.

The Renewal Corporation will remove the concrete dam after the historic diversion channel is reopened, Klamath River flows are routed, and the reservoir is substantially lowered (2,515 ft or lower). Concrete removal methods include mechanical demolition, drilling, and controlled blasting to break up and remove concrete in lifts from the top down. The top-down concrete removal will allow the Renewal Corporation to remove the dam while the work platform level remains above the 5% probable flood level. Dam concrete will be removed to establish a long-term volitional fish passage channel through the former dam footprint. The Renewal Corporation proposes to remove the concrete foundation in August or September (depending on the water year) when river flows will be at seasonal lows. Bypass of inflows through the diversion tunnel and seepage reduction at the existing cofferdam will limit the need to dewater the work site once the removal line progresses lower than elevation 2,515 ft. However, the Renewal Corporation will conduct pumping as necessary to keep the work site dewatered if seepage were to occur.

After the Renewal Corporation removes the concrete foundation at the dam site and establishes the final channel downstream, the historic cofferdam will be removed to restore flow through the former dam site. The cofferdam will only be accessible in periods of low flow and will be removed by drilling and blasting during the excavation and grading of the upstream portion of the river channel. Following removal of the concrete dam and foundation concrete, including the historic cofferdam and diversion tunnel inlet structure, the Renewal Corporation will permanently block the diversion tunnel by backfilling and burying the inlet and outlet portals with earthfill barriers. Blocking the diversion tunnel will prevent access and the possibility of Klamath River flows passing through the historic tunnel. The portal barriers will be comprised of compacted earthfill with sufficient length to satisfy the allowable hydraulic gradient to prevent piping and downstream erosion of the tunnel plug and impermeable erosion protection concrete plug. The outlet portal plug is designed with a filter layer at the base to allow drainage and prevent hydrostatic pressure build-up.

3.2 Copco No. 2

3.2.1 Pre-Drawdown

Pre-drawdown works at Copco No. 2 utilize the existing diversion dam structure to pass river flows and avoid the use of cofferdams or the need to develop new large structures in the river channel. The base-case design involves removing a portion of a spillway bay and preparing the remaining concrete plug for initiation of drawdown. After drawdown, the dam will be progressively removed laterally.

The Renewal Corporation is considering an option that involves using Copco No. 1 to fully dewater the Copco No. 2 Reservoir, which allows for total dam removal without the need for staged diversion and removal. Construction activities will proceed directly to removal of the entire concrete diversion dam and a portion of the intake structure during the pre-drawdown year.

Pre-Drawdown works include removing the downstream portion of the left-most spillway bay (Spillway Bay No. 1). The Renewal Corporation will remove this concrete while the Copco No. 2 powerhouse remains in service. Concrete removal for Pre-Drawdown will extend down to the concrete apron and will remove all concrete except for the upstream 17 ft of the ogee spillway, which will be left in place as a concrete plug. A structural analysis was completed to confirm the concrete plug is adequate to keep the facility in compliance with applicable stability requirements.

3.2.2 Reservoir Drawdown

Copco No. 2 drawdown will not be initiated prior to January 1 of the drawdown year. The Renewal Corporation will initiate drawdown of the reservoir by opening the spillway gates and increasing the flow through the conveyance system to the powerhouse. Drawdown below the spillway crest can be completed entirely through the intake, provided inflows to Copco No. 2 are not substantially higher than average (2,000 cfs) during the drawdown period. By using the

conveyance system to lower the reservoir, removal of the final 17 ft of dam at Spillway Bay No. 1 can occur under a lower head.

The Renewal Corporation can remove the Spillway Bay No. 1 concrete plug to elevation 2,459.5 ft through a controlled blast or by mechanical methods. The intake caterpillar gate will be closed permanently after Spillway Bay No. 1 is opened and the reservoir level can then become limited by constriction at the spillway bay.

3.2.3 Dam Removal

The Renewal Corporation will complete demolition and dam removal works at Copco No. 2 with the river flowing through the removed Spillway Bay No. 1. The Renewal Corporation will construct a temporary work platform to elevation 2,465.0 ft on the spillway apron to elevate construction equipment above the river diversion flow level. Thde Renewal Corporation will remove concrete down to elevation 2,453.5 ft. The excavation will remove the spillway apron, remaining ogee crest, both abutment wing walls, and part of the intake structure.

The Renewal Corporation will complete removal of the historic cofferdam upstream of the Copco No. 2 Dam during the low-flow summer period. An excavator will traverse the river from the right bank and notch out a portion of the left bank side of the historic cofferdam at a natural low point in the riverbed to provide an alternative flow path for river flow. This allows for the current opening to be backfilled to facilitate construction equipment access for the removal of the entire cofferdam. The Renewal Corporation will drain the Copco No. 2 Reservoir to allow the concrete diversion dam and the historic cofferdam to be removed in the dry as discussed previously.

The Renewal Corporation will partially remove the earthfill embankment with 1.5 horizontal to 1 vertical (1.5H:1V) excavated side slopes. This temporary excavation will be backfilled to the final channel grade. The Renewal Corporation will permanently leave in place the portion of the earthfill embankment and gunite wall that is not within the footprint of the temporary excavation. Removal of ancillary facilities (e.g., conveyance structures, penstocks, electrical components, Copco No. 2 village components) can begin after drawdown, when the caterpillar gate is permanently closed and the conveyance system is isolated from the river. Conveyance tunnels portal openings must be permanently closed after removal of the water conveyance infrastructure. The Renewal Corporation will backfill the channel banks with a combination of Erosion Protection material and ‘Riverbed Material’ as described in the design (Knight Piésold, 2020b) and Reservoir Area Management Subplan.

3.3 Iron Gate

3.3.1 Pre-Drawdown

Pre-drawdown works at Iron Gate will involve developing access to the low-level outlet, installing a new concrete liner system in a portion of the tunnel, and installing an air vent. Access to the tunnel outlet is required during the pre-drawdown construction works period to install the concrete liner and tunnel ventilation. The Renewal Corporation will develop two access routes for this purpose: the left bank access road and the right bank access road.

The Renewal Corporation will use the existing diversion tunnel reinforced concrete bulkhead control gate as the main drawdown control mechanism. The Renewal Corporation will perform testing and recommissioning of the gate during pre-drawdown works. Pre-drawdown operation and testing is also required to confirm that the hoist system can be used to achieve the full open condition of the control gate, which will be needed during drawdown.

Downstream tunnel modifications are required to facilitate safe discharge and maintain the tunnel's structural integrity during drawdown operations (e.g., new reinforced concrete liner, new vent pipes, specific existing tunnel component removal). During the pre-drawdown construction period, PacifiCorp will operate the Iron Gate facility at minimum levels (elevation 2,327.3 ft) by directing maximum flows through the powerhouse.

3.3.2 Reservoir Drawdown

The Renewal Corporation will commence drawdown operations at Iron Gate on or about January 1 of the drawdown year, depending on water year, and drawdown will continue concurrently with embankment removal until water levels are low enough to initiate the final controlled dam breach. The Renewal Corporation will initiate drawdown of the reservoir by opening the existing outlet control gate to its maximum opening height of 57 inches. The maximum outflow rate, at full reservoir with the control gate fully open, is estimated to be 4,000 cfs and the flow rate will decrease as the reservoir level lowers. The gate will remain fully open for the period of reservoir drawdown. The upgraded tunnel concrete liner will provide erosion protection to safely pass outflows throughout drawdown and dam removal. The Renewal Corporation determined use of the existing gate in the fully open position to be an acceptable drawdown method. The Renewal Corporation considered reservoir rim and embankment stability, downstream erosion, and tunnel integrity in making this determination.

3.3.3 Dam Removal

Demolition and removal work at Iron Gate will involve the decommissioning and removal of the dam and all facility components. The subsections below detail proposed deconstruction activities. After reservoir water levels have been lowered, the Renewal Corporation will remove the embankment dam at a rate that will provide a required 3 ft of freeboard on the monthly 1% probable flood event until the extended work platform at the upstream toe of the dam is established. The design freeboard will then be based on 3 ft above the monthly 5% probable flood event until the controlled breach is prepared and implemented. The final breach will occur when the reservoir level corresponds to expected average monthly flows. The planned controlled breach avoids downstream flood impacts and public risk.

The Renewal Corporation anticipates that flow rates in the Klamath River will decrease (normal hydrologic cycle) through the dam removal period, which will result in the lowest possible reservoir levels occurring around the time of the final dam breach (August/September). The remaining embankment will be notched and progressively removed by conventional excavation to provide a controlled upstream cofferdam breach section and canal section and allow release of the remaining small reservoir. Embankment, cofferdam, and temporary access roads/work

platform removal will involve removing earthfill to the designed elevation, channel width, and grade.

The Renewal Corporation will use the power intake to assist with reservoir drawdown using the existing turbines or bypass valve. Removal of the power intake structure will happen concurrently with the embankment removal when the appropriate embankment elevation has been reached. Following drawdown, the Renewal Corporation will remove the embankment while the control gate is in the open position. The portion of the gate shaft extending above bedrock will be removed in a sequence that facilitates the final closure of the diversion tunnel following dam breach. Removal of ancillary facilities (e.g., powerhouse facilities, electrical components) can occur at any point during the drawdown year after the water conveyance system has been isolated and drained.

3.4 Bank Stabilization

Refer to the Reservoir Area Management Subplan for information regarding bank stabilization.

3.5 Potential Slope Instability

3.5.1 Areas of Potential Instability

Stability analyses were conducted for each of the facilities to evaluate the safety of the existing dams and if dam modifications result in an unacceptable structural response and risk (Knight Piésold, 2020b). Analyses focused on the PFMs related to the main dam sections, where dam modifications could cause adverse effects to the overall stability or structural response of the dams. The slope stability response to drawdown is relevant to two facility components: the dam embankments and the reservoir rims. Stability analyses of the Copco No. 1 concrete dam, during excavation of the low-level outlet and when there is no impoundment, is not unstable and no monitoring is required. Monitoring of the dam earthfill embankments is proposed for the following facilities:

- Copco No. 2 Dam Embankment: upstream face and crest of the dam; and
- Iron Gate Dam Embankment: upstream face and crest of the dam.

Results from the reservoir rim terrain and slope stability analyses (Knight Piésold, 2020a) suggest a tiered monitoring approach will best address the size of the limits of work and the short duration of the drawdown period. The primary level of monitoring will provide coverage to the areas of potential instability. A secondary level of monitoring will provide greater data resolution of the following identified potential areas of instability, which were selected based on their proximity to private properties and roads or a potential for impeding flow. These areas are displayed on Figures 2-1 and 2-2.

- Copco No.1 Reservoir:
    - Segments S5, S11a, S12b, and S23 where private properties and existing residential dwellings are located.

  - Segments N2, N5, N7, N10, and N11 where potential slope instability impacts to roads were identified.
  - Segment S1 and the canyon portion of the reservoir rim immediately upstream of the dam where the valley floor is narrow and instability could potentially result in constricted flow.
- Iron Gate Reservoir:
  - Locations I11, I12a, I12b, and I23 where possible landslides were identified between the road and the reservoir rim and cracks were identified on the road pavement.
  - Locations I1, I5, and I7 where previous slope instability was identified at the reservoir rim down slope from Copco Road.
  - Locations I17 and I19 where slope angles show the possibility of slope instability related to the drawdown and where instability could potentially constrict flow due to the narrow valley floor.

3.5.2 Proposed Measures

If instability issues are confirmed in these areas, the Renewal Corporation will implement the following measures:

1. Slope monitoring;
2. Installation of retaining walls;
3. Installation of buttresses; and/or
4. Local re-routing of Copco Road.

Additionally, with the consent of an affected property owner, the Renewal Corporation could temporarily relocate residents until slope stability conditions are resolved.

3.6 Roads

Improvements to existing roads and development of new temporary access routes are required to support Proposed Action construction activities, both to improve access safety and to facilitate movement of construction equipment and traffic. Additional details regarding road improvement and maintenance are included in the Traffic Management Plans. The Renewal Corporation proposes additional monitoring of areas of potential slope instability, as discussed in Section 6.

3.7 Borrow and Disposal Areas

Borrow and disposal areas are required for construction of the Proposed Action. Borrow and disposal sites are designed and developed with stable permanent slopes and suitable drainage requirements (best management practices [BMPs]). The Renewal Corporation will place material in the disposal site in layers, track-walk the material, and grade it with a bulldozer. The Renewal Corporation will grade the disposal sites to promote surface drainage. The Renewal Corporation will visually monitor slopes during construction and excavation works and modify them as needed based on an observational approach, as described in the Erosion and Sediment Control Plan and the California Waste Disposal Plan.

4.0 Management Plan Updates

If additional risk areas are encountered, the Renewal Corporation will revise the monitoring procedures. The Renewal Corporation will document this review and associated amendments to the plan in the log in Attachment A.

5.0 Pre-Drawdown Phase

The existing monitoring program for the dams and embankments will continue to be conducted up to the drawdown period. Section 5 discusses the monitoring and inspection procedures that PacifiCorp implements and will allow the Proposed Action to maintain compliance with ongoing monitoring during pre-drawdown. These measures are consistent with what is currently taking place at the structures (e.g., consistent with the requirements of the STIDs for each applicable structure). The schedule for this phase is also included.

5.1 Schedule of Events

Pre-drawdown construction activities will occur prior to January 1 of the drawdown year, depending on the water year. The pre-drawdown period is proposed to occur over the following timeframes for each of the identified areas:

- Project-wide (Fall Creek construction, road/bridge improvements, recreation area demolition) – Late June through the end of December of the year preceding drawdown.
- Copco No. 1 (site preparation/erosion control, upstream and downstream work, including low-level outlet construction and local dredging) – Mid-July through mid-December of the year preceding drawdown.
- Copco No. 2 (access work/erosion control; partial spillway, coffer dam, and dam removal/alternative removal option) – Mid-July through mid-October of the year preceding drawdown.
- Iron Gate (access work/erosion control, tunnel lining) – Mid-July through mid-December of the year preceding drawdown.

5.1.1 Erosion Protection

The Renewal Corporation will conduct construction and removal works required for the Proposed Action in a manner that provides environmental protection and BMPs for erosion and sediment control as outlined in the California Stormwater Pollution Prevention Plan. In general, the Renewal Corporation will restore areas disturbed by construction of the Proposed Action components to final lines and grades as soon as practical. The Renewal Corporation will install erosion protection at various locations throughout the limits of work (e.g., river channels, scour hole, volitional fish passage channels, Copco No. 1 diversion tunnel erosion protection plug). The hydraulics of final channels were modeled to determine the design parameters for the required slope erosion protection and to determine the size and thickness of erosion protection, as specified in the design (Knight Piésold, 2020b).

5.2 Monitoring Procedures and Frequency

This Section 5.2 is included for information only. It describes monitoring procedures under the existing Federal Energy Regulatory Commission License.

Each dam is inspected on a daily, weekly, monthly, and annual basis, and after unusual events such as earthquakes or high flow events, as outlined in the STIDs for each facility. Under the terms of the transferred License, PacifiCorp under the Operations and Maintenance Agreement will continue to conduct monitoring under normal operations during the pre-drawdown phase. Daily and weekly inspections are performed by PacifiCorp Operations personnel that live locally and have developed a familiarity with the Project based on daily visits as part of their normal duties and per FERC requirements. Annual inspections are performed by the PacifiCorp Dam Safety Engineering staff with the assistance of PacifiCorp Operations personnel. Dam specific monitoring information is included below.

5.2.1 Copco No. 1 and Copco No. 2 Dams

PacifiCorp Operations personnel are present in the Copco No. 1 and Copco No. 2 dam facility areas on an eight hour per day, seven day per week basis. There are four Operations personnel stationed at the Copco No. 2 facility that rove between the Copco No. 1, Copco No. 2, Iron Gate, and Fall Creek facilities. Operations personnel live nearby at Copco No. 2, Iron Gate, and Fall Creek and are available to respond for local control on short notice. When not staffed, the response time to the Project is approximately 20 minutes by the first responder, and up to an additional 1.5 hours if support staff are needed to assist the first responder. All personnel involved in the surveillance and monitoring program for Copco No. 1 Dam must understand the DSSMP included in the STID for the facility (PacifiCorp, 2016). It should be noted that Copco No. 2 is a low-hazard dam, and does not require PFMA or many of the other requirements of the other dam STIDs. Therefore, their STID is limited to a Hydro Plant Overview to assist staff in meeting the requirements of the Copco No. 2 Hydro Plant Operator Training (PacifiCorp, 2007).

The Copco No. 1 Reservoir level is monitored from the Hydro Control Center (HCC) at Merwin. Daily routine checks are made at the plant. During periods of flood operation requiring the Iron Gate discharge water to overflow its fixed crest spillway, any changes to the discharge at Copco No.1 directly influence the discharge from Iron Gate Dam. Under these conditions, the discharge at Copco No.1 becomes the control for discharge levels downstream of Iron Gate Dam, and is closely monitored to verify compliance with license requirements for up-ramp and down-ramp of the Klamath River below Iron Gate Dam.

Similar to Iron Gate, the Copco No. 2 Dam (combination of embankment and concrete diversion structure) is visually inspected for cracking, seepage, and excess vegetation. Copco No.1 and Copco No. 2 facilities are also inspected following a flood event or an earthquake of magnitude greater than 5.0 and within 50 miles of the dam, in accordance with the DSSMP. On a periodic basis (annual if possible) operations personnel inspect reservoir shorelines to identify woody debris or other deleterious material that could pose a potential risk to dam safety.

5.2.2 Iron Gate Dam

PacifiCorp Operations personnel are present at the Iron Gate Dam on an eight hour per day, seven day per week basis. Operations personnel conduct inspections and document their observations on the following:

- Daily Logs and Check Lists;
- Weekly/Monthly Inspection Check Lists;
- Annual Engineering Inspection Check Sheet;

Examples of these forms are included in Appendix B. In addition to the above, inspections are conducted after earthquake or high flow events. All personnel involved in the surveillance and monitoring program for the Iron Gate Dam must understand their respective Dam Safety Surveillance and Monitoring Plans (DSSMPs) included in the STIDs for the facility (PacifiCorp, 2015). Procedures for daily, weekly, annual, and event-driven inspections are described in the following subsections.

5.2.2.1 Daily Surveillance

Visual monitoring is the most critical component of the surveillance and monitoring plan. Visual surveillance is essential to providing complete coverage of facility features and identifying changed conditions. Facilities are inspected on a daily basis for changes from the previous day. Reservoirs are inspected for signs of shoreline instability and debris accumulating on the embankment dams and intake screens for the penstocks. Embankments and downstream slopes are inspected for settlement or misalignment, cracking, erosion, sinkholes, new seepage locations, animal burrows, loss of material, and vegetation. The condition of the upstream slopes riprap, and any riprap loss or beaching is recorded. Additional monitoring will also be included as described further in the dam-specific DSSMP.

In the event there is an observation that is judged to be outside of the usual, a copy of the inspection check sheet is reviewed by PacifiCorp's Dam Safety Engineer within 24 hours of receipt.

5.2.2.2 Weekly and Monthly Surveillance and Monitoring

As outlined in the STIDs, weekly surveillance, in addition to the daily surveillance items, are included on the one page Weekly/Monthly Inspection Check List. One weekly check list is sent to PacifiCorp's Dam Safety Engineer as the monthly inspection.

For Iron Gate, the water level, water temperature, and Secchi disk reading in Manhole #3, at the toe of the embankment, are recorded on a monthly basis. The water level is measured by a weighted tape, and changes in turbidity are measured using the Secchi tube. This data is used to evaluate potential changes in seepage through the embankment. Turbidity and temperature measurements at Manhole #3 are compared to the reservoir and tailrace to determine if there is a correlation to either or both. If seepage from the toe drain is carrying sediment from the dam, the Secchi tube readings from the manhole are expected to be higher than from the reservoir or tailrace.

5.2.2.3 Annual Surveillance and Monitoring

Annual Engineering Inspections (AEI) are performed by PacifiCorp's Dam Safety Engineer. The AEIs include a visual inspection of all facility features; a review of the monitoring and instrumentation (i.e., survey monuments; water level, temperature, and turbidity gauges; weir) data for the last year; confirmation of records retained by Operations personnel for their inspections; and a check of Dam Safety Surveillance and Monitoring documents, STIDs, and Emergency Action Plans (EAPs) retained at the respective powerhouses for completeness and the most recent revision. The AEI is typically scheduled approximately two weeks ahead of the FERC annual Dam Safety Inspection (DSI). All weekly inspection items are included in the AEI as well as additional, more detailed information on all major components of each facility.

As part of annual surveillance, reservoir shorelines are evaluated for the potential for instability and checked for debris accumulation against the water retaining structures. The tailrace is inspected for erosion, back cutting, sloughing, or obstructions. The embankment crest, upstream slope, and downstream slope are inspected for settlement, misalignment, cracking, erosion, sinkholes, brush and vegetation, seepage, unusual green areas, and animal burrows. The condition of the riprap and accumulation of debris are also noted, and the toe is inspected for seepage and cloudy water downstream of the dam and fish ladder.

Existing surveillance monitoring monuments have been installed at select locations within the limits of work to compare slope erosion and displacement. Consistent with current operations, elevation measurements will also be collected for each structure during the pre-drawdown phase to evaluate horizontal and vertical movement. These survey readings are collected by a licensed professional surveyor under the direction of PacifiCorp's Dam Safety Engineer. Readings for Iron Gate include five survey monuments located on the crest of the dam, two monuments on each gate shaft, and two control points set in rock above the side channel spillway and about 100 ft uphill on the east side of the dam. These monuments are surveyed using a Global Positioning System (GPS) to calculate vertical and horizontal movements of each monument relative to previously established baseline locations. The Surveyor forwards the results of the survey directly to the Dam Safety Engineer in the Portland offices of PacifiCorp. The survey data is reviewed by the Dam Safety Engineer for completeness and suitability. The format of the survey data provided allows review without additional processing. Time history plots of the vertical and horizontal movements are created by the Dam Safety Engineer and are presented in the DSSMP. Additional information on the procedures currently followed for surveillance monitoring and data review are included in the STIDs.

5.2.2.4 Inspections and Procedures after Unusual Events

Unusual events that trigger inspections include earthquakes and floods/high flow events. Earthquakes that specifically trigger inspections include those of magnitude greater than 5.0 and within 50 miles of the dam, if ground shaking is felt by Operations personnel at the site, or as directed by PacifiCorp's Dam Safety Engineer. High flow events are defined as periods when the reservoir level exceeds elevation 2,331.0 for Iron Gate Reservoir. Reservoir levels are continuously monitored through the powerhouse control room and HCC at Merwin Dam on the Lewis River in Washington. Flows can increase the amount of debris deposited against log

booms and other components during these events. Erosion, back cutting, sloughing, or obstruction in the spillway or tailrace channels might occur. Special attention to these areas is included in the surveillance of the facility during or after high flow events.

Unusual event inspections follow the procedures for annual inspections and the Annual Engineering Inspection Check Sheet in Appendix B is completed, with “Other” as the reason circled, and the event that necessitated the unusual inspection recorded on the sheet. A copy of these inspection check sheets is filed in the respective powerhouse control room and a copy is sent to the PacifiCorp Chief Dam Safety Engineer for review and eventual inclusion in the DSSMR. It may be necessary to use the diversion tunnel to pass large floods if the threshold elevation is reached at the Iron Gate Reservoir, or to act as a low level outlet to dewater the reservoir.

In the event visual observations or instrument readings indicate a changed condition or is above an Action Level or Threshold Value (refer to Section 10.1), the PacifiCorp Chief Dam Safety Engineer is notified immediately. The PacifiCorp Chief Dam Safety Engineer will determine, based on an event-specific review, if measurement of the survey monuments will be conducted after an unusual observation.

6.0 Active Drawdown and Dam Removal Phase

Section 6 discusses monitoring and inspection procedures that the Renewal Corporation will implement once drawdown commences. The schedule for this phase is also included. Additional details related to drawdown procedures are included in the California Reservoir Drawdown and Diversion Plan.

6.1 Monitoring Measures

The Renewal Corporation will undertake stability monitoring for the earthen embankment structures and reservoir rim during drawdown. The Renewal Corporation will monitor the Copco No. 1, Copco No. 2, and Iron Gate dams during drawdown for evidence of impending embankment instability. Monitoring includes daily visual observations of the upstream slope for signs of instability such as cracking or slumping. The Renewal Corporation will select monitoring techniques and frequencies based on FERC requirements and the proposed drawdown sequencing and staging.

6.2 Schedule of Events

Drawdown of the primary reservoirs (i.e., Copco No. 1 and Iron Gate) is proposed to take place from January 1 through June 15 (dependent on the water year), and completion of Copco No. 2 by May 1 in the year following the initiation of drawdown (i.e., within approximately six months of drawdown initiation). The specific schedule for the drawdown and removal of each dam is further described below, with supporting information provided for informational purposes.

6.2.1 Copco No. 1 Dam

Drawdown for the Copco No. 1 Reservoir begins on or around January 1 of the drawdown year, dependent on the water year. Operation of the reservoir during drawdown will achieve successful evacuation of the reservoir impoundment, and the Renewal Corporation will provide failure protection for the selected flood events. Discharges during the drawdown stages will occur through the newly constructed low-level outlet, exiting historic diversion tunnel, and spillway releases. During the operation of the diversion tunnel in the summer months, the discharges and flow depth conditions will cause lower critical shear stress indicating that there will be little or no scouring as the channel equilibrium will be reached during operation of the low-level outlet. Large bed load material movement causing potential blockages is not expected.

A drawdown model was used to assess the drawdown sequencing in terms of reservoir water surface levels under a range of hydrologic conditions. These assessments were performed to provide the magnitude and timing of expected reservoir water surface elevations, inflows, and outflows, which were important for the design and staging of drawdown. Drawdown modeling for Copco No. 1 indicates the following:

- Approximately 80% of the simulations drawdown to a water surface elevation of approximately 2,520 ft in June/July (dependent on the water year), which is the lowest water surface elevation achievable using the low-level outlet prior to the historic diversion tunnel opening. However, the reservoir refills in the higher flow months of February through May, and there can be large fluctuations in the reservoir water surface levels from March through June.
- The model currently shows the historic diversion tunnel opens after June 15 (dependent on the water year), once the reservoir water surface elevation is at or below 2,530 ft. Overall, simulations have reservoir water levels below the 2,530 ft (dependent on the water year):
    - Approximately 50% by June 1;
    - Approximately 30% as early as May 1; and
    - An anticipated 100% by the end of June.
- Drawdown is achieved when the water surface elevation is maintained below the crest of the historic diversion dam (2,515 ft) and can only be achieved after the historic diversion tunnel is opened. Approximately 80% of the simulations have reservoir water surface elevations sustained below the crest of the historic diversion dam within a few days (June 19-dependent on the water year) of the historic diversion tunnel opening on June 15 (dependent on the water year), with 100% of the simulations achieving this by July 2 (dependent on the water year).

Copco No. 1 Dam removal activities are anticipated to start in the Spring of the year drawdown is completed. Site setup and dam, powerhouse and penstock, and electrical transmission/distribution equipment removal will take place over an approximate 7-month period. Additional detail regarding removal dates for specific dam components is included in the design (Knight Piésold, 2020b).

6.2.2 Copco No. 2 Dam

The Renewal Corporation will initiate drawdown for the Copco No. 2 Reservoir by removing Spillway Bay No. 1 in January of the drawdown year (dependent on the water year). Operation of the reservoir during drawdown and post-drawdown will achieve successful evacuation of the reservoir impoundment. Copco No. 2 is operated as a run-of-river facility with minimal storage volume; therefore, evacuation of the reservoir will occur quickly. During drawdown, the behavior of the reservoir will reflect upstream conditions, particularly conditions at Copco No. 1.

The historic diversion dam located within the Copco No. 2 Reservoir controls water surface levels upstream of the dam during low flows. The historic diversion dam is anticipated to be porous given the original wood facing has deteriorated, which will ultimately lower the water surface elevations further.

Reservoir water surface levels were simulated in a drawdown model. The simulated water surface levels indicate there is a reduction in the reservoir water levels in mid-June (dependent on the water year), with the majority of the simulated years achieving sustained low level water levels by the end of July (dependent on the water year). Lower reservoir levels will be sustained after July 1 depending on the hydrologic conditions and when the Copco No. 1 historic diversion tunnel is opened. The post-drawdown water surface levels 100 ft upstream of the dam face are within the range of 2466.0 ft to 2469.5 ft for all of the drawdown model simulations.

There will be varying levels of scour potential immediately upstream of the outlet structures during the drawdown operation. It is anticipated that the flow will have the potential to scour and mobilize large cobbles (5 to 10 inches) throughout the reservoir area, and for localized zones, the potential to mobilize medium to large boulders (20 to 35 inches). Given the 26-ft opening of Spillway Bay No. 1, blockage from mobilized bed material is not anticipated.

As identified in Section 5.1, Copco No. 2 Dam removal activities are anticipated to occur during the year prior to drawdown. Associated powerhouse, penstocks, and electrical transmission/distribution equipment removal will start in the Spring of the year drawdown is completed, and be accomplished over an approximate 4-month period. Additional detail regarding removal dates for specific dam components is included in the design report (Knight Piésold, 2020b).

6.2.3 Iron Gate Dam

The Renewal Corporation will complete drawdown for the Iron Gate Reservoir on or around January 1 of the drawdown year (dependent on the water year) using the spillway, power intake and turbine/bypass, and the existing outlet control gate in the diversion tunnel. Drawdown modeling indicates reservoir drawdown is achieved in June (dependent on the water year); however, the reservoir refills in the higher flow months of February through May (dependent on the water year). There can be large fluctuations in the reservoir water surface levels, but the modeling indicates approximately 40% of the simulations have reservoir water levels sustained below the crest of the historic cofferdam by June 1 (dependent on the water year), with 100% of the simulations by July 7 (dependent on the water year). River diversion is achieved when the

diversion tunnel is free flowing, and open channel flow conditions exist when no reservoir is present on the upstream side of the diversion inlet (i.e., outflows are roughly equal to inflows).

The Renewal Corporation will perform removal of the embankment dam at Iron Gate in stages so that stability will equal or exceed current condition (i.e., as included in the STID). This will be achieved by:

- Basing dam removal stages on removal with horizontal lifts;
- Making upstream and downstream slopes equal to or shallower than those existing; and
- Making the crest width buttressing the impervious core zone material equal to or wider than the current dam crest.

The removal sequence is governed by the applicable flood probability and need to maintain a 3-ft freeboard for the associated flood level. The dam crest is progressively lowered in the final stage to a target elevation of the Extended Cofferdam, which is estimated to occur between July and September (dependent on the water year). The flows in this period are typically low and peak floods are primarily driven by controllable releases at the Upper Klamath Lake. The Renewal Corporation will remove the dam embankment, and restore the river channel, by excavating the existing embankment to form temporary and permanent slopes. Excavated slopes are designed to be stable with suitable drainage. The Renewal Corporation will excavate to bedrock areas where excavated slopes within the dam footprint cannot be considered stable in the long term due to the valley geometry.

The final controlled cofferdam breach will occur during the late summer low-flow period, allowing for the lowest possible reservoir levels at the time of the actual breach. The release of water during the final breach will result in a pulse of water propagating through the downstream river network. The criteria is to limit the peak discharge of the pulse to a maximum of 6,000 cfs. This maximum flow will keep the river flow within its banks downstream. The final dam breach is controlled through application of engineering measures including grouting and riprapping of critical sections.

Iron Gate Dam removal activities are anticipated to start in the Spring of the year drawdown is completed. Site setup and embankment, powerhouse/penstock/fish facility, and electrical transmission/distribution equipment removal will take place over an approximate 9-month period.

6.3 Monitoring Procedures and Frequency

The Renewal Corporation will monitor slope stability during the active drawdown and dam removal phase, and following storm events, for changes in ground conditions, changes in displacement of the ground surface, and changes in the reservoir level. The Renewal Corporation will conduct daily, weekly, and monthly monitoring during active drawdown and dam removal.

6.3.1 Remote Sensing Technology

The Renewal Corporation will monitor daily displacements of the ground surface (reservoir rims and embankments) during the drawdown period by remote-sensing technologies (radar and/or LiDAR). Surface displacement monitoring by remote-sensing technologies provides the greatest spatial coverage for daily evaluation of the response to reservoir drawdown in the form of differential displacement maps between scans. Data acquisition will be airborne and ground-based at Copco No. 1 Reservoir. The Renewal Corporation will assess daily monitoring after data acquisition/download and report any variations indicating potential displacement reported to the Engineer of Record (EoR).

6.3.2 Visual Inspections

Similar to the pre-drawdown phase, the Renewal Corporation will visually inspect dam embankments (upstream face and crest) daily for signs of slope instability. Visual inspection locations may be restricted due to safety concerns and challenges from gaining site access, and the Renewal Corporation will adjust these locations to achieve the best vantage point for inspection. The Renewal Corporation will initially use established site access as its first course of action for inspection, when possible. If not possible, the Renewal Corporation will use remote monitoring. Due to safety concerns, some areas on private property may not be accessible for inspection.

6.3.3 Surveillance Monuments

The Renewal Corporation will use existing survey monuments at the dam embankments, as accessible, during the active drawdown phase until dam removal. The Renewal Corporation will monitor surveys included in the pre-drawdown phase on a weekly basis. Additionally, the Renewal Corporation will establish overall site control through the installation of temporary control points (metal monuments embedded in rock) in locations that will not be impacted by dam removal activities. The Renewal Corporation will establish permanent monuments on the rock abutments on either side of the dam, as needed.

6.3.4 Other Monitoring

The Renewal Corporation will monitor reservoirs by level sensors and stream gauges during drawdown. Once reservoirs drop below the normal operating range, water level gauges will no longer be operational. The Renewal Corporation will continue to collect water level and turbidity readings at Manhole #3 during drawdown, at the toe of the Iron Gate Dam, as an indicator of changes in seepage through the embankment. Turbidity in the water might be an indication of seepage erosion occurring through the core. Operators will continue to take Secchi tube readings from the reservoir, powerhouse tailrace, and Manhole #3 during drawdown. The manhole will also be removed as the dam is demolished. The United States Geological Survey (USGS) Klamath River stream gauge monitoring requirements are included in the California Water Quality Monitoring Plan.

The Renewal Corporation will perform daily checks of the dam, monitor water levels, and coordinate with the Bureau of Reclamation with respect to potential storm events. Downstream

flows will be estimated to provide adequate response time to implement the contingency measures discussed in Section 6.4.

6.3.5 Bank Stability Monitoring

Refer to the Reservoir Area Management Subplan for information regarding bank stability monitoring.

6.4 Contingency Measures

Section 10 and Appendix D proposes measures for responding to various emergency situations. Potential emergency situations should follow the lines of communication established in the Emergency Response Plan for the Proposed Action. Specific adaptive actions for implementation during drawdown and removal of the reservoirs are described below.

If excess flows are identified during drawdown of the Iron Gate Reservoir, the Renewal Corporation will continue to use the spillway as a fail-safe to accommodate overflow situations. If water levels rise, excess flows will go over the existing spillway. During post-drawdown dam demolition, and dependent on the water year conditions, the Renewal Corporation can notch a portion of the dam to act as a temporary spillway to accommodate raised water levels. The Renewal Corporation will use either a liner or riprap for this potential notched temporary spillway to prevent erosion and protect the core of the dam from instability.

If excess flows are identified during drawdown of the Copco No. 1 and No. 2 Reservoirs, the Renewal Corporation will continue to use the spillway as a fail-safe for overflow situations. During post-drawdown dam demolition, and dependent on the water year conditions, the Renewal Corporation can vacate the site during excess flow conditions. Water will spill over the dam wherever things stand at that point in the removal. The Renewal Corporation will continue dam removal activities once conditions return to a safe and normal flow situation.

After reservoir water levels have been lowered, the Renewal Corporation will remove embankment dams at a rate that will provide a required 3 ft of freeboard on the monthly or semi-monthly 1% probable flood event to maintain safety, up to the point of breach then the 5% probable flood event will govern safety requirements. The Renewal Corporation will implement the above fail-safe measures once adverse conditions are observed.

7.0 Post-Drawdown Phase

Post-drawdown stability monitoring following removal of the dam (e.g., river banks) is addressed by the Erosion and Sediment Control Plan and Reservoir Area Management Plan.

8.0 Equipment Maintenance Program

Section 8 describes measures for maintenance of the monitoring equipment, types of maintenance requirements, and schedule/frequency for monitoring and maintenance activities. The Renewal Corporation will monitor to determine maintenance needs and maintain the desired condition. The Renewal Corporation's maintenance program will address such items as potential structure and channel adjustments that may occur preceding, during, and following Proposed Action implementation.

8.1 Survey Monuments

Per the STID for Iron Gate, survey monuments are permanent, and waterproof covers have been installed. The weatherproof caps protect the monuments and, therefore, require little maintenance. The Renewal Corporation will protect survey monuments from movement or damage from vehicles or other equipment traversing the crests.

8.2 Remote Sensing Technology

The service provider selected to conduct remote sensing inspections will maintain their equipment. The Renewal Corporation will establish specific maintenance procedures with the selected service provider.

8.3 Other Instrumentation

Continuous measurements of reservoir levels are made by level sensors. Level sensors located at each powerhouse continuously monitors tailrace rate of change levels. The reservoirs have a fixed gauge allowing a comparison of the water levels measured by the instruments with the levels indicated on the gauges. Operators or the Foreman make a daily reading of the fixed gauges and these readings are checked against the level readings reported by the instruments. Any significant difference in water level readings between these two measurements initiates work to repair or recalibrate the instruments.

There is not an instrumentation equipment maintenance program for the equipment in Manhole #3 at Iron Gate as the monitoring instrumentation, including the Secchi tube, does not require maintenance.

9.0 Reporting

The STIDs already include reporting with respect to the annual and weekly/monthly inspections. Inspection forms documenting slope stability monitoring, inspection information, and implemented corrective actions are included in Appendix B. The Renewal Corporation will provide reporting with respect to inspections and monitoring conducted during the pre-drawdown phase and active drawdown and dam removal phases, as included below.

9.1 Pre-Drawdown Phase

This Section 9.1 is included for information only.

Under the existing license, surveillance and monitoring of the Dam is currently performed by either the PacifiCorp Operators or Foreman. The Operators and Foreman report directly to the Hydro Production Manager for PacifiCorp's Hydro South area, and all Operations personnel report/interact directly with PacifiCorp's Dam Safety Engineer (PacifiCorp Dam Safety Lead Engineer and/or Chief Dam Safety Engineer) for dam safety-related issues. If an Operations staff member observes a condition that may be a significant dam safety issue, one that might require implementation of the EAP, it is reported immediately to the HCC at Merwin, which monitors PacifiCorp's entire hydroelectric system. The HCC then notifies PacifiCorp, FERC, and other state and local agencies personnel as necessary.

Originals of the completed Iron Gate Dam Weekly/Monthly Check Lists and Daily Logs are kept on file at the Iron Gate powerhouse control room. One weekly inspection check sheet is transmitted directly by the Operator/Foreman to the Dam Safety Engineer once per month, serving as the monthly inspection. It is the responsibility of personnel at each level of responsibility to review the monitoring check sheets and document any observations or comments. After review of completed check sheets by the Dam Safety Engineer, the check sheets are submitted to the PacifiCorp records retention center.

9.2 Active Drawdown and Dam Removal Phase

The Renewal Corporation will complete the same reporting during drawdown and during dam removal as described above. The Renewal Corporation will provide two additional forms of reporting during the active drawdown and dam removal phase. Daily reporting of river flows, reservoir water levels, visual observations, and displacement changes will be provided to the EoR for site response if required, and monthly reporting of the same information will be provided to state agencies.

10.0 Potential Failure Modes

PFMs identified in the PFMA Reports (PacifiCorp, 2015 and 2016) have been used to guide previous stability evaluations and are briefly discussed below. The dams covered under STIDs function as-is until dam demolition is initiated. PFMs will be re-evaluated as part of an upcoming PFMA specifically addressing reservoir drawdown and dam removal.

10.1 Current PFMA Results

Stability analyses of the primary water retaining structures of the Copco No.1 and Iron Gate facilities have been performed and the results are included in their respective STIDs. Brief summaries of relevant results from these analyses as well as identified PFMs from these STIDs are included below for each of the applicable facilities. As stated earlier, Copco No. 2 is a low-hazard dam, and does not require PFMA.

10.1.1 Copco No. 1 Dam

Analyses of the dam were made under two load combinations in 1990 and generally one additional load combinations in 1996 (PacifiCorp, 2016):

- Usual load under normal operating condition – The normal operating level of the reservoir was assumed to be at elevation 2606.0 feet (spillway gates closed).
- Unusual load under probable maximum flood condition – The probable maximum flood reservoir level was assumed to be at elevation 2611.9 feet (spillway gates open).
- Extreme load under seismic condition – The normal operating level of the reservoir was assumed to be at elevation 2606.0 feet (spillway gates closed), with seismic loading.

An assessment of the entire dam foundation was made in order to identify possible areas of overstressing. The foundation was considered structurally acceptable. Failure modes with respect to Copco No. 1 were focused primarily on concrete structures, since no earthfill embankment structures are present. The following PFMs are applicable to the Copco No. 1 rim and associated facilities, and have the ability to potentially impact monitoring requirements in this subplan:

Table 10-1. Potential Failure Modes – Copco No. 1 Reservoir Rim

PFM	PFM DESCRIPTION	2014 CATEGORY	RELATED COMPONENT OF DSSMP
13	Rockfall due to Seismic Event.	IV	Perform an inspection of the abutments and surveillance monument survey for earthquakes of magnitude 5.0 or greater at 50 miles or less from the site.
14A	Rockfall due to Seismic Event Adjacent to Right Abutment of Dam.	II	Perform an inspection of the abutments and surveillance monument survey for earthquakes of magnitude 5.0 or greater at 50 miles or less from the site.
14B	Rockfall due to Seismic Event Adjacent to Exposed Penstocks.	II	Perform an inspection of the abutments and surveillance monument survey for earthquakes of magnitude 5.0 or greater at 50 miles or less from the site.

10.1.2 Iron Gate Dam

Analyses of the embankment's slopes were made under multiple loading conditions (PacifiCorp, 2015). Loading conditions evaluated for the reservoir included normal full (elevation 2328.0 feet), flood (peak elevation 2,345.4 feet), and seismic loading. The following summarizes the conclusions of the embankment PFM slope stability analyses:

- The dam is founded on sound basalt bedrock. The downstream shell of the dam is underlain by filter zones and a horizontal blanket filter. Since the blanket is filtered, the potential for uncontrolled seepage at the toe is judged to be remote.
- The embankment is dense and well compacted according to construction records. Therefore, the embankment fill is not considered to be susceptible to liquefaction. The dam was constructed on a sound rock foundation that has no liquefaction potential.
- The yield accelerations for the upstream slope are less than for the downstream slope, making the upstream slope more critical (more subject to deformation) during a seismic event. However, the analysis indicates that the Iron Gate Dam is adequate to withstand the maximum credible earthquake without loss of reservoir due to excessive deformation.

No Category I PFMs were identified during the last PFMA review with respect to the Iron Gate embankment. The following embankment dam PFMs are listed in the STID as well as their relationship to monitoring under the Iron Gate DSSMP:

Table 10-2. Potential Failure Modes – Iron Gate Embankment

PFM	PFM DESCRIPTION	2014 CATEGORY	RELATED COMPONENT OF DSSMP
1A	Downstream Slope Failure of Embankment during Flooding	II	Perform detailed inspections after large floods (reservoir level exceeds 2,331.0-feet), and timely repair of damage, if any occurs.
1B	Embankment Failure due to Right Abutment Wall Instability	II	Provide regular visual inspection and annual surveys of monuments.
2	Embankment Overtopping Failure during Flooding	IV	Perform detailed inspections after large floods (reservoir level exceeds 2,331.0-feet), and timely repair of damage, if any occurs.
3C	Embankment Overtopping during Flooding by Side Channel Spillway Rock Fall Blockage	II	Perform detailed inspections after large floods (reservoir level exceeds 2,331.0-feet), and timely repair of damage, if any occurs. Provide geologic inspection of the rock face, adjacent to the side channel spillway and chute, to assess requirements to maintain adequate stability (e.g., scaling, rock bolted mesh, rock bolt reinforcing) every 5-years.
4A / 4B	Embankment Upstream Slope Failure due to Rapid Drawdown of the Reservoir Embankment Downstream Slope Failure	IV for 4A II for 4B	Provide regular visual inspection.

PFM	PFM DESCRIPTION	2014 CATEGORY	RELATED COMPONENT OF DSSMP
5A / 5B	Piping Failure through Embankment Core into the Shell Piping Failure from the Shell into the Toe Drain	II	Monitor water level, temperature and turbidity at Manhole #3 on a monthly basis.
6A / 6B	Piping Failure from the Core into the Foundation Piping Failure from the Downstream Shell into the Foundation	II	Monitor water level, temperature and turbidity at Manhole #3 on a monthly basis.
8A	Piping Failure along the Penstock Concrete Encasement Soil-Structure Interface	IV	Provide regular visual inspection.
8B / 8D	Piping Failure along the Penstock Concrete Encasement Soil-Structure Interface during Flooding Piping Failure through Desiccation Cracks in the Upper Core during Flooding	II for 8B IV for 8D	Perform detailed inspections after large floods (reservoir level exceeds 2,331.0-feet), and timely repair of damage, if any occurs.
8C	Piping Failure along the Penstock Concrete Encasement Soil-Structure Interface under Seismic Loading	II	Perform detailed inspections after felt earthquakes or a seismic event greater than magnitude 5.0 within 50 miles, and timely repair of damage, if any occurs.
10A / 10B / 10C	Embankment Failure under Seismic Loading (Piping of Core into Downstream Shell) Embankment Failure under Seismic Loading (Crest Settlement below Reservoir Level) Embankment Failure under Seismic Loading (Induced Transverse Cracking Deformation)	II	Perform detailed inspections after felt earthquakes or a seismic event greater than magnitude 5.0 within 50 miles, and timely repair of damage, if any occurs. Provide embankment crest surveillance monument survey if required by the PacifiCorp Chief Dam Safety Engineer.
15	Seiche Wave Overtops the Embankment	IV	Inspect reservoir rim for landslide potential after felt earthquakes or a seismic event greater than magnitude 5.0 within 50 miles.

10.2 Threshold and Action Levels

Threshold values and action levels are important for monitoring and to assist in determining if readings are approaching a level that could cause concern regarding stability of reservoir rim or embankment areas. The threshold level is the first level requiring an evaluation. Where specific action values have not been determined for an instrument or monitored condition, threshold

levels and a range of expected (acceptable) values can be developed based on historical data. Critical threshold and action levels for different type situations/inspections and associated guidance for determining the proper emergency level for various situations are covered by the existing PacifiCorp EAP, as well as the Emergency Response Plan for the Proposed Action. However, this section includes a brief summary of typical remedial actions for various situations.

Threshold values and action levels for the instrumentation at the Iron Gate Dam were derived as follows.

- Survey Monuments: No threshold values and action levels have been established for the survey data. Any significant change in elevation or horizontal location outside of the historical range is treated as a threshold value and evaluated by PacifiCorp's Dam Safety Engineer to determine if an adverse trend is developing. An embankment dam is expected to settle, and settlements of 1 percent of the height have been recorded at other embankment dams. Maximum settlement is well within the expected range.
- Iron Gate Manhole #3 Water Level and Turbidity: Threshold and action levels have not been established for the water levels and turbidity measurements. Any reading outside of the historical range is evaluated by PacifiCorp's Dam Safety Engineer. The time history plots are reviewed to determine if a trend may be developing. Data collected since 2006 has shown no indication of turbidity levels in the manhole above those in the tailrace or reservoir. The maximum Secchi tube reading is 120 centimeters, and generally the observations are in line with the reservoir and tailrace readings.

The Renewal Corporation will develop action levels with respect to the remote sensing technology with the remote sensing provider based on the selected technology.

10.2.1 Emergency Levels and Expected Actions

After an unusual or emergency event is detected or reported, the PacifiCorp Chief Dam Safety Engineer, DSOD, and FERC will classify the event into one of the below three emergency levels. Emergency remedial actions outside the scope of activities listed below require FERC Regional Engineer and California Division of Safety of Dams approval, if time permits.

10.2.1.1 Emergency Level 1: Non-emergency, Unusual Event; Slowly Developing:

This situation is not normal but has not yet threatened the operation or structural integrity of the reservoir rim or embankment, but possibly could if it continues to develop.

A. The EoR should be contacted to inspect the reservoir rim or embankment and recommend actions to be taken. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir rim limits, reservoir water levels, abutments, and downstream channel for signs of changing conditions. If increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to the FERC Regional Engineer and California Division of Safety of Dams; refer to the emergency level

table for guidance in determining the appropriate event level for the new condition and recommended actions.

B. The condition of the impacted reservoir rim or embankment should be closely monitored, especially during storm events, to detect any development of a potential or imminent failure situation.

C. Record all information, observations, and actions taken on the Unusual or Emergency Event Log form (Appendix B). Note the time of changing conditions. Document the situation with photographs and video if possible.

D. The EoR must contact the Renewal Corporation Owners Representative and request an investigation of the situation and recommend corrective actions.

E. The Renewal Corporation Owners Representative must contact the FERC Regional Engineer and California Division of Safety of Dams, advise them of the situation and what action is being proposed, and obtain approval.

F. Local Emergency Responders should also be informed since the emergency level may possibly develop into a worse condition that may require emergency actions.

G. If time permits, the emergency remedial actions included in Table D-1 of Appendix D should be considered for Level 1 conditions, as appropriate.

10.2.1.2 Emergency Level 2: Potential Failure Situation; Rapidly Developing:

This situation may eventually lead to reservoir rim or embankment failure and release of impounded water and/or eroded rock and soil/sediment or may endanger the structural integrity of the reservoir rim or embankment, but there is not an immediate threat of failure.

A. The EoR must contact the Renewal Corporation Owners Representative, who will in turn contact the FERC Division of Dam Safety and Inspections, to report the situation and, if time permits, request technical assistance to investigate the situation and recommend corrective actions. The FERC Division of Dam Safety and Inspections' approval of any emergency remedial action outside the scope of activity listed below is required, if time permits.

B. The Renewal Corporation Owners Representative must contact the Local Emergency Responders to inform them that the EAP/Emergency Response Plan has been activated and if current conditions get worse, an emergency situation may require evacuation or warning. Preparations should be made for possible road closures, warnings, and evacuations.

C. The EoR must closely monitor the condition of the reservoir rim or embankment and periodically report the status of the situation to the Renewal Corporation Owners Representative, who will in turn notify the necessary authorities. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir rim limits, reservoir water levels, abutments, and downstream channel for signs of changing conditions. If piping, increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to the FERC Regional Engineer and California Division of Safety of Dams; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.

D. The EoR must provide updates to the Local Emergency Responders to assist in making timely decisions concerning the need for warnings and evacuations. If the reservoir rim or embankment condition worsens and failure becomes imminent, the County Dispatch Authority must be notified immediately of the change in the emergency level to begin the evacuation process for the people at risk downstream.

E. Record all information, observations, and actions taken on the Unusual or Emergency Event Log form (Appendix B). Note the time of changing conditions. Document the situation with photographs and video if possible.

F. If time permits, the Renewal Corporation Owners Representative must evaluate the situation and recommend remedial actions to prevent failure of the reservoir rim or embankment. The Renewal Corporation Owners Representative must obtain FERC Regional Engineer and California Division of Safety of Dams verbal approval of the recommended action, if time permits, and initiate remedial repairs (note local resources that may be available). Time available to employ remedial actions may be hours or days.

G. If time permits, the emergency remedial actions included in Table D-2 of Appendix D should be considered for Level 2 conditions, as appropriate.

10.2.1.3 Emergency Level 3: Urgent; Failure is Imminent or in Progress

This is an extremely urgent situation. A reservoir rim or embankment failure is occurring and release of impounded water and/or eroded rock and soil/sediment has occurred or is obviously about to occur and cannot be prevented. No time is available to control the reservoir rim or embankment failure and the ultimate release of impounded water and/or eroded rock and soil/sediment.

A. The EoR must immediately contact the Renewal Corporation Owners Representative, who will in turn contact the Local Emergency Responders and the FERC Regional Engineer and California Division of Safety of Dams.

B. The County Dispatch Authority must be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed. The Incident Commander will notify local personnel to initiate warnings and evacuations of people at risk downstream from the dam.

C. Emergency Management Services personnel and local law enforcement will alert the general public and immediately evacuate at-risk people and close roads as necessary.

D. The EoR must maintain continuous communication and provide Local Emergency Responders with updates of the situation to assist in making timely decisions concerning warnings and evacuations.

E. Verify personnel monitoring the reservoir rim or embankment are safe and out of harms way.

The individual or personnel that will perform the Level 3 remedial actions (included in Table D-3 of Appendix D) should evaluate their own personal safety, as well as those performing the remedial actions. Actions that are deemed to be unsafe or could result in potential hazards should not be performed. Personal safety is essential. However, if time permits and it is safe

for personnel to perform actions, the following emergency remedial actions should be considered after review by the FERC Regional Engineer and California Division of Safety of Dams. Close monitoring of the reservoir/embankment must be maintained to confirm the success of any remedial action taken at the reservoir/embankment. Potential Emergency Remedial Actions include:

A. Reduce flows, pumping down reservoir area or diverting through spillways;
B. Fill in breached areas with coarse soil material; and/or
C. Try to control the extent of the breached area.

The above emergency situations and expected remedial actions should be discussed and approved through the lines of communication established in the EAPs for PacifiCorp (pre-drawdown phase) and Emergency Response Plan for the Proposed Action (active drawdown and dam removal phase and post-drawdown phase). Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the reservoir rim or embankment. The remedial actions listed do not require FERC Regional Engineer and California Division of Safety of Dams approval prior to implementing the action. Several of the listed adverse or unusual conditions may be apparent at the reservoir rim or embankment at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the reservoir rim or embankment must be maintained to confirm the success of any remedial action taken. Time permitting, any remedial action should be developed through consultation with the EoR, the Renewal Corporation Owners Representative, FERC Regional Engineer, and California Division of Safety of Dams.

See the following table for guidance in determining the proper emergency level for various situations. The table is meant to cover several situations; however, an event or condition may arise that is not covered. In the circumstance of multiple events occurring with conflicting event levels, always designate the higher level as the governing event level. The table also provides situations that are considered maintenance concerns and do not constitute an emergency situation. Notification during maintenance activities is the responsibility of the PacifiCorp Chief Dam Safety Engineer, as deemed necessary.

Table 10-3. Guidance for Determining the Emergency Level

EVENT	SITUATION	EMERGENCY LEVEL*
Erosion	Surface erosion is identified on the exterior face of the embankment that is greater than previously and has resulted in scour but has not resulted in any headcutting.	Maintenance
	Surface erosion is identified on the exterior face of the embankment that is greater than previously and has resulted in scour and headcutting.	1
	Surface erosion is headcutting through the embankment with significant scour that has begun to headcut.	2
	Surface erosion is headcutting at a measurable rate.	3

EVENT	SITUATION	EMERGENCY LEVEL*
Low Embankment Crest	Low or uneven crest or depressed areas. Reduced available freeboard and reduced embankment cross-section, and/or increased water pressure behind the embankment. Crest can be restored and eroded areas are minimal.	Maintenance
	Sudden appearance of a low or uneven crest or depressed areas with visible seepage. Reduced available freeboard and reduced embankment cross-section.	1
	Low or uneven crest could potentially lead to overtopping or depressed areas with uncontrolled water seepage.	2
	Low or uneven crest that has resulted in overtopping, leading to erosion of the surface, or depressed areas with increased seepage leading to erosion of the surface and loss of the slope.	3
Sinkhole	Sinkhole on and/or surrounding the embankment face.	1
	Sinkhole on and/or surrounding the embankment face with visible water inflow or outflow.	2,3
Whirlpool	Water flowing in a swirling motion in an area on the upstream side of the embankment. This is a dangerous condition requiring immediate action. All whirlpools should be addressed with extreme caution.	3
Sand Boils	Soil particles deposited around a water exit forming a cone, generally only a few inches in diameter, with water running clear.	Maintenance
	Soil particles deposited around a downstream seepage flow, forming a cone, with a sustained cloudy seepage flow.	1
	Soil particles deposited around a water exit forming a cone, varying from a few inches in diameter, spaced 2 to 3 feet apart, to isolated locations several feet in diameter in the floodplain downstream.	2,3
Seepage	Wet area on downstream embankment slope or any other area downstream of the embankment, with very little or no surface water or very minor seeps.	Maintenance
	Same wet area as above with moderate seepage of clear or relatively clear water, with a flow rate that is steady but not noticeably increasing.	1,2
	Same wet area as above with seepage of clear or relatively clear water greater than 100 gallons per minute.	3
Piping	Seepage along with the transport of material from the foundation or the embankment with very little or no active flow which does not increase over a monitoring period of several days.	Maintenance
	Seepage along with the transport of material from the foundation or the embankment with active flows of cloudy water and steady flow rate that is not noticeably increasing.	1,2
	Seepage along with the transport of material from the foundation or the embankment with active flows of muddy water at an increasing rate.	3

EVENT	SITUATION	EMERGENCY LEVEL*
Flooding	Extreme precipitation event allowing accumulation of direct precipitation or surface water runon to the embankment surface.	1
	Extreme precipitation event allowing accumulation of direct precipitation or surface water runon to the embankment surface. Water surface is initiating erosion of the toe.	2
	Extreme precipitation event allowing accumulation of direct precipitation or surface water runon to the embankment surface. Water surface is eroding through the toe and exceeds an erosion depth of 2 feet.	3
Movement	New cracks in the embankment, without seepage, and are not increasing in size (unless the cracks are located in the upper portion of the slope, parallel to the embankment crest, and a bulge is forming near the toe – see below).	Maintenance
	Formation of tension cracks on the upper portions of the slope, parallel to the embankment crest, and a bulge near the embankment toe.	1
	Same as above with movement that has resulted in large fissures or openings along the periphery and crest of the embankment and a pronounced bulge has begun to develop at the toe.	2
	Same as above with material observed collapsing into open fissures and increased seepage that may be associated with the development of a toe bulge.	3
Slides	Movement of a portion of the embankment or downstream slope toward the toe of the embankment that does not pass through the crest and does not extend into the embankment more than 5 feet, measured perpendicular to the slope.	2
	Movement of a portion of the embankment or downstream slope toward the toe of the embankment that passes through the crest of the embankment or near the surface water elevation.	3
Bulge	Wet area on downstream embankment slope or any other area downstream of the embankment, with very little to no surface water or very minor seeps.	1
	Same wet area as above with moderate seepage of clear or relatively clear water, with a flow rate that is nearly steady but not noticeably increasing.	2
	Same wet area as above with moderate seepage of clear or relatively clear water at an increasing rate.	3
Embankment Overtopping	Minor overtopping flow not eroding the embankment slope.	2
	Major overtopping flow eroding the embankment slope.	3
Embankment Cracking	New cracks in the embankment greater than 1/4-inch wide with no seepage.	1
	Cracks in the embankment with seepage.	2
Instruments	Instrumentation readings beyond predetermined values.	1
Earthquake	Measurable earthquake felt or reported on or within 50 miles of the dam.	Maintenance

EVENT	SITUATION	EMERGENCY LEVEL*
	Earthquake resulting in visible damage to the dam or appurtenances.	2
	Earthquake resulting in uncontrolled release of water from the dam or appurtenances.	3
Sabotage	Damage to dam or appurtenances with no impact to its function.	Maintenance
	Damage to dam or appurtenances that has resulted in seepage flow.	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release.	3

Notes:

Emergency Level 1: Non-emergency, unusual event, slowly developing
Emergency Level 2: Potential dam failure situation, rapidly developing
Emergency Level 3: Urgent, dam failure is imminent or in progress

11.0 Training and Awareness

Section 11 discusses the qualifications required for maintenance personnel including training requirements and documentation. The Renewal Corporation will provide personnel and required training as discussed below.

11.1 Current Responsibilities and Training

PacifiCorp Operations personnel consist of Operators and Foremen, reporting to the Production Manager. The Operators are either journeymen or apprentice, and the Foreman is a General Foreman Hydro. The Foreman is responsible for Operators that perform surveillance duties and read the active instrumentation at the Project (except for the movement surveys). The Foreman and Operators are also responsible for relaying copies of the inspection check lists and sheets to the Dam Safety Engineer. The Foreman is experienced in the safe operation of hydroelectric projects and has participated in all dam safety-related training associated with the execution of dam-specific DSSMPs. The Operators and Foreman are responsible for carrying out surveillance duties and reading active instrumentation at their respective dams. Temporary monument surveys are the responsibility of the Renewal Corporation.

Personnel training in surveillance and monitoring includes review and familiarization of the most current PFMA study and the DSSMP. New personnel at any level of responsibility are trained by experienced personnel at the same or greater level of responsibility. Training includes a review of the surveillance procedures included in the DSSMP and the Daily Log, Weekly Check Sheet, and Annual Engineering Inspection Check Sheets included in Appendix B. New staff review the procedures and accompany an experienced Operators or Foreman to gain an understanding of each aspect of surveillance activities and learn the type of observations and readings needed for valid data input.

11.2 Training, Awareness, and Competency

Training is required for all personnel prior to commencing work on site. The level of training is commensurate with the level of individual risk their works are likely to entail. Trainings include:

- Environmental and safety policies, site management plans, as well as environmental roles and responsibilities;
- The significance of environmental impacts caused by individual roles and activities;
- Incident management; and
- Potential consequences of non-conformance.

The Renewal Corporation will document training associated with implementation of activities in this plan on the log in Appendix B.

11.3 Inductions

All personnel working onsite will undergo mandatory Project training to cover the key requirements of the Workplace Safety Management Plan and California SSMP.

11.3.1 Project Induction

The Project induction will cover an overview and related safety-, environmental-, and community-related risks and responsibilities for the Proposed Action. It is the responsibility of all personnel to adhere to the safety requirements of the Project. The Project induction with respect to slope stability will include:

- Overview of the California Slope Stability Monitoring Plan,
- Project contact details;
- Potential Areas of Concern and inaccessible areas;
- Notification procedures; and
- EAP, Emergency Response Plan for the Proposed Action, and other emergency protocols.

11.3.2 Visitor Induction

Visitors must undergo a visitor's induction and their host is responsible for all actions and conduct of the visitor. The Renewal Corporation will restrict visitor access, and personnel who have previously undergone Project induction and safety training will accompany visitors at all times.

12.0 References

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FERC. 2020. Order Approving Partial Transfer of License, Lifting Stay of Order Amending License, and Denying Motion for Clarification and Motion to Dismiss. FERC Project Nos. 2082-062, 2082-066, 14803-000, and 14803-003. 172 FERC ¶ 61,062. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing. July 16.

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Oregon State Department of Environmental Quality (ODEQ). 2018a. Final Clean Water Act Section 401 Certification for the Klamath River Renewal Corporation License Surrender and Removal of the Lower Klamath Project (FERC No. 14803) Klamath County, Oregon. September 7.

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Appendix A

Figures

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION

(CEII)

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APPENDIX A: FIGURES

Appendix B

Technical Amendment Logs

Technical Amendment Log

Any technical amendments to this Plan will be re-certified in accordance with Section I of this Plan template.

Description and Certification of Technical Amendments		
Review Date	Description of Technical Amendment	Name and signature of person certifying this technical amendment

Facility Name: _____

Appendix C

Inspection Forms and Personnel Training Logs

Personnel Training and Briefing Log

Personnel Training and Briefing Log		
Date	**Description / Scope**	**Attendees**

Facility Name: _____

The Renewal Corporation will develop inspection forms at a later date per FERC and DSOD requirements. The EoR will work with the remote sensing contractor to develop additional inspection forms with respect to the selected remote sensing technology

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Appendix D

Additional Emergency Action Plan Information

Table D-1. Emergency Level 1 – Potential Remedial Actions

CONDITION	ACTION
Erosion	Locate and quantify the extent of erosion at the reservoir rim or embankment.
	Fill and, if possible, compact the eroded area(s) with course soil material, filter sand, and/or gravel/rock fill as appropriate for conditions.
	Place and crimp straw mulch and tackifier.
	Monitor the erosion area(s) weekly following the precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Sinkhole	Locate and characterize the lateral limits and depth of the sinkhole(s).
	Fill the sinkhole with reverse filter composed of drain gravel, filter sand, and compacted coarse soil material.
	Monitor the sinkhole daily for the following week and following the next precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Sand Boils	Locate and quantify the sand boil(s).
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material from the boil by initially constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of the material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover sand boil area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor the sand boil daily for the following week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).

CONDITION	ACTION
Seepage	Install a flow-measuring device.
	Measure the flow periodically. Note changes in quality or clarity.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevations and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Piping	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material by constructing a ring dike. The goal of the ring is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor daily for the following week. Measure the rate of leakage and clarity of the water (e.g. muddy appearance).
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Flooding	Monitor flood conditions in the reservoir.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe and measure elevations of water and seepage daily.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Embankment Movement	Mark the movement area(s). Consider contracting a surveyor to survey the movement area(s).
	Visually monitor the movement area(s).
	Develop, evaluate, and implement measures to resolve the observed condition(s).
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).

CONDITION	ACTION
Earthquake	Monitor conditions at the reservoir rim and embankment daily for at least one week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Instruments	Re-measure the reading and verify the reading was made correctly. Once human error is ruled out, verify the instrument is operating properly.
	After human error and instrument error is ruled out, contact engineering support for additional technical assistance if needed.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Bulge	Install a flow-measuring device.
	Measure the flow periodically. Observe and note changes in quality or clarity.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Sabotage	Develop, evaluate, and implement measures to resolve the situation.
	Monitor the situation at the reservoir rim or embankment daily for the following week, or until the situation has ended.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).

Table D-2. Emergency Level 2 – Potential Remedial Actions

CONDITION	ACTION
All Conditions	Mobilize personnel and equipment necessary to address ongoing conditions.
Erosion	Locate and quantify the extent of erosion at the reservoir rim or embankment.
	Fill and, if possible, compact the eroded area(s) with course soil material, filter sand, and/or gravel/rock fill as appropriate for conditions.
	Place and crimp straw mulch and tackifier.
	Monitor the erosion area(s) weekly following the precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Sinkhole	Locate and characterize the lateral limits and depth of the sinkhole(s).
	Fill the sinkhole with reverse filter composed of drain gravel, filter sand, and compacted coarse soil material.
	Monitor the sinkhole daily for the following week and following the next precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Sand Boils	Locate and quantify the sand boil(s).
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material from the boil by initially constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of the material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover sand boil area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor the sand boil daily for the following week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.

CONDITION	ACTION
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Seepage	Install a flow-measuring device.
	Measure the flow periodically. Note changes in quality or clarity.
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill
	Control the movement of material by constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and the flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 ft of filter sand and drain gravel. A drain pipe or filter may be added.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevations and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Piping	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material by constructing a ring dike. The goal of the ring is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor daily for the following week. Measure the rate of leakage and clarity of the water (e.g. muddy appearance).
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Flooding	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Monitor flood conditions in the reservoir.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe and measure elevations of water and seepage daily.

CONDITION	ACTION
	Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Embankment Movement	Mark the movement area(s). Consider contracting a surveyor to survey the movement area(s).
	Visually monitor the movement area(s).
	Fill and, if possible, compact the area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Earthquake	Immediately conduct a general overall visual inspection of the reservoir rim and embankment.
	Perform field survey to determine if there has been any settlement and movement of the rim, dam crest, embankment, downstream slope, and downstream toe area. Observe for any signs of additional erosion, seepage, or cracking.
	Activate pump(s) to dewater the reservoir.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Instruments	Re-measure the reading and verify the reading was made correctly. Once human error is ruled out, verify the instrument is operating properly.
	After human error and instrument error is ruled out, contact engineering support for additional technical assistance if needed.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Bulge	Install a flow-measuring device.
	Measure the flow periodically. Observe and note changes in quality or clarity.
	Place a stability berm to buttress the bulge.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).

CONDITION	ACTION
Whirlpool	Control the movement of material by constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than slowing the movement of material.
	Observe the dam from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Slides	Contact the EoR for assistance in evaluating the surface feature (e.g. tension crack). If the feature does not extend across the dam, and the reservoir elevation is more than 10 ft below the base of the feature, fill with soil and/or rock and compact to help stabilize the slope/toe.
	If the surface feature extends across the dam and the reservoir level is less than 10 ft, install a filter overlain by a berm.
	Stabilize damaged areas on the downstream slope by weighting the toe area below the slide with additional soil, rock, or gravel.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Embankment Overtopping	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Increase freeboard by placing sandbags or other erosion-resistant material on the dam crest.
	Cover the dam crest and downstream slope with riprap, sandbags, plastic sheeting, or other materials to provide erosion-resistant protection.
	Monitor the depth, duration, and location of the overtopping. Watch for erosion, backcutting, and slides.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Embankment Cracking	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure elevations of applicable water levels and seepage daily.
	Continuously monitor the cracking. Mark the extent of the cracking with stakes, to monitor any increase or change in pattern.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Sabotage	Develop, evaluate, and implement measures to resolve the situation.
	Monitor the situation at the reservoir rim or embankment daily for the following week, or until the situation has ended.

CONDITION	ACTION
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).

Table D-3. Emergency Level 3 – Potential Remedial Actions

CONDITION	ACTION
All Conditions	Mobilize personnel and equipment necessary to stabilize or at least minimize impacts downstream.
Erosion	Observe and continually monitor conditions at the reservoir rim or embankment, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Sinkhole	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Observe and continually monitor conditions at the dam/embankment, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Sand Boils	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Take actions noted under piping (below).
	Observe and continually monitor conditions at the dam, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Piping	If the entrance to the leak can be found in the reservoir, then on the embankment or abutments (sinkhole), try to plug the leak with whatever materials are available, such as plastic sheeting, straw bales, gravel and cobbles, etc.
	Document and photograph the location for future comparison.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Seepage	If the entrance to the leak can be found in the reservoir, then on the embankment or abutments (sinkhole), try to plug the leak with whatever materials are available, such as plastic sheeting, straw bales, gravel and cobbles, etc.
	Document and photograph the location for future comparison.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Flooding	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Monitor flood conditions in the reservoir.
	Observe and continuously monitor the conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible.

CONDITION	ACTION
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Embankment Movement	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Observe and continuously monitor conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should be noted.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Earthquake	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Observe and continuously monitor conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should be noted.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Bulge	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Install a flow-measuring device.
	Observe condition constantly for any further changes in flow rates or clarity, unless notified otherwise by the EoR.
	Observe and continuously monitor conditions at the dam from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should also be noted.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Whirlpool	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Take actions noted under piping (above).
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Observe and continually monitor conditions at the dam, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Slides	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.

CONDITION	ACTION
	If the slide is on the downstream slope, stabilize the toe of the slide by constructing a berm with additional soil and rock. If there is significant leakage (indicated by muddy ground), install a filter overlain by a berm (see Piping above).
	Monitor settlement, rate of settlement, and extent of slide.
	Observe and continually monitor conditions at the dam from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should also be noted.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Embankment Overtopping	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Observe and continuously monitor conditions from high ground.
	Increase freeboard by placing sandbags or other erosion resistant materials on the dam crest. Use riprap or other materials to provide erosion protection for the crest and downstream slope.
	Monitor the depth, duration, and location of the overtopping. Watch for erosion, backcutting, and slides.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).
Sabotage	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Appendix C).

Appendix C

Oregon Reservoir Drawdown and Diversion Plan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Oregon Reservoir Drawdown and Diversion Plan

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February 2021

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1.0 Introduction

The Oregon Reservoir Drawdown and Diversion Plan described herein is a subplan of the Reservoir Drawdown and Diversion Plan that will be implemented as part of the Proposed Action for the Lower Klamath Project (Project).

1.1 Purpose of the Oregon Reservoir Drawdown and Diversion Plan

The purpose of the Oregon Reservoir Drawdown and Diversion Plan is to describe the proposed drawdown methods, procedures, schedules, and monitoring measures that the Renewal Corporation will implement as part of the Proposed Action.

The Renewal Corporation and PacifiCorp have entered into an Operations and Maintenance Agreement. Upon acceptance of the License transfer order and subsequently acceptance of the License surrender order, PacifiCorp will continue to operate the Project as the Renewal Corporation assignee, until such time operation is no longer required under decommissioning.

1.2 Relationship to Other Management Plans

The Oregon Reservoir Drawdown and Diversion Plan is supported by elements of the following management plans for effective implementation: Reservoir Drawdown and Diversion Plan sub-plans, Erosion and Sediment Control Plan, Remaining Facilities Plan, Historic Properties Management Plan, Emergency Response Plan, Waste Disposal and Hazardous Materials Management Plan, Health and Safety Plan, and the Reservoir Area Management Plan. So as not duplicate information, elements from these other management plans are not repeated herein but are, where appropriate, referred to in this Oregon Reservoir Drawdown and Diversion Plan.

2.0 Background

2.1 J.C. Boyle Site Conditions

The J.C. Boyle Dam bedrock foundation is comprised of basalt and tuff as described in Section 5 of the STID by Black & Veatch (PacifiCorp, 2015) as follows:

> “At the dam right abutment, there is an exposure of basalt between elevation 3,740.0 ft and elevation 3,770.0 ft, just downstream of the earthfill dam. The rock is dark gray, dense to slightly vesicular olivine basalt. The rock is jointed by two nearly vertical joint sets which strike northwesterly and northeasterly. These joint sets are generally spaced at least 4 ft apart. The rock contains laminations which result in nearly horizontal joints spaced about 3 inches apart. The joints appear tight, but the vertical dipping sets contain minor amounts of fines.

Another exposure of dense basalt occurs along the reservoir rim at elevation 3,790.0 ft, just upstream from the right abutment. The basalt in this exposure is fine grained and dense with joints generally spaced more than 2 ft apart. Tailwater covers the river channel section just

downstream of the earthfill dam and boulder debris mantles the river channel downstream from the spillway section. A study of geologic logs of drill holes and exposures along the river cut banks indicate that the river channel is cut into volcanic tuff in these areas. The tuff extends upstream under the earthfill section of the dam, where construction records indicate that it is capped by a relatively thin layer of hard basalt throughout most of the foundation limits. This tuff is sufficiently compact and dense so that it is not subject to piping.

Rock is almost continuously exposed south of the fish ladder, in the spillway channel, and up the left abutment. Rock above elevation 3,730.0 ft is mainly fine grained olivine basalt. Locally the basalt is scoriaceous, but it is generally dense. Thin beds of moderately hard tuff and agglomerate occur locally within this sequence. These rocks are generally traversed by near vertical joints that strike westerly and northwesterly and are spaced 2 to 6 ft apart. The horizontal joints are spaced less than 6 inches in some areas, but generally are spaced 6 inches to 1 ft apart. The joints are generally tight, but the horizontal joints are open slightly in exposed faces. A tuff bed, averaging about 35 ft thick, occurs below the lower basalt contact at about elevation 3,730.0 ft. This rock is composed of soft, consolidated but uncemented clayey ash. Local zones contain particles of volcanic cinders and bombs. The rock, where protected from erosion, makes a suitable foundation. However, in the lower end of the spillway channel and below the transverse leg of the fish ladder, the tuff has eroded from under the thin cap of hard basalt. This has resulted in collapse debris composed of hard basalt in these areas."

3.0 Drawdown and Diversion Plan

3.1 Drawdown Criteria

Pertinent drawdown criteria for the Proposed Action are summarized in the below Table 3.1, which includes information from the Design Report A (Knight Piésold, 2020b).

Table 3.1 Reservoir Drawdown Design Criteria

FEATURE/CONSIDERATION	CRITERIA	REMARKS	REFERENCE
OPERATING REQUIREMENTS			
Daily Minimum Downstream Flows	Downstream of Iron Gate: • September through November and March - 1,000 cfs • December through February - 950 cfs • April - 1,325 cfs • May - 1,175 cfs • June - 1,025 cfs • July and August - 900 cfs	• Minimum flows will be dictated by USBR requirements which may supersede the biological opinion flows as set out. Minimum flows only applicable up to completion of drawdown.	• USBR, BIOP 2019
Normal Maximum Operating Surface Elevation (ft msl)	• J.C. Boyle = 3,796.7 ft		FERC License Application - Exhibit A (2004) - NAVD88 Elevations
Normal Minimum Operating Surface Elevation (ft msl)	• J.C. Boyle = 3,791.7 ft		
PRE-DRAWDOWN			
Pre-Drawdown Construction Activities (Downstream of Reservoirs)	• Construction and commissioning to occur prior to January 1 of the drawdown year		
	• All reservoirs to be operated at or below minimum operating water levels during early works construction; minimum operating water levels are specific to each facility	• Water levels to be defined through consultation with PacifiCorp	• PacifiCorp STID Section 4 Standard Operations Procedures
Pre-Drawdown Flow Regulation	• Regulate project operation flows at or below minimum operating levels to maintain construction safety • The reservoir lowering will begin prior to construction and will be accomplished through normal project power and water bypass operations on a site-specific basis	• Required for construction staging and work safety	• PacifiCorp STID Section 4 Standard Operations Procedures

FEATURE/CONSIDERATION	CRITERIA	REMARKS	REFERENCE
DRAWDOWN			
Initial Drawdown	• To begin on or about January 1 of the drawdown year.		
Reservoir Drawdown Rate	• Target drawdown water surface level rate 5 ft/day	• Each facility is unique relative to reservoir area capacity and proposed drawdown. Actual drawdown will be based on the actual water year	
Drawdown Completion	• Water surface level at or below historic cofferdam level		• Knight Piésold Memo VA20-01231 - Klamath Drawdown Model
GEOTECHNICAL REQUIREMENTS			
Slope Stability Of Reservoir Rim			
Minimum Required FOS	• Drawdown FOS = 1.2	• Reservoir Drawdown criterion applies to existing dam, rim, and embankment slopes.	• USBR Design Standard No. 13 • USACE EM 1110-2-1902, 2003
	• Long-term, Post Drawdown FOS = 1.5		• USBR Design Standard No. 13 • USACE EM 1110-2-1902, 2003
Design Earthquake for Temporary Construction	• 10% Probability of Exceeding Operating Basis Earthquake in 50 Years (1/475-Year Event); 0.2% Probability in 1 Year • • 2% Probability of Exceeding Maximum Design Earthquake in 50 Years (1/2,475- Year Event); 0.04% Probability in 1 Year		• Appendix A4 of the Design Report
Slope Stability of Temporary Embankment Slopes			

FEATURE/CONSIDERATION	CRITERIA	REMARKS	REFERENCE
Reservoir Drawdown	FOS = 1.3	• Reservoir Drawdown criterion applies to temporary embankment slopes during removal.	• USBR Design Standard No. 13 • USACE EM 1110-2-1902, 2003

Notes:

BIOP = Biological Opinion
CFS = Cubic feet per second
EM = Engineer Manual
FERC = Federal Energy Regulatory Commission
FOS = Factor of Safety
FT MSL = Feet above Mean Sea Level
NAVD88 = North American Vertical Datum of 1988
STID = Supporting Technical Information Document
USBR = United States Bureau of Reclamation
USACE = United States Army Corps of Engineers

3.1.1 Discharge Volumes and Rates

3.1.1.1 J.C. Boyle Facility

Discharges during the drawdown stages will be made through the existing outlets at the intake structure: three spillways bays, the power intake, and the two diversion culverts. The Renewal Corporation will not alter the existing outlets except for the removal of the concrete stop logs upstream of the two diversion culverts. Development of discharge rating capacities for the outlets are outlined in Appendix B of the Design Report (Knight Piésold, 2020b) and are summarized below. Relevant information is included in Appendix B of this subplan. The discharge rating curves for J.C. Boyle are also presented in Appendix B (drawing C1056).

Table 3.2 J.C. Boyle Total Discharge Capacity and Drawdown Operations Plan

RESERVOIR WATER SURFACE ELEVATION (FEET, NAVD88)	TOTAL DISCHARGE RATE CAPACITY					
	SPILLWAY ONLY (CFS)	POWER INTAKE ONLY (CFS)	ONE CULVERT - NO POWER (CFS)	ONE CULVERT - WITH POWER (CFS)	TWO CULVERTS (CFS)	TWO CULVERTS PLUS SPILLWAY (CFS)
3,801.7	30,402	2,850	3,786	6,636	7,572	37,974
3,800.7	27,680	2,850	3,740	6,590	7,480	35,160
3,799.7	25,045	2,850	3,694	6,544	7,388	32,433
3,798.7	22,500	2,850	3,647	6,497	7,294	29,794
3,797.2	20,046	2,850	3,599	6,449	7,198	27,244
3,796.7	17,690	2,850	3,550	6,400	7,100	24,790
3,795.7	15,433	2,850	3,501	6,351	7,002	22,435
3,794.7	13,282	2,850	3,451	6,301	6,902	20,184
3,793.7	11,241	2,850	2,915	5,765	5,830	17,071
3,791.7	9,265	2,850	2,868	5,718	5,736	15,001
3,791.7	7,433	2,850	2,820	5,670	5,640	13,073
3,790.7	5,752	2,850	2,772	5,622	5,544	11,296
3,789.7	4,233	2,850	2,723	5,573	5,446	9,679
3,788.7	2,887	2,805	2,674	5,479	5,348	8,235
3,787.7	1,733	2,531	2,623	5,154	5,246	6,979
3,786.7	801	2,269	2,572	4,841	5,144	5,945
3,785.7	153	2,020	2,520	4,540	5,040	5,193
3,785.2	–	1,784	2,494	4,278	4,988	4,988
3,784.7	–	1,561	2,467	4,028	4,934	4,934
3,783.7	–	1,351	2,414	3,765	4,828	4,828

RESERVOIR WATER SURFACE ELEVATION (FEET, NAVD88)	TOTAL DISCHARGE RATE CAPACITY					
	SPILLWAY ONLY (CFS)	POWER INTAKE ONLY (CFS)	ONE CULVERT - NO POWER (CFS)	ONE CULVERT - WITH POWER (CFS)	TWO CULVERTS (CFS)	TWO CULVERTS PLUS SPILLWAY (CFS)
3,782.7	–	1,155	2,359	3,514	4,718	4,718
3,781.7	–	973	2,303	3,276	4,606	4,606
3,780.7	–	805	2,240	3,045	4,480	4,480
3,779.7	–	651	2,187	2,838	4,374	4,374
3,778.7	–	512	2,128	2,640	4,256	4,256
3,777.7	–	388	2,066	2,454	4,132	4,132
3,776.7	–	279	2,003	2,282	4,006	4,006
3,775.7	–	187	1,939	2,126	3,878	3,878
3,774.7	–	111	1,872	1,983	3,744	3,744
3,773.7	–	54	1,803	1,857	3,606	3,606
3,772.7	–	15	1,731	1,746	3,462	3,462
3,771.7	–	–	1,657	1,657	3,314	3,314
3,770.7	–	–	1,578	1,578	3,156	3,156
3,769.7	–	–	1,496	1,496	2,992	2,992
3,768.7	–	–	1,409	1,409	2,818	2,818
3,767.7	–	–	1,316	1,316	2,632	2,632
3,766.7	–	–	1,135	1,135	2,270	2,270
3,765.7	–	–	1,098	1,098	2,196	2,196
3,764.7	–	–	868	868	1,736	1,736
3,763.7	–	–	735	735	1,470	1,470
3,762.7	–	–	609	609	1,218	1,218
3,761.7	–	–	491	491	982	982
3,760.7	–	–	382	382	764	764
3,760.2	–	–	331	331	662	662
3,760.0	–	–	312	312	624	624
3,759.7	–	–	283	283	566	566
3,758.7	–	–	194	194	388	388
3,757.7	–	–	117	117	234	234
3,756.7	–	–	54	54	108	108
3,755.7	–	–	10	10	20	20
3,755.2	–	–	–	–	–	–

Notes:

Source: Northwest Hydraulic Consultants computational fluid dynamics modeling in Appendix B2 of the Design Report (Knight Piésold, 2020b).

3.1.2 J.C. Boyle Facility Slope-Stability Analysis

The Reservoir Rim Stability Report (Knight Piésold, 2020a) provides analysis in support of this section of the Oregon Reservoir Drawdown and Diversion Plan and describes the reservoir rim and associated properties (private vs. public) abutting the rim. The reservoir rim is defined as the terrain that lies within the normal operating levels of the reservoir. The terrain downslope and upslope of the rim are defined as submarine slopes and upslope areas, respectively. Additional details are included in the Slope Stability Monitoring Subplan (Appendix A). Drawdown of the J.C. Boyle Reservoir will not result in large-scale slope instability effecting adjacent infrastructure or properties. No management measures are necessary.

There are no known residential properties adjacent to the J.C. Boyle Reservoir rim. A bridge crossing on Highway 66 separates the broad north part of the reservoir from the south part, which in mainly confined within a canyon.

Undercutting has been identified at one location around the J.C. Boyle Reservoir rim. There is an approximately 15 ft-high, steep shoreline slopes, comprised of diatomite, in the north part of the reservoir that has been undercut by wave action (Figure 3.1). The terrain analysis identified a possible ‘relict’ (i.e., occurred greater than 100 years ago) rockslide on the south side (e.g., left side looking in the downstream direction) of the bedrock canyon adjacent to the west part of the reservoir (Figure 3.2) (Knight Piésold, 2020a). No submarine landslides were identified in the terrain analysis. The soft sediment that has accumulated on the floor of the reservoir will be highly susceptible to erosion upon drawdown.

Previous studies completed by PanGeo (2008) and the Renewal Corporation (2019) and supported by a recent study by Knight Piésold (2020a), indicate that drawdown of the J.C. Boyle Reservoir will not result in large-scale slope instability effecting adjacent infrastructure or properties. There is local potential for slope instability at the diatomite cliff on the north side (e.g., right side looking in the downstream direction) of the reservoir during drawdown. However, the occurrence of gentle slopes beneath the diatomite cliff will render the possibility low. The lower slopes of the southwest oriented bedrock canyon, south of the road crossing, are comprised of geological materials that are not expected to be prone to slope instability during the drawdown.

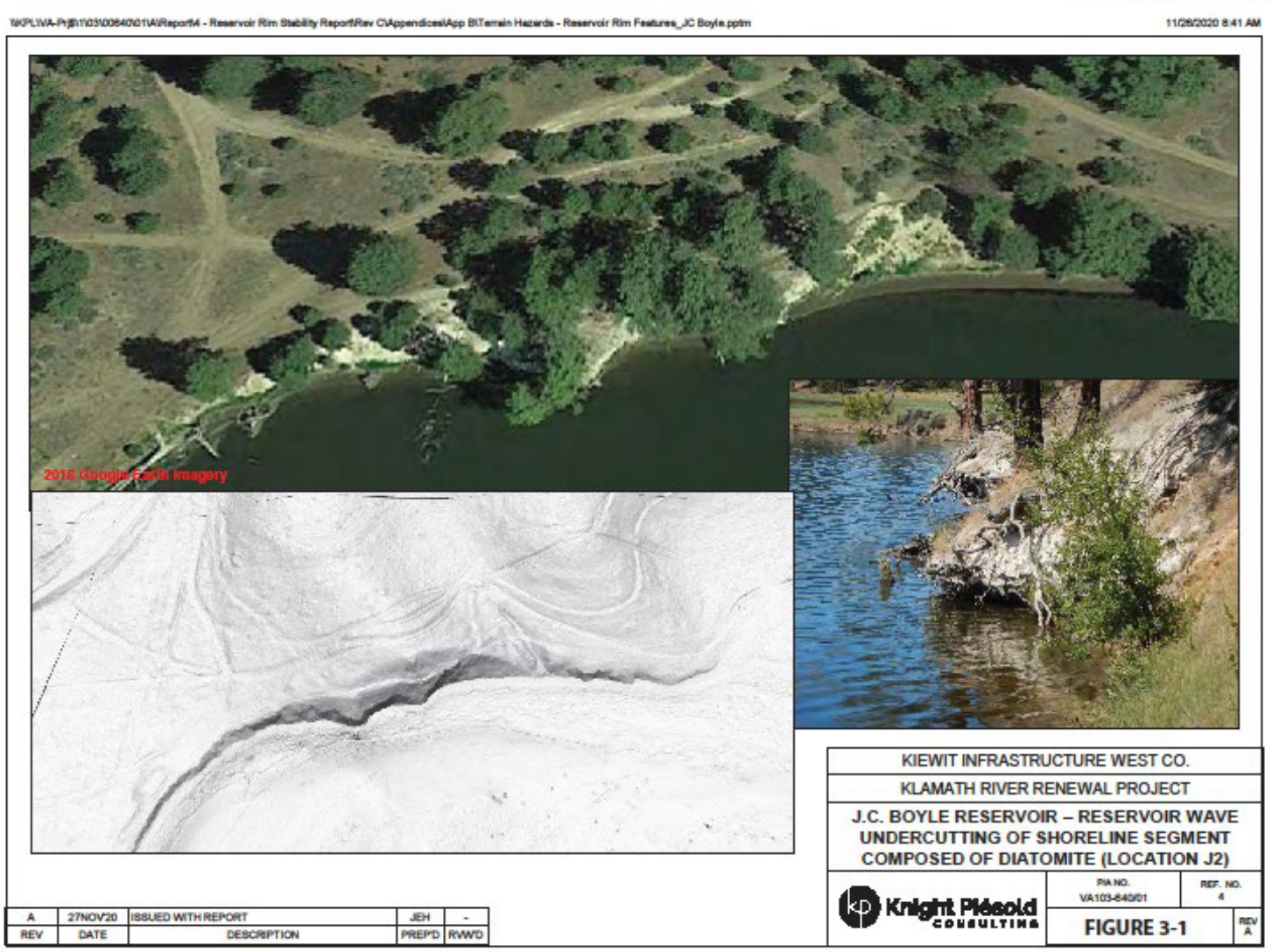

Figure 3.1 J.C. Boyle Reservoir – Reservoir Wave Undercutting of Shoreline Segment Composed of Diatomite (Location J2)

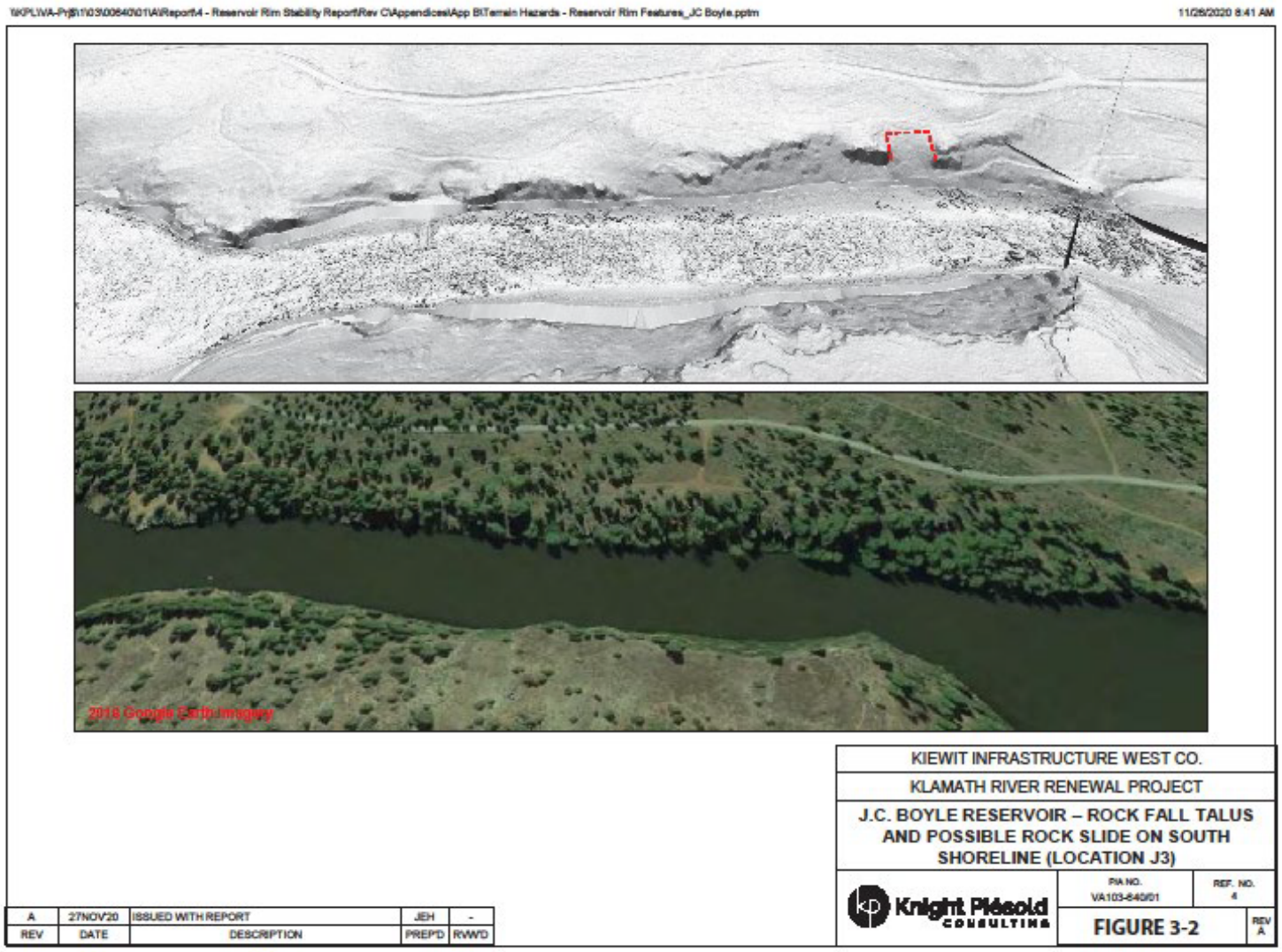

Figure 3.2 J.C. Boyle Reservoir – Rock Fall Talus and Possible Rock Slide On South Shoreline (Location J3)

3.2 Drawdown and Diversion Procedures

The Renewal Corporation will initiate the release of sediment to the Klamath River from the three larger reservoirs (J.C. Boyle, Copco No. 1, and Iron Gate) with reservoir drawdown. Initial reservoir releases will be accomplished with the facilities' existing structures to bring the reservoirs at or near their minimum allowable operating levels, which will occur prior to January 1st. Starting January 1, Stage 1 of 4 stages will commence, allowing for regulated releases to draw down the reservoirs and release associated sediment in a controlled manner. Drawdown will continue until removal of the dams. The following reservoir drawdown and diversion approach described in this section is from the Design Report (Knight Piésold, 2020b).

3.2.1 Existing Facility Components

The J.C. Boyle facility construction is well documented in historic design drawings and construction photographs. Historic drawings are provided in Appendix K of the Design Report (Knight Piésold, 2020b). The STID is provided in Appendix J of the Design Report.

3.2.2 Pre-Drawdown Works

The Renewal Corporation will utilize existing facility features to assist with pre-drawdown and drawdown at the J.C. Boyle facility. The Renewal Corporation will use two existing diversion culverts under the current spillway to facilitate reservoir drawdown and flow passage during dam removal. The historic cofferdam and earthfill dam embankment divert water into the diversion culverts.

The dam site is accessible without additional access improvements. The Renewal Corporation can commence site preparation, equipment mobilization, and construction access improvements to other parts of the facility after drawdown is complete.

Under the original license, the J.C. Boyle Reservoir operation during the pre-drawdown period will follow the PacifiCorp STID operating levels (PacifiCorp, 2015). The reservoir operation elevations are defined as follows:

- Normal maximum reservoir operation level: 3,796.7 ft (NAVD88)
- Normal minimum reservoir operation level: 3,791.7 ft (NAVD88)

3.2.3 Reservoir Operation

After the License transfer order is accepted, the Renewal Corporation will lower the reservoir and maintain it at a targeted level just below the spillway crest by controlled spillway releases or by using normal power operations prior to the commencement of drawdown (January 1 of the drawdown year)."

3.2.4 Drawdown Works

The Renewal Corporation will commence drawdown operation at J.C. Boyle on or about January 1 of the drawdown year. No special provisions for pre-drawdown are needed for J.C.

Boyle; however, the Renewal Corporation will drawdown the reservoir to the normal minimum operating level prior to January 1, as inflows allow. The proposed drawdown occurs in four stages; the first utilizes the spillway gates, the second utilizes the power facilities, and the third and fourth utilize a sequenced removal of the diversion culvert stoplogs (shown on drawing C1050 in Appendix B).

The Renewal Corporation will maintain a reservoir water surface level of 3,783.2 ft (2 ft below the spillway crest) to initiate both Stage 3 and Stage 4. This level allows workers to safety access the downstream side of the diversion culverts. River forecasting and coordination with the United States Bureau of Reclamation (USBR), operator of Link River Dam and Upper Klamath Lake, is required so the reservoir water level will remain below the spillway crest while crews are actively working on the downstream side of the diversion culverts. The maximum rate of drawdown varies from stage to stage due to inflow, the geometry of the reservoir, and the nature of the outflow (free-flowing) through the diversion culverts.

The design analysis completed to support the Design Report (Knight Piésold, 2020b) compared steady-state inflows to culvert rating curves to determine the maximum flow allowable for crews to safely access the downstream side of the diversion culverts. These are presented in the Stage 2 and Stage 3 drawdown sections below. The United States Bureau of Reclamation (USBR) controls Link River Dam releases, which therefore has the capacity to regulate flows into JC Boyle. For safety of working crews, during Stage 2 and Stage 3, flow coordination with the USBR will be finalized when climatic information is available and flow forecasts are prepared by the USBR to keep JC Boyle reservoir below the spillway crest.

Steady state water surface elevations are provided on drawing C1055 in Appendix B.

3.2.4.1 Stage 1 Drawdown

The Renewal Corporation will commence Stage 1 drawdown no earlier than January 1 of the drawdown year, with the reservoir at or above the minimum operating elevation of 3,791.7 ft. The Renewal Corporation will achieve this stage of drawdown by using the gated spillway bays to lower reservoir levels at a target rate of 5 ft per day. The Renewal Corporation will achieve reservoir drawdown rate control by varying spillway openings according to actual reservoir inflow rates. The power intake may be closed during Stage 1 except in the case of extreme wet conditions (high inflow rates), when the additional capacity of the power facilities is required to achieve drawdown.

The Renewal Corporation will undertake to complete Stage 1 drawdown within 48 to 72 hours of commencement, when the water level in the reservoir has stabilized above the spillway crest (spillway crest El. 3,785.2 ft). The stabilized elevation marking completion of Stage 1 may depend on the reservoir inflows at the time of drawdown.

3.2.4.2 Stage 2 Drawdown

The Renewal Corporation may initiate Stage 2 drawdown by continued power operations once Stage 1 is completed, and with the use of the spillways during wet year inflows. With power operations, outflow rates will initially increase and then quickly subside as water levels recede (ranging up to 2,850 cfs). The diversion culverts may remain closed during Stage 2.

Stage 2 drawdown may be complete when the water level in the reservoir has stabilized at least 2 ft below the spillway crest (spillway crest El. 3,785.2 ft). The stabilized elevation marking completion of Stage 2 may depend on the reservoir inflows at the time of drawdown. A reservoir water level which is 2 ft below the spillway crest is associated with a reservoir inflow of 1,260 cfs and may require river forecasting and coordination with the USBR, operator of Link River Dam and Upper Klamath Lake to achieve this flow release.

A concrete stoplog needs to be removed from diversion culvert #1 to initiate Stage 3 drawdown. The explosives required to remove the culvert stoplog and initiate Stage 3 can only be set when there is no flow coming over the spillway. The Renewal Corporation may complete culvert stoplog removal work at the end of Stage 2 when reservoir water surface elevations are below the spillway invert and reservoir outflows are passing through power operations. The Renewal Corporation will close the spillway gates when work is being performed on the downstream side of the low-level diversion culverts. The Renewal Corporation will prepare and remove diversion culvert #1 stoplog over a period of about 24 hours.

3.2.4.3 Stage 3 Drawdown

The Renewal Corporation will initiate Stage 3 drawdown once Stage 2 is completed by removing one of the diversion culvert concrete stoplogs. The Renewal Corporation will remove the diversion culvert #1 stoplog by controlled blasting. Diversion culvert #1 is located below the gated spillways and provides a 9.5 ft by 10 ft opening with an invert elevation of 3,755.2 ft. With diversion culvert #1 opened, outflow rates will initially increase and then subside as reservoir water levels recede (ranging up to 3,786 cfs). The Renewal Corporation will close the power intake wheel gate simultaneously with (or immediately prior to) the removal of the diversion culvert #1 stoplog. Once the power intake is closed, it will remain closed for the duration of the drawdown period.

The J.C. Boyle reservoir is narrow and does not have a large storage capacity below the spillway crest elevation. As a result, the culvert outflow rate will quickly equalize with the reservoir inflow rates over a 48- to 72-hour period. The maximum anticipated drawdown rate for Stage 3 is 10 ft per day. The stabilized elevation marking completion of Stage 3 will depend on the reservoir inflows at the time of drawdown. Similarly, to Stage 2, a reservoir water level that is 2 ft below the spillway crest is required for access to the downstream side of diversion culvert #2 to prepare for Stage 4. While water is flowing from diversion culvert #1, the Renewal Corporation will cut an access hole in the roof of diversion culvert #2 to gain access to the diversion culvert #2 stoplog. This process will allow the Renewal Corporation to conduct diversion culvert #2 concrete stoplog demolition work in the dry (i.e., isolated from diversion culvert #1 outflows, to the greatest extent possible). This reservoir elevation is associated with a

reservoir inflow of about 2,120 cfs and may require river forecasting and coordination with the USBR, operator of Link River Dam and Upper Klamath Lake to achieve this flow release.

3.2.4.4 Stage 4 Drawdown

The Renewal Corporation will initiate Stage 4 drawdown on or about June 10 of the drawdown year by removing the diversion culvert #2 concrete stoplog. The exact timing of the removal of the stoplog for Stage 4 will take into consideration and may be adjusted to best accommodate the inflow rates and water levels at the time.

The Renewal Corporation will remove the diversion culvert #2 stoplog by controlled blasting, if required. Diversion culvert #2 is located below the gated spillways and provides a 9.5 ft by 10 ft opening with an invert elevation of 3,755.2 ft. The outflow rate will initially increase and then equalize with the reservoir inflow rates over approximately 12 to 24 hours, as the reservoir water level drops (ranging up to 7,572 cfs). The maximum anticipated drawdown rate for Stage 4 is 10 ft per day. Completion of the Stage 4 drawdown may provide the lowest possible drawdown of the reservoir based on reservoir inflow.

The drawdown is will be complete when both diversion culverts are operating, the J.C. Boyle reservoir has been substantially dewatered, and reservoir inflows and outflows equalize (water levels are relatively stable). The diversion culverts will remain open and will pass all river flows until the historic cofferdam breach is conducted.

3.3 Flood Frequency and Hydrological Evaluation

This section of the Oregon Reservoir Drawdown and Diversion Plan is informational and discusses the results of the drawdown model and implications to the Proposed Action. The section does not contain specific measures to be implemented by the Renewal Corporation as part of the Proposed Action.

Operation of the J.C. Boyle reservoir during drawdown and post-drawdown will lower the reservoir impoundment and provide the required flood control. The Renewal Corporation will complete the reservoir drawdown sequencing over four stages as described in the prevision section and as outlined in detail in the design report (Knight Piésold, 2020b) and on drawing C1050 in Appendix B. The drawdown model was developed to assess the drawdown sequencing in terms of reservoir water surface levels under a range of hydrologic conditions.

3.3.1 Reservoir Conditions During Drawdown

Hydrologic simulations of the reservoir drawdown inflows into the J.C. Boyle Reservoir and drawdown regulation and outflows through the J.C. Boyle Dam are included in Appendix B. Appendix B also shows the hydrologic simulations of the reservoir drawdown inflows into the Copco No.1, Copco No. 2, and Iron Gate Reservoirs and drawdown regulation and outflows from the upstream dam.

Reservoir water surface levels were simulated in the drawdown model for the full record of inflows available for the 2019 Biological Opinion (2019 BiOp [NMFS, 2019]) dataset. The 2019 BiOp flows reflect 36 years of river flows, from October 1980 through September 2016. The results of the drawdown model are summarized in three ways:

- Individual year simulations were produced for the J.C. Boyle Simulated Drawdown. These plots indicate the following:
    - Reservoir water surface levels.
    - Daily average inflows, total outflows, and outflows for each outlet structure (i.e., spillway, power intake, and flows through the diversion culverts).
- Maximum daily reservoir water surface level daily non-exceedance percentiles (percentiles) are shown on Figure 3.3., and on drawing C1056 in Appendix B. This figure represents the results from all 36 model simulations as non-exceedance percentiles to summarize the distribution of the results on any given day of the simulations. These results do not represent a simple simulation and are based on all the model simulations.
- Ensemble figures, Figure 3.4, with each line representing a single model simulation for a different year. This figure overlaps the simulated reservoir water surface levels on a common x-axis that spans January 1 to September 30. Each line represents a single model simulation.

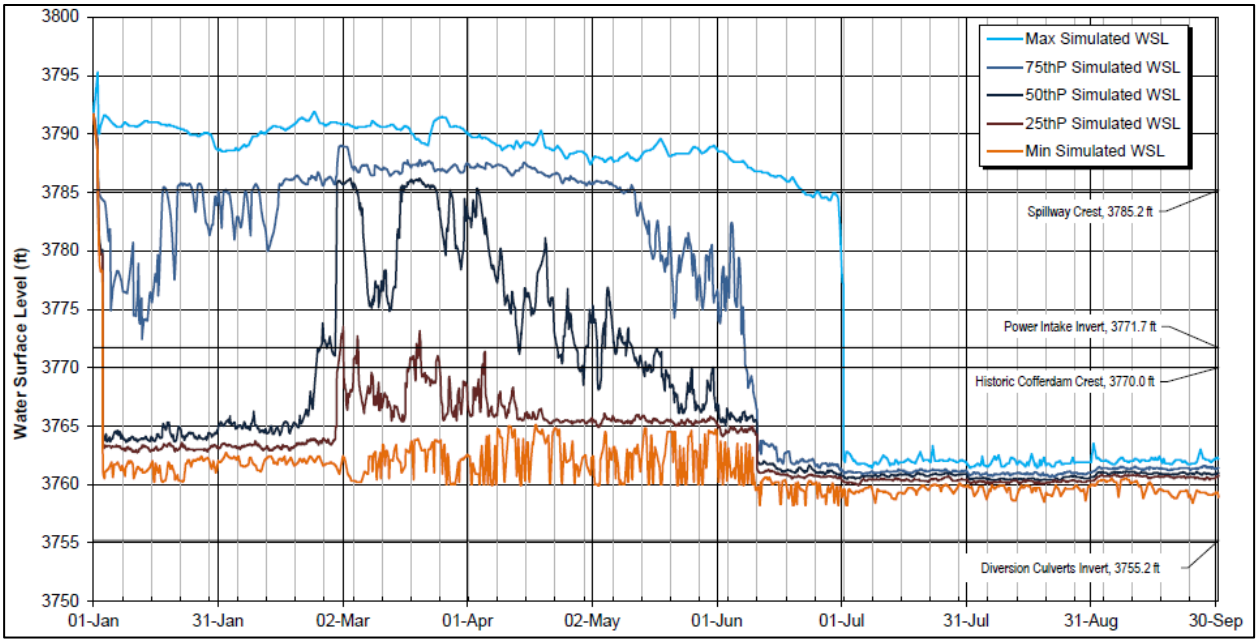

Figure 3.3. J.C. Boyle Reservoir Drawdown Simulated Water Surface Levels Non-Exceedance Percentiles

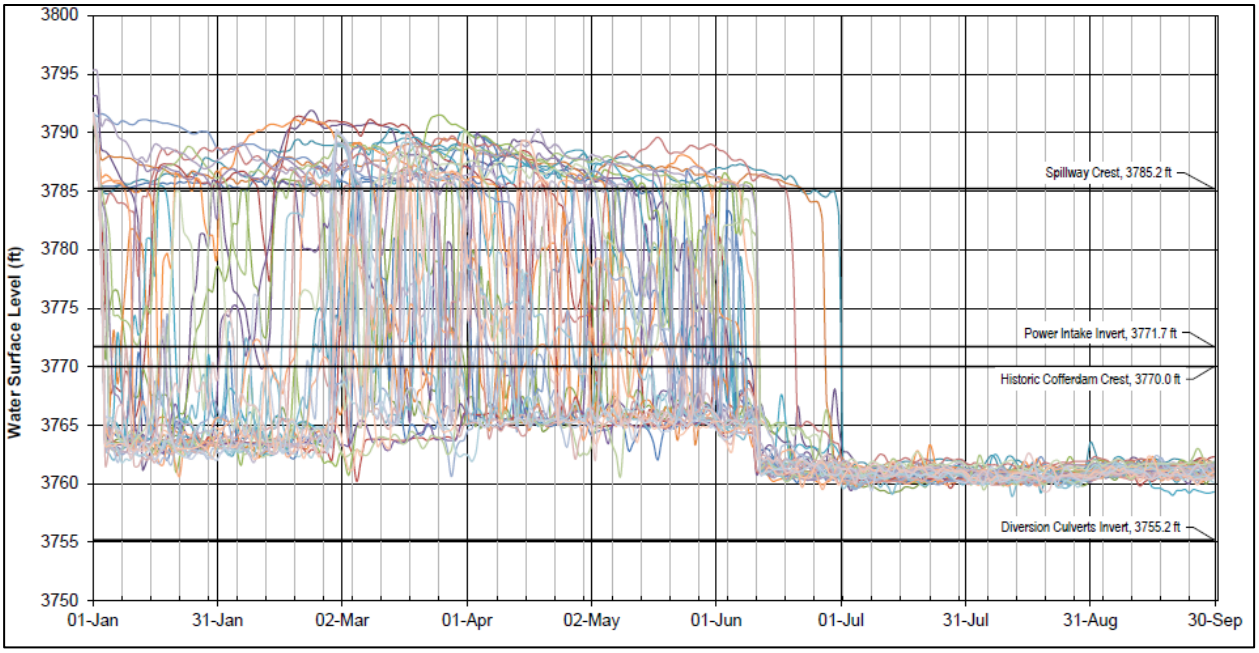

Figure 3.4. J.C. Boyle Reservoir Drawdown Simulated Water Surface Levels Ensemble Plot

The simulated water surface levels on Figure 3.3. and Figure 3.4 show that there is a substantial reduction in the reservoir water levels in mid-June with the majority of the simulated years achieving sustained water levels below the historical cofferdam crest in early June. This is a function of initiating Stage 4 of drawdown on June 10 and the inflow hydrology, which indicates a reduction in streamflow for the second half of June (Appendix A6 of the Design Report [Knight Piésold, 2020b]). There are three model years (1983, 1984, and 1998) that show elevated reservoir water surface levels past June 15. However, in these years, the reservoir water surface levels do drop below the crest of the historic cofferdam prior to July 1.

Figure 3.4 shows that there are large fluctuations in the reservoir water surface levels from January through June as a function of the inflow hydrology into the J.C. Boyle reservoir. The J.C. Boyle reservoir has a small storage capacity, and the reservoir can refill quickly during the higher flow months, typically in January through May, resulting in spillway flows. Lower reservoir levels will be sustained below the crest of the historic cofferdam after June 1 depending on the hydrologic conditions and throughout Stage 4.

Figure 3.5. shows the cumulative percent of model simulations and the date when the reservoir water surface level is lower, and sustained, below the crest of the historic cofferdam. The drawdown model indicates that approximately 50% of the simulations have reservoir water levels sustained below the crest of the historic cofferdam by June 1, with 100% of the simulations by July 1. Note that these water levels are for average daily conditions and do not account for the low probability flood flows (i.e., the 1% and 5% probable flood flows).

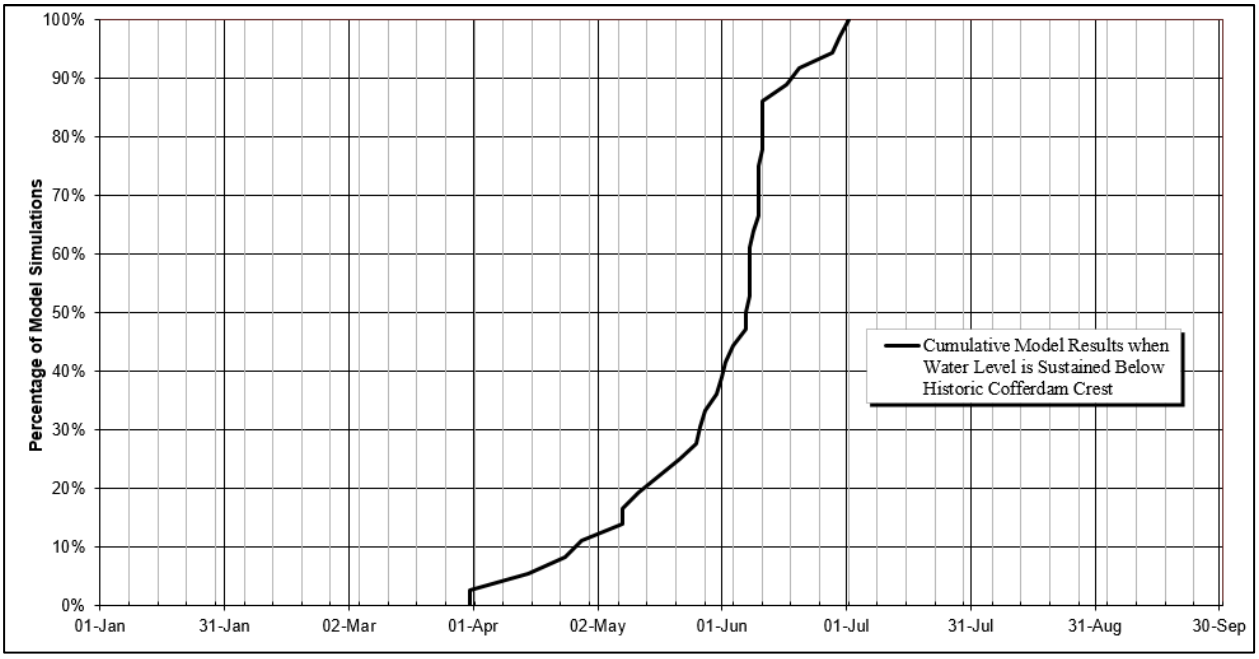

Figure 3.5. J.C. Boyle Reservoir Drawdown Cumulative Model Simulation Dates to Achieve and Sustain Reservoir Water Surface Levels below the Crest of the Historic Cofferdam

The results of the reservoir drawdown model are outlined below for each stage of drawdown.

- Stage 1 - Spillway Gates:
    - The spillway gates are used to target a drawdown of 5 ft/day, and drawdown occurs over one day.
- Stage 2 - Power Intake is Opened:
    - The reservoir water levels are controlled by the discharge capacity of the power intake and are dependent on the reservoir inflows.
    - Outflows through the power intake are limited to 2,850 cfs. The total outflow can be higher if the spillway is still engaged.
    - The reservoir can lower up to 5 ft when the power intake is initially opened in drier climatic conditions, as seen in the simulated results for 1990 and 2015.
    - The drop in reservoir water surface levels is not as large in wetter climatic conditions, and may be maintained above the spillway crest, as seen in simulated results for 1984 and 1997.
    - The duration of Stage 2 is determined by the hydrologic conditions and when the downstream of the diversion culverts can be accessed to successful remove the stoplogs. Approximately 75% of the simulations indicate that the duration of Stage 2 is limited to less than a week under the simulated drawdown methodology. Years with much higher than average inflows (wet years) indicate that Stage 2 can be sustained for many weeks and beyond April 1. This is observed in less than 15 % of the simulated years (1983, 1984, 1985, 1997, and 2006). In approximately 10% of simulations, Stage 2 was limited to 2 weeks (1982, 1996, 1998, and 2002).

  - River forecasting and coordination with the upstream refilling of Upper Klamath Lake may be utilized to limit the duration of Stage 2. Reduced inflows to the reservoir will result in lower reservoir water levels, therefore, allowing for safe access to the downstream end of the diversion culverts. The steady-state inflow to the reservoir to maintain a water level 2 ft below the spillway crest with the power intake is 1,250 cfs for Stage 2. Alterations to the flow releases from refilling of Upper Klamath Lake outside of the 2019 BiOp flows were not simulated with the drawdown model.
- Stage 3 – Diversion Culvert #1 is Opened:
  - A temporary drop in reservoir water surface level and an increase in outflow is observed when the diversion culvert is opened. The reservoir water surface levels can drop below 3,765 ft under most hydrological conditions when the diversion culvert is opened. Wetter hydrological conditions will result in a lesser drop in the reservoir level (e.g., 1998 drops to approximately 3,770 ft as there is an increase in reservoir inflows shortly after removing the diversion culvert stoplogs).
  - After removal of the diversion culvert #1 concrete stoplog, the power tunnel intake will be permanently closed.
  - Outflows through the diversion culvert are limited to approximately 2,400 cfs prior to the spillway being engaged. Total outflows in Stage 3 can be higher if the spillway is still engaged.
  - The reservoir water surface level is likely to increase periodically after opening Diversion Culvert #1. Nearly 90% of the model simulations indicate that the spillway will be reengaged during Stage 3.
  - The drawdown model report notes that under the drawdown operating criteria evaluated for the drawdown model, in some years both diversion culverts open on the same date (June 11). Under these hydrological conditions, coordination with the refilling of Upper Klamath Lake will be required to permit the opening of diversion culvert # 1 on an earlier date, therefore initiating Stage 3 of drawdown prior to June 10.
- Stage 4 – Diversion Culvert #2 is Opened:
  - Stage 4 represents the final stage of drawdown.
  - Stage 4 is initiated on or after June 10 and when the reservoir water surface level is 2 ft below the spillway crest, or lower. The steady-state inflow to the reservoir to maintain a water level 2 ft below the spillway crest with diversion culvert #1 open is 2,120 cfs.
  - Over 90% of the drawdown model simulations indicate that diversion culvert #2 is opened on June 10. Under wet hydrological conditions, such as those in simulation years 1983, 1984, and 1998, the opening on the diversion culvert is delayed – the latest date resulting from the simulations is June 29.
  - The reservoir water surface levels can drop below 3,763 ft under most hydrological conditions when diversion culvert #2 is opened. Wetter hydrological conditions will result in a lesser drop in the reservoir level (e.g., 1993, 1998, 1999

and 2011 drops to approximately 3,765 ft with the initial opening of the diversion culvert).

After the diversion culvert has been opened, and after July 1, the reservoir water surface levels remain low and are within the range of 3,758.0 to 3,763.5 ft. for all the model simulations.

4.0 Monitoring Plan

4.1 Reservoir Level Monitoring

Under the existing license, reservoir levels are currently continuously monitored through the powerhouse control room and Hydro Control Center (HCC) at Merwin Dam on the Lewis River in Washington (PacifiCorp, 2015). Flows can increase the volume of debris deposited against facility components during potentially high-flow storm events. Erosion, back cutting, sloughing, or obstruction in the spillway or tailrace channels might occur as a result of these high-flow conditions. Special attention to these areas is included in the monitoring and surveillance of the facility during or after high-flow events. In accordance with the requirements in the STIDs, the Proposed Action will comply with high-flow event monitoring. If obstructions occur, the Renewal Corporation can implement measures to remove obstructions, such as mechanical means of removal and controlled blasting.

The Renewal Corporation will monitor reservoir levels during drawdown by level sensors and staff gauge, per the PacifiCorp STID. If readings are approaching a level that could cause concern regarding stability of the reservoir rim or embankment areas, the Renewal Corporation will implement the contingency measures discussed in Section 5.4 and, if necessary, take remedial actions described in the Emergency Response Plan (Kiewit, 2020) for the Project and Appendix A (Oregon Slope Stability Monitoring Subplan) to this plan.

4.2 Flow Monitoring

The Renewal Corporation will continue to monitor USGS stream gages (11509500 below Keno Reservoir and 11510700 below J.C. Boyle Reservoir) as described in the Oregon Water Quality Management Subplan.

4.3 Embankment and Reservoir Rim Monitoring

Slope stability monitoring for the J.C. Boyle Reservoir rim and embankment structures is included in Appendix A of this Oregon Reservoir Drawdown and Diversion Plan. The Slope Stability Monitoring Subplan presents the Renewal Corporation's proposed monitoring and evaluates practices to avoid and minimize potential water quality impacts related to slope stability. The subplan proposes measures to address instability and discharges that may impact water quality. Appendix A (Slope Stability Monitoring) includes proposed monitoring activities, consistent with the PacifiCorp STID, as follows:

- Proposed survey monuments to monitor slope stability during and following drawdown.

- Visual monitoring schedule for evidence of potential slumping, cracking, or slope failure of dam embankment during dam removal; and

- Monitoring of J.C. Boyle Reservoir elevation and streamflow at the United States Geological Survey (USGS) gauge 11509500 below Keno Reservoir and guage 11510700 below J.C. Boyle powerhouse during drawdown.

4.4 Sediment Monitoring

The Renewal Corporation will conduct the sediment monitoring described in the Oregon Reservoir Area Management Plan (RAMP) (RES, 2020). Per the RAMP, the Renewal Corporation will use aerial data capture methods and ground-based surveying to inform design progression following drawdown and assist sediment evacuation at the priority tributary restoration sites. Refer to the RAMP for additional information regarding sediment and vegetation monitoring and associated adaptive management approaches.

5.0 Implementation Plan

5.1 J.C. Boyle Facility

Section 5 describes the post-drawdown decommissioning and removal measures. Water surface elevations based on steady state flood flows and with both low-level outlets (diversion culverts #1 and #2) open, are provided on drawing C1055. The drawdown modeling provides simulated water surface levels through to October 1 of the drawdown year. Additional information is provided in the design drawings provided in Appendix B and supporting details of the Design Report (Knight Piésold, 2020b).

5.1.1 Dam and Intake Concrete Removal

With the diversion culverts operating as described above, the Renewal Corporation will remove the concrete components at the dam and intake. Dam and intake structure removals are shown on drawings C1210 and C1220 (Appendix B) and are described in the subsections below.

5.1.1.1 Concrete Removal

The Renewal Corporation will remove spillway gates and hoisting equipment after drawdown is complete. Partial removal of the concrete spillway may occur in the low flow summer period coinciding with the decline in flood water surface elevations. The Renewal Corporation will remove the fish ladder, concrete cut-off wall and power intake concrete in conjunction with dam embankment removal. The phased removal elevations are shown on drawings C1234 and C1239. The final removal elevation at the intake is about 3,785.2 ft. Removal methods include dam embankment excavation, mechanical demolition, drilling, and controlled blasting. Following use as an access road to the left bank, the Renewal Corporation will bury concrete below this elevation in place. The Renewal Corporation will place excavated concrete rubble in the scour hole. The top-down concrete removal process will confirm structural stability criteria are met throughout the entire concrete structure removal process.

5.1.2 Earthfill Embankment Removal

The Renewal Corporation will commence embankment removal and demolition work following reservoir drawdown. The removal plan allows for the majority of the dam removal to occur in the dry, by leaving the upstream portion of the dam embankment and historic cofferdam in place and removing the dam embankment in phases (as shown in Table 5.1). The Renewal Corporation will remove the embankment in Phases 1 to 7, remove the historic cofferdam in Phase 8, and bury the diversion culvert channel and remaining concrete in Phase 9. Additional detail is provided in the following subsections.

Proposed stability requirements for the embankment through drawdown and embankment removal are provided in Table 3.1, and embankment removal drawings (C1230 to C1232, and C1234 to C1239) are included in Appendix B.

5.1.2.1 Stability, Freeboard, and Removal Phases

Removal of the J.C. Boyle earthfill dam embankment and concrete structures is planned and proposed in a manner that maintains the current stability criteria. This is achieved by removing the embankment in a sequence that does not result in narrowing of the crest or steepening of the downstream embankment slopes (drawing C1050 in Appendix B). Appendix B of the Design Report provides a description of the geotechnical, civil, and hydrotechnical details proposed for the phased dam embankment removal. The embankment removal work is broken into multiple phases related to flood water surface elevations. The phased embankment removal, historic cofferdam removal, and downstream rockfill grading, including historic cofferdam breach and removal are shown on the design drawings in Appendix B.

In addition to meeting the stability criteria discussed above, the Renewal Corporation will remove the dam in a manner that provides a 3-ft freeboard for a reservoir water level corresponding to a 1% flood event (100-year instantaneous flood flow), as shown on the design drawings in Appendix B.

5.1.2.2 Final Embankment Removal

The Phase 5 embankment crest will be at El. 3,770.7 ft. The Renewal Corporation will complete the majority of embankment dam fill removal in the dry, as the historic cofferdam upstream is anticipated to route flows to the diversion culverts. The Renewal Corporation will excavate the final river channel footprint to approximately 3,739 ft at the dam embankment centerline based on the anticipated bedrock depth. This river bottom elevation is lower than the diversion culvert invert elevation of 3,755.2 ft. The Renewal Corporation will complete visual inspection of the historic cofferdam and remaining sediment prior to removal of the Phase 6 embankment. The Renewal Corporation will complete the removal of the Phase 6 embankment in conjunction with the riverbank slope protection installation, as shown on drawing C1230 in Appendix B.

5.1.3 Historic Cofferdam and Sediment Removal

The Renewal Corporation will use the historic cofferdam that is located about 450 ft upstream of the dam embankment centerline. No historic design or construction cofferdam details are

available. The Renewal Corporation will assess the condition of the historic cofferdam after the reservoir is lowered and make any repairs needed for the cofferdam to function as originally intended. This may include:

- Adding earthfill to the crest to restore original crest elevation and freeboard
- Lining the upstream portion of the cofferdam with impervious material
- Mechanically removing sediment from the diversion culvert approach channel

Following use of the historic cofferdam to divert flows to the diversion culverts, the Renewal Corporation will remove the cofferdam as well as accumulated sediment between the embankment dam and the cofferdam. This is required to restore the river channel and achieve volitional fish passage.

The Renewal Corporation will cut the cofferdam embankment back towards the right bank (drawing C1239 in Appendix B). Once the cofferdam is breached, flow will naturally erode and remove portions of the historic cofferdam. The Renewal Corporation will remove material remaining and place this material in the disposal area. This removal will return flows to the historic channel and allow for in-water removal of the remaining fill.

5.1.4 Final River Channel

The Renewal Corporation will remove the embankment, historic cofferdam, and soft sediment to an elevation that provides channel width and grade suitable for volitional fish passage. No bedrock or rockfill will be excavated. The Renewal Corporation will install erosion protection prior to historic cofferdam breach. The Renewal Corporation will line areas along the final river channel that are expected to be inundated during the 1% flood with a layer of bedding material to provide the appropriate filter relationship with the subgrade material, and rock material to mitigate scour. Proposed gradations and appropriate thicknesses are detailed in the Design Report (Knight Piésold, 2020b). The final grading plan of the channel through the J.C. Boyle site is shown on drawing C1230 in Appendix B.

5.2 Drawdown Implementation Timeline

Table 5.1 summarizes key dates and associated work activities with respect to the drawdown of the J.C. Boyle Reservoir. A complete implementation schedule for the Oregon Reservoir Drawdown and Diversion Plan is provided in Appendix C.

Table 5.1. Key Intake and Embankment Elevations and Removal Timing

REMOVAL ITEM	ELEVATION (FT)	EARLIEST REMOVAL DATE	DESIGN FLOOD EVENT	COMMENTS
Spillway Gates and Trunnions	3,790.0	January 1	-	Trunnions and spillway gates are not necessary for spillway operation and can be removed after drawdown.

REMOVAL ITEM	ELEVATION (FT)	EARLIEST REMOVAL DATE	DESIGN FLOOD EVENT	COMMENTS
Diversion Culvert #1 (Drawdown Stage 3)	3,755.2 ft	Varies	-	See drawdown section (Stage 3).
Embankment Removal **Phase 1**	-	March 15	1% Probable Flood + 3ft freeboard	Remove erosion protection material from downstream face of the dam.
Embankment Removal **Phase 2**	3792.1	June 1	1% Probable Flood + 3ft freeboard	Remove embankment to June 1 1% probable flood with 3 ft freeboard.
Diversion Culvert #2 (Drawdown Stage 4)	3,755.2	Varies	-	See drawdown section (Stage 4).
Embankment Removal **Phase 3**	3,784.7	June 15	1% Probable Flood + 3ft freeboard	Remove embankment to June 15 1% probable flood with 3 ft freeboard.
Spillway Structure	3785.2	July 1	1% Probable Flood + 3ft freeboard	Remove spillway and intake structure to max removal elevation – maintain 15 ft width for access to left bank.
Abutment Left Wall Phase 1	3,785.2	July 1	1% Probable Flood + 3ft freeboard	Match left wall elevation to spillway and elevation.
Embankment Removal **Phase 4**	3,776.7	July 1	1% Probable Flood + 3ft freeboard	Remove embankment to July 1 1% probable flood with 3 ft freeboard.
Embankment Removal **Phase 5**	3,770.4	July 15	1% Probable Flood + 1ft freeboard	Criteria changes from 1% probable flood with 3 ft freeboard to 1% probable flood with 1 ft freeboard. Remove embankment to July 15 1% probable flood with 1 ft freeboard.
Embankment Removal **Phase 6** and Erosion Protection Installation	-	Aug 1	1% Probable Flood + 1ft freeboard	Remove remaining embankment and silt. Excavate final channel to lines and grades shown on C1230, followed by installation of erosion protection and bedding material. Stockpile material for eventual placement in diversion culvert channel and to bury intake concrete (Phase 9).
Evaluate/Grade Downstream Rockfill **Phase 7**	3770.0	Aug 1	1% Probable Flood + 1ft freeboard	Evaluate rockfill for use in final channel following removal Phase 6 and grade as required.

REMOVAL ITEM	ELEVATION (FT)	EARLIEST REMOVAL DATE	DESIGN FLOOD EVENT	COMMENTS
Historic Cofferdam Breach **Phase 8**	3,755.2 (min)	September 1	-	To start no earlier than September 1 and be completed no later than September 30. Breaching of the historic cofferdam must take place after the final channel excavation is substantially complete.
Intake Cover **Phase 9**	-	September 1	-	To occur after cofferdam breach and substantial completion of the Final River Channel. Place material in diversion culvert channel and bury intake concrete.

5.3 Potential Failure Mode Analysis (PFMA)

Potential Failure Modes (PFMs) were determined as part of the December 11 and 14, 2020 informal PFMA workshop.

5.4 Contingency Measures

Contingency measures identifying, evaluating, and addressing potential issues that may occur during reservoir drawdown and removal include procedures for assessing and responding to:

- Reservoir discharge obstructions caused by physical blockages, mechanical failure, or other conditions that may restrict outflow;
- Embankment stability, slumping, or loss of erosion protection;
- Cultural resource discovery; and
- Other events that may directly or indirectly affect the reservoir drawdown schedule.

The above measures are further discussed in the following paragraphs. Adaptive management strategies related to potential corrective measures for erosion, sedimentation, or a lowering of water quality are included in the Oregon RAMP. Additionally, response procedures related to the discovery of cultural resources are discussed in the HPMP.

Appendix A of this subplan contains measures for slope stability. Section 10 and Attachment D of Appendix A proposes measures for responding to various emergency situations. Specific contingency measures to be implemented by the Renewal Corporation (if and as needed) during drawdown and removal of the reservoirs are described below.

If excess flows are identified during drawdown of the J.C. Boyle Reservoir, the Renewal Corporation will continue to use the spillway as a fail-safe to accommodate overflow situations. If water levels rise, excess flows will go over the existing spillway. During post-drawdown dam demolition, and dependent on the water year conditions, the Renewal Corporation can notch a portion of the dam to act as a temporary spillway to accommodate raised water levels. The

Renewal Corporation will use either a liner or riprap for this potential notched temporary spillway to prevent erosion and protect the core of the dam from instability.

After reservoir water levels have been lowered, the Renewal Corporation will remove embankment dams at a rate that will provide a required 3 ft of freeboard on the monthly or semi-monthly 1% probable flood event to maintain safety, up to the point of breach then the 5% probable flood event will govern safety requirements. The Renewal Corporation will implement these measures if adverse conditions are observed. Embankment removal work is broken into multiple phases related to flood water surface levels. The proposed phased embankment removal, downstream rockfill grading, and historic cofferdam breach and removal, as applicable, are shown in detail on the design drawings (Appendix B). These surface levels were selected based on data from past water years, and there is a high degree of certainty with respect to the elevations identified.

5.5 Coordination with Agencies and Stakeholders During Drawdown and Removal

Methods used for notification of FERC; site emergency response personnel; and local, State, and Federal Emergency Response Centers are included in the Emergency Response Plan (Kiewit, 2020) for the Project. In addition, the Renewal Corporation will notify ODEQ within 72 hours of an event that may substantially delay drawdown or cause the timeline to complete drawdown to exceed the anticipated schedule.

Any emergency or incident should be immediately communicated to a direct supervisor and, once it is safe to do so, all supervisors will report as outlined in the Emergency Response Plan and Health and Safety Plan for the Project. Each dam site has an existing alarm system in place that will sound to alert all personnel in nearby areas of a danger. Emergency Contact Information is included is also included in the Emergency Response Plan, which outline measures for directing emergency responses as well as notifications to the public, as necessary.

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Appendix A

Oregon Slope Stability Monitoring Subplan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Oregon Slope Stability Monitoring Appendix A

J.C. Boyle

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February 2021

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Attachments

1.0 Introduction

1.1 Purpose of Management Plan

This Oregon Slope Stability Monitoring Plan contained herein, is an appendix to the Oregon Reservoir Drawdown and Diversion Plan, which is a subplan to the Reservoir Drawdown and Diversion Plan that the Renewal Corporation will implement as part of the Proposed Action for the Lower Klamath Project (Project).

The Oregon Slope Stability Monitoring Plan Appendix describes the Renewal Corporation's proposed monitoring and evaluates practices related to slope stability. The Oregon Slope Stability Monitoring Plan Appendix identifies reservoir slopes and other areas within the limits of work prone to instability and describes the Renewal Corporation's proposed monitoring measures for instability during drawdown and dam removal under the Proposed Action. The appendix also describes the Renewal Corporation's proposed measures to address instability and discharges that violate water quality standards. The Renewal Corporation's proposed measures are also intended to protect private property, structures, and cultural sites.

The Renewal Corporation will implement the following measure through this Oregon Slope Stability Monitoring Plan Appendix (or by reference to other management plans):

- Describe proposed survey monuments to monitor slope stability during and following drawdown.
- Visually monitor for evidence of potential slumping, cracking, or slope failure of dam embankment during dam removal.
- Monitor J.C. Boyle Reservoir elevation and stream flow at the United States Geological Survey (USGS) gauge 11509500 below Keno Reservoir and 11510700 below J.C. Boyle powerhouse during drawdown.
- Provide contingency and notification procedures to respond to confirmed or suspected issues for slope instability or loss of erosion protection.
- Submit monthly and annual reports.

1.2 Relationship to Other Management Plans

The Oregon Slope Stability Monitoring Plan is supported by elements of the following management plans for effective implementation: Erosion and Sediment Control Plan, Water Quality Monitoring and Protection Plans, and Reservoir Drawdown and Diversion Plan.

1.3 Oregon 401 Water Quality Certificate Condition 5

The current Supporting Technical Information Document (STID) for J.C. Boyle does not include piezometer or inclinometer instrumentation (PacifiCorp, 2015). This instrumentation was not necessary in the past for dam safety or monitoring. Modeling for the design (Knight Piésold, 2020b) showed that dam stability increases during reservoir drawdown and the proposed dam removal. Therefore, the Oregon Slope Stability Monitoring Plan does not include the number and location of piezometer wells and inclinometers proposed for installation by the Oregon 401

Water Quality Certificate Condition 5. However, the Oregon Slope Stability Monitoring Plan does include monitoring of drainage and visual observations of the dam faces by the Renewal Corporation during drawdown and dam removal.

2.0 Supporting Information

2.1 Reservoir Rim

This section of the subplan is informational and includes excepts from the Reservoir Rim Stability Report (Knight Piésold, 2020a). The section does not contain specific measures to be implemented by the Renewal Corporation as part of the Proposed Action.

The Reservoir Rim Stability Report (Knight Piésold, 2020a) summarizes the findings of an evaluation of the reservoir rim stability during and following drawdown. The Reservoir Rim is defined as the terrain that lies within the normal operating levels of the reservoir. The terrain downslope and upslope of the rim are defined as submarine slopes and upslope areas, respectively. The evaluation focused on the potential for large-scale deep-seated instabilities that could affect residences and other resources adjacent to the rim, such as transportation infrastructure. This concise analysis is consistent with previous evaluations completed by the Renewal Corporation (2019) and PanGeo (2008).

The approach utilized for Knight Piésold's stability analyses (Knight Piésold, 2020a) commenced with a review of the Renewal Corporation's analyses and conclusions (2019). Knight Piésold's stability models were developed based on the interpretation of data and observations collected by the Renewal Corporation as influenced by the challenges of gaining site access. Terrain analyses, identifying and characterizing terrain hazards, were completed for each of the four reservoir sites and guided the development of slope models for analyses. The analysis for JC Boyle established that there were no hazards identified. Attachment A, Figures 2-1 and 2-2, identify the features/hazards from the terrain analysis at Copco and Irongate. These have been provided as informational to demonstrate the types of terrain hazards that are not applicable to JC Boyle. In addition, the completion of Limit Equilibrium (LE) analyses also allowed for identification of influential factors that govern slope stability due to drawdown of the reservoir.

Each stability model evaluated existing conditions to identify the possible extent of instability during drawdown for the current surveyed ground surface (topography and bathymetry), the assumed geological model, and an established piezometric low (assuming that the minimum operating reservoir level represents drawdown conditions). These results provide a framework for judging the results of the drawdown analyses.

2.1.1 Geological Setting

The limits of work are predominantly contained in the Western and High Cascades. The Klamath River predates the formation of the Cascade Mountain Range and maintained a relatively similar course through the mountain building events. The bedrock within the limits of

work comprises volcanic rocks (up to 45 million years old) and includes basalt and andesite lava flows, tuffs, tuff-breccias, and volcaniclastic sandstone. The volcanic rocks are intruded by numerous dikes and plugs of andesite, rhyolite, and basalt. Many of the volcanoes associated with the Western Cascades have since eroded, but large shield volcanoes and vents of the High Cascades remain and are still active in present times.

Large deposits of coarse alluvium were deposited along the Klamath River during the period of the last glaciation when the river had a higher discharge. Lacustrine deposits were laid down in former temporary lakes that were created at the present-day site of the J.C. Boyle Reservoir when the Klamath River was temporarily 'dammed' by volcanic activity. Diatomite deposits surround much of the north shore of the J.C. Boyle Reservoir. Diatomite is a very fine-grained sedimentary rock most often used as a filter aid in commercial applications (SWRCB, 2020). The presence of diatomaceous deposits and associated fluvio-lacustrine terrace deposits along the rim and below the reservoir water level present the greatest potential for slope instability during drawdown.

2.1.2 J.C. Boyle Reservoir Rim

There are no known residential properties adjacent to the J.C. Boyle Reservoir rim. A bridge crossing on Highway 66 separates the broad north part of the reservoir from the south part, which is mainly confined within a canyon.

Undercutting has been identified at one location around the J.C. Boyle Reservoir rim. There is an approximately 15 foot-high, steep shoreline slope, comprised of diatomite, in the north part of the reservoir that has been undercut by wave action. The terrain analysis identified a possible 'relict' (i.e., occurred greater than 100 years ago) rockslide upslope on the south side of the bedrock canyon adjacent to the west part of the reservoir (Knight Piésold, 2020a). No submarine landslides were identified in the terrain analysis. Soft sediment that has accumulated on the floor of the reservoir will likely be susceptible to erosion upon drawdown.

Previous studies completed by PanGeo (2008) and the Renewal Corporation (2019), and as supported by a recent study by Knight Piésold (2020a), indicate the drawdown of the J.C. Boyle Reservoir is not expected to result in large-scale slope instability effecting adjacent infrastructure or properties. There is local potential for slope instability at the diatomite cliff in the north part of the reservoir during drawdown. However, the occurrence of gentle slopes beneath the diatomite cliff will render the possibility low. The lower slopes of the southwest oriented bedrock canyon, south of the road crossing, are comprised of geological materials that are not expected to be particularly prone to slope instability during the drawdown.

3.0 Embankment and Reservoir Rim Stability

This Oregon Slope Stability Monitoring Plan Appendix addresses embankment and reservoir rim stability during the pre-drawdown and active drawdown and dam removal phases. The following sections describe the Renewal Corporation's proposed activities for the pre-drawdown phase

and active drawdown and dam removal phase for each reservoir and identify potential slope stability areas of concern.

3.1 J.C. Boyle

3.1.1 Pre-Drawdown

The Renewal Corporation will utilize existing Project features to facilitate pre-drawdown and drawdown. The Renewal Corporation will use two existing diversion culverts to facilitate reservoir drawdown and flow passage during dam removal. The historic cofferdam and earthfill dam embankment divert water into the diversion culverts.

The reservoir operation during the pre-drawdown period follows operating levels in the PacifiCorp STID. STIDs are required by the FERC Division of Dam Safety and Inspections and are comprehensive documents that contain studies for geology, hydrology, hydraulics, stability analyses, potential failure mode analyses (PFMAs) as well as data on operations, correspondence, inspection reports, and surveillance. PacifiCorp will lower and maintain the reservoir at the normal minimum reservoir operation level (elevation 3,791.7 ft) by controlled spillway releases and/or by utilizing normal power operations prior to the commencement of drawdown.

3.1.2 Reservoir Drawdown

The Renewal Corporation and PacifiCorp have entered into an Operations and Maintenance Agreement. Upon acceptance of the License transfer order and subsequently acceptance of the License surrender order, PacifiCorp will continue to operate the Project as the Renewal Corporation assignee, until such time operation is no longer required under decommissioning.

The Renewal Corporation will commence drawdown operation at J.C. Boyle on or about January 1 of the drawdown year, depending on the water year. No special provisions for pre-drawdown have been provided for J.C. Boyle; however, the Renewal Corporation will drawdown the reservoir to the normal minimum operating level prior to January 1, depending on the water year, and if inflows allow. The proposed drawdown occurs in four stages, the first of which utilizes the spillway gates, the second the power facilities, and the third and fourth by a sequenced removal of the diversion culvert stoplogs.

The Renewal Corporation will maintain a reservoir water surface level of 3,783.2 ft (2 ft below the spillway crest) to initiate both Stage 3 and Stage 4. This level allows workers to safety access the downstream side of the diversion culverts. Sustained flows that result in higher reservoir water surface levels will require an altered drawdown strategy. River forecasting and coordination with the Upper Klamath River Basin is required so the reservoir water level will remain below the spillway crest while crews are actively working on the downstream side of the diversion culverts.

The maximum rate of drawdown varies from stage to stage due to inflow, geometry of the reservoir, and nature of the outflow (free-flowing) through the diversion culverts. The analysis compared steady-state inflows to culvert rating curves to determine the maximum flow allowable for crews to safely access the downstream side of the diversion culverts. These are presented in the Stage 2 and Stage 3 drawdown sections below. The United States Bureau of Reclamation (USBR) controls Link River Dam releases, which therefore has the capacity to regulate flows into JC Boyle. For safety of working crews, during Stage 2 and Stage 3, flow coordination with the USBR will be finalized when climatic information is available and flow forecasts are prepared by the USBR to keep JC Boyle reservoir below the spillway crest.

3.1.2.1 Stage 1 Drawdown

The Renewal Corporation will commence Stage 1 drawdown no earlier than January 1 of the drawdown year, depending on the drawdown year, with the reservoir at or above the minimum operating elevation of 3,791.7 ft. The Renewal Corporation will achieve this stage of drawdown by using the gated spillway bays to lower reservoir levels at a target rate of 5 ft per day (ft/day). The Renewal Corporation will achieve reservoir drawdown rate control by varying spillway openings according to actual reservoir inflow rates. The power intake can be closed during Stage 1 except in the case of extreme wet conditions (high inflow rates), when the additional capacity of the power facilities is required to achieve drawdown.

The Renewal Corporation will undertake to complete Stage 1 drawdown within 48 hours of commencement, when the water level in the reservoir has stabilized above the spillway crest (spillway crest elevation 3,785.2 ft). The stabilized elevation marking completion of Stage 1 will depend on the reservoir inflows at the time of drawdown.

3.1.2.2 Stage 2 Drawdown

The Renewal Corporation will initiate Stage 2 drawdown by continued power operations once Stage 1 is completed, and with the use of the spillways during wet year inflows. With power operations, outflow rates will initially increase and then quickly subside as water levels recede. The diversion culverts can remain closed during Stage 2.

The Renewal Corporation may complete Stage 2 drawdown when the water level in the reservoir has stabilized at least 2 ft below the spillway crest (spillway crest elevation 3,785.2 ft). The stabilized elevation marking completion of Stage 2 may depend on the reservoir inflows at the time of drawdown. A reservoir water level that is 2 ft below the spillway crest is associated with a reservoir inflow of 1,260 cfs and may require river forecasting and coordination with the Upper Klamath River Basin to achieve this flow release.

The explosives required to initiate Stage 3 can only be set when the spillways are inactive. The Renewal Corporation can complete this work at the end of Stage 2 when reservoir water surface elevations are below the spillway invert and reservoir outflows are passing through power operations. The Renewal Corporation will close the spillway gates when work is being performed on the downstream side of the low-level diversion culverts. The Renewal Corporation will prepare and remove diversion culvert #1 stoplog over a period of about 24 hours.

3.1.2.3 Stage 3 Drawdown

The Renewal Corporation will initiate Stage 3 drawdown once Stage 2 is completed by removing one of the diversion culvert concrete stoplogs. The Renewal Corporation will remove the Diversion Culvert #1 stoplog by controlled blasting. The diversion culvert is located below the gated spillways and provides a 9.5 ft by 10 ft opening with an invert elevation of 3,755.2 ft. With the first diversion culvert opened, outflow rates will initially increase and then quickly subside as reservoir water levels recede. The Renewal Corporation will close the power intake wheel gate simultaneously with (or immediately prior to) the removal of the diversion culvert #1 stoplog. Once the power intake is closed, it will remain closed for the duration of the drawdown period.

The J.C. Boyle Reservoir is narrow and does not have a large storage capacity below the spillway crest elevation. As a result, the culvert outflow rate will quickly equalize with the reservoir inflow rates over a 48-hour period. The maximum anticipated drawdown rate for Stage 3 is 10 ft/day. The stabilized elevation marking completion of Stage 3 will depend on the reservoir inflows at the time of drawdown. Similar to Stage 2, a reservoir water level that is 2 ft below the spillway crest is required for access to the downstream side of the second diversion culvert to prepare for Stage 4. This reservoir elevation is associated with a reservoir inflow of about 2,120 cfs and will require river forecasting and coordination with the Upper Klamath River Basin to achieve this flow release.

3.1.2.4 Stage 4 Drawdown

The Renewal Corporation will initiate Stage 4 drawdown on or about June 10 of the drawdown year, depending on the drawdown year, by removing the second diversion culvert concrete stoplog. Evaluation of the inflow rates and water levels at the time will help determine the optimal time to remove this stoplog.

The Renewal Corporation will remove the Diversion Culvert #2 stoplog by controlled blasting, if required. The second diversion culvert is located below the gated spillways and provides a 9.5 ft by 10 ft opening with an invert elevation of 3,755.2 ft. The outflow rate will initially increase and then equalize with the reservoir inflow rates over approximately 12 to 24 hours as the reservoir water level drops. The maximum anticipated drawdown rate for Stage 4 is 10 ft/day. Completion of the Stage 4 drawdown may provide the lowest possible drawdown of the reservoir based on reservoir inflow.

The Renewal Corporation will complete the proposed drawdown when both diversion culverts are operating, the J.C. Boyle Reservoir is substantially dewatered, and reservoir inflows and outflows equalize (water levels are relatively stable). The diversion culverts will remain open and will pass all river flows until the historic cofferdam breach is conducted.

3.1.3 Dam Removal

With the diversion culverts operating as described in Section 3.1, the Renewal Corporation will remove the concrete components at the dam and intake. The Renewal Corporation will remove spillway gates and hoisting equipment after drawdown is complete. Partial removal of the

concrete spillway can occur in the low flow summer period coinciding with the decline in flood water surface elevations. The Renewal Corporation will remove the fish ladder, concrete cut-off wall, and power intake concrete in conjunction with dam embankment removal. Removal methods include mechanical demolition, drilling, and controlled blasting. The top-down concrete removal process will confirm structural stability criteria are met throughout the entire concrete structure removal process.

The Renewal Corporation will commence earthfill embankment removal and demolition work following reservoir drawdown. The Renewal Corporation will remove the embankment from the top down, maintaining the current slopes and toes of the embankment. The removal plan allows for the majority of dam removal to occur in the dry, by leaving the upstream portion of the dam embankment and historic cofferdam in place and removing the dam embankment in phases. The Renewal Corporation will excavate the final portion of the embankment to create the final river channel. This excavation methodology is prescribed so that embankment stability is maintained through the removal process. The Renewal Corporation will remove the historic cofferdam in the final work stages. Removal of the J.C. Boyle earthfill dam embankment and concrete structures is planned and proposed in a manner that maintains the current stability criteria, by removing the embankment in a sequence that does not result in narrowing of the crest or steepening of the downstream embankment slopes. The embankment removal work is broken into multiple phases related to flood water surface elevations. The phased embankment removal, historic cofferdam removal, and downstream rockfill grading, including historic cofferdam breach and removal details are included in the design (Knight Piésold, 2020b) and on drawings in Appendix C of the overarching Oregon Reservoir Drawdown and Diversion Subplan.

In addition to meeting the stability criteria discussed above, the Renewal Corporation will remove the dam in a manner that will provide 3-ft freeboard for a reservoir water level corresponding to a 1% flood event (100-year instantaneous flood flow). The Renewal Corporation will excavate the final river channel footprint to approximately 3,738 ft at the dam embankment centerline based on the anticipated bedrock depth. This river bottom elevation is lower than the diversion culvert invert elevation of 3,755.2 ft. The Renewal Corporation will complete visual inspection of the historic cofferdam and remaining sediment prior to removing the final embankment. The Renewal Corporation will complete final embankment removal in conjunction with the riverbank slope protection installation. The Renewal Corporation will line the final river channel with erosion protection and bedding materials, stored from embankment excavation, prior to breaching the historic cofferdam.

The Renewal Corporation will use the historic cofferdam that is located about 450 ft upstream of the dam embankment centerline. The Renewal Corporation will assess the condition of the historic cofferdam after the reservoir is lowered and make any repairs needed for the cofferdam to function as originally intended. Following use of the historic cofferdam to divert flows to the diversion culverts, the Renewal Corporation will remove the cofferdam as well as accumulated sediment between the embankment dam and the cofferdam. This removal is required to restore the river channel and achieve volitional fish passage. The Renewal Corporation will complete the cofferdam breach by cutting the cofferdam embankment back towards the right bank. It is anticipated that once the cofferdam is breached, flow will naturally erode and remove portions of

the historic cofferdam. Flows will return to the historic channel and allow for in-water removal of the remaining fill.

The Renewal Corporation will remove the embankment, historic cofferdam, and soft sediment to an elevation that provides channel width and grade suitable for volitional fish passage. No bedrock will be excavated. The Renewal Corporation will install erosion protection as described in the Oregon Erosion and Sediment Control Subplan and as included in the Reservoir Area Management Subplan. Summary discussions regarding sediment and slope stability with respect to removal of the remaining reservoir facilities are included below and under Sections 6 and 7, with detail included under the Reservoir Area Management Subplan and Erosion and Sediment Control Subplan.

The Renewal Corporation will place demolished concrete materials removed from the canal and other areas in the scour hole below the canal forebay spillway. The proposed method of backfill is to push the fill into the hole from the top. Once the fill is at the maximum designated elevation of 3,728.0, the Renewal Corporation will cut back slopes to provide construction access to the surface of the fill. The Renewal Corporation will grade fill slope at 1.5 horizontal to 1 vertical (1.5H:1V) and flatten the cut slopes to 1.5H:1V. The Renewal Corporation will contour the fill to drain towards the center of the fill and line with erosion protection material. The Renewal Corporation will install a collection ditch upstream of the scour hole to divert runoff around the scour hole fill. The stability of the scour hole design fill slope was assessed by LE analysis as part of the design (Knight Piésold, 2020b). Two loading conditions were assessed as part of this analysis: static long-term and yield acceleration determination for approximating seismic displacement. Acceptance criteria require a Factor of Safety (FOS) of 1.5 for static long-term stability and FOS of 1.0 for seismic displacement. The analyses indicate the static FOS is 1.5, which satisfies the target FOS for dry conditions. The critical failure is predicted to involve a volume of approximately 13,500 cubic yards with a maximum depth of roughly 35 ft. A sizeable seismic failure, extending from the fill crest to about mid-height, produced a displacement estimate greater than 2 ft. The maximum depth of the associated failure is approximately 17 ft and involves a volume of approximately 4,500 cubic yards. The estimated volume of such a failure is not expected to dam the river, given it is less than 10% of the overall volume of the design fill, and erosion of the scour hole is not known to have historically dammed the river or impeded its flow. A full-height (30-ft deep) seismic failure was estimated to involve a volume of approximately 11,500 cubic yards and predicted to displace less than 2 ft.

3.1.4 Dam Embankment Stability During Drawdown

The stability of the final excavated slope of the dam embankment was assessed in a similar manner as the scour hole, based on results from drawdown simulations (1981 through 2016). Acceptance criterion is defined by a FOS of 1.3, based on the more conservative recommendation of the United States Army Corps of Engineers (USACE) (2003). The drawdown simulations indicated variable drawdown rates and multiple drawdown-refill cycles that could involve sizeable changes in water level elevation over a short duration. As a result, a generalized curve was defined to drawdown at the fastest simulated rate for the largest total head difference, and to provide sufficient time for re-saturation on reservoir refilling. The stability analyses indicated the lowest FOS occurred at the initial reservoir drawdown. Consequently, a

higher resolution drawdown curve was developed for the first eight days of the full drawdown curve. The stability results indicate the lowest FOS for the failure scenarios evaluated is 1.7 for the base case and 1.4 for a sensitivity analyses that varied input parameters (e.g., hydraulic conductivity, unit weight, friction angle, cohesion). These results indicate the dam embankment is expected to be stable during the defined drawdown curve (Knight Piésold, 2020b).

Additionally, the stability of the final excavated slope of the dam embankment at the left bank was assessed by LE analysis for the same loading conditions as the scour hole: static long-term and seismic displacement. Acceptance criteria require a FOS of 1.5 for static long-term stability and FOS of 1.0 for seismic displacement. The J.C. Boyle STID (PacifiCorp 2015) also indicates displacements of up to 2 ft are acceptable according to a FERC guideline for the operating dam. The analyses indicate the static FOS is 1.8 and is associated with a maximum failure depth of approximately 14 ft and predicted volume of 4,500 cubic yards. These results indicate the final design slope of 3H:1V satisfies the requirements of the acceptance criteria. Smaller-scale slope failures are possible under long-term static conditions; however, such occurrences are expected to be localized and not sizeable enough to dam the river. Seismic displacement estimates indicate the shallow failure scenario will likely displace greater than 2 ft. However, the predicted failure is small in volume (500 cubic yards) and shallow in depth (5 ft at its maximum). The consequence of this size of failure is not expected to dam the river. The larger-scale failure scenario, approximately 15 ft deep with a volume of 4,200 cubic yards, is predicted to displace less than 2 ft.

3.1.5 Bank Stabilization

Refer to the Reservoir Area Management Subplan for information regarding bank stabilization.

3.2 Potential Slope Instability

3.2.1 Areas of Potential Instability

The slope stability response to drawdown is relevant to two facility components: the dam embankments and the reservoir rims. Monitoring of the J.C. Boyle Dam earthfill embankment is proposed for the upstream face and crest of the dam.

Results from the reservoir rim terrain and slope stability analyses (Knight Piésold, 2020a) suggest a tiered monitoring approach will best address the size of the limits of work and the short duration of the drawdown period. The primary level of monitoring will provide coverage to the areas of potential instability. A secondary level of monitoring will provide greater data resolution of any areas of instability. Details regarding the primary and secondary levels of monitoring for the above areas of concern are included in Section 6.

3.2.2 Proposed Measures

If instability issues are confirmed at J.C. Boyle, the Renewal Corporation will implement the following measures:

- Slope monitoring;
- Installation of retaining walls; and/or
- Installation of buttresses.

3.3 Roads

Improvements to existing roads and development of new temporary access routes are required to support Proposed Action construction activities, both to improve access safety and to facilitate movement of construction equipment and traffic. Additional details regarding road improvement and maintenance are included in the Traffic Management Plans. The Renewal Corporation proposes additional monitoring of areas of potential slope instability, as discussed in Section 6.

3.4 Borrow and Disposal Areas

Borrow and disposal areas are required for construction of the Proposed Action. Borrow and disposal sites are designed and developed with stable permanent slopes and suitable drainage requirements (best management practices [BMPs]). The Renewal Corporation will place material in the disposal site in layers, track-walk the material, and grade it with a bulldozer. The Renewal Corporation will grade the disposal sites to promote surface drainage. The Renewal Corporation will visually monitor slopes during construction and excavation works and modify them as needed based on an observational approach, as described in the Oregon Erosion and Sediment Control Plan and the California Waste Disposal Plan.

4.0 Management Plan Updates

The Renewal Corporation will review the Oregon Slope Stability Monitoring Plan Appendix quarterly, or more frequently if additional risk areas are encountered, to address if more appropriate procedures can be implemented to improve monitoring. The Renewal Corporation will document this review and associated amendments to the plan in the log in Attachment B.

5.0 Pre-Drawdown Phase

The existing monitoring program for the dams and embankments will continue to be conducted up to the drawdown period. This section discusses the monitoring and inspection procedures that PacifiCorp implements and will allow the Proposed Action to maintain compliance with ongoing monitoring during pre-drawdown. These measures are consistent with what is currently taking place at the structures (e.g., consistent with the requirements of the STID for applicable structures). The schedule for this phase is also included.

5.1 Schedule of Events

Pre-drawdown construction activities will occur prior to January 1 of the drawdown year, depending on the water year. The pre-drawdown period is proposed to occur over the following timeframes for each of the identified areas:

- Project-wide (Fall Creek construction, road/bridge improvements, recreation area demolition) – Late June through the end of December of the year preceding drawdown.
- J.C. Boyle – Only existing Project features are utilized and site is accessible without additional access improvements.

5.1.1 Erosion Protection

The Renewal Corporation will conduct construction and removal works required for the Proposed Action in a manner that provides environmental protection and BMPs for erosion and sediment control as outlined in the Oregon Erosion and Sediment Control Plan. In general, the Renewal Corporation will restore areas disturbed by construction of the Proposed Action components to final lines and grades as soon as practical. The Renewal Corporation will install erosion protection at various locations throughout the limits of work (e.g., river channels, scour hole, volitional fish passage channels). The hydraulics of final channels were modeled to determine the design parameters for the required slope erosion protection and to determine the size and thickness of erosion protection, as specified in the design (Knight Piésold, 2020b).

5.2 Monitoring Procedures and Frequency

Each dam is inspected on a daily, weekly, monthly, and annual basis, and after unusual events such as earthquakes or high flow events, s outlined in the STID for the facility. PacifiCorp will conduct monitoring under normal operations during the pre-drawdown phase. Daily and weekly inspections are performed by PacifiCorp Operations personnel that live locally and have developed a familiarity with the Project based on daily visits part of their normal duties and per FERC requirements. Annual inspections are performed by the PacifiCorp Dam Safety Engineering staff with the assistance of PacifiCorp Operations personnel. Dam specific monitoring information is included below.

5.2.1 J.C. Boyle Dam

PacifiCorp Operations personnel are present in the J.C. Boyle Dam area on an eight hour per day, seven day per week basis. Operations personnel conduct inspections and document their observations on the following:

- Daily Logs and Check Lists;
- Weekly/Monthly Inspection Check Lists;
- Annual Engineering Inspection Check Sheet;

Examples of these forms are included in Attachment B. In addition to the above, inspections are conducted after earthquake or high flow events. All personnel involved in the surveillance and monitoring program for the J.C. Boyle Dam must understand the associated Dam Safety Surveillance and Monitoring Plan (DSSMP) included in the STID for the facility (PacifiCorp, 2015). Procedures for daily, weekly, annual, and event-driven inspections are described in the following subsections.

5.2.1.1 Daily Surveillance

Visual monitoring is the most critical component of the surveillance and monitoring plan. Visual surveillance is essential to providing complete coverage of facility features and identifying changed conditions. Facilities are inspected daily for changes from the previous day. The reservoir is inspected for signs of shoreline instability and debris accumulating on the embankment dam and intake screens for the penstocks. Embankments and downstream slopes are inspected for settlement or misalignment, cracking, erosion, sinkholes, new seepage locations, animal burrows, loss of material, and vegetation. The condition of the upstream slopes riprap, and any riprap loss or beaching is recorded.

The reservoir level monitor is automated and requires no operator involvement in obtaining a reading other than recording a reading from a digital display. Staff gauge readings are taken on a daily basis for comparison with the digital displays to confirm the measured water levels. Additional monitoring, as described further in the dam-specific DSSMP, will also be included. In the event there is an observation that is judged to be outside of the usual, a copy of the inspection check sheet is reviewed by PacifiCorp's Dam Safety Engineer within 24 hours of receipt.

5.2.1.2 Weekly and Monthly Surveillance and Monitoring

As outlined in the STID, weekly surveillance, in addition to the daily surveillance items, are included on the one page Weekly/Monthly Inspection Check List. One weekly check list is sent to PacifiCorp's Dam Safety Engineer as the monthly inspection.

5.2.1.3 Annual Surveillance and Monitoring

Annual Engineering Inspections (AEI) are performed by PacifiCorp's Dam Safety Engineer. The AEIs include a visual inspection of all facility features; a review of the monitoring and instrumentation (i.e., survey monuments; water level, temperature, and turbidity gauges; weir) data for the last year; confirmation of records retained by Operations personnel for their inspections; and a check of Dam Safety Surveillance and Monitoring documents, STIDs, and Emergency Action Plans (EAPs) retained at the respective powerhouses for completeness and the most recent revision. The AEI is typically scheduled approximately two weeks ahead of the FERC annual Dam Safety Inspection (DSI). All weekly inspection items are included in the AEI as well as additional, more detailed information on all major components of each facility.

As part of annual surveillance, reservoir shorelines are evaluated for the potential for instability and checked for debris accumulation against the water retaining structures. The tailrace is inspected for erosion, back cutting, sloughing, or obstructions. The embankment crest, upstream slope, and downstream slope are inspected for settlement, misalignment, cracking, erosion, sinkholes, brush and vegetation, seepage, unusual green areas, and animal burrows. The condition of the riprap and accumulation of debris are also noted, and the toe is inspected for seepage and cloudy water downstream of the dam and fish ladder.

Existing surveillance monitoring monuments have been installed at select locations within the limits of work to compare slope erosion and displacement. Consistent with current operations, elevation measurements will also be collected for each structure during the pre-drawdown phase to evaluate horizontal and vertical movement. These survey readings are collected by a licensed professional surveyor under the direction of PacifiCorp's Dam Safety Engineer. Readings for J.C. Boyle include the four survey monuments on the dam crest and intake and two control points set in rock on the north and south ends of the dam. These monuments are surveyed using a Global Positioning System (GPS) to calculate vertical and horizontal movements of each monument relative to previously established baseline locations. The Surveyor forwards the results of the survey directly to the Dam Safety Engineer in the Portland offices of PacifiCorp. The survey data is reviewed by the Dam Safety Engineer for completeness and suitability. The format of the survey data provided allows review without additional processing. Time history plots of the vertical and horizontal movements are created by the Dam Safety Engineer and are presented in the DSSMP. Additional information on the procedures currently followed for surveillance monitoring and data review are included in the STIDs.

5.2.1.4 Inspections and Procedures after Unusual Events

Unusual events that trigger inspections include earthquakes and floods/high flow events. Earthquakes that specifically trigger inspections include those of magnitude greater than 5.0 and within 50 miles of the dam, if ground shaking is felt by Operations personnel at the site, or as directed by PacifiCorp's Dam Safety Engineer. High flow events are defined as periods when the reservoir level exceeds elevation 3,794.0 for J.C. Boyle Reservoir. Reservoir levels are continuously monitored through the powerhouse control room and Hydro Control Center (HCC) at Merwin Dam on the Lewis River in Washington. Flows can increase the amount of debris deposited against log booms and other components during these events. Erosion, back cutting, sloughing, or obstruction in the spillway or tailrace channels might occur. Special attention to these areas is included in the surveillance of the facility during or after high flow events.

Unusual event inspections follow the procedures for annual inspections and the Annual Engineering Inspection Check Sheet in Attachment B is completed, with "Other" as the reason circled, and the event that necessitated the unusual inspection recorded on the sheet. A copy of these inspection check sheets is filed in the respective powerhouse control room and a copy is sent to the PacifiCorp Chief Dam Safety Engineer for review and eventual inclusion in the DSSMR.

In the event visual observations or instrument readings indicate a changed condition or is above an Action Level or Threshold Value (refer to Section 10.1), the PacifiCorp Chief Dam Safety Engineer is notified immediately. The PacifiCorp Chief Dam Safety Engineer will determine, based on an event-specific review, if measurement of the survey monuments will be conducted after an unusual observation.

6.0 Active Drawdown and Dam Removal Phase

This section discusses monitoring and inspection procedures that the Renewal Corporation will implement once drawdown commences. The schedule for this phase is also included. Additional details related to drawdown procedures are included in the Oregon Reservoir Drawdown and Diversion Plan.

6.1 Proposed Monitoring Measures

The Renewal Corporation proposes stability monitoring for the earthen embankment structures and reservoir rim during drawdown. The Renewal Corporation will monitor the J.C. Boyle Dam during drawdown for evidence of impending embankment instability. Monitoring includes daily visual observations of the upstream slope for signs of instability such as cracking or slumping. The Renewal Corporation will select final monitoring techniques and frequencies based on FERC requirements and the proposed drawdown sequencing and staging.

6.2 Schedule of Events

Drawdown of the J.C. Boyle reservoir is proposed to take place from January 1 through June 10 (dependent on the water year). The specific schedule for the drawdown and removal of the dam is further described below, with supporting information provided for informational purposes.

6.2.1 J.C. Boyle Dam

Drawdown modeling was conducted to assess drawdown sequencing in terms of reservoir water surface levels under a range of hydrologic conditions. These assessments were performed to provide the magnitude and timing of expected reservoir water surface elevations, inflows, and outflows, which were important for the design and staging of drawdown. The Renewal Corporation will complete reservoir drawdown sequencing for J.C. Boyle over four stages as outlined below. It should be noted that the drawdown model does not include coordination with the Upper Klamath River Basin (Keno Dam and/or Upper Klamath Lake) or initiation of Stage 4 drawdown prior to June 10, depending on the drawdown year, which is an acceptable if Stage 3 drawdown is complete and the charges have been set on downstream side of diversion culvert #2.

- Stage 1 – Spillway Gates:
    - Stage 1 drawdown operations will commence on or about January 1 of the drawdown year (dependent on the water year).
    - The spillway gates are used to target a drawdown of 5 ft/day, and drawdown occurs over one day.
- Stage 2 – Power Intake is Opened:
    - Stage 2 drawdown can be initiated by continued power operations once Stage 1 is completed.
    - The reservoir water levels are controlled by the discharge capacity of the power intake and are dependent on reservoir inflows.

  - Outflows through the power intake are limited to 2,850 cfs. The total outflow can be higher if the spillway is still engaged.
  - Stage 2 drawdown may be complete when the water level in the reservoir has stabilized to at least 2 ft below the spillway crest (spillway crest elevation 3,785.2 ft, dependent on the water year).
  - The duration of Stage 2 is determined by hydrologic conditions and when the downstream side of the diversion culverts can be accessed to successfully remove the stoplogs. Approximately 75% of the simulations conducted for drawdown modeling indicate that the duration of Stage 2 is limited to less than a week. Years with much higher than average inflows (wet years) indicate that Stage 2 can be sustained for many weeks and beyond April 1 (dependent on the water year).
  - River forecasting and coordination with the Upper Klamath River Basin can be utilized to limit the duration of Stage 2. Reduced inflows to the reservoir will result in lower reservoir water levels, thereby allowing safe access to the downstream end of the diversion culverts. The steady-state inflow to the reservoir to maintain a water level 2 ft below the spillway crest with the power intake is 1,260 cfs for Stage 2 (dependent on the water year).
- Stage 3 – Diversion Culvert #1 is Opened:
  - Stage 3 drawdown will be initiated once Stage 2 is completed. The maximum anticipated drawdown rate for Stage 3 is 10 ft/day.
  - Outflows through the diversion culvert are limited to approximately 2,400 cfs prior to engaging the spillway crest. Total outflows in Stage 3 can be higher if the spillway is still engaged.
  - Drawdown modeling indicates that in some years both diversion culverts open on the same date (June 11, dependent on the water year). Under these hydrological conditions, coordination with upstream irrigation activities (reduced reservoir inflows) will be required to permit the opening of Diversion Culvert # 1 on an earlier date, thereby initiating Stage 3 of drawdown prior to June 10 (dependent on the water year).
  - The reservoir water surface level is likely to increase periodically after opening Diversion Culvert #1. Nearly 90% of the model simulations indicate that the spillway will be reengaged during Stage 3 (dependent on the water year).
- Stage 4 – Diversion Culvert #2 is Opened:
  - Stage 4 drawdown will be initiated on or about June 10 of the drawdown year (dependent on the water year), and when the reservoir water surface level is 2 ft below the spillway crest, or lower. The maximum anticipated drawdown rate for Stage 4 is 10 ft/day (dependent on the water year).
  - The steady-state inflow to the reservoir to maintain a water level 2 ft below the spillway crest with Diversion Culvert #1 open is 2,120 cfs (dependent on the water year).
  - Stage 4 can be initiated as early as January (dependent on the water year) once the charges are set on diversion culvert #2 and Stage 3 drawdown is complete; therefore, extending the initiation until June 10 is not required by the design.

- Drawdown modeling indicates that after the diversion culvert has been opened, and after July 1, the reservoir water surface levels remain low and are within the range of 3758.0 to 3763.5 ft (dependent on the water year).
- Drawdown is considered completed when both diversion culverts are operating, the J.C. Boyle Reservoir has been substantially dewatered, and reservoir inflows and outflows equalize (water levels are relatively stable).

Design criteria and hydrology determine the projected water surface levels at the J.C. Boyle facility, which ultimately dictate the removal schedule for the components of the facility in direct contact with the Klamath River. The only components of the facility in direct contact with the river are at the J.C. Boyle Dam (i.e., intake, spillway, diversion culverts, embankment, and historic cofferdam). J.C. Boyle Dam removal activities are anticipated to start in the Spring of the year drawdown is completed. Site setup and dam/intake/spillway, embankment, power canal, powerhouse and penstock, and electrical transmission/distribution equipment removal will take place over an approximate 6-month period. It should be noted that the spillways must remain operational until June 15, depending on the drawdown year, during which time the 1% probable flood water surface level with freeboard is at or above the spillway invert elevation of 3,785.2 ft. Additional detail regarding removal dates for specific dam components is included in the overarching Oregon Reservoir Drawdown and Diversion Subplan.

6.3 Monitoring Procedures and Frequency

The Renewal Corporation will monitor slope stability during the active drawdown and dam removal phase, and following storm events, for changes in ground conditions, changes in displacement of the ground surface, and changes in the reservoir level. The Renewal Corporation will conduct daily, weekly, and monthly monitoring during active drawdown and dam removal.

6.3.1 Remote Sensing Technology

The Renewal Corporation will monitor daily displacements of the ground surface (reservoir rims and embankments) during the drawdown period by remote-sensing technologies (radar and/or LiDAR). Surface displacement monitoring by remote-sensing technologies provides the greatest spatial coverage for daily evaluation of the response to reservoir drawdown in the form of differential displacement maps between scans. Data acquisition will be airborne and ground-based. The Renewal Corporation will assess daily monitoring after data acquisition/download and report any variations indicating potential displacement reported to the Engineer of Record (EoR).

6.3.2 Visual Inspections

Similar to the pre-drawdown phase, the Renewal Corporation will visually inspect dam embankments (upstream and downstream face and crest) daily for signs of slope instability. Visual inspection locations may be restricted due to safety concerns and challenges from gaining site access, and the Renewal Corporation will adjust these locations to achieve the best vantage point for inspection. The Renewal Corporation will initially use established site access as its first course of action for inspection, when possible. If not possible, the Renewal

Corporation will use remote monitoring. Due to safety concerns, some areas on private property may not be accessible for inspection.

6.3.3 Surveillance Monuments

The Renewal Corporation will use existing survey monuments at the dam embankments, as accessible, during the active drawdown phase until dam removal. The Renewal Corporation will monitor surveys included in the pre-drawdown phase on a weekly basis. Additionally, the Renewal Corporation will establish overall site control through the installation of temporary control points (metal monuments embedded in rock) in locations that will not be impacted by dam removal activities. The Renewal Corporation will establish permanent monuments on the rock abutments on either side of the dam, as needed.

6.3.4 Other Monitoring

The Renewal Corporation will monitor reservoirs by level sensors and stream gauges during drawdown. Once reservoirs drop below the normal operating range, water level gauges will no longer be operational. The USGS stream gauge monitoring requirements (11509500 below Keno Reservoir and 11510700 below J.C. Boyle powerhouse) are included in the Oregon Water Quality Management Subplan.

The Renewal Corporation will perform daily checks of the dam, monitor water levels, and coordinate with the Bureau of Reclamation with respect to potential storm events. Downstream flows will be estimated to provide adequate response time to implement the contingency measures discussed in Section 6.4.

6.3.5 Bank Stability Monitoring

Refer to the Reservoir Area Management Subplan for information regarding bank stability monitoring.

6.4 Contingency Measures

Section 10 and Attachment C proposes measures for responding to various emergency situations. Potential emergency situations should follow the lines of communication established in the Emergency Response Plan for the Proposed Action. Specific contingency measures to be implemented by the Renewal Corporation (if and as needed) during drawdown and removal of the reservoirs are described below.

If excess flows are identified during drawdown of the J.C. Boyle Reservoir, the Renewal Corporation will continue to use the spillway as a fail-safe to accommodate high flow situations. If water levels rise, excess flows will go over the existing spillway. During post-drawdown dam demolition, and dependent on the water year conditions, the Renewal Corporation can notch a portion of the dam to act as a temporary spillway to accommodate raised water levels. The Renewal Corporation will use either a liner or riprap for this potential notched temporary spillway to prevent erosion and protect the core of the dam from instability.

After reservoir water levels have been lowered, the Renewal Corporation will remove embankment dams at a rate that will provide a required 3 ft of freeboard on the monthly or semi-monthly 1% probable flood event to maintain safety, up to the point of breach then the 5% probable flood event will govern safety requirements. The Renewal Corporation will implement the above fail-safe measures once adverse conditions are observed. Embankment removal work is broken into multiple phases related to flood water surface levels. The phased embankment removal, downstream rockfill grading, and historic cofferdam breach and removal, as applicable, are shown in detail on the design drawings in Appendix C of the overarching Oregon Reservoir Drawdown and Diversion Subplan. These surface levels were selected based on data from past water years.

7.0 Post-Drawdown Phase

Post-drawdown stability monitoring following removal of the dam is addressed by the Oregon Erosion and Sediment Control Plan and Reservoir Area Management Plan.

8.0 Equipment Maintenance Program

This section proposes measures for maintenance of the monitoring equipment, types of maintenance requirements, and schedule/frequency for monitoring and maintenance activities. The Renewal Corporation will monitor to determine maintenance needs and maintain the desired condition. The Renewal Corporation's maintenance program will address such items as potential structure and channel adjustments that may occur preceding, during, and following Proposed Action implementation.

8.1 Survey Monuments

Per the STID for J.C. Boyle, survey monuments are permanent, and waterproof covers have been installed. The weatherproof caps protect the monuments and, therefore, require little maintenance. The Renewal Corporation will protect survey monuments from movement or damage from vehicles or other equipment traversing the crests. These monuments will only serve a purpose up to the point of Post Drawdown Phase commencing. There will be no need to monitor the dam stability after the water has been drawn down.

8.2 Remote Sensing Technology

The service provider selected to conduct remote sensing inspections will maintain their equipment. The Renewal Corporation will establish specific maintenance procedures with the selected service provider.

8.3 Other Instrumentation

Continuous measurements of reservoir levels are made by level sensors. Level sensors located at each powerhouse continuously monitors tailrace rate of change levels. The reservoir has a fixed gauge allowing a comparison of the water levels measured by the instrument with the

levels indicated on the gauge. Operators or the Foreman make a daily reading of the fixed gauges and these readings are checked against the level readings reported by the instruments. Any significant difference in water level readings between these two measurements initiates work to repair or recalibrate the instruments.

The USGS will maintain the water quality and streamflow gauge downstream of J.C. Boyle through Proposed Action development.

9.0 Reporting

Consistent with reporting conditions in the OR 401 WQC, the STID already includes reporting with respect to the annual and weekly/monthly inspections. Inspection forms documenting slope stability monitoring, inspection information, and implemented corrective actions are included in Attachment B. The Renewal Corporation will provide reporting with respect to inspections and monitoring conducted during the pre-drawdown phase and active drawdown and dam removal phases, as included below.

9.1 Pre-Drawdown Phase

Surveillance and monitoring of the Dam is currently performed by either the PacifiCorp Operators or Foreman. The Operators and Foreman report directly to the Hydro Production Manager for PacifiCorp's Hydro South area, and all Operations personnel report/interact directly with PacifiCorp's Dam Safety Engineer (PacifiCorp Energy's Dam Safety Lead Engineer and/or Chief Dam Safety Engineer) in Portland, Oregon for dam safety-related issues. If an Operations staff member observes a condition that may be a significant dam safety issue, one that might require implementation of the EAP, it is reported immediately to the HCC at Merwin, which monitors PacifiCorp's entire hydroelectric system. The HCC then notifies PacifiCorp, FERC, and other state and local agencies personnel as necessary.

Originals of the completed Weekly/Monthly Check Lists and Daily Logs are kept on file at the J.C. Boyle powerhouse control room. One weekly inspection check sheet is transmitted directly by the Operator/Foreman to the Dam Safety Engineer once per month, serving as the monthly inspection. It is the responsibility of personnel at each level of responsibility to review the monitoring check sheets and document any observations or comments. After review of completed check sheets by the Dam Safety Engineer, the check sheets are submitted to the PacifiCorp records retention center.

9.2 Active Drawdown and Dam Removal Phase

The Renewal Corporation will complete the same reporting during drawdown and during dam removal as described above. The Renewal Corporation will provide two additional forms of reporting during the active drawdown and dam removal phase. Daily reporting of river flows, reservoir water levels, visual observations, and displacement changes will be provided to the EoR for site response if required, and monthly reporting of the same information will be provided to state agencies.

10.0 Potential Failure Modes

PFMs identified in the PFMA Report (PacifiCorp, 2015) have been used to guide previous stability evaluations and are briefly discussed below. The dams covered under STIDs function as-is until dam demolition is initiated. PFMs will be re-evaluated as part of an upcoming PFMA specifically addressing reservoir drawdown and dam removal.

10.1 Current PFMA Results

Stability analyses of the primary water retaining structures of the J.C. Boyle facility have been performed and the results are included in its respective STID. Brief summaries of relevant results from these analyses as well as identified PFMs from the STID are included below.

10.1.1 J.C. Boyle Dam

The analyses of the embankment's slopes were made under static, pseudo-static (seismic), rapid drawdown, and probable maximum flood conditions (PacifiCorp, 2015). The normal full reservoir surface was assumed to be at elevation 3793.0 feet, with tailwater at the toe. The probable maximum flood reservoir level was assumed to be 3,797.8 feet with tailwater at 3,773.6 feet. Since the core of the dam will limit the response of the increased headpond during a probable maximum flood due to the limited time of the event, analysis was conducted as a “post-probable maximum flood” case, where the relatively high tailwater raises the downstream phreatic surface in the embankment, which is assumed to stay high after the tailwater recedes (essentially a downstream slope rapid drawdown situation). The analysis considered three failure modes for the upstream and downstream slopes: half and full height failure circles, and a block failure sliding along or near top of rock. The analyses also considered stability of the embankment under probable maximum flood loading. The following summarizes the conclusions of the embankment PFM slope stability analyses:

- The dam is predominately founded on bedrock, and the potential for uncontrolled seepage at the toe is considered highly remote.
- The embankment is supported on a dense foundation and the embankment was constructed using modern compaction-controlled lift methods; therefore, liquefaction is not anticipated.
- The analysis indicates that the embankment will likely survive the maximum credible earthquake without an uncontrolled release of reservoir; however, significant repairs/reconstruction could be necessary.

No Category I PFMs (highest risk) were identified during the last PFMA review with respect to the J.C. Boyle embankment. The following embankment dam and connected retaining wall/fish ladder PFMs are listed in the STID as well as their relationship to monitoring under the J.C. Boyle DSSMP:

Table 10-1. Potential Failure Modes – J.C. Boyle Embankment and Retaining Wall/Fish Ladder

PFM	PFM DESCRIPTION	2014 CATEGORY	RELATED COMPONENT OF DSSMP
1	Upstream or downstream slope failure of embankment during the probable maximum flood, resulting in catastrophic loss of the reservoir.	II	Inspection requirements covered by PFM, inspect after floods that surcharge the reservoir.
2	Upstream or downstream embankment retaining wall/fish ladder failure during the probable maximum flood, resulting in catastrophic loss of the reservoir.	IV	Inspection requirements covered by PFM 13, inspect after floods.
7 (A & B)	Normal operation embankment slope failure, resulting in catastrophic loss of the reservoir.	IV for 7A II for 7B	Perform routine visual inspection for settlement, slope movement, sinkholes, or seepage at the toe or right abutment. Keep vegetation cover mowed to allow easy visual inspection. Complete annual embankment crest monument surveys. Inspect for leakage and subsidence along fish attraction pipe alignment, and cloudy plumes downstream of the fish ladder.
8 (A, B, C, & D)	Piping failure through embankment core or foundation under normal operation, resulting in catastrophic loss of the reservoir.	IV for 8A & 8D II for 8B & 8C	Inspection requirements covered by PFM 7.
9 (A & B)	Failure by piping along retaining wall/fish ladder through the embankment, resulting in catastrophic loss of the reservoir.	II for 9A IV for 9B	Inspection requirements covered by PFM 7.
10	Failure of fish attraction pipe due to corrosion causing washout of downstream embankment, resulting in catastrophic loss of the reservoir.	IV	Inspection requirements covered by PFM 7.
13	Retaining wall/fish ladder failure during normal operation, resulting in catastrophic loss of the reservoir.	II	Perform routine visual inspection for any indication of distress, condition of dam face, and leakage.
16	Embankment slope failure during earthquake, resulting in catastrophic loss of the reservoir.	IV	Inspection requirements covered by PFM 7. Inspect after earthquakes felt at the site or magnitude 5.0 earthquake within 50 miles.

PFM	PFM DESCRIPTION	2014 CATEGORY	RELATED COMPONENT OF DSSMP
18	Retaining wall/fish ladder failure during earthquake, resulting in catastrophic loss of the reservoir.	II	Inspection requirements covered by PFM 13, inspect after felt earthquakes.
25	Seiche wave overtops the Embankment.	IV	Inspection requirements covered by PFM 13, inspect after felt earthquakes.

10.2 Threshold and Action Levels

Threshold values and action levels are important for monitoring and to assist in determining if readings are approaching a level that could cause concern regarding stability of reservoir rim or embankment areas. The threshold level is the first level requiring an evaluation. Where specific action values have not been determined for an instrument or monitored condition, threshold levels and a range of expected (acceptable) values can be developed based on historical data. Critical threshold and action levels for different type situations/inspections and associated guidance for determining the proper emergency level for various situations are covered by the existing PacifiCorp EAP, as well as the Emergency Response Plan for the Proposed Action. However, this section includes a brief summary of typical remedial actions for various situations.

No threshold values and action levels have been established for the survey monument data. Any significant change in elevation or horizontal location outside of the historical range is treated as a threshold value and evaluated by PacifiCorp's Dam Safety Engineer to determine if an adverse trend is developing. An embankment dam is expected to settle, and settlements of 1 percent of the height have been recorded at other embankment dams. Maximum settlement is well within the expected range.

The Renewal Corporation will develop action levels with respect to the remote sensing technology with the remote sensing provider based on the selected technology.

10.2.1 Emergency Levels and Expected Actions

After an unusual or emergency event is detected or reported, the PacifiCorp Chief Dam Safety Engineer, DSOD, and FERC will classify the event into one of the below three emergency levels. Emergency remedial actions outside the scope of activities listed below require FERC Regional Engineer and Oregon Dam Safety approval, if time permits.

10.2.1.1 Emergency Level 1: Non-emergency, Unusual Event; Slowly Developing:

This situation is not normal but has not yet threatened the operation or structural integrity of the reservoir rim or embankment, but possibly could if it continues to develop.

A. The EoR should be contacted to inspect the reservoir rim or embankment and recommend actions to be taken. At a minimum, inspect the full length of the upstream

slope, crest, downstream toe, and downstream slope. Also check the reservoir rim limits, reservoir water levels, abutments, and downstream channel for signs of changing conditions. If increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to the FERC Regional Engineer and Oregon Dam Safety; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.

B. The condition of the impacted reservoir rim or embankment should be closely monitored, especially during storm events, to detect any development of a potential or imminent failure situation.
C. Record all information, observations, and actions taken on the Unusual or Emergency Event Log form (Attachment B). Note the time of changing conditions. Document the situation with photographs and video if possible.
D. The EoR must contact the Renewal Corporation Owners Representative and request an investigation of the situation and recommend corrective actions.
E. The Renewal Corporation Owners Representative must contact the FERC Regional Engineer and Oregon Dam Safety, advise them of the situation and what action is being proposed, and obtain approval.
F. Local Emergency Responders should also be informed since the emergency level may possibly develop into a worse condition that may require emergency actions.
G. If time permits, the emergency remedial actions included in Table C-1 of Attachment D should be considered for Level 1 conditions, as appropriate.

10.2.1.2 Emergency Level 2: Potential Failure Situation; Rapidly Developing:

This situation may eventually lead to reservoir rim or embankment failure and release of impounded water and/or eroded rock and soil/sediment or may endanger the structural integrity of the reservoir rim or embankment, but there is not an immediate threat of failure.

A. The EoR must contact the Renewal Corporation Owners Representative, who will in turn contact the FERC Division of Dam Safety and Inspections, to report the situation and, if time permits, request technical assistance to investigate the situation and recommend corrective actions. The FERC Division of Dam Safety and Inspections' approval of any emergency remedial action outside the scope of activity listed below is required, if time permits.
B. The Renewal Corporation Owners Representative must contact the Local Emergency Responders to inform them that the EAP/Emergency Response Plan has been activated and if current conditions get worse, an emergency situation may require evacuation or warning. Preparations should be made for possible road closures, warnings, and evacuations.
C. The EoR must closely monitor the condition of the reservoir rim or embankment and periodically report the status of the situation to the Renewal Corporation Owners Representative, who will in turn notify the necessary authorities. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir rim limits, reservoir water levels, abutments, and downstream channel for signs of changing conditions. If piping, increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to the FERC

Regional Engineer and Oregon Dam Safety; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.

D. The EoR must provide updates to the Local Emergency Responders to assist in making timely decisions concerning the need for warnings and evacuations. If the reservoir rim or embankment condition worsens and failure becomes imminent, the County Dispatch Authority must be notified immediately of the change in the emergency level to begin the evacuation process for the people at risk downstream.
E. Record all information, observations, and actions taken on the Unusual or Emergency Event Log form (Attachment B). Note the time of changing conditions. Document the situation with photographs and video if possible.
F. If time permits, the Renewal Corporation Owners Representative must evaluate the situation and recommend remedial actions to prevent failure of the reservoir rim or embankment. The Renewal Corporation Owners Representative must obtain FERC Regional Engineer and Oregon Dam Safety verbal approval of the recommended action, if time permits, and initiate remedial repairs (note local resources that may be available). Time available to employ remedial actions may be hours or days.
G. If time permits, the emergency remedial actions included in Table C-2 of Attachment D should be considered for Level 2 conditions, as appropriate.

10.2.1.3 Emergency Level 3: Urgent; Failure is Imminent or in Progress

This is an extremely urgent situation. A reservoir rim or embankment failure is occurring and release of impounded water and/or eroded rock and soil/sediment has occurred or is obviously about to occur and cannot be prevented. No time is available to control the reservoir rim or embankment failure and the ultimate release of impounded water and/or eroded rock and soil/sediment.

A. The EoR must immediately contact the Renewal Corporation Owners Representative, who will in turn contact the Local Emergency Responders and the FERC Regional Engineer and Oregon Dam Safety.
B. The County Dispatch Authority must be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed. The Incident Commander will notify local personnel to initiate warnings and evacuations of people at risk downstream from the dam.
C. Emergency Management Services personnel and local law enforcement will alert the general public and immediately evacuate at-risk people and close roads as necessary.
D. The EoR must maintain continuous communication and provide Local Emergency Responders with updates of the situation to assist in making timely decisions concerning warnings and evacuations.
E. Verify personnel monitoring the reservoir rim or embankment are safe and out of harms way.

The individual or personnel that will perform the Level 3 remedial actions (included in Table C-3 of Attachment D) should evaluate their own personal safety, as well as those performing the remedial actions. Actions that are deemed to be unsafe or could result in potential hazards

should not be performed. Personal safety is essential. However, if time permits and it is safe for personnel to perform actions, the following emergency remedial actions should be considered after review by the FERC Regional Engineer and Oregon Dam Safety. Close monitoring of the reservoir/embankment must be maintained to confirm the success of any remedial action taken at the reservoir/embankment. Potential Emergency Remedial Actions include:

1. Reduce flows, pumping down reservoir area or diverting through spillways;
2. Fill in breached areas with coarse soil material; and/or
3. Try to control the extent of the breached area.

The above emergency situations and expected remedial actions should be discussed and approved through the lines of communication established in the EAPs for PacifiCorp (pre-drawdown phase) and Emergency Response Plan for the Proposed Action (active drawdown and dam removal phase and post-drawdown phase). Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the reservoir rim or embankment. The remedial actions listed do not require FERC Regional Engineer and Oregon Dam Safety approval prior to implementing the action. Several of the listed adverse or unusual conditions may be apparent at the reservoir rim or embankment at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the reservoir rim or embankment must be maintained to confirm the success of any remedial action taken. Time permitting, any remedial action should be developed through consultation with the EoR, the Renewal Corporation Owners Representative, FERC Regional Engineer, and Oregon Dam Safety.

See the following table for guidance in determining the proper emergency level for various situations. The table is meant to cover several situations; however, an event or condition may arise that is not covered. In the circumstance of multiple events occurring with conflicting event levels, always designate the higher level as the governing event level. The table also provides situations that are considered maintenance concerns and do not constitute an emergency situation. Notification during maintenance activities is the responsibility of the PacifiCorp Chief Dam Safety Engineer, as deemed necessary.

Table 10-2. Guidance for Determining the Emergency Level

EVENT	SITUATION	EMERGENCY LEVEL*
Erosion	Surface erosion is identified on the exterior face of the embankment that is greater than previously and has resulted in scour but has not resulted in any headcutting.	Maintenance
	Surface erosion is identified on the exterior face of the embankment that is greater than previously and has resulted in scour and headcutting.	1

EVENT	SITUATION	EMERGENCY LEVEL*
	Surface erosion is headcutting through the embankment with significant scour that has begun to headcut.	2
	Surface erosion is headcutting at a measurable rate.	3
Low Embankment Crest	Low or uneven crest or depressed areas. Reduced available freeboard and reduced embankment cross-section, and/or increased water pressure behind the embankment. Crest can be restored and eroded areas are minimal.	Maintenance
	Sudden appearance of a low or uneven crest or depressed areas with visible seepage. Reduced available freeboard and reduced embankment cross-section.	1
	Low or uneven crest could potentially lead to overtopping or depressed areas with uncontrolled water seepage.	2
	Low or uneven crest that has resulted in overtopping, leading to erosion of the surface, or depressed areas with increased seepage leading to erosion of the surface and loss of the slope.	3
Sinkhole	Sinkhole on and/or surrounding the embankment face.	1
	Sinkhole on and/or surrounding the embankment face with visible water inflow or outflow.	2,3
Whirlpool	Water flowing in a swirling motion in an area on the upstream side of the embankment. This is a dangerous condition requiring immediate action. All whirlpools should be addressed with extreme caution.	3
Sand Boils	Soil particles deposited around a water exit forming a cone, generally only a few inches in diameter, with water running clear.	Maintenance
	Soil particles deposited around a downstream seepage flow, forming a cone, with a sustained cloudy seepage flow.	1
	Soil particles deposited around a water exit forming a cone, varying from a few inches in diameter, spaced 2 to 3 feet apart, to isolated locations several feet in diameter in the floodplain downstream.	2,3
Seepage	Wet area on downstream embankment slope or any other area downstream of the embankment, with very little or no surface water or very minor seeps.	Maintenance
	Same wet area as above with moderate seepage of clear or relatively clear water, with a flow rate that is steady but not noticeably increasing.	1,2
	Same wet area as above with seepage of clear or relatively clear water greater than 100 gallons per minute.	3
Piping	Seepage along with the transport of material from the foundation or the embankment with very little or no active flow which does not increase over a monitoring period of several days.	Maintenance
	Seepage along with the transport of material from the foundation or the embankment with active flows of cloudy water and steady flow rate that is not noticeably increasing.	1,2

EVENT	SITUATION	EMERGENCY LEVEL*
	Seepage along with the transport of material from the foundation or the embankment with active flows of muddy water at an increasing rate.	3
Flooding	Extreme precipitation event allowing accumulation of direct precipitation or surface water runon to the embankment surface.	1
	Extreme precipitation event allowing accumulation of direct precipitation or surface water runon to the embankment surface. Water surface is initiating erosion of the toe.	2
	Extreme precipitation event allowing accumulation of direct precipitation or surface water runon to the embankment surface. Water surface is eroding through the toe and exceeds an erosion depth of 2 feet.	3
Movement	New cracks in the embankment, without seepage, and are not increasing in size (unless the cracks are located in the upper portion of the slope, parallel to the embankment crest, and a bulge is forming near the toe – see below).	Maintenance
	Formation of tension cracks on the upper portions of the slope, parallel to the embankment crest, and a bulge near the embankment toe.	1
	Same as above with movement that has resulted in large fissures or openings along the periphery and crest of the embankment and a pronounced bulge has begun to develop at the toe.	2
	Same as above with material observed collapsing into open fissures and increased seepage that may be associated with the development of a toe bulge.	3
Slides	Movement of a portion of the embankment or downstream slope toward the toe of the embankment that does not pass through the crest and does not extend into the embankment more than 5 feet, measured perpendicular to the slope.	2
	Movement of a portion of the embankment or downstream slope toward the toe of the embankment that passes through the crest of the embankment or near the surface water elevation.	3
Bulge	Wet area on downstream embankment slope or any other area downstream of the embankment, with very little to no surface water or very minor seeps.	1
	Same wet area as above with moderate seepage of clear or relatively clear water, with a flow rate that is nearly steady but not noticeably increasing.	2
	Same wet area as above with moderate seepage of clear or relatively clear water at an increasing rate.	3
Embankment Overtopping	Minor overtopping flow not eroding the embankment slope.	2
	Major overtopping flow eroding the embankment slope.	3
Embankment Cracking	New cracks in the embankment greater than 1/4-inch wide with no seepage.	1
	Cracks in the embankment with seepage.	2

EVENT	SITUATION	EMERGENCY LEVEL*
Instruments	Instrumentation readings beyond predetermined values.	1
Earthquake	Measurable earthquake felt or reported on or within 50 miles of the dam.	Maintenance
	Earthquake resulting in visible damage to the dam or appurtenances.	2
	Earthquake resulting in uncontrolled release of water from the dam or appurtenances.	3
Sabotage	Damage to dam or appurtenances with no impact to its function.	Maintenance
	Damage to dam or appurtenances that has resulted in seepage flow.	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release.	3

Notes:

Emergency Level 1: Non-emergency, unusual event, slowly developing
Emergency Level 2: Potential dam failure situation, rapidly developing
Emergency Level 3: Urgent, dam failure is imminent or in progress

11.0 Training and Awareness

This section discusses the qualifications required for maintenance personnel including training requirements and documentation. The Renewal Corporation will provide personnel and required training as discussed below.

11.1 Current Responsibilities and Training

PacifiCorp Operations personnel consist of Operators and Foremen, reporting to the Production Manager. The Operators are either journeymen or apprentice, and the Foreman is a General Foreman Hydro. The Foreman is responsible for Operators that perform surveillance duties and read the active instrumentation at the Project (except for the movement surveys). The Foreman and Operators are also responsible for relaying copies of the inspection check lists and sheets to the Dam Safety Engineer. The Foreman is experienced in the safe operation of hydroelectric projects and has participated in all dam safety-related training associated with the execution of dam-specific DSSMPs. The Operators and Foreman are responsible for carrying out surveillance duties and reading active instrumentation at their respective dams. Temporary monument surveys are the responsibility of the Renewal Corporation.

Personnel training in surveillance and monitoring includes review and familiarization of the most current PFMA study and the DSSMP. New personnel at any level of responsibility are trained by experienced personnel at the same or greater level of responsibility. Training includes a review of the surveillance procedures included in the DSSMP and the Daily Log, Weekly Check Sheet, and Annual Engineering Inspection Check Sheets included in Attachment B. New staff review the procedures and accompany an experienced Operators or Foreman to gain an understanding of each aspect of surveillance activities and learn the type of observations and readings needed for valid data input.

11.2 Training, Awareness, and Competency

Training is required for all personnel prior to commencing work on site. The level of training is commensurate with the level of individual risk their works are likely to entail. Trainings include:

- Environmental and safety policies, site management plans as well as environmental roles and responsibilities, The significance of environmental impacts caused by individual roles and activities,
- Incident management, and
- Potential consequences of non-conformance.

The Renewal Corporation will document training associated with implementation of activities in this plan on the log in Appendix B.

11.3 Inductions

All personnel working onsite will undergo mandatory Project training to cover the key requirements of the Workplace Safety Management Plan and Oregon Slope Stability Monitoring Plan Appendix.

11.3.1 Project Induction

The Project induction will cover an overview and related safety-, environmental-, and community-related risks and responsibilities for the Proposed Action. It is the responsibility of all personnel to adhere to the safety requirements of the Project. The Project induction with respect to slope stability will include:

- Overview of the Project Oregon Slope Stability Monitoring Plan Appendix,
- Project contact details;
- Potential Areas of Concern and inaccessible areas;
- Notification procedures; and
- EAP, Emergency Response Plan for the Proposed Action, and other emergency protocols.

11.3.2 Visitor Induction

Visitors must undergo a visitor's induction and their host is responsible for all actions and conduct of the visitor. The Renewal Corporation will restrict visitor access, and personnel who have previously undergone Project induction and safety training will accompany visitors at all times.

12.0 References

California State Water Resources Control Board (SWRCB). 2020. Final Environmental Impact Report for the Lower Klamath Project License Surrender.

Federal Energy Regulatory Commission (FERC). 2018 Order Amending License and Deferring Consideration of Transfer Application FERC Project Nos. 2082-062 and 14803-000. 162 FERC ¶ 61,236. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing.

FERC. 2020. Order Approving Partial Transfer of License, Lifting Stay of Order Amending License, and Denying Motion for Clarification and Motion to Dismiss. FERC Project Nos. 2082-062, 2082-066, 14803-000, and 14803-003. 172 FERC ¶ 61,062. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing. July 16.

Knight Piésold, 2020a. Reservoir Rim Stability Report. Prepared for Klamath River Renewal Project. February.

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Oregon State Department of Environmental Quality (ODEQ). 2018a. Final Clean Water Act Section 401 Certification for the Klamath River Renewal Corporation License Surrender and Removal of the Lower Klamath Project (FERC No. 14803) Klamath County, Oregon. September 7.

ODEQ. 2018b. Evaluations and Findings Report. Section 401 Water Quality Certification for the Removal of the Lower Klamath Project (FERC Project Number 14803). September 2018.

PacifiCorp. 2004. Environmental Report. Final License Application, Volume 2, Exhibit E. Klamath Hydroelectric Project (FERC Project No. 2082).

PacifiCorp, 2015. J.C. Boyle Development, Klamath River Project, Supporting Technical Information Document (STID). April.

PanGEO. 2008. Geotechnical Report – Klamath River Dam Removal Project – California and Oregon. Project No. 07-153. Prepared for Philip Williams & Associates, Ltd. and California State Coastal Conservancy. August.

Renewal Corporation, 2019. Geotechnical Data Report. Prepared by the Renewal Corporation Technical Representatives: AECOM Technical Services, Inc. and CDM Smith. June.

USACE, 2003. Slope Stability, EM-1110-2-1902.

Attachment A

Figures

PUBLIC VERSION

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION (CEII)

REDACTED

ATTACHMENT A: FIGURES

Attachment B

Technical Amendment Logs

Technical Amendment Log

Any technical amendments to this Plan will be re-certified in accordance with Section I of this Plan template.

Description and Certification of Technical Amendments		
Review Date	Description of Technical Amendment	Name and signature of person certifying this technical amendment

Facility Name: _____

Attachment C

Inspection Forms and Personnel Training Logs

Personnel Training and Briefing Log

Personnel Training and Briefing Log		
Date	**Description / Scope**	**Attendees**

Facility Name: _____

The Renewal Corporation will develop inspection forms at a later date per FERC and DSOD requirements. The EoR will work with the remote sensing contractor to develop additional inspection forms with respect to the selected remote sensing technology.

Attachment D

Additional Emergency Action Plan Information

Table D-1. Emergency Level 1 – Potential Remedial Actions

CONDITION	ACTION
Erosion	Locate and quantify the extent of erosion at the reservoir rim or embankment.
	Fill and, if possible, compact the eroded area(s) with course soil material, filter sand, and/or gravel/rock fill as appropriate for conditions.
	Place and crimp straw mulch and tackifier.
	Monitor the erosion area(s) weekly following the precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Sinkhole	Locate and characterize the lateral limits and depth of the sinkhole(s).
	Fill the sinkhole with reverse filter composed of drain gravel, filter sand, and compacted coarse soil material.
	Monitor the sinkhole daily for the following week and following the next precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Sand Boils	Locate and quantify the sand boil(s).
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material from the boil by initially constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of the material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover sand boil area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor the sand boil daily for the following week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Seepage	Install a flow-measuring device.

CONDITION	ACTION
	Measure the flow periodically. Note changes in quality or clarity.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevations and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Piping	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material by constructing a ring dike. The goal of the ring is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor daily for the following week. Measure the rate of leakage and clarity of the water (e.g. muddy appearance).
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Flooding	Monitor flood conditions in the reservoir.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe and measure elevations of water and seepage daily.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Embankment Movement	Mark the movement area(s). Consider contracting a surveyor to survey the movement area(s).
	Visually monitor the movement area(s).
	Develop, evaluate, and implement measures to resolve the observed condition(s).
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
	Monitor conditions at the reservoir rim and embankment daily for at least one week.

CONDITION	ACTION
Earthquake	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment B).
Instruments	Re-measure the reading and verify the reading was made correctly. Once human error is ruled out, verify the instrument is operating properly.
	After human error and instrument error is ruled out, contact engineering support for additional technical assistance if needed.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment B).
Bulge	Install a flow-measuring device.
	Measure the flow periodically. Observe and note changes in quality or clarity.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment B).
Sabotage	Develop, evaluate, and implement measures to resolve the situation.
	Monitor the situation at the reservoir rim or embankment daily for the following week, or until the situation has ended.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).

Table D-2. Emergency Level 2 – Potential Remedial Actions

CONDITION	ACTION
All Conditions	Mobilize personnel and equipment necessary to address ongoing conditions.
Erosion	Locate and quantify the extent of erosion at the reservoir rim or embankment.
	Fill and, if possible, compact the eroded area(s) with course soil material, filter sand, and/or gravel/rock fill as appropriate for conditions.
	Place and crimp straw mulch and tackifier.
	Monitor the erosion area(s) weekly following the precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Sinkhole	Locate and characterize the lateral limits and depth of the sinkhole(s).
	Fill the sinkhole with reverse filter composed of drain gravel, filter sand, and compacted coarse soil material.
	Monitor the sinkhole daily for the following week and following the next precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Sand Boils	Locate and quantify the sand boil(s).
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material from the boil by initially constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of the material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover sand boil area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor the sand boil daily for the following week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.

CONDITION	ACTION
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Seepage	Install a flow-measuring device.
	Measure the flow periodically. Note changes in quality or clarity.
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill
	Control the movement of material by constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and the flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 ft of filter sand and drain gravel. A drain pipe or filter may be added.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevations and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Piping	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material by constructing a ring dike. The goal of the ring is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor daily for the following week. Measure the rate of leakage and clarity of the water (e.g. muddy appearance).
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Flooding	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Monitor flood conditions in the reservoir.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe and measure elevations of water and seepage daily.

CONDITION	ACTION
	Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Embankment Movement	Mark the movement area(s). Consider contracting a surveyor to survey the movement area(s).
	Visually monitor the movement area(s).
	Fill and, if possible, compact the area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Earthquake	Immediately conduct a general overall visual inspection of the reservoir rim and embankment.
	Perform field survey to determine if there has been any settlement and movement of the rim, dam crest, embankment, downstream slope, and downstream toe area. Observe for any signs of additional erosion, seepage, or cracking.
	Activate pump(s) to dewater the reservoir.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Instruments	Re-measure the reading and verify the reading was made correctly. Once human error is ruled out, verify the instrument is operating properly.
	After human error and instrument error is ruled out, contact engineering support for additional technical assistance if needed.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Bulge	Install a flow-measuring device.
	Measure the flow periodically. Observe and note changes in quality or clarity.
	Place a stability berm to buttress the bulge.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).

CONDITION	ACTION
Whirlpool	Control the movement of material by constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than slowing the movement of material.
	Observe the dam from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Slides	Contact the EoR for assistance in evaluating the surface feature (e.g. tension crack). If the feature does not extend across the dam, and the reservoir elevation is more than 10 ft below the base of the feature, fill with soil and/or rock and compact to help stabilize the slope/toe.
	If the surface feature extends across the dam and the reservoir level is less than 10 ft, install a filter overlain by a berm.
	Stabilize damaged areas on the downstream slope by weighting the toe area below the slide with additional soil, rock, or gravel.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Embankment Overtopping	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Increase freeboard by placing sandbags or other erosion-resistant material on the dam crest.
	Cover the dam crest and downstream slope with riprap, sandbags, plastic sheeting, or other materials to provide erosion-resistant protection.
	Monitor the depth, duration, and location of the overtopping. Watch for erosion, backcutting, and slides.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Embankment Cracking	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure elevations of applicable water levels and seepage daily.
	Continuously monitor the cracking. Mark the extent of the cracking with stakes, to monitor any increase or change in pattern.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Sabotage	Develop, evaluate, and implement measures to resolve the situation.
	Monitor the situation at the reservoir rim or embankment daily for the following week, or until the situation has ended.

CONDITION	ACTION
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).

Table D-3. Emergency Level 3 – Potential Remedial Actions

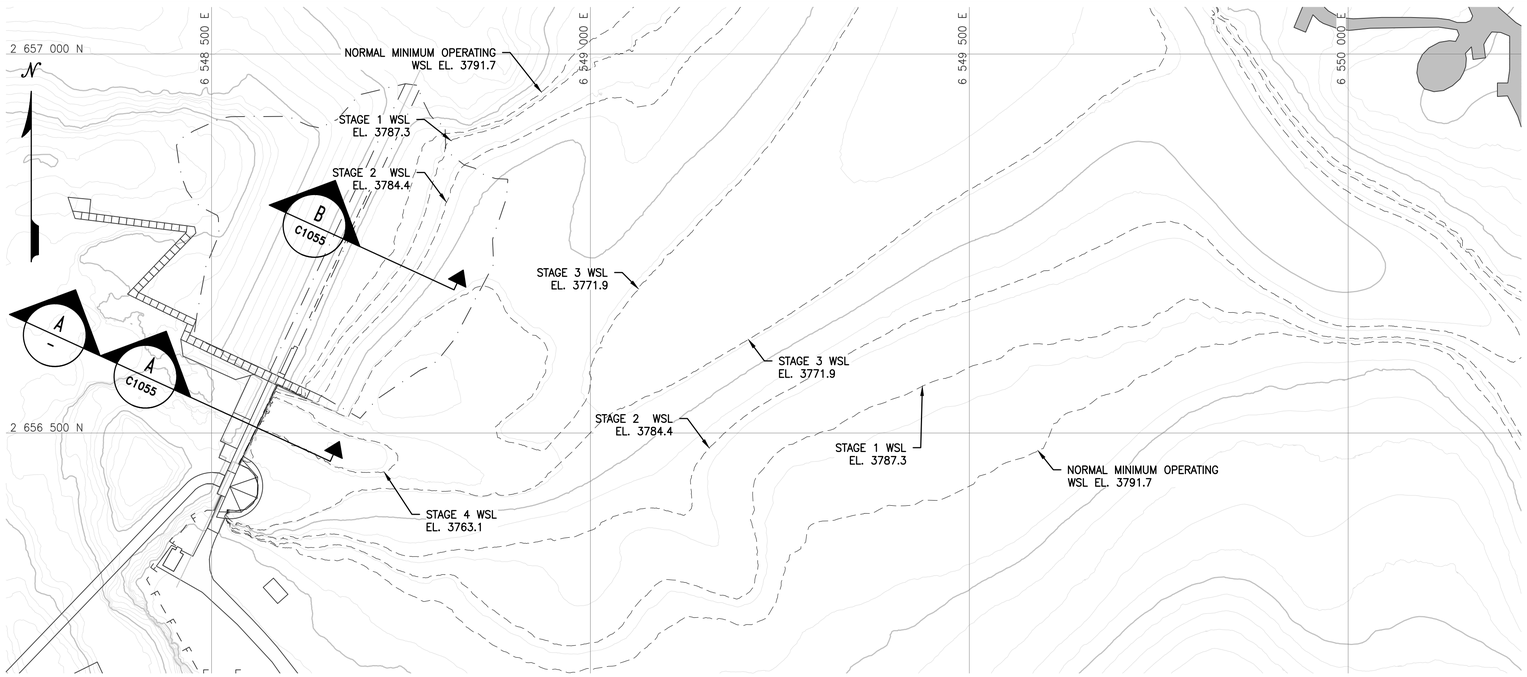
CONDITION	ACTION
All Conditions	Mobilize personnel and equipment necessary to stabilize or at least minimize impacts downstream.
Erosion	Observe and continually monitor conditions at the reservoir rim or embankment, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Sinkhole	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Observe and continually monitor conditions at the dam/embankment, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Sand Boils	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Take actions noted under piping (below).
	Observe and continually monitor conditions at the dam, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Piping	If the entrance to the leak can be found in the reservoir, then on the embankment or abutments (sinkhole), try to plug the leak with whatever materials are available, such as plastic sheeting, straw bales, gravel and cobbles, etc.
	Document and photograph the location for future comparison.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Seepage	If the entrance to the leak can be found in the reservoir, then on the embankment or abutments (sinkhole), try to plug the leak with whatever materials are available, such as plastic sheeting, straw bales, gravel and cobbles, etc.
	Document and photograph the location for future comparison.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Flooding	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.

CONDITION	ACTION
	Monitor flood conditions in the reservoir.
	Observe and continuously monitor the conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Embankment Movement	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Observe and continuously monitor conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should be noted.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Earthquake	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Observe and continuously monitor conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should be noted.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Bulge	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Install a flow-measuring device.
	Observe condition constantly for any further changes in flow rates or clarity, unless notified otherwise by the EoR.
	Observe and continuously monitor conditions at the dam from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should also be noted.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Whirlpool	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Take actions noted under piping (above).
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Observe and continually monitor conditions at the dam, where safe. The situation should be well documented with photographs and videotape if possible.

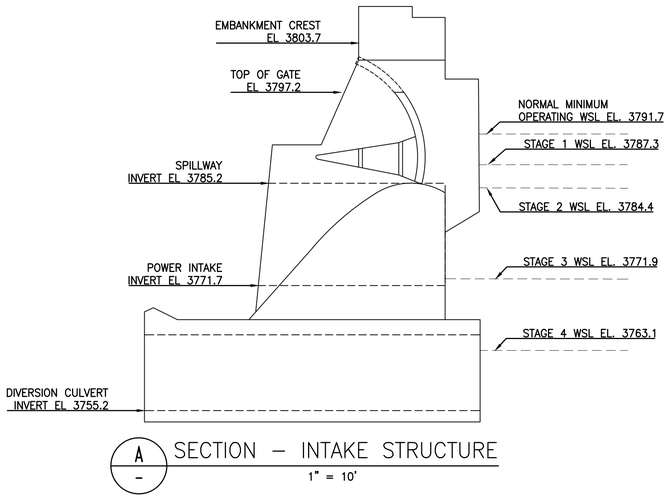
CONDITION	ACTION
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Slides	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	If the slide is on the downstream slope, stabilize the toe of the slide by constructing a berm with additional soil and rock. If there is significant leakage (indicated by muddy ground), install a filter overlain by a berm (see Piping above).
	Monitor settlement, rate of settlement, and extent of slide.
	Observe and continually monitor conditions at the dam from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should also be noted.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Embankment Overtopping	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Observe and continuously monitor conditions from high ground.
	Increase freeboard by placing sandbags or other erosion resistant materials on the dam crest. Use riprap or other materials to provide erosion protection for the crest and downstream slope.
	Monitor the depth, duration, and location of the overtopping. Watch for erosion, backcutting, and slides.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).
Sabotage	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Record all information, observations, and actions on the Unusual or Emergency Event Log form (Attachment C).

Appendix B

Design Report Drawings



PLAN
1" = 100'



A
–
SECTION – INTAKE STRUCTURE
1" = 10'

PRE–DRAWDOWN PRODEDURE:

1. OPERATE THE FACILITY BETWEEN RESERVOIR WATER SURFACE LEVELS AS PER FERC APPROVAL.
   1.1. NORMAL MAXIMUM RESERVOIR OPERATING SURFACE LEVEL: 3796.7 ft.
   1.2. NORMAL MINIMUM RESERVOIR OPERATING SURFACE LEVEL: 3791.7 ft.

2. LOWER RESERVOIR TO NORMAL MINIMUM OPERATING LEVEL PRIOR TO JANUARY 1 OF THE DRAWDOWN YEAR BY CONTROLLED SPILLWAY RELEASES OR BY UTILIZING THE POWER INTAKE, AND MAINTAIN AT THIS LEVEL UNTIL DRAWDOWN IS INITIATED.

DRAWDOWN PRODEDURE:

1. STAGE 1 – DRAWDOWN USING SPILLWAY GATES:
   1.1. DRAWDOWN IS INITIATED ON JANUARY 1.
   1.2. THE SPILLWAY GATES ARE TO BE UTILIZED TO DRAWDOWN THE RESERVOIR WATER LEVEL AT A TARGET RATE OF 5 ft/DAY.

2. STAGE 2 – DRAWDOWN USING POWER INTAKE TO LOWER THE RESERVOIR LEVEL TO BELOW THE SPILLWAY CREST.
   2.1. STAGE 2 IS INITIATED ON JANUARY 2. THE POWER INTAKE OPENS TO DRAW THE RESERVOIR LEVEL TO 2 ft BELOW THE SPILLWAY CREST.
   2.2. SET CHARGES ON DIVERSION CULVERT #1 STOPLOG FROM DOWNSTREAM SIDE OF DIVERSION CULVERT #1 ONCE THE RESERVOIR WATER LEVEL IS 2 ft BELOW THE SPILLWAY CREST. RIVER FORECASTING AND COORDINATION WITH THE UPSTREAM PROJECT IS REQUIRED TO VERIFY THAT THE RESERVOIR WATER LEVEL WILL REMAIN BELOW THE SPILLWAY CREST WHILE CREWS ARE ACTIVELY WORKING ON THE DOWNSTREAM SIDE OF THE DIVERSION CULVERTS. THE RESERVOIR WATER LEVEL 2 ft BELOW THE SPILLWAY CREST IS ASSOCIATED WITH A STEADY–STATE INFLOW OF 1260 cfs.

3. STAGE 3 – REMOVE DIVERSION CULVERT #1 STOPLOG:
   3.1. STAGE 3 CAN BEGIN ONCE STAGE 2 CHARGES HAVE BEEN SET AND STAGE 2 IS COMPLETE.
   3.2. BLAST DIVERSION CULVERT #1 STOPLOG TO INITIATE FLOW THROUGH DIVERSION CULVERT #1.
   3.3. THE POWER INTAKE IS CLOSED ONCE DIVERSION CULVERT #1 IS OPENED. ONCE THE POWER INTAKE IS CLOSED, IT IS TO REMAIN CLOSED TO ISOLATE THE DOWNSTREAM FACILITY COMPONENTS.
   3.4. SET CHARGES ON DIVERSION CULVERT #2 STOPLOG FROM DOWNSTREAM SIDE OF DIVERSION CULVERT #2 ONCE THE RESERVOIR WATER LEVEL IS 2 ft BELOW THE SPILLWAY CREST AND BEFORE JUNE 10 OF THE DRAWDOWN YEAR. RIVER FORECASTING AND COORDINATION WITH THE UPSTREAM PROJECT IS REQUIRED TO VERIFY THAT THE RESERVOIR WATER LEVEL WILL REMAIN BELOW THE SPILLWAY CREST WHILE CREWS ARE ACTIVELY WORKING ON THE DOWNSTREAM SIDE OF THE DIVERSION CULVERT. THE RESERVOIR WATER LEVEL 2 ft BELOW THE SPILLWAY CREST IS ASSOCIATED WITH A STEADY–STATE INFLOW OF 2120 cfs.

4. STAGE 4 – REMOVE DIVERSION CULVERT #2 STOPLOG:
   4.1. STAGE 4 CAN BEGIN ONCE STAGE 3 CHAGES HAVE BEEN SET ONCE STAGE 3 IS COMPLETE. STAGE 4 INITIATION CAN BE DELAYED UNTIL JUNE 10 AT THE LATEST.
   4.2. BLAST DIVERSION CULVERT #2 STOPLOG TO INITIATE FLOW THROUGH DIVERSION CULVERT #2.

POST–DRAWDOWN/RIVER DIVERSION PRODEDURE:

1. RIVER DIVERSION IS ACHIEVED ONCE THE INFLOWS INTO THE RESERVOIR ARE EQUAL TO THE DISCHARGE CAPACITY WITH NO RESERVOIR IMPOUNDMENT.

2. DIVERSION OF ALL INFLOWS THROUGH THE DIVERSION CULVERTS REQUIRE RE–ESTABLISHMENT OF THE HISTORIC COFFERDAM.

FOR INFORMATION ONLY

LEGEND:

– – – – – – – WATER SURFACE LEVEL

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. THE STAGED ELEVATIONS REPRESENT FINAL ELEVATIONS AFTER COMPLETION OF EACH STAGE ASSUMING AVERAGE INFLOWS AND THE CORRESPONDING WATER SURFACE ELEVATIONS HIGHLIGHTED ON DRAWING C1055.
3. RESERVOIR DRAWDOWN MONITORING SHALL BE ESTABLISHED BY THE CONTRACTOR TO MEASURE WATER SURFACE LEVELS AS REQUIRED BY THE JCB STID AND TECHNICAL SPECIFICATIONS.

0 100 200 300
1" = 100'

0 10 20 30
1" = 10'

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	CBN	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	CBN	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY
Knight Piésold CONSULTING
Kiewit

DESIGNED	C. NIAMIR
DRAWN	A. NASIRI
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE
J.C. BOYLE FACILITY
DRAWDOWN STAGES
AVERAGE INFLOW - PLAN AND SECTION

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C1050

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Flow Condition		Discharge (cfs)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	14,000	14,200	14,200	13,600	9,900	7,300	4,400	3,200	1,800	1,800	2,500	3,000	3,800	4,600	5,500	7,200	10,500
	5% Probable Flood	8,000	9,700	10,900	9,400	6,800	4,400	2,800	2,100	1,700	1,700	2,100	2,400	2,900	3,300	3,800	4,400	6,300
	20% Probable Flood	4,400	4,900	8,000	6,800	4,300	2,800	1,800	1,400	1,500	1,500	1,700	1,900	2,200	2,400	2,600	2,900	3,900
	50% Probable Flood	2,600	2,700	6,300	4,500	2,700	1,800	1,400	1,000	1,400	1,400	1,400	1,500	1,700	1,700	1,800	2,000	2,500
Monthly Flow Duration 25% of Time Equaled or Exceeded		1,850	2,540	3,880	3,390	2,330	1,670	1,020	810	830	810	880	880	890	950	1,020	820	1,240
Mean Monthly Flow		1,500	1,900	2,800	2,370	1,760	1,330	960	740	760	760	800	790	810	890	980	950	1,110
Monthly Flow Duration 75% of Time Equaled or Exceeded		600	630	1,220	1,040	980	820	730	660	670	630	730	710	750	760	780	650	590

Flow Condition		Water Surface Levels at Intake Structure - Stage 2 (Spillway and Power Intake Open) (ft)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	3793.6	3793.7	3793.7	3793.4	3791.4	3789.8	3787.9	3787.0	3785.4	3785.4	3786.3	3786.8	3787.5	3788.1	3788.7	3789.7	3791.7
	5% Probable Flood	3790.2	3791.3	3792.0	3791.1	3789.5	3787.9	3786.6	3785.9	3785.3	3785.3	3785.9	3786.2	3786.7	3787.1	3787.5	3787.9	3789.2
	20% Probable Flood	3787.9	3788.3	3790.2	3789.5	3787.9	3786.6	3785.4	3783.9	3784.4	3784.4	3785.3	3785.6	3786.0	3786.2	3786.4	3786.7	3787.6
	50% Probable Flood	3786.4	3786.5	3789.2	3788.0	3786.5	3785.4	3783.9	3781.8	3783.9	3783.9	3783.9	3784.4	3785.3	3785.3	3785.4	3785.8	3786.3
Monthly Flow Duration 25% of Time Equaled or Exceeded		3785.5	3786.3	3787.5	3787.1	3786.1	3785.2	3782.0	3780.7	3780.9	3780.7	3781.1	3781.1	3781.2	3781.6	3782.0	3780.8	3783.1
Mean Monthly Flow		3784.4	3785.6	3786.6	3786.2	3785.4	3783.6	3781.6	3780.3	3780.4	3780.4	3780.7	3780.6	3780.7	3781.2	3781.7	3781.6	3782.5
Monthly Flow Duration 75% of Time Equaled or Exceeded		3779.3	3779.6	3783.0	3782.1	3781.7	3780.8	3780.2	3779.8	3779.8	3779.6	3780.2	3780.1	3780.3	3780.4	3780.5	3779.7	3779.3

Flow Condition		Water Surface Levels at Intake Structure - Stage 3 (Diversion Culvert #1 Open, Power Intake Closed) (ft)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	3793.7	3793.8	3793.8	3793.5	3791.6	3790.0	3787.9	3786.8	3776.8	3776.8	3785.8	3786.5	3787.4	3788.1	3788.8	3790.0	3791.9
	5% Probable Flood	3790.5	3791.5	3792.1	3791.3	3789.7	3787.9	3786.3	3782.8	3775.1	3775.1	3782.8	3785.7	3786.4	3786.9	3787.4	3787.9	3789.4
	20% Probable Flood	3787.9	3788.3	3790.5	3789.7	3787.8	3786.3	3776.8	3770.4	3765.8	3770.4	3770.4	3771.9	3775.1	3775.1	3776.8	3780.7	3785.8
	50% Probable Flood	3786.0	3786.1	3789.4	3788.0	3786.1	3776.8	3770.4	3765.8	3770.4	3770.4	3770.4	3771.9	3775.1	3775.1	3776.8	3780.7	3785.8
Monthly Flow Duration 25% of Time Equaled or Exceeded		3777.8	3785.9	3787.5	3787.0	3785.5	3774.6	3765.9	3764.3	3764.4	3764.3	3764.8	3764.8	3764.9	3765.3	3765.9	3764.3	3768.3
Mean Monthly Flow		3771.9	3778.7	3786.3	3785.6	3776.1	3769.5	3765.4	3763.7	3763.9	3763.9	3764.2	3764.1	3764.3	3764.9	3765.6	3765.3	3766.8
Monthly Flow Duration 75% of Time Equaled or Exceeded		3762.6	3762.9	3768.1	3766.1	3765.6	3764.3	3763.7	3763.1	3763.2	3762.9	3763.7	3763.5	3763.8	3763.9	3764.0	3763.0	3762.5

Flow Condition		Water Surface Levels at Intake Structure Diversion - Stage 4 (Culverts #1 and #2 Open, Power Intake Closed) (ft)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood						3788.4	3784.9	3773.4	3765.0	3765.0	3768.4	3771.9	3778.7	3785.6	3786.8	3788.3	3790.5
	5% Probable Flood						3784.9	3770.4	3766.2	3764.6	3764.6	3766.2	3767.8	3771.1	3774.2	3778.7	3784.9	3787.6
	20% Probable Flood						3770.4	3765.0	3763.4	3763.8	3763.8	3764.6	3765.3	3766.7	3767.8	3769.1	3771.1	3779.7
	50% Probable Flood						3765.0	3763.4	3761.8	3763.4	3763.4	3763.4	3763.8	3764.6	3764.6	3765.0	3765.8	3768.4
Monthly Flow Duration 25% of Time Equaled or Exceeded							3764.5	3761.9	3760.9	3761.0	3760.9	3761.2	3761.2	3761.3	3761.6	3761.9	3761.0	3762.8
Mean Monthly Flow							3763.1	3761.6	3760.6	3760.7	3760.7	3760.9	3760.8	3760.9	3761.3	3761.7	3761.6	3762.2
Monthly Flow Duration 75% of Time Equaled or Exceeded							3761.0	3760.5	3760.2	3760.2	3760.0	3760.5	3760.4	3760.6	3760.7	3760.8	3760.1	3759.8

TABLE 1: MONTHLY INFLOWS AND STEADY–STATE WATER LEVELS AT INTAKE STRUCTURE FOR DRAWDOWN AND POST–DRAWDOWN

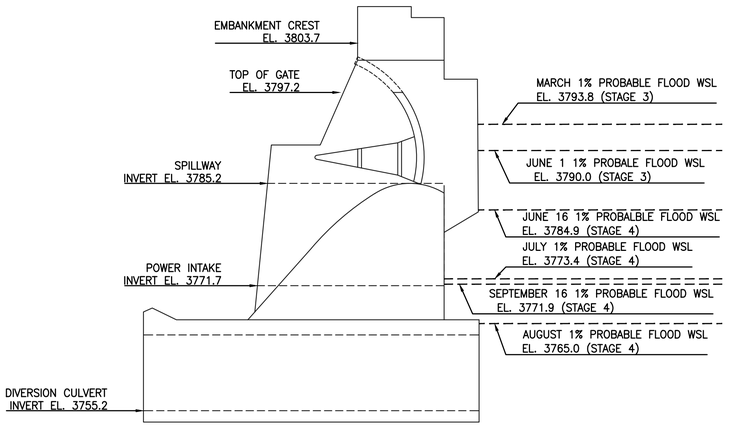
Flow Condition		Discharge (cfs)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	14,000	14,200	14,200	13,600	9,900	7,300	4,400	3,200	1,800	1,800	2,500	3,000	3,800	4,600	5,500	7,200	10,500
	5% Probable Flood	8,000	9,700	10,900	9,400	6,800	4,400	2,800	2,100	1,700	1,700	2,100	2,400	2,900	3,300	3,800	4,400	6,300
	20% Probable Flood	4,400	4,900	8,000	6,800	4,300	2,800	1,800	1,400	1,500	1,500	1,700	1,900	2,200	2,400	2,600	2,900	3,900
	50% Probable Flood	2,600	2,700	6,300	4,500	2,700	1,800	1,400	1,000	1,400	1,400	1,400	1,500	1,700	1,700	1,800	2,000	2,500
Monthly Flow Duration 25% of Time Equaled or Exceeded		1,850	2,540	3,880	3,390	2,330	1,670	1,020	810	830	810	880	880	890	950	1,020	820	1,240
Mean Monthly Flow		1,500	1,900	2,800	2,370	1,760	1,330	960	740	760	760	800	790	810	890	980	950	1,110
Monthly Flow Duration 75% of Time Equaled or Exceeded		600	630	1,220	1,040	980	820	730	660	670	630	730	710	750	760	780	650	590

Flow Condition		Water Surface Level at Embankment - Stage 4 (Culverts #1 and #2 Open, Power Intake Closed) (ft)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood						3789.1	3781.7	3773.7	3768.0	3768.0	3769.7	3771.1	3777.4	3784.6	3787.7	3789.0	3791.4
	5% Probable Flood						3781.7	3769.8	3768.1	<3768	<3768	3768.1	3768.7	3770.2	3774.8	3777.4	3781.7	3788.0
	20% Probable Flood						3769.8	3768.0	<3768	<3768	<3768	<3768	3768.0	3768.2	3768.7	3769.7	3770.2	3777.8
	50% Probable Flood						3768.0	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	3768.0	3768.1	3769.7
Monthly Flow Duration 25% of Time Equaled or Exceeded							<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768
Mean Monthly Flow							<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768
Monthly Flow Duration 75% of Time Equaled or Exceeded							<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768

SEE NOTE 9

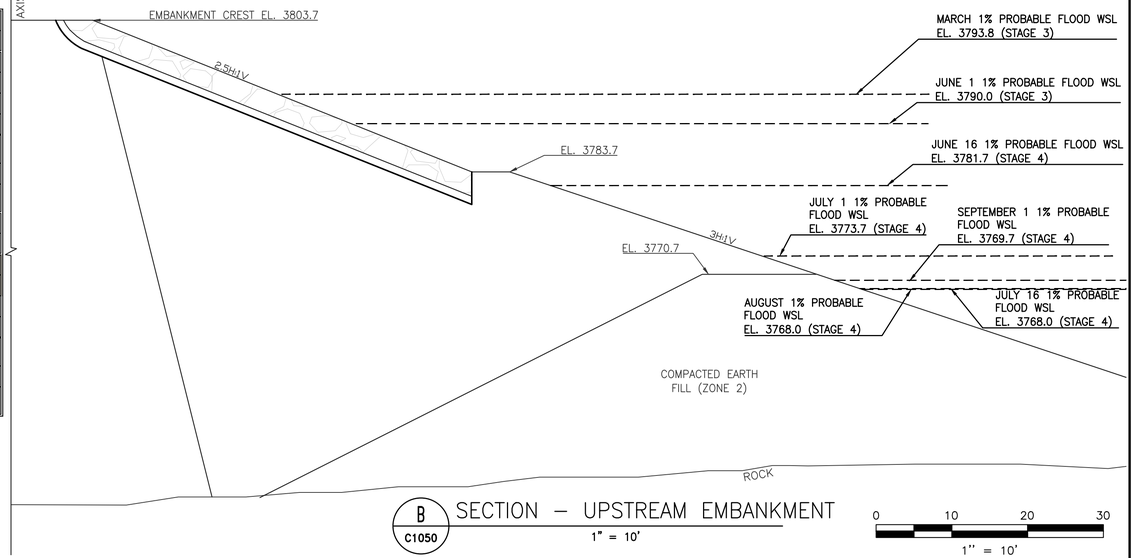
TABLE 2: MONTHLY INFLOWS AND STEADY–STATE WATER LEVELS AT UPSTREAM EMBANKMENT FOR DRAWDOWN AND POST–DRAWDOWN

FOR INFORMATION ONLY



A C1050 SECTION – INTAKE STRUCTURE
1" = 10'

AXIS OF DAM



B C1050 SECTION – UPSTREAM EMBANKMENT
1" = 10'

0 10 20 30
1" = 10'

LEGEND:

– – – – – WATER SURFACE LEVEL

NOTE:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. WATER SURFACE LEVELS SHOWN IN TABLE 2 AND SECTION B CORRESPOND TO LEVELS AT THE UPSTREAM FACE OF THE EMBANKMENT.
3. SELECT LEVELS SHOWN ON SECTIONS. ADDITIONAL LEVELS SHOWN ON TABLE 1.
4. THE WATER LEVELS IN TABLE 1 AND TABLE 2 ARE DETERMINED USING STEADY–STATE FLOWS IN TABLE 1 AND THE RATING CURVES SHOWN ON DRAWING C1056.
5. SHADED VALUES IN TABLE 1 AND TABLE 2 REPRESENT WATER SURFACE LEVELS WITH SPILLWAY FLOW.
6. BOLDED CELLS CORRESPOND TO RESERVOIR ELEVATIONS SHOWN ON DRAWING C1050.
7. STARTING JUNE 1 OF THE DRAWDOWN YEAR, EMBANKMENT MATERIALS CAN BE REMOVED ACCORDING TO THE STAGING DRAWINGS SHOWN ON C1234 TO C1239, SUCH THAT:
   - 7.1. 3 ft FREEBOARD IS MAINTAINED ON THE RELEVANT FLOOD EVENT PRIOR TO JULY 16.
   - 7.2. 1 ft FREEBOARD IS MAINTAINED ON THE RELEVANT FLOOD EVENT POST JULY 16.
8. CONTRACTOR TO ASSESS THE FLOOD RISK BASED ON USBR FORECAST REPORT AND CURRENT WATER CONDITIONS WHICH WILL INFLUENCE REMOVAL SCHEDULE.
9. ALL WATER LEVELS DENOTED BY <3768 INDICATE THAT THE INFLOW IS FULLY DIVERTED BY THE HISTORIC COFFERDAM. IN THESE CASES, THERE IS NO WATER SURFACE ELEVATION AT THE EMBANKMENT BUT ONLY AT THE INTAKE STRUCTURE.
10. WATER LEVELS SHOWN ON THIS DRAWING ARE NO LONGER VALID ONCE THE CONTROL IS REVISED AND THE INTAKE/SPILLWAY STRUCTURE IS DEMOLISHED.

REV	DESCRIPTION	BY	CHK	APP	DATE
C	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
B	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
A	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	V. MARTIN
DRAWN	A. NASIRI
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
SHEET TITLE: J.C. BOYLE FACILITY HYDROLOGIC AND HYDRAULIC INFORMATION POST-DRAWDOWN WATER SURFACE LEVELS

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C1055

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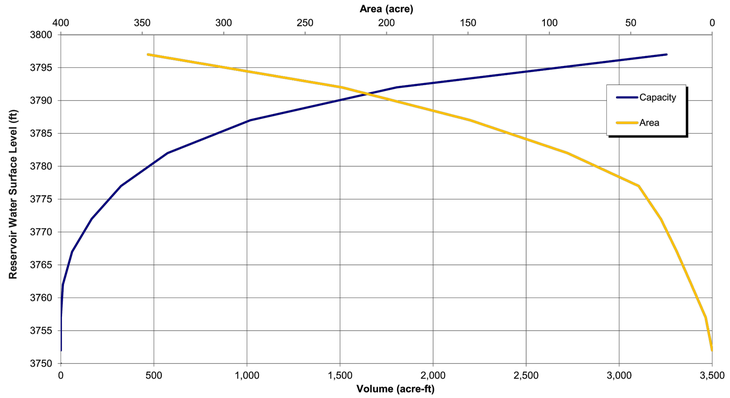

FIGURE 1: J.C. BOYLE DEPTH AREA CAPACITY CURVE

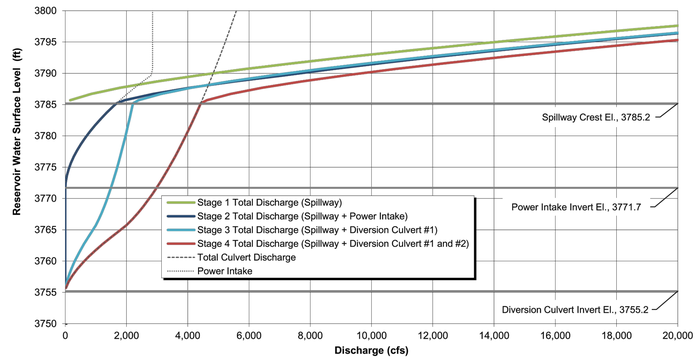

FIGURE 2: J.C. BOYLE RESERVOIR DISCHARGE RATING CURVE (INTAKE STRUCTURE)

FOR INFORMATION ONLY

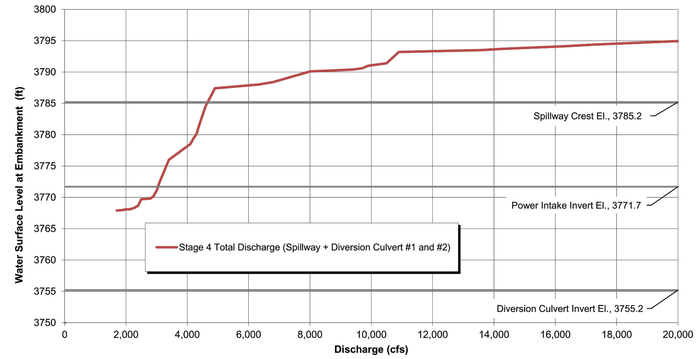

FIGURE 3: J.C. BOYLE RESERVOIR DISCHARGE RATING CURVE (EMBANKMENT)

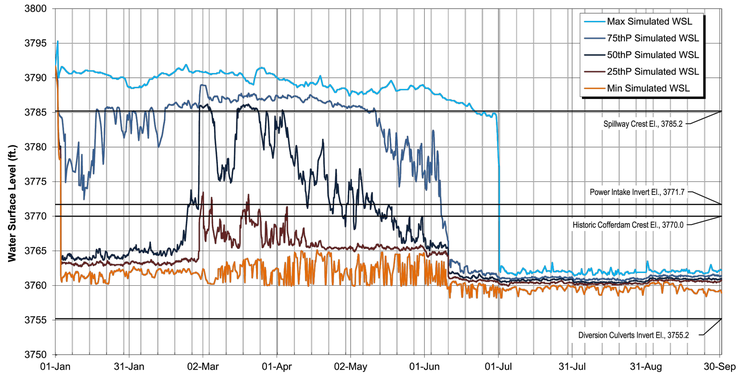

FIGURE 4: J.C. BOYLE RESERVOIR DRAWDOWN PERCENTILE WATER SURFACE LEVELS

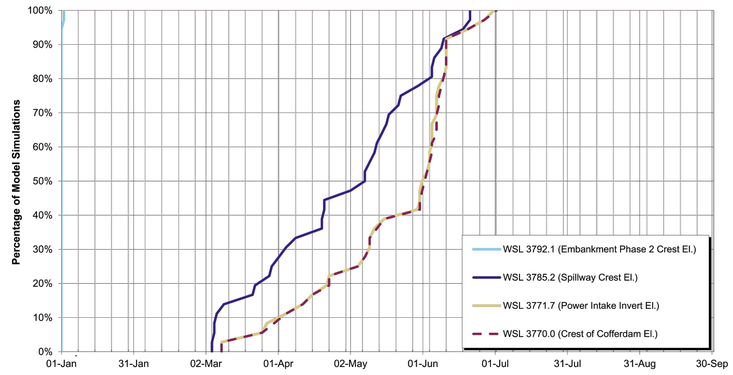

FIGURE 5: J.C. BOYLE SUSTAINED RESERVOIR DRAWDOWN AT SELECTED ELEVATIONS OVER PERIOD OF RECORD MODEL RUNS BY DATE

NOTES:

1. FOR RESERVOIR DRAWDOWN OPERATIONS NOTES SEE DRAWING C1050.
2. RESERVOIR STORAGE AREA CAPACITY CURVE (FIGURE 1) IS BASED ON THE 2018 BATHYMETRIC SURVEY AS NOTED ON DRAWING G0006.
3. DISCHARGE CAPACITY OF SPILLWAY ON FIGURE 2 IS FOR ALL THREE GATES OPEN.
4. DISCHARGE CAPACITY OF DIVERSION CULVERTS ON FIGURE 2 ARE FOR FREE DISCHARGE CONDITIONS. DIVERSION CULVERT #1 AND #2 HAVE THE SAME INVERT ELEVATION AND DISCHARGE RATING CURVE CAPACITY. A SINGLE DISCHARGE RATING CURVE IS SHOWN THAT REPRESENTS THE CAPACITY OF A SINGLE CULVERT.
5. DISCHARGE RATING CURVE ON FIGURE 2 IS FOR WATER LEVELS IMMEDIATELY UPSTREAM OF THE INTAKE STRUCTURE.
6. DISCHARGE RATING CURVE ON FIGURE 3 IS FOR WATER LEVELS AT THE CENTER OF THE UPSTREAM EMBANKMENT UNDER STAGE 4 OF DRAWDOWN CONDITIONS (THREE SPILLWAY GATES OPEN AND DIVERSION CULVERTS OPEN).
7. RESERVOIR WATER LEVELS SHOWN IN FIGURE 4 ARE THE RESERVOIR WATER SURFACE LEVEL MODEL RUN RESULTING PERCENTILES IMMEDIATELY UPSTREAM OF THE DAM USING DRAWDOWN MODEL. THE PERCENTILES ARE CALCULATED BASED ON THE ENTIRE 36 YEAR RECORD OF 2019 JOINT BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. THE RESERVOIR WATER LEVELS ARE SIMULATED USING THE RESERVOIR DRAWDOWN OPERATIONS ON DRAWING C1055. WATER LEVELS CAN BE OUTSIDE OF THE VALUES DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR.
8. THE CURVES SHOWN ON FIGURE 5 REPRESENT THE PERCENTAGE OF MODEL SIMULATIONS AT WHICH RESERVOIR DRAWDOWN WATER SURFACE LEVELS ARE SUSTAINED BELOW SELECTED ELEVATIONS BASED ON THE DRAWDOWN MODEL USING THE ENTIRE 36 YEAR RECORD OF 2019 JOIN BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. THE ACTUAL DATE A WATER SURFACE LEVEL IS SUSTAINED AT A CERTAIN ELEVATION CAN BE DIFFERENT THAN SHOWN DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR AND THE DRAWDOWN SEQUENCING SHOWN ON DRAWING C1055.

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A	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20

WARNING
0 1/2 1
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PREPARED BY: Knight Piésold CONSULTING / Kiewit

DESIGNED	V. MARTIN
DRAWN	A. NASIRI
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: J.C. BOYLE FACILITY HYDROLOGIC AND HYDRAULIC INFORMATION FIGURES
DWG C1056

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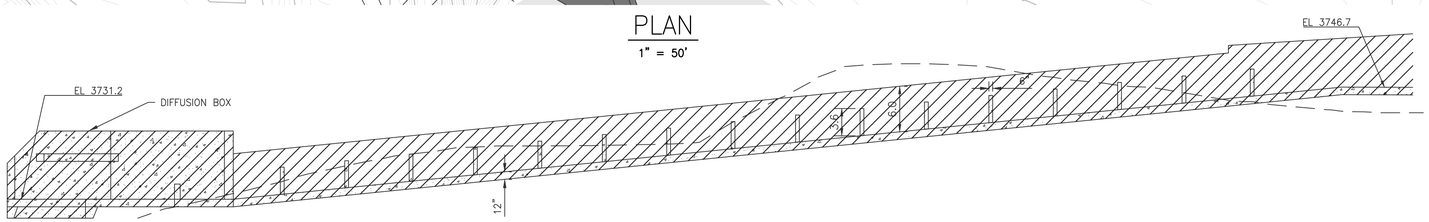
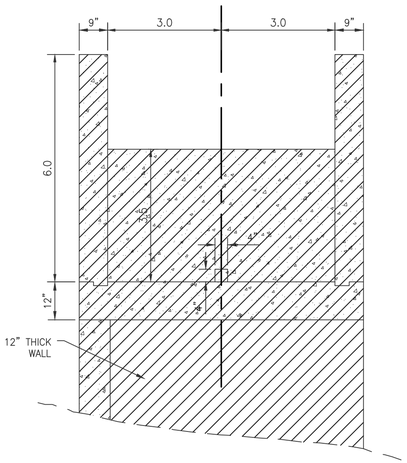
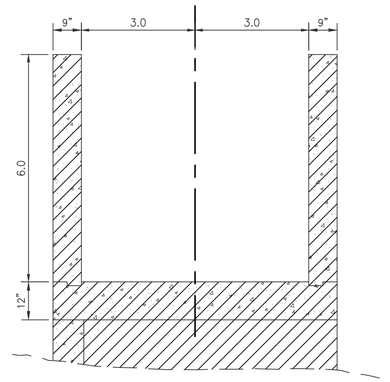
PLAN
1" = 50'



A SECTION
1" = 10'



C SECTION
1" = 2'



D SECTION
1" = 2'

WORK POINTS TABLE			
WORK POINTS	EASTING	NORTHING	ELEVATION
SOP-1	6,548,227.6	2,656,860.8	3735.0
SOP-2	6,548,312.3	2,656,964.8	3778.0
SOP-3	6,548,553.2	2,656,914.0	3762.0
SOP-4	6,548,529.0	2,656,696.3	3766.5
SOP-5	6,548,475.1	2,656,853.6	3735.5
SOP-6	6,548,133.5	2,656,618.4	3731.0
SOP-7	6,548,261.3	2,656,756.7	3736.0
SOP-8	6,548,277.2	2,656,619.1	3734.0
SOP-9	6,548,085.0	2,656,532.2	3724.5
SOP-10	6,548,298.4	2,656,557.9	3736.5
SOP-11	6,548,219.7	2,656,517.9	3730.5
SOP-12	6,548,249.2	2,656,330.5	3723.0

LEGEND:

- (E) CONCRETE
- DEMOLITION / REMOVAL
- F — F — FENCE
- EXTENT OF EMBANKMENT
- BORROW SOURCE LIMITS
- TO BE REMOVED
- 1 FISH LADDER
- 2 EMBANKMENT CREST
- 3 DIVERSION CULVERTS
- 4 GATED SPILLWAY
- 5 INTAKE STRUCTURE
- 6 DAM COMMUNICATIONS BLDG
- 7 14' PIPELINE

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. LOCATION AND EXTENT OF HISTORIC COFFERDAM IS BASED ON HISTORIC PHOTOS AND MAY VARY. THE CONTRACTOR SHALL LOCATE AND ASSESS THE HISTORIC COFFERDAM PRIOR TO COMMENCING EXCAVATION SO EXCAVATION LIMITS CAN BE UPDATED AS REQUIRED.
3. POTENTIAL BORROW SOURCE LOCATED IN CULTURALLY SENSITIVE AREA.
4. REMOVE FISH LADDER COMPLETELY.
5. DIMENSIONS BASED ON HISTORIC DRAWING 78112.

0 2 4 6
1" = 2'

0 10 20 30
1" = 10'

0 50 100 150
1" = 50'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
C	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
B	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
A	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20

WARNING
0 1/2 1
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PREPARED BY: Knight Piésold CONSULTING, Kiewit

DESIGNED	C. NIAMIR
DRAWN	A. NASIRI
REVIEWED	N. BISHOP
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: J.C. BOYLE FACILITY EMBANKMENT, INTAKE AND FISH LADDER REMOVAL PLAN AND SECTIONS
DWG C1210

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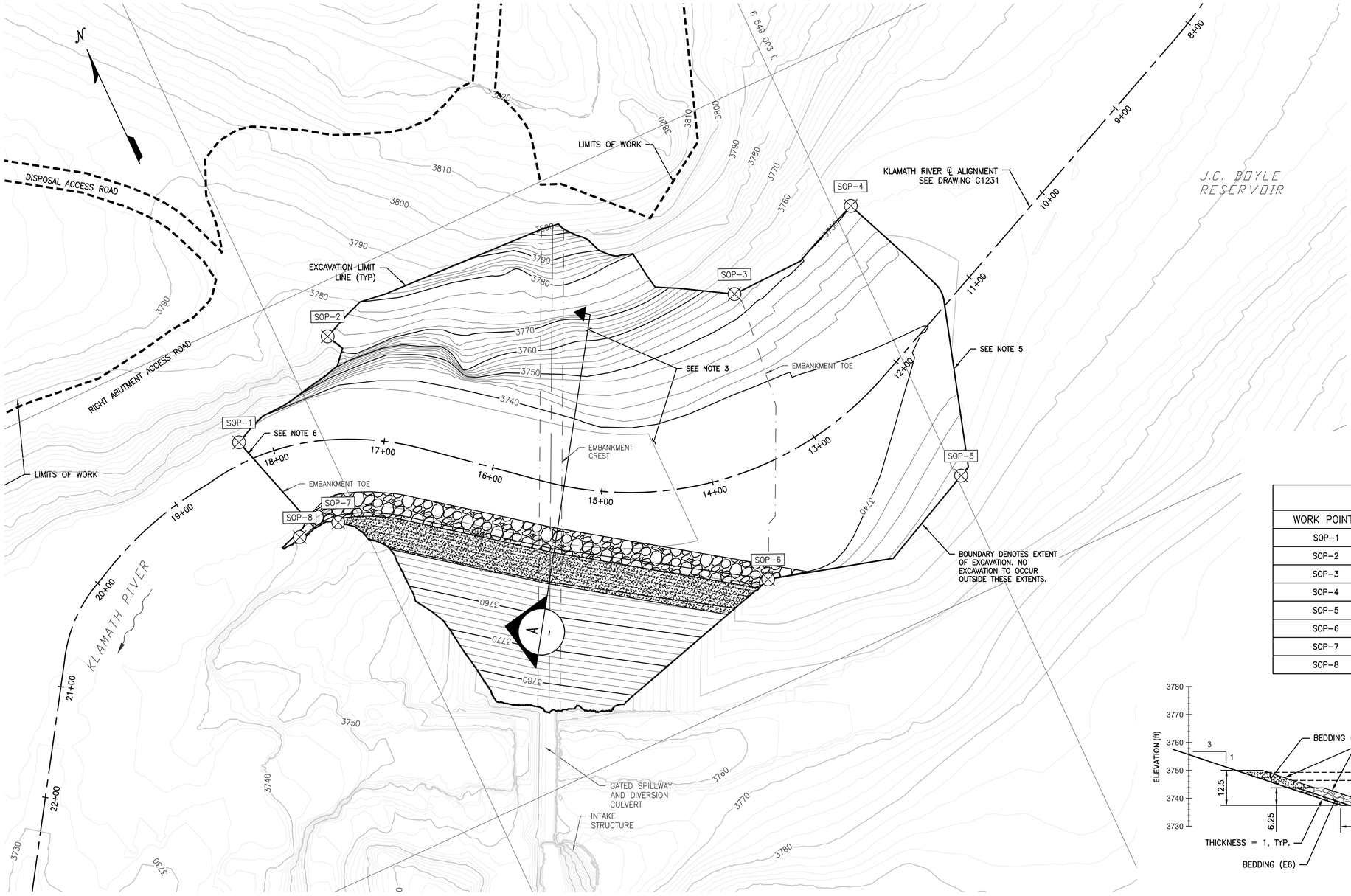
PUBLIC VERSION

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION (CEII)

REDACTED

DESIGNSHEET C1220: SPILLWAY AND INTAKE REMOVAL



PLAN
1" = 50'

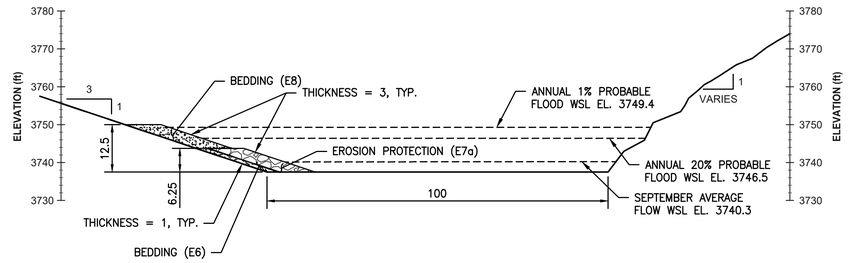
NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. REMOVE DAM EMBANKMENT FILL TO LINES AND GRADES SHOWN. EROSION PROTECTION AND BEDDING MATERIALS TO BE PLACED PRIOR TO COFFERDAM BREACH.
3. FINAL RIVER CHANNEL EXCAVATED TO BEDROCK ALONG THE RIGHT BANK AND BOTTOM. DO NOT EXCAVATE INTO BEDROCK SURFACE.
4. EXCAVATED FILL TO BE PLACED IN DISPOSAL AREAS SHOWN ON C1240 OR USED AS COVER MATERIAL.
5. EXTENT OF REMAINING SEDIMENT AND DEBRIS TO BE EVALUATED FOLLOWING DRAWDOWN. REMOVAL LIMIT CORRESPONDS TO HISTORIC COFFERDAM UPSTREAM TOE. ADDITIONAL SEDIMENT AND DEBRIS REMOVAL MAY BE NECESSARY TO ACCESS THIS POINT. REMOVAL OF MATERIAL UPSTREAM OF THIS POINT, UNLESS TO ACCESS TO THE HISTORIC COFFERDAM TOE, WILL BE COMPLETED BY OTHERS AND IS OUTSIDE THE SCOPE OF THIS DESIGN.
6. FOLLOWING EMBANKMENT REMOVAL, EVALUATE ROCKFILL AT DOWNSTREAM TOE AND GRADE AS REQUIRED.
7. CHANNEL SECTIONS BY STATION SHOWN ON C1232.
8. THE ANTICIPATED WATER SURFACE LEVELS AT SECTION A FOR VARIOUS FLOW CONDITIONS DURING CONSTRUCTION ARE SUMMARIZED IN APPENDIX B1.
9. EXCAVATION EXTENTS ARE INTERPRETED BASED ON THE HISTORIC DRAWINGS AND ARE INTENDED TO ILLUSTRATE THE GROUND SURFACE ONCE THE EMBANKMENT IS REMOVED. HOWEVER, ADDITIONAL EXCAVATION MAY BE REQUIRED. BEDROCK DEPTH MAY VARY.

LEGEND:

- EROSION PROTECTION (E7a)
- BEDDING (E6/E8)
- WATER SURFACE LEVEL
- LIMITS OF WORK

WORK POINTS TABLE			
WORK POINTS	EASTING	NORTHING	ELEVATION
SOP-1	6,548,430.0	2,656,901.0	3736.5
SOP-2	6,548,542.0	2,656,954.0	3773.0
SOP-3	6,548,888.5	2,656,835.5	3774.5
SOP-4	6,549,016.0	2,656,864.0	3777.5
SOP-5	6,549,004.5	2,656,603.0	3770.5
SOP-6	6,548,808.5	2,656,591.5	3765.0
SOP-7	6,548,480.7	2,656,798.9	3744.0
SOP-8	6,548,444.0	2,656,801.5	3740.0



A — A' SECTION
1" = 20'

FOR INFORMATION ONLY

0 20 40 60
1" = 20'

0 50 100 150
1" = 50'

REV	DESCRIPTION	BY	CHK	APP	DATE
G	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
F	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
E	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20
D	ISSUED WITH 60% DESIGN REPORT	CBN	NB	SRM	02/07/20
C	ISSUED WITH DRAFT 60% DESIGN REPORT	CBN	NB	SRM	12/17/19

WARNING
0 1/2 1
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PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. NIAMIR
DRAWN	R. McLELLAN
REVIEWED	H. ELWIN
IN CHARGE	N.BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: J.C. BOYLE FACILITY EMBANKMENT REMOVAL PLAN
DWG C1230

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PUBLIC VERSION

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION

(CEII)

REDACTED

DESIGN SHEET C1231:EMBANKMENT REMOVAL

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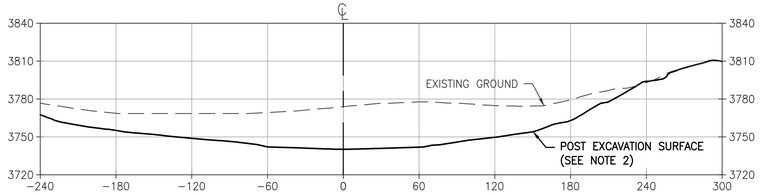
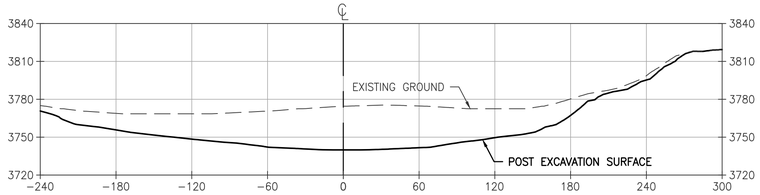


STA 12+00



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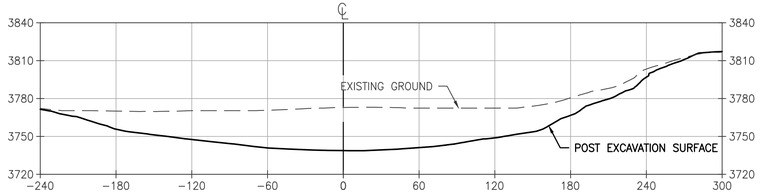

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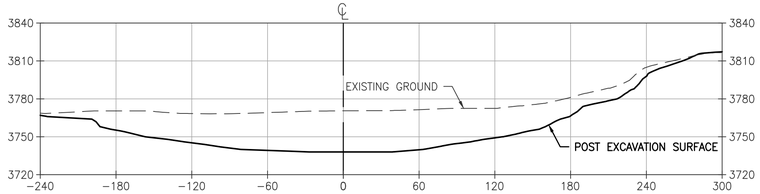

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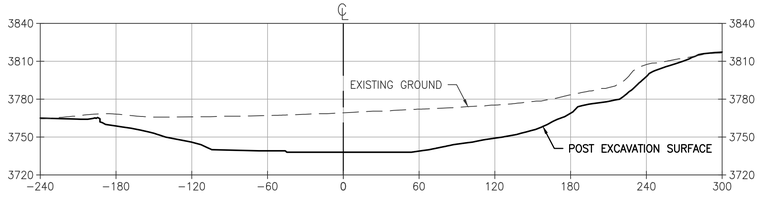
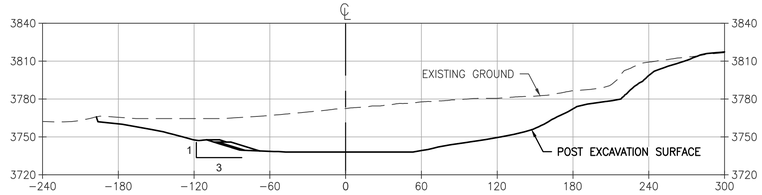


STA 14+00



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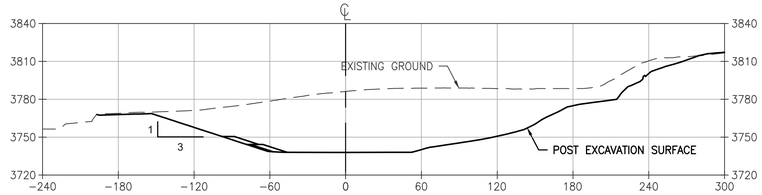
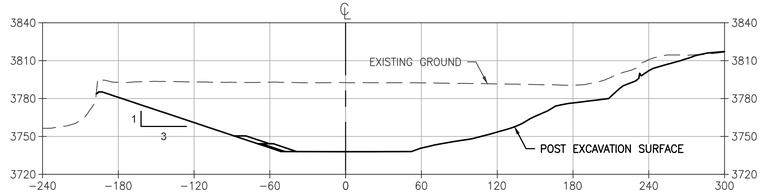


STA 15+00



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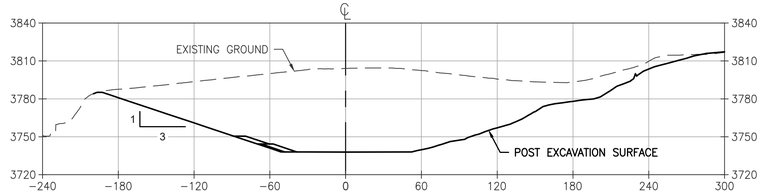

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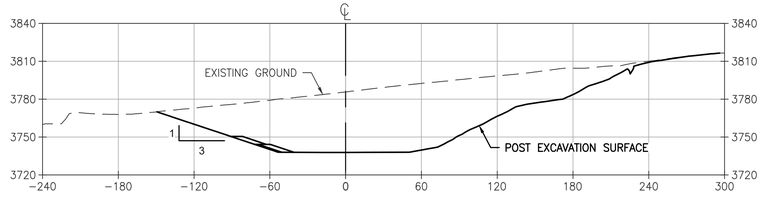

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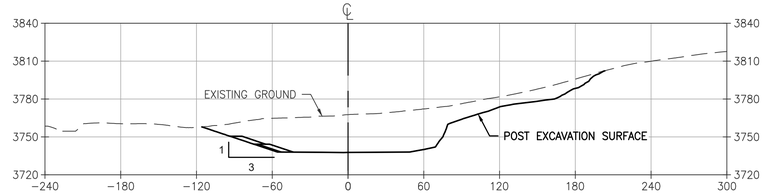

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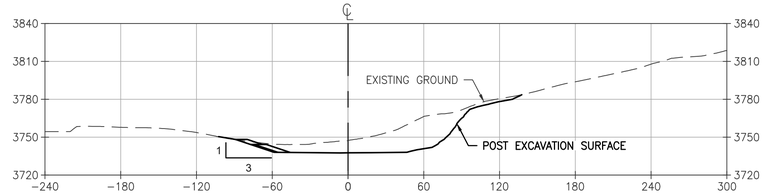

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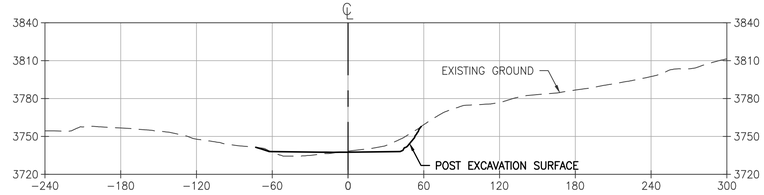

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. ACTUAL BEDROCK ELEVATION TO DETERMINE POST EXCAVATION SURFACE. NO EXCAVATION IS TO OCCUR INTO BEDROCK OR ROCKFILL.
3. REMOVE DAM EMBANKMENT FILL TO LINES AND GRADES SHOWN OR UNTIL BEDROCK/ROCKFILL IS ENCOUNTERED. EROSION PROTECTION AND BEDDING MATERIALS TO BE PLACED ON LEFT BANK POST EXCAVATION SURFACE.
4. FINAL RIVER CHANNEL ROCK SURFACE BOTTOM WIDTH AND RIGHT BANK ERODIBLE FILLS TO BE REMOVED PRIOR TO HISTORIC COFFERDAM BREACH.
5. EXCAVATION EXTENTS ARE INTERPRETED BASED ON THE HISTORIC DRAWINGS AND ARE INTENDED TO ILLUSTRATE THE GROUND SURFACE ONCE THE EMBANKMENT IS REMOVED. HOWEVER, ADDITIONAL EXCAVATION MAY BE REQUIRED. BEDROCK DEPTH MAY VARY.

FOR INFORMATION ONLY

0 60 120 180
1" = 60'

REV	DESCRIPTION	BY	CHK	APP	DATE
G	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
F	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
E	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20
D	ISSUED WITH 60% DESIGN REPORT	CBN	NB	SRM	02/07/20
C	ISSUED WITH DRAFT 60% DESIGN REPORT	CBN	NB	SRM	12/17/19

WARNING
0 1/2 1
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PREPARED BY
Knight Piésold CONSULTING
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REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE
J.C. BOYLE FACILITY
EMBANKMENT REMOVAL
EXCAVATION SECTIONS

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C1232

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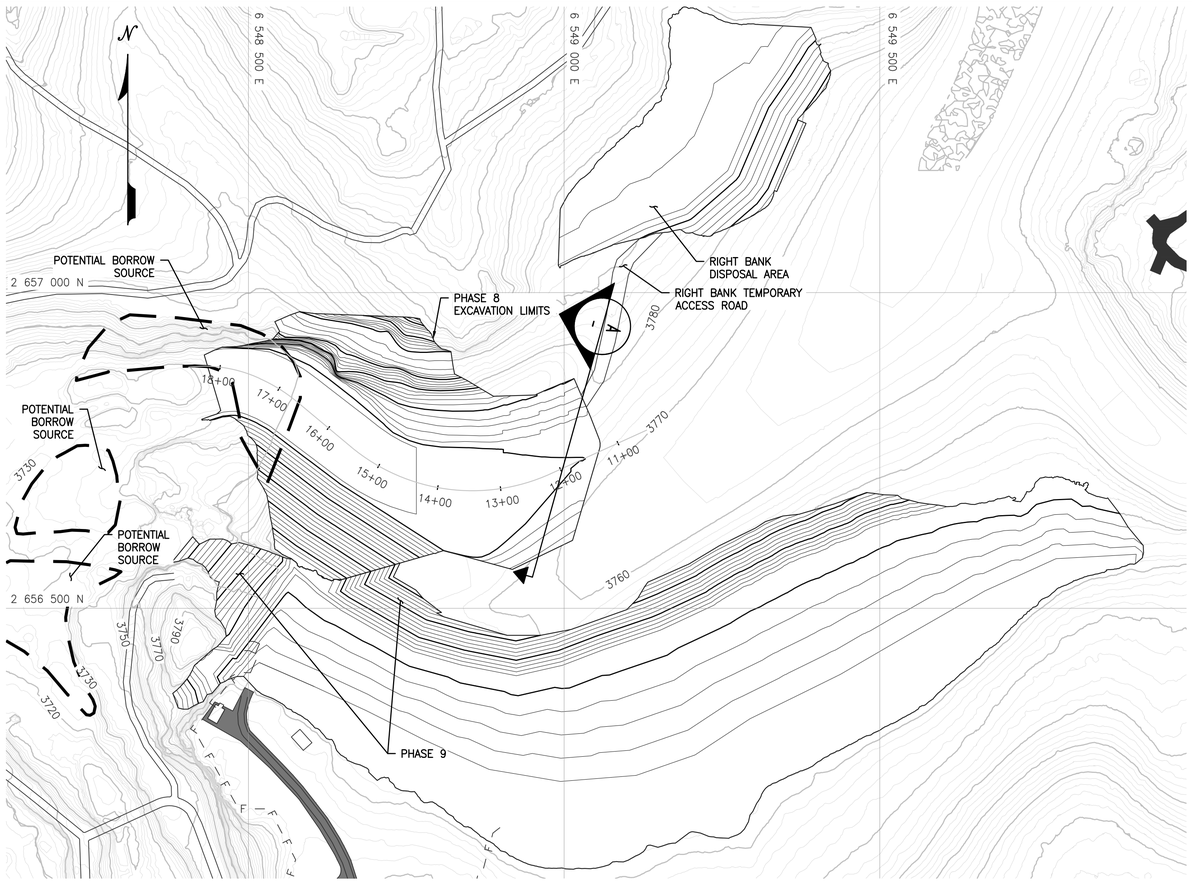
PUBLIC VERSION

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION

(CEII)

REDACTED

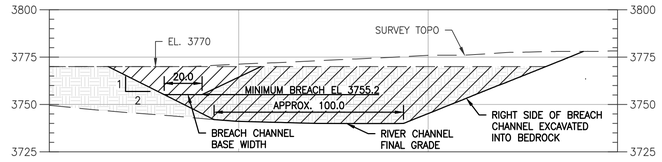
DESIGN SHEETS C1234-C1238: EMBANKMENT REMOVAL



PLAN

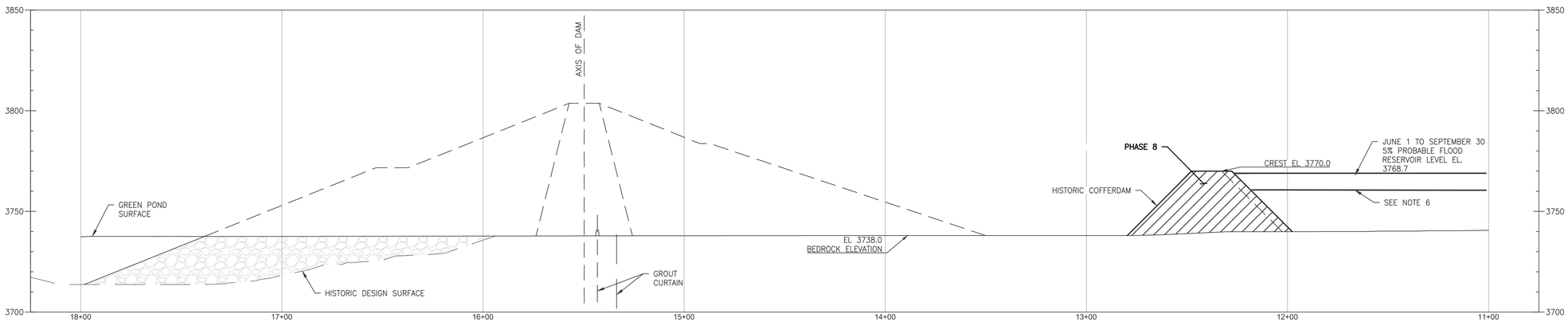
1" = 120'

FOR INFORMATION ONLY



A – SECTION – HISTORIC COFFERDAM BREACH

NTS



PROFILE – EMBANKMENT REMOVAL MAXIMUM

1" = 30'

REMOVAL SEQUENCE NOTES – GENERAL ARRANGEMENT SEQUENCE NOTES (SEE DRAWINGS C1234 TO C1239):

1. PHASE 8 BREACH TO MATCH FINAL CHANNEL SLOPE ONCE FINAL RIVER CHANNEL IS SUBSTANTIALLY COMPLETE.
2. PHASE 9 PLACE STOCKPILED MATERIAL IN DIVERSION CULVERT CHANNEL AND BURY LEFT–IN–PLACE CONCRETE.

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. LOCATION AND EXTENT OF HISTORIC COFFERDAM IS BASED ON HISTORIC PHOTOS AND MAY VARY. THE CONTRACTOR SHALL LOCATE AND ASSESS THE HISTORIC COFFERDAM PRIOR TO COMMENCING EXCAVATION SO EXCAVATION LIMITS CAN BE UPDATED AS REQUIRED.
3. HISTORIC COFFERDAM REMOVAL EXTENTS AS SHOWN ON SECTION A ARE APPROXIMATE AND WILL BE FIELD FIT BASED ON ENCOUNTERED CONDITIONS DURING REMOVAL.
4. BREACH DEPTH OF 3755.2 ft REQUIRED TO DIVERT FLOWS FROM THE DIVERSION CULVERTS TO THE FINAL RIVER CHANNEL.
5. EXCAVATE TO BREACH FROM RIGHT BANK. AVOID HAVING EXCAVATOR WORK FROM ERODIBLE FILLS
6. RESERVOIR ELEVATION AT TIME OF BREACH WILL DEPEND ON DIVERSION CULVERT INFLOW HYDRAULICS. TO BE EVALUATED POST DRAWDOWN.

LEGEND:

DEMOLITION / REMOVAL

(E) RIPRAP

0 30 60 90

1" = 30'

0 120 240 360

1" = 120'

REV	DESCRIPTION	BY	CHK	APP	DATE
C	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
B	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
A	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING, Kiewit

DESIGNED	C. NIAMIR
DRAWN	A. NASIRI
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE: J.C. BOYLE FACILITY
EMBANKMENT REMOVAL
GENERAL ARRANGEMENT SEQUENCE - (SHEET 6 OF 6)

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C1239

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Source: Northwest Hydraulic Consultants Drawdown Model Report for the Klamath River Renewal Project in Appendix G of the 100% Design Report (Knight Piésold, 2020b).

Drawdown Plots for J.C. Boyle Reservoir

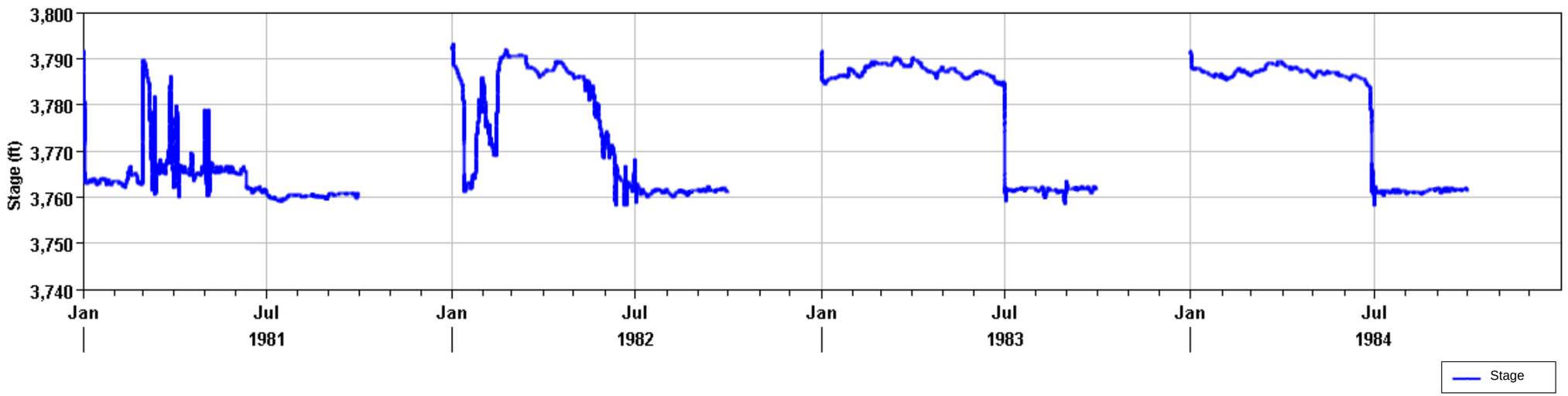


Figure 1: J.C. Boyle Drawdown Stage for years 1981 through 1984

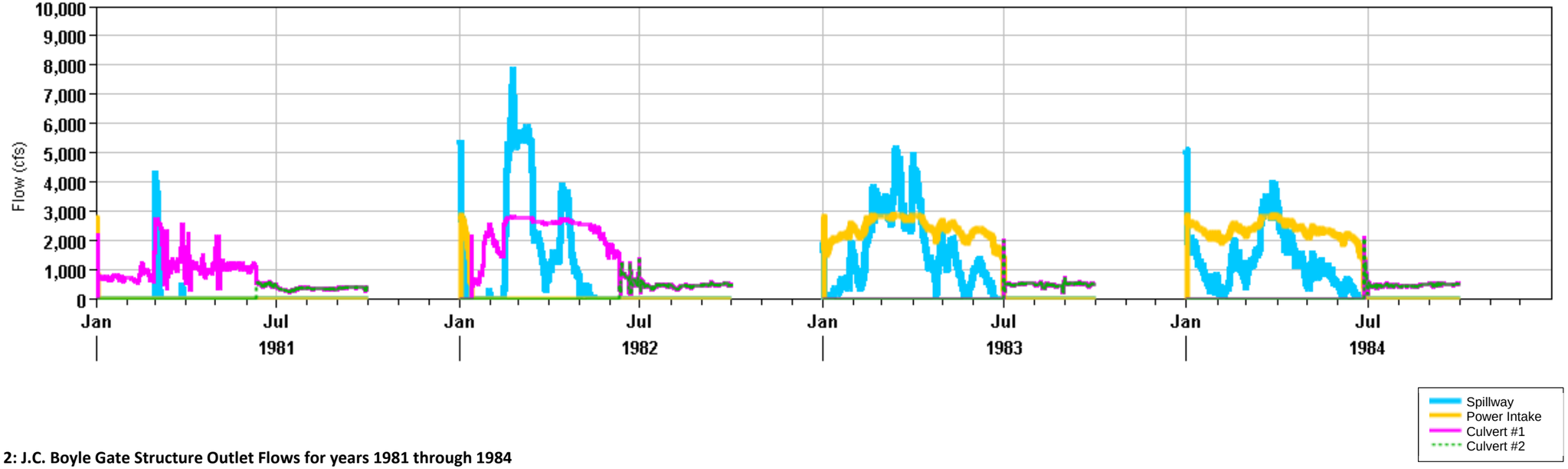


Figure 2: J.C. Boyle Gate Structure Outlet Flows for years 1981 through 1984

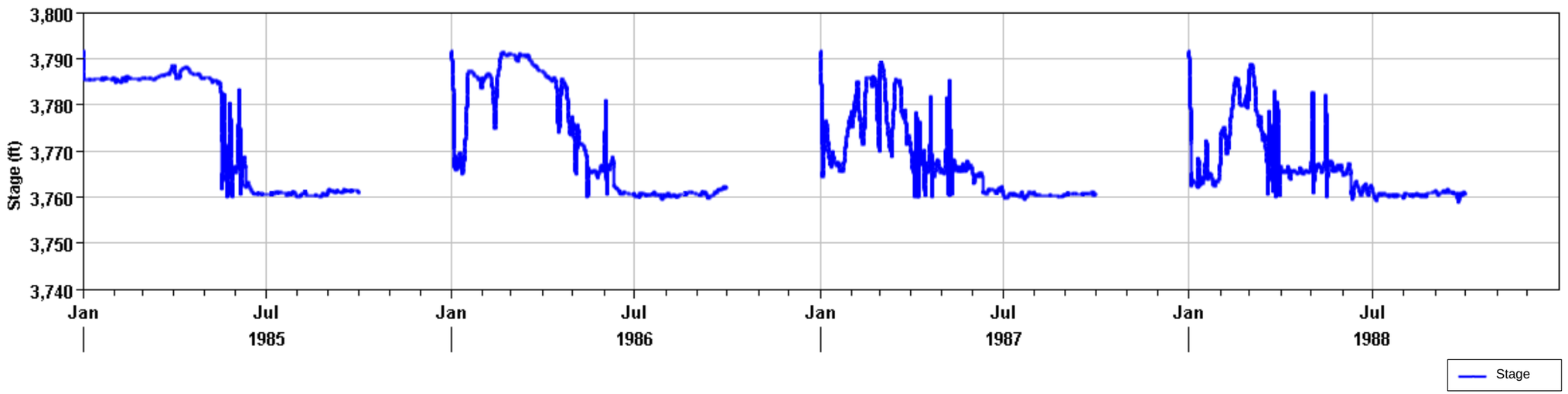


Figure 3: J.C. Boyle Drawdown Stage for years 1985 through 1988

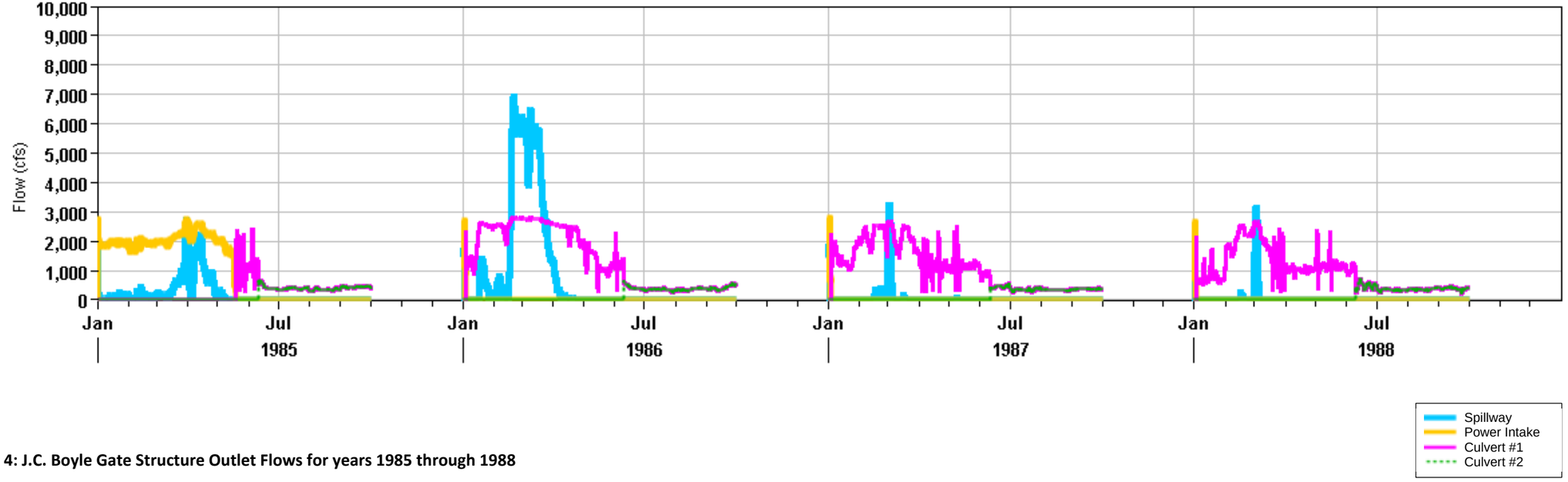


Figure 4: J.C. Boyle Gate Structure Outlet Flows for years 1985 through 1988

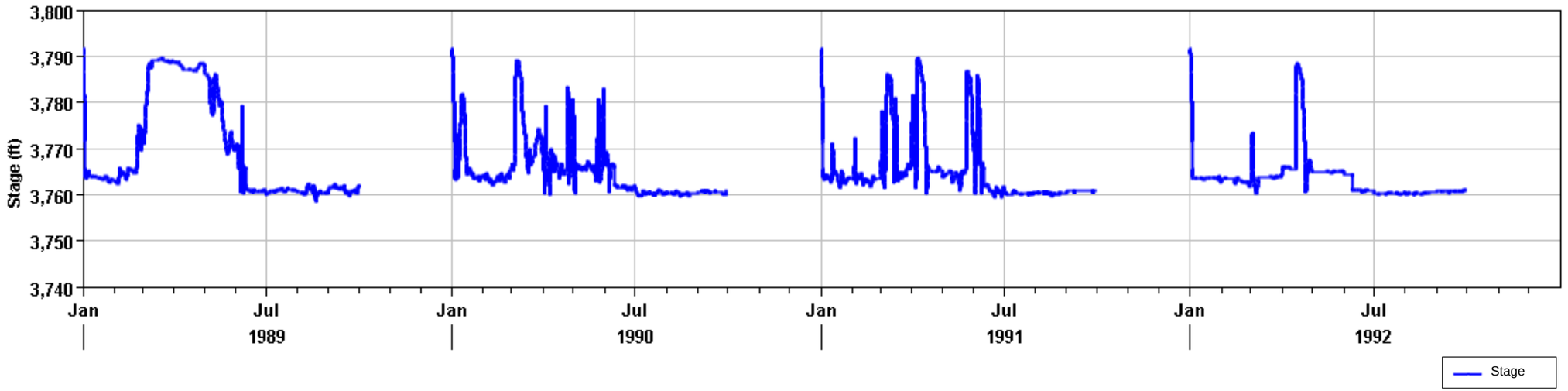


Figure 5: J.C. Boyle Drawdown Stage for years 1989 through 1992

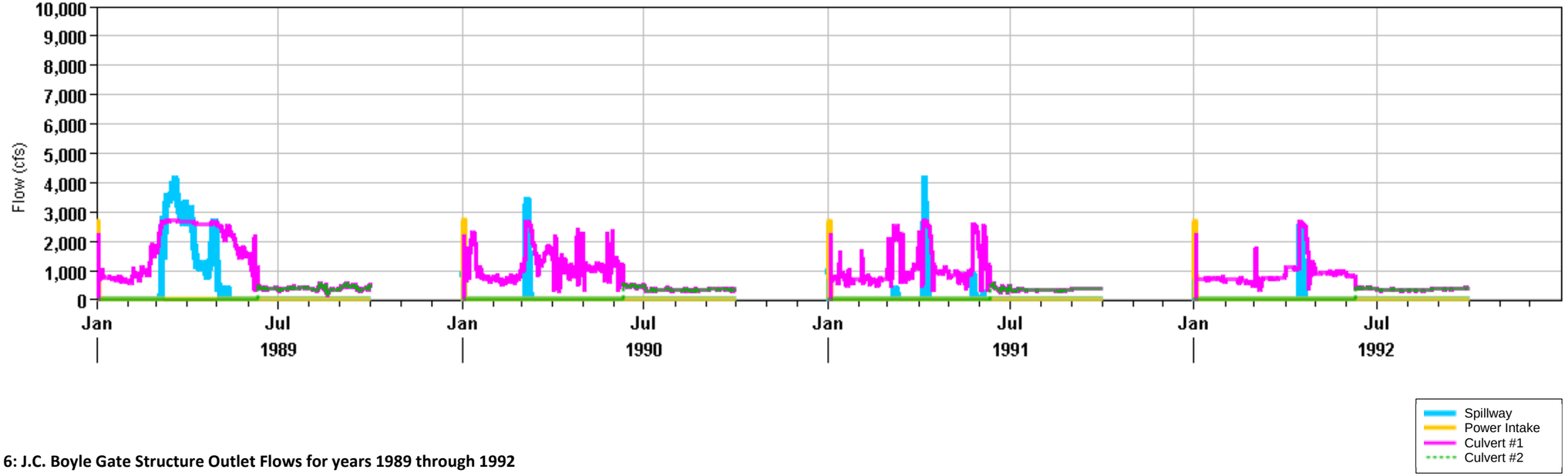


Figure 6: J.C. Boyle Gate Structure Outlet Flows for years 1989 through 1992

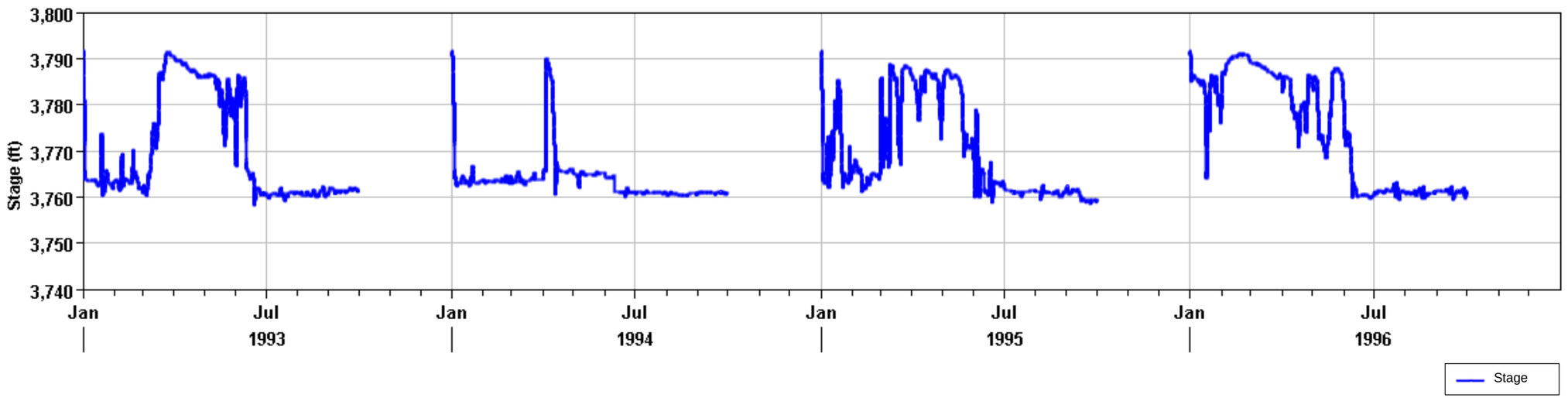


Figure 7: J.C. Boyle Drawdown Stage for years 1993 through 1996

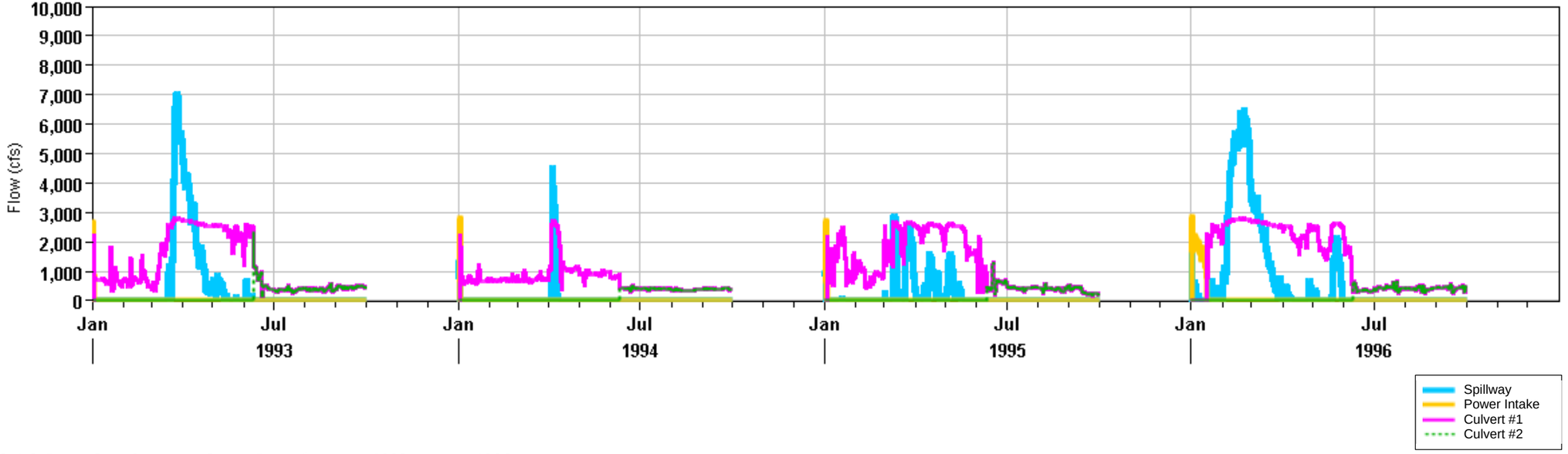


Figure 8: J.C. Boyle Gate Structure Outlet Flows for years 1993 through 1996

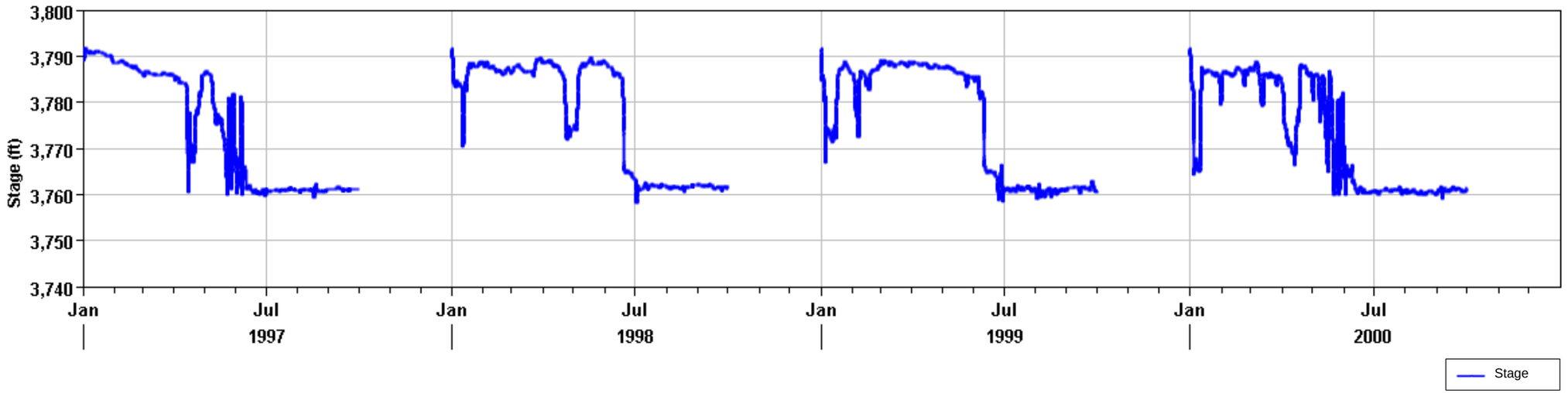


Figure 9: J.C. Boyle Drawdown Stage for years 1997 through 2000

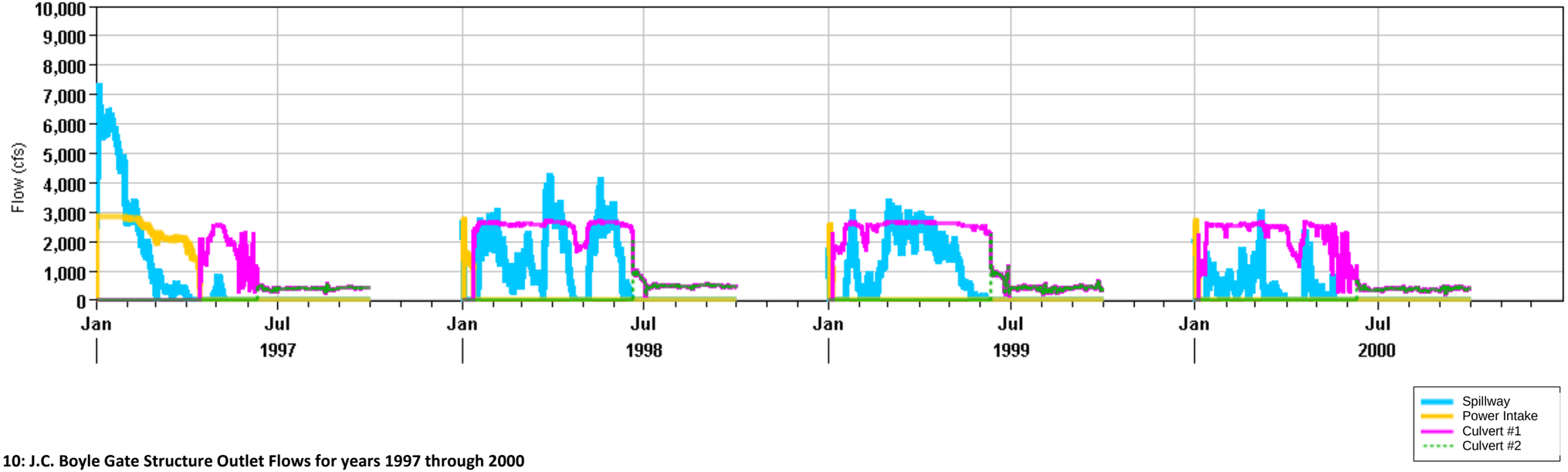


Figure 10: J.C. Boyle Gate Structure Outlet Flows for years 1997 through 2000

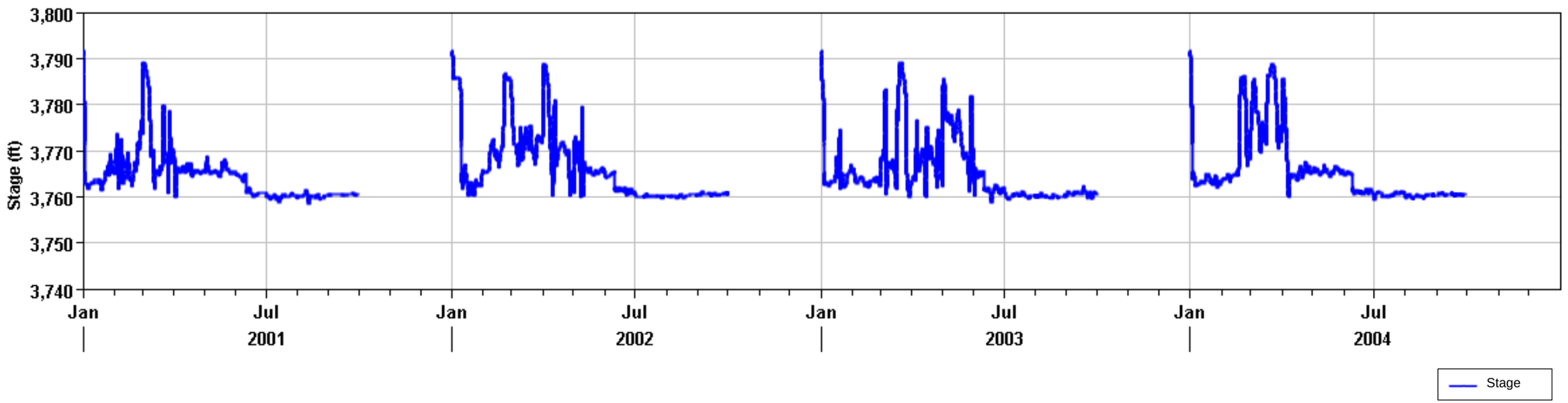


Figure 11: J.C. Boyle Drawdown Stage for years 2001 through 2004

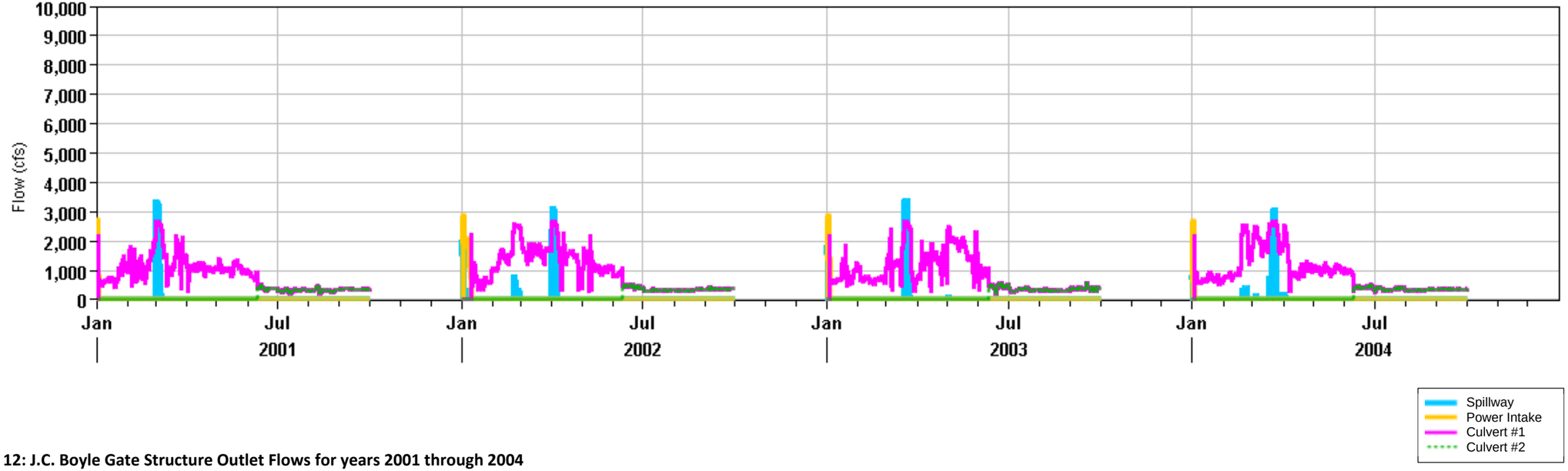


Figure 12: J.C. Boyle Gate Structure Outlet Flows for years 2001 through 2004

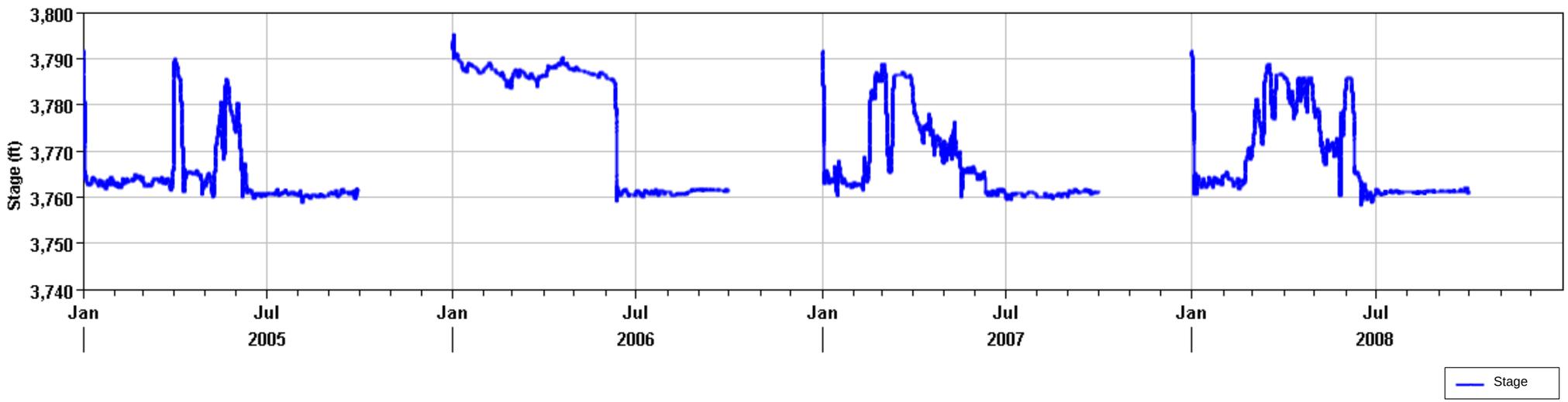


Figure 13: J.C. Boyle Drawdown Stage for years 2005 through 2008

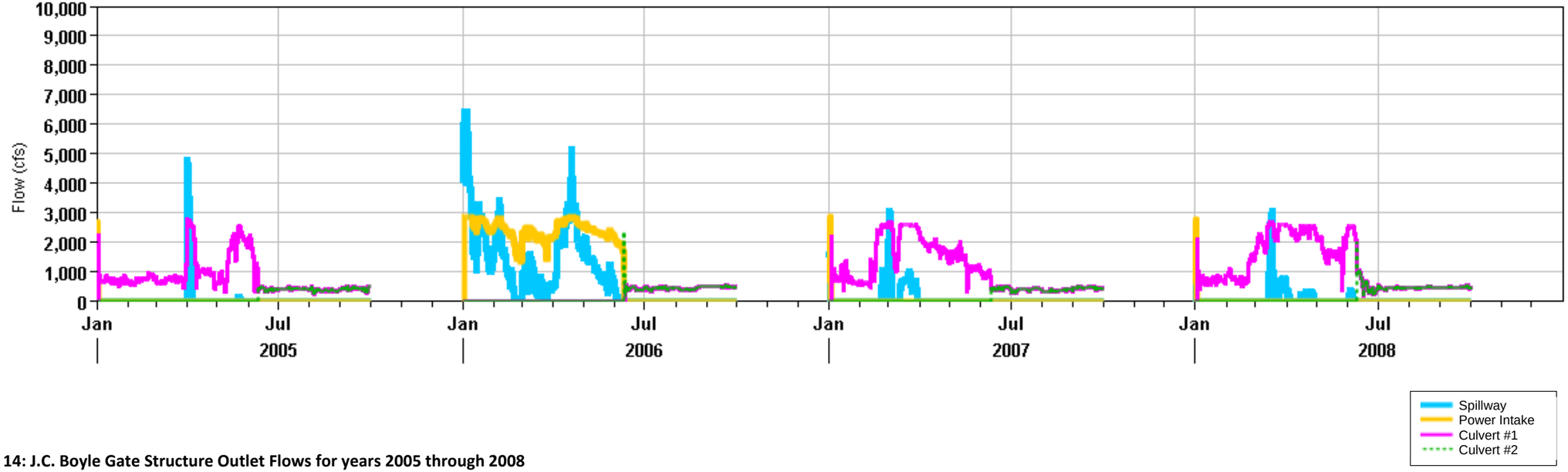


Figure 14: J.C. Boyle Gate Structure Outlet Flows for years 2005 through 2008

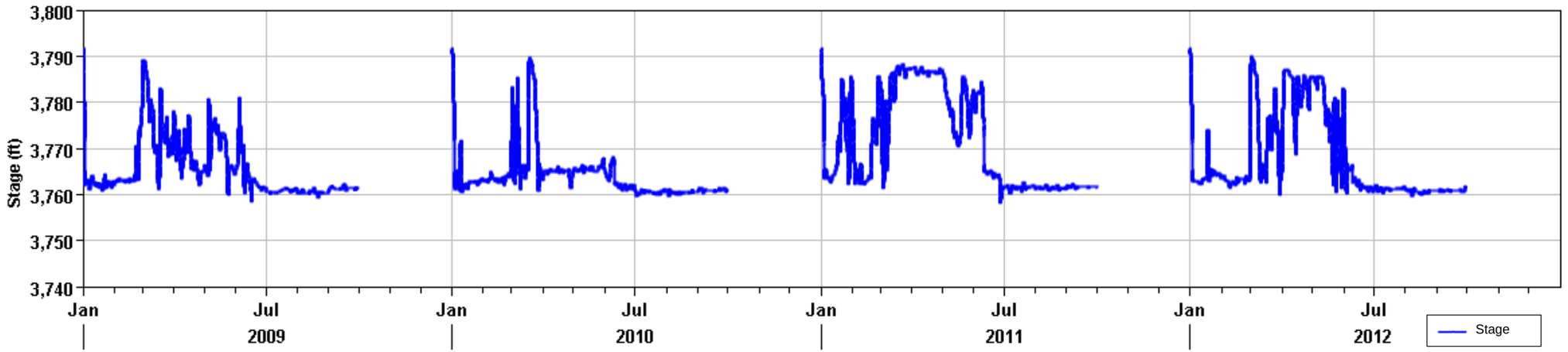


Figure 15: J.C. Boyle Drawdown Stage for years 2009 through 2012

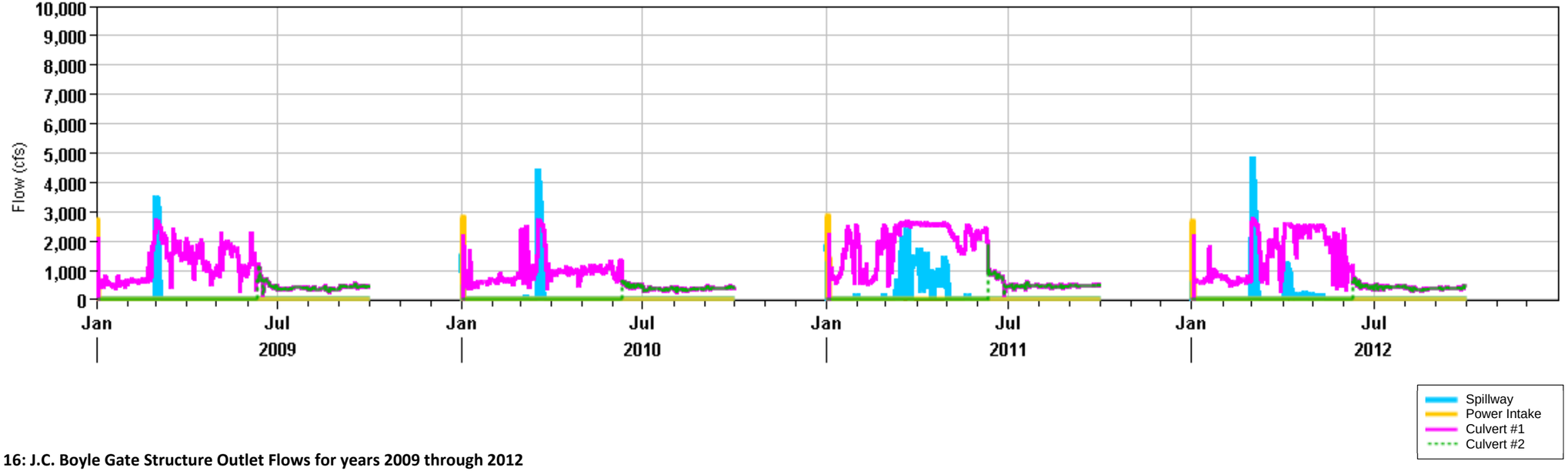


Figure 16: J.C. Boyle Gate Structure Outlet Flows for years 2009 through 2012

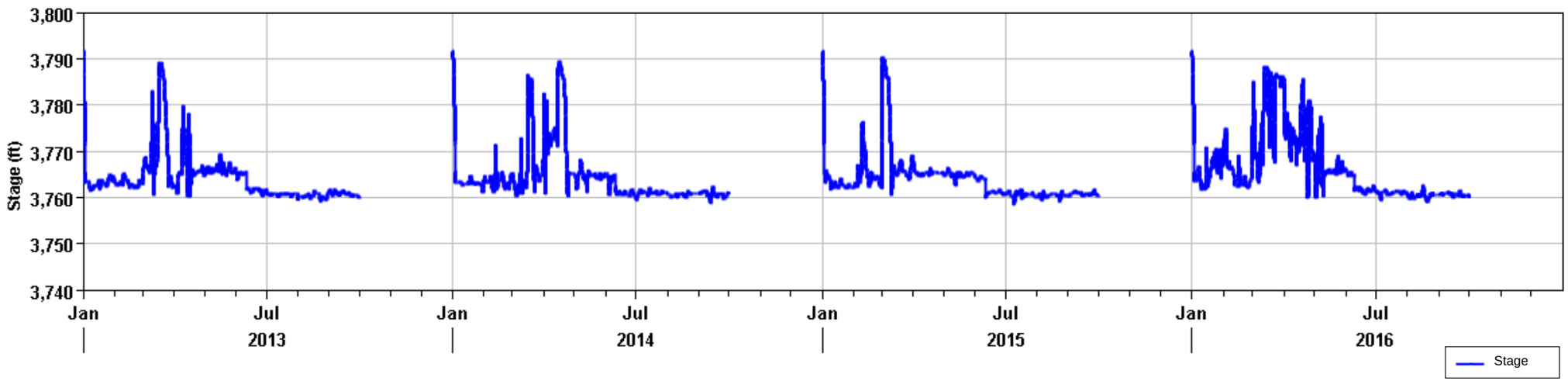


Figure 17: J.C. Boyle Drawdown Stage for years 2013 through 2016

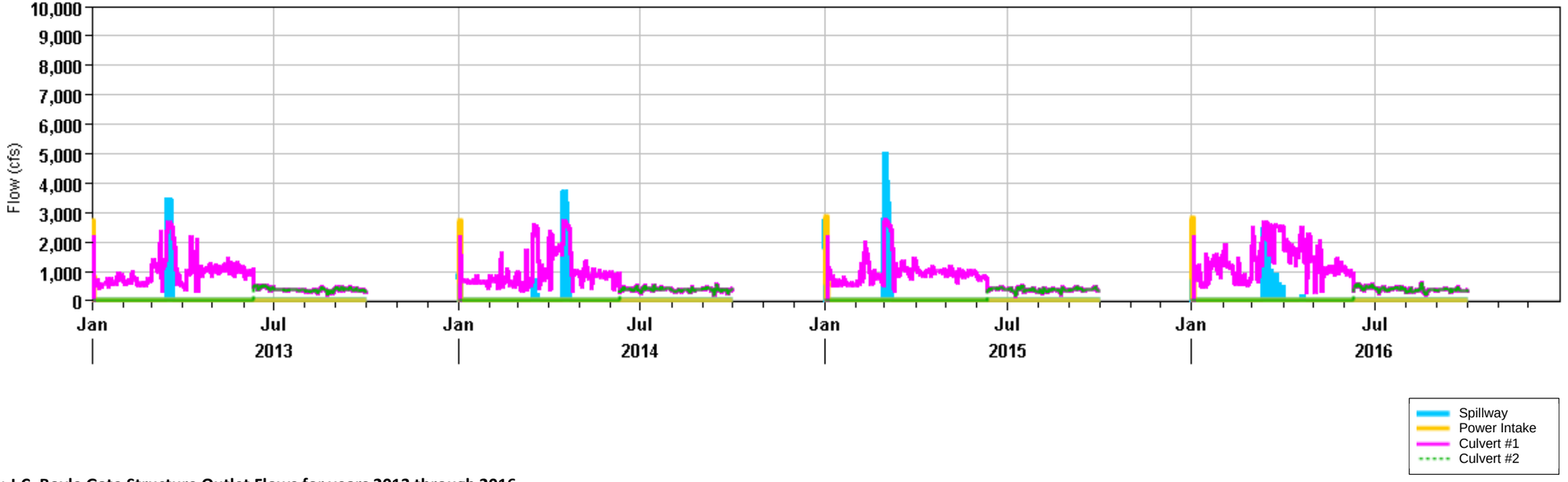


Figure 18: J.C. Boyle Gate Structure Outlet Flows for years 2013 through 2016

Drawdown Plots for Copco No. 1 Reservoir

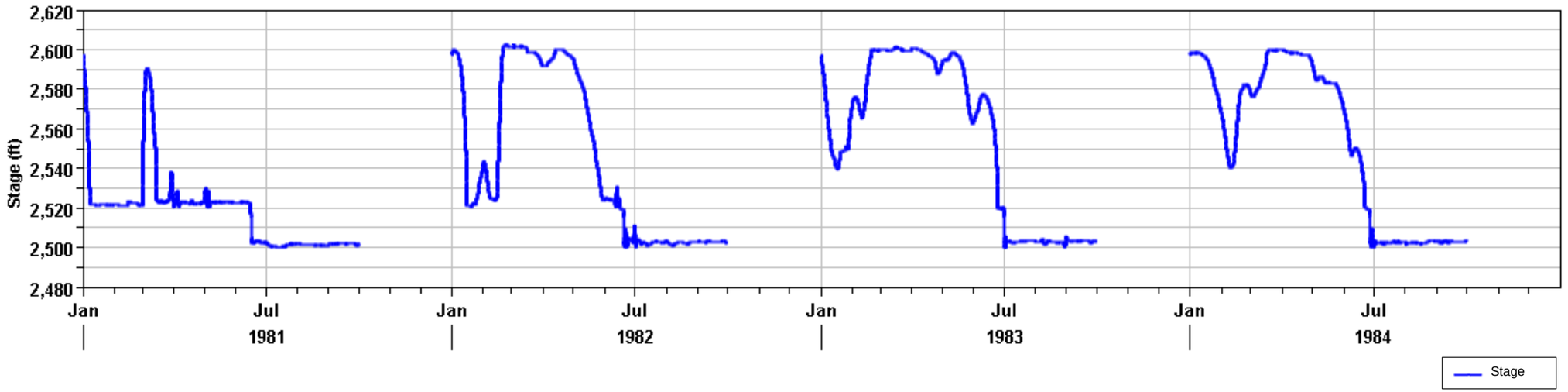


Figure 19: Copco No. 1 Drawdown Stage for years 1981 through 1984

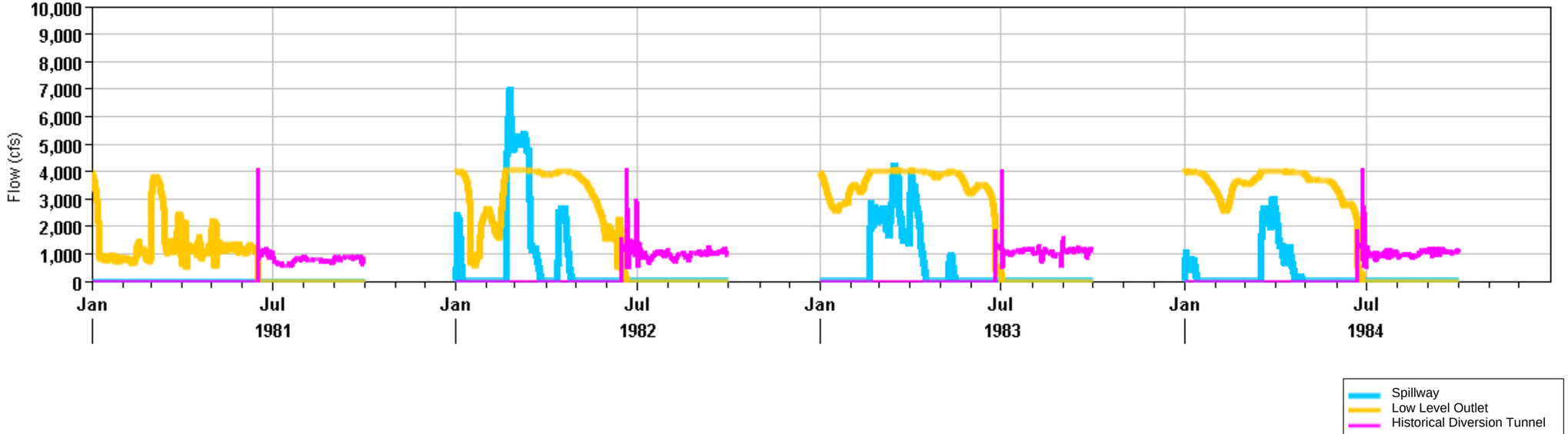


Figure 20: Copco No. 1 Gate Structure Outlet Flows for years 1981 through 1984

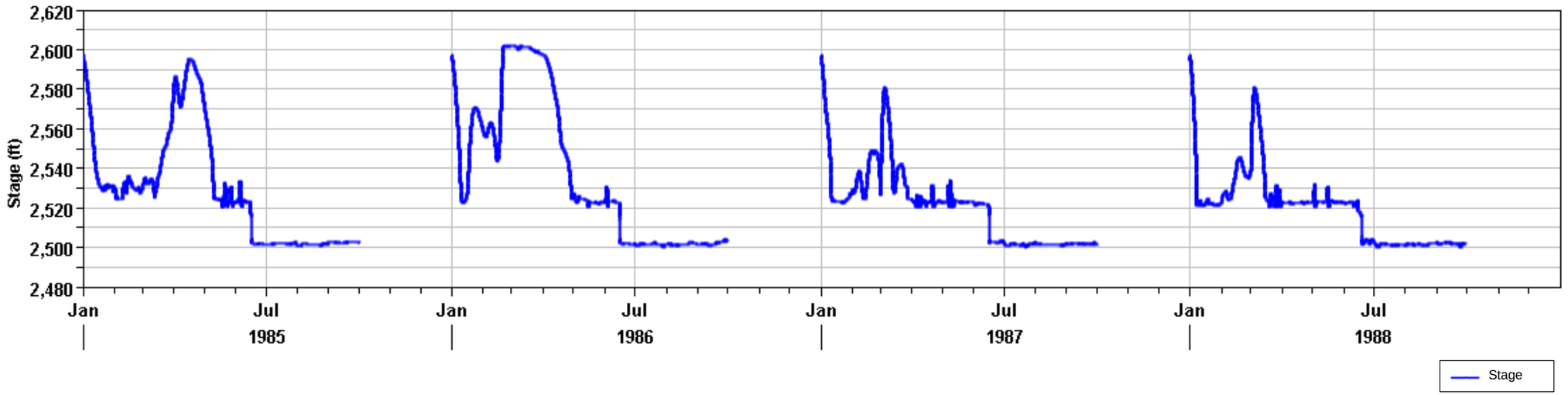


Figure 21: Copco No. 1 Drawdown Stage for years 1985 through 1988

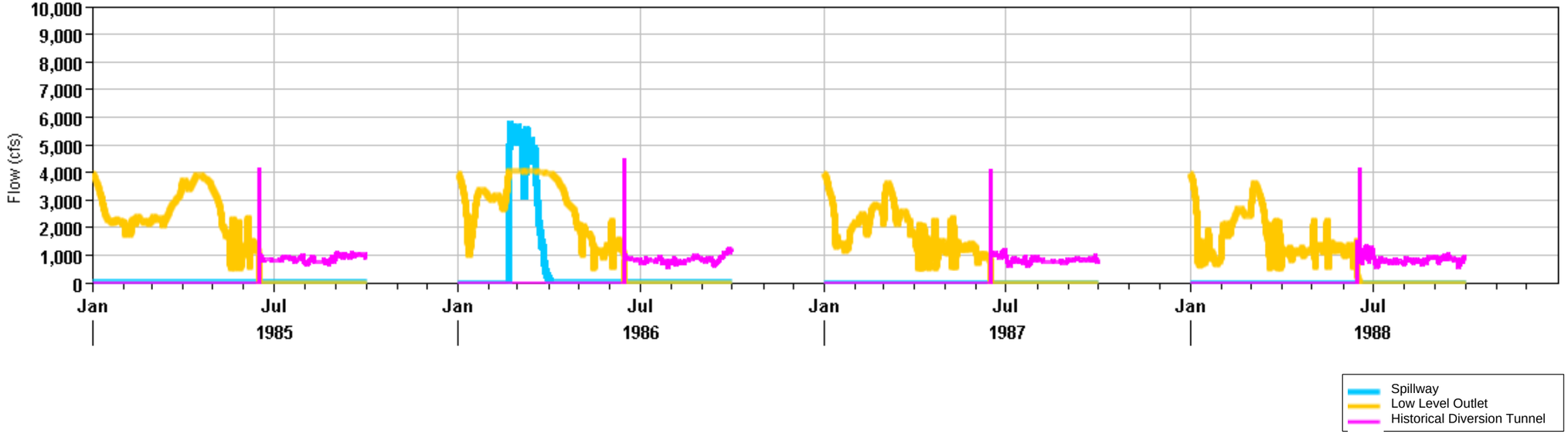


Figure 22: Copco No. 1 Gate Structure Outlet Flows for years 1985 through 1988

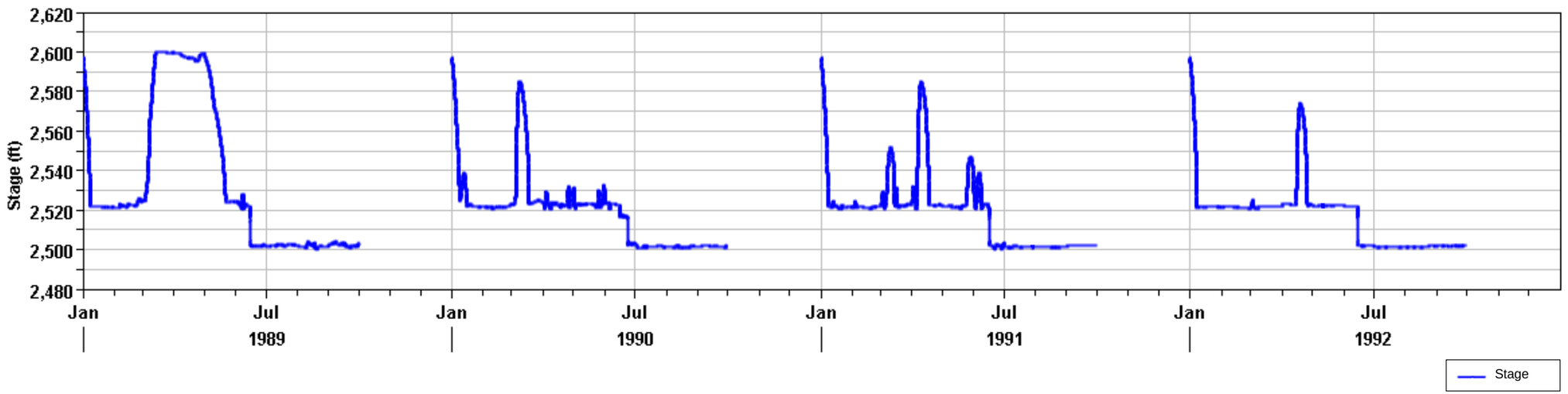


Figure 23: Copco No. 1 Drawdown Stage for years 1989 through 1992

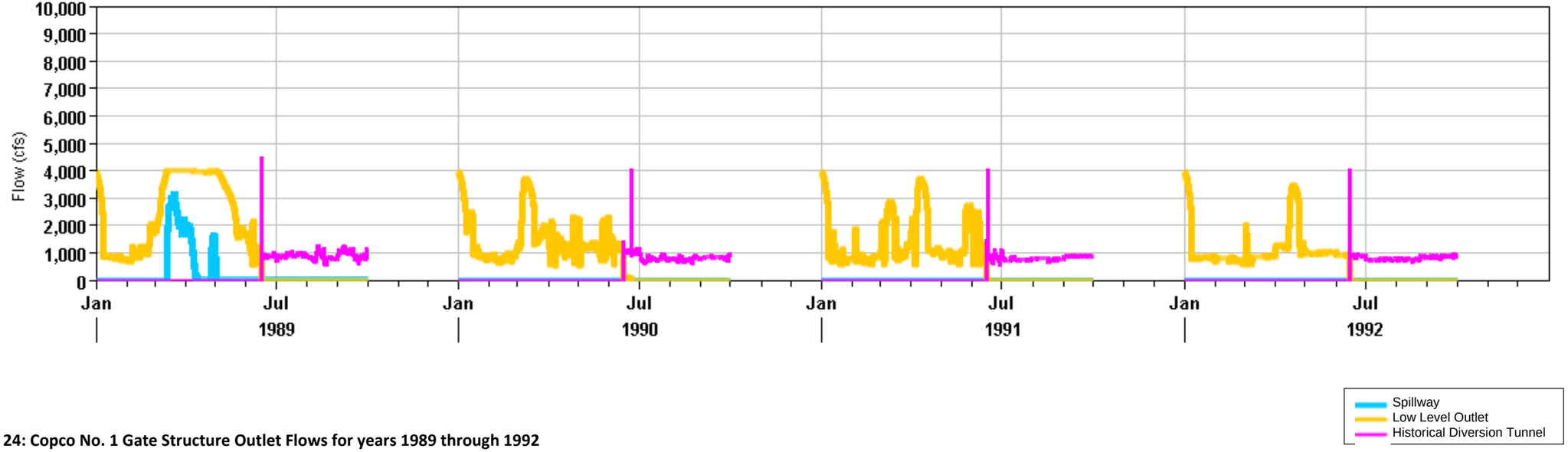


Figure 24: Copco No. 1 Gate Structure Outlet Flows for years 1989 through 1992

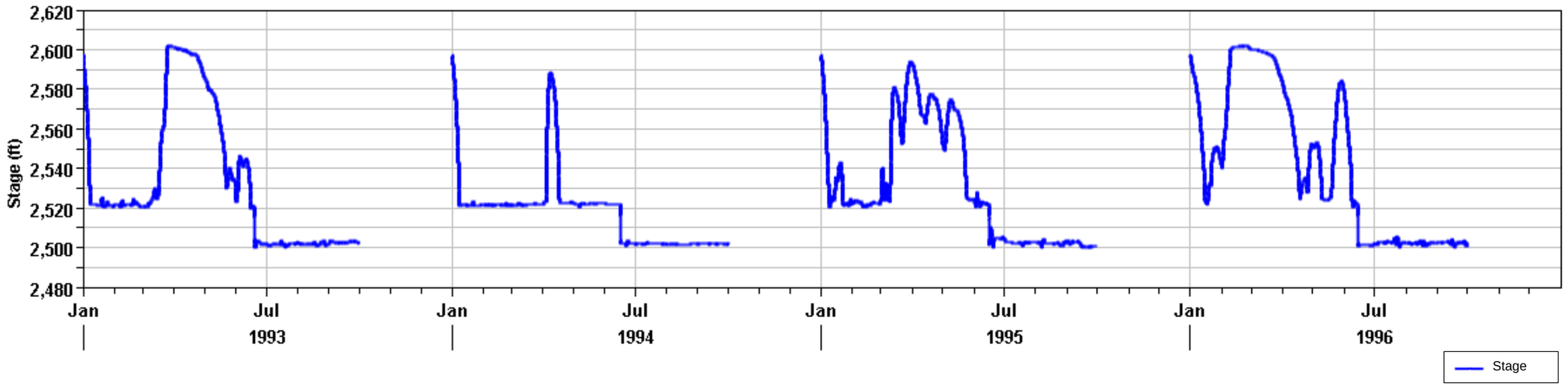


Figure 25: Copco No. 1 Drawdown Stage for years 1993 through 1996

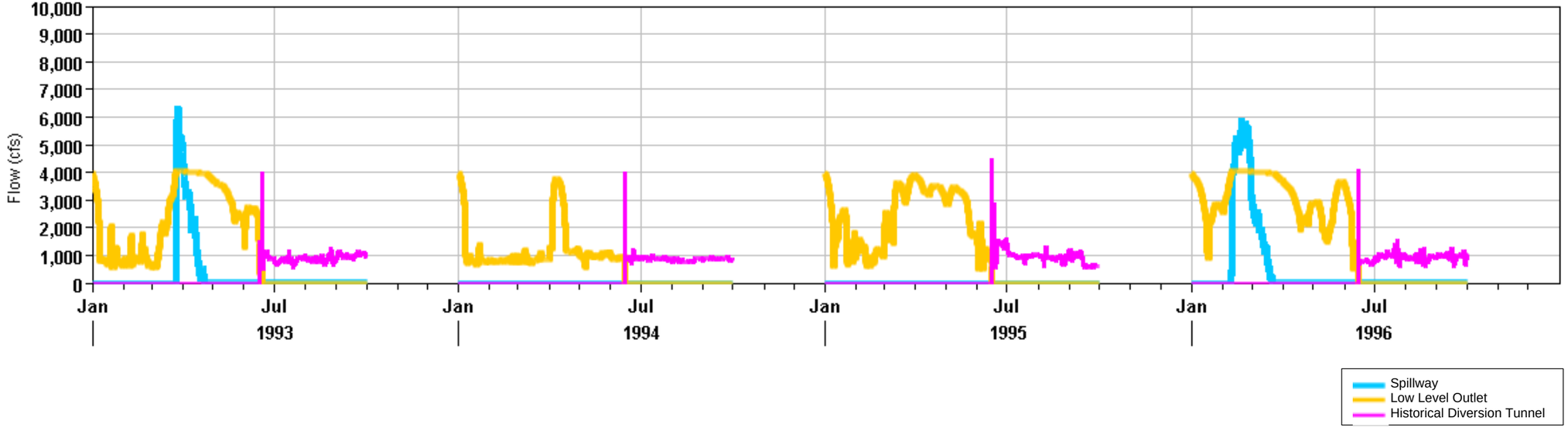


Figure 26: Copco No. 1 Gate Structure Outlet Flows for years 1993 through 1996

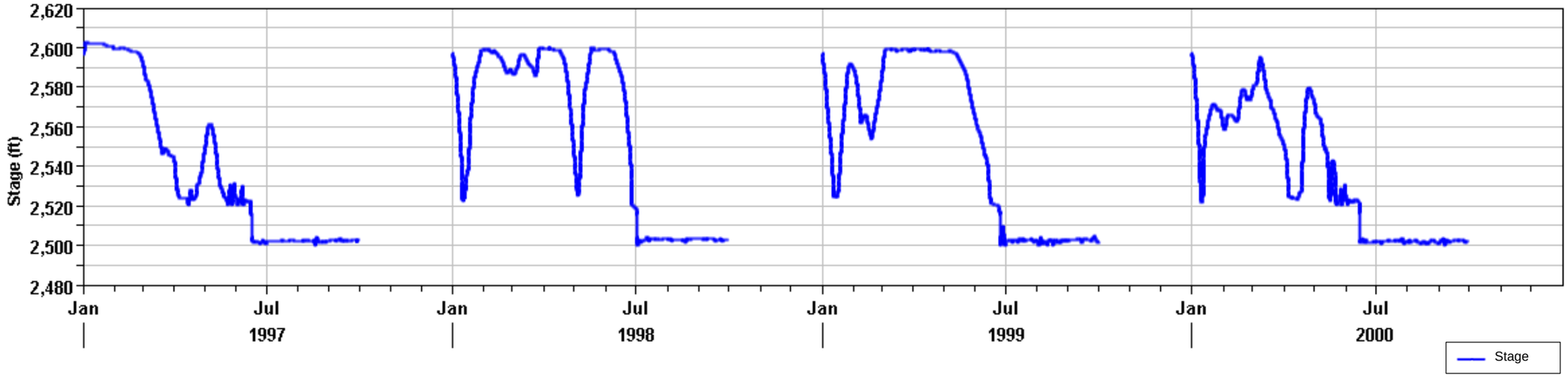


Figure 27: Copco No. 1 Drawdown Stage for years 1997 through 2000

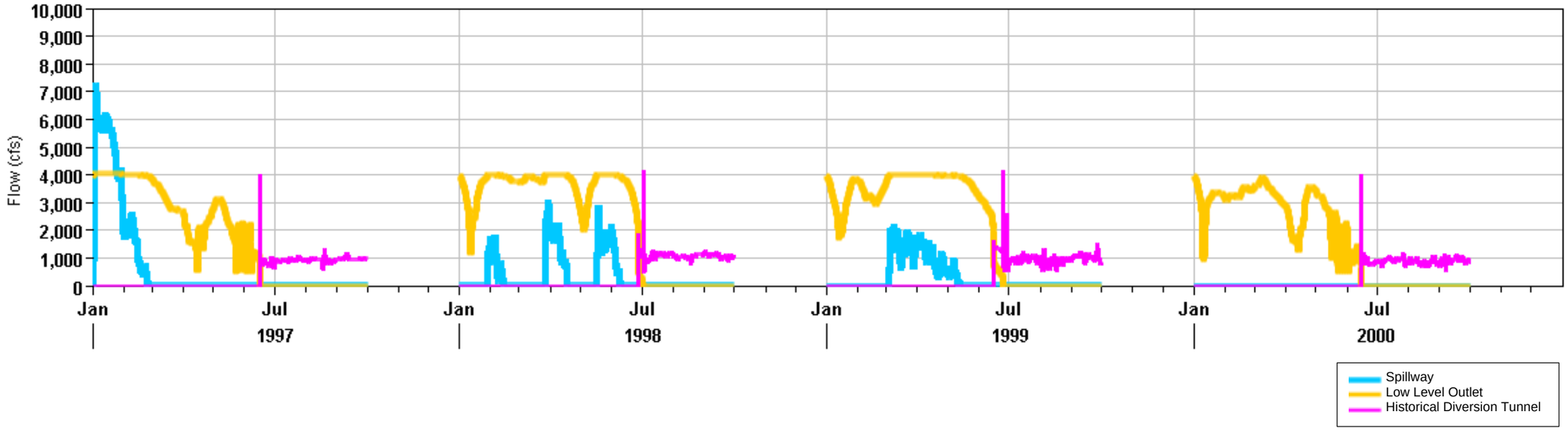


Figure 28: Copco No. 1 Gate Structure Outlet Flows for years 1997 through 2000

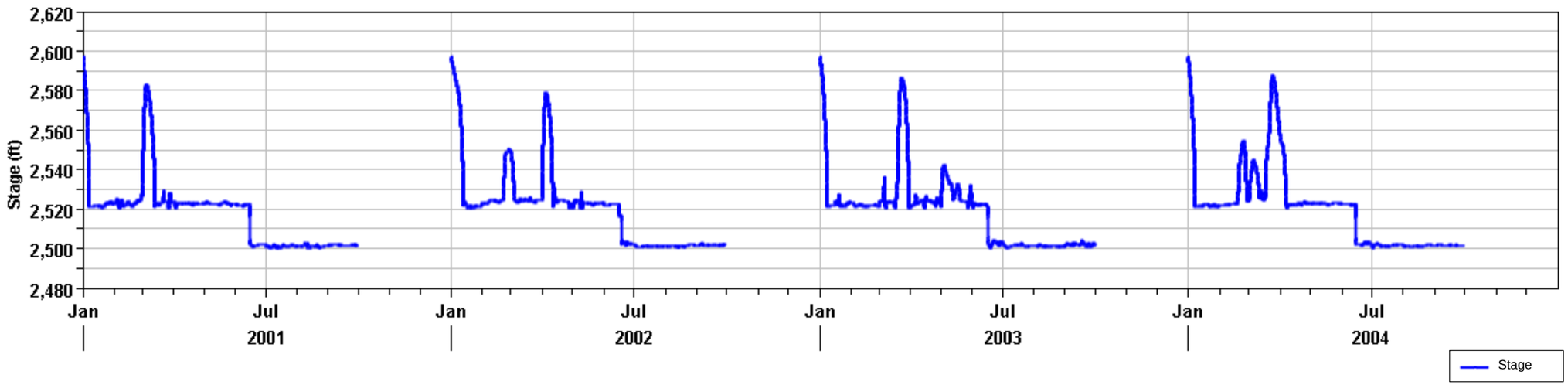


Figure 29: Copco No. 1 Drawdown Stage for years 2001 through 2004

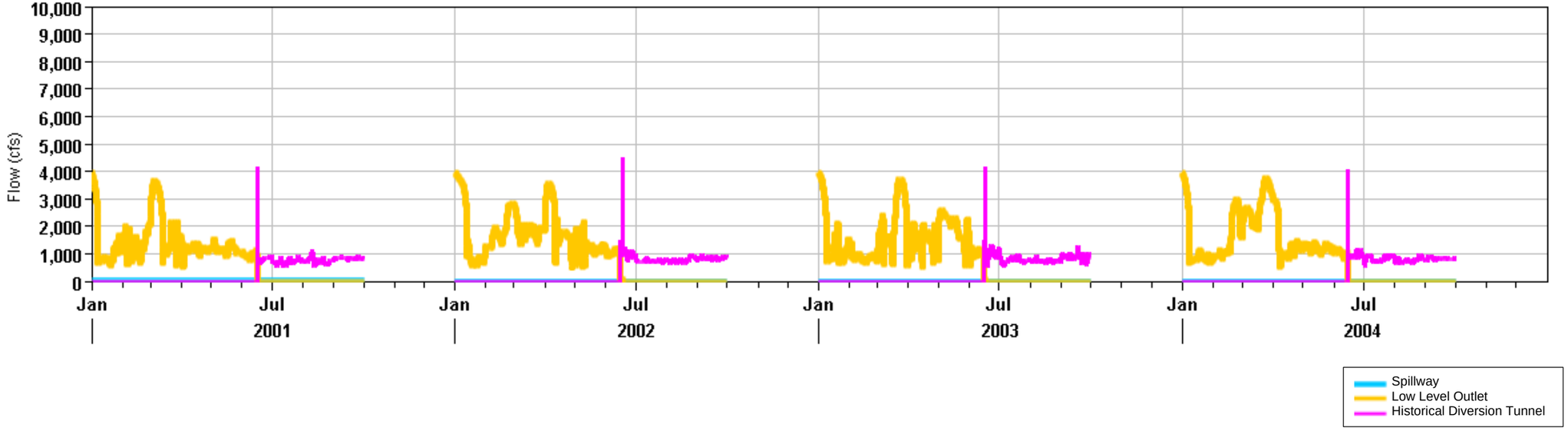


Figure 30: Copco No. 1 Gate Structure Outlet Flows for years 2001 through 2004

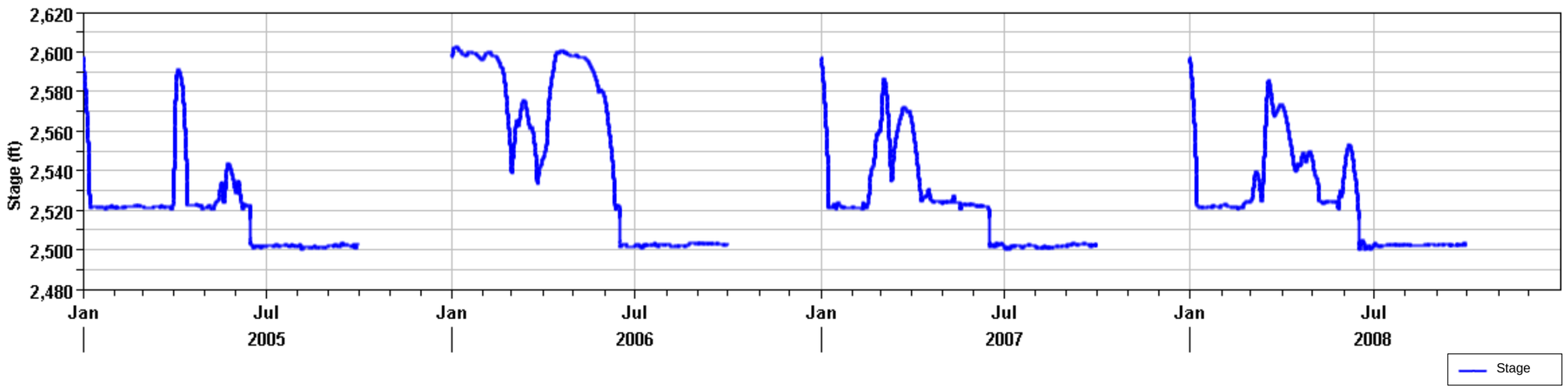


Figure 31: Copco No. 1 Drawdown Stage for years 2005 through 2008

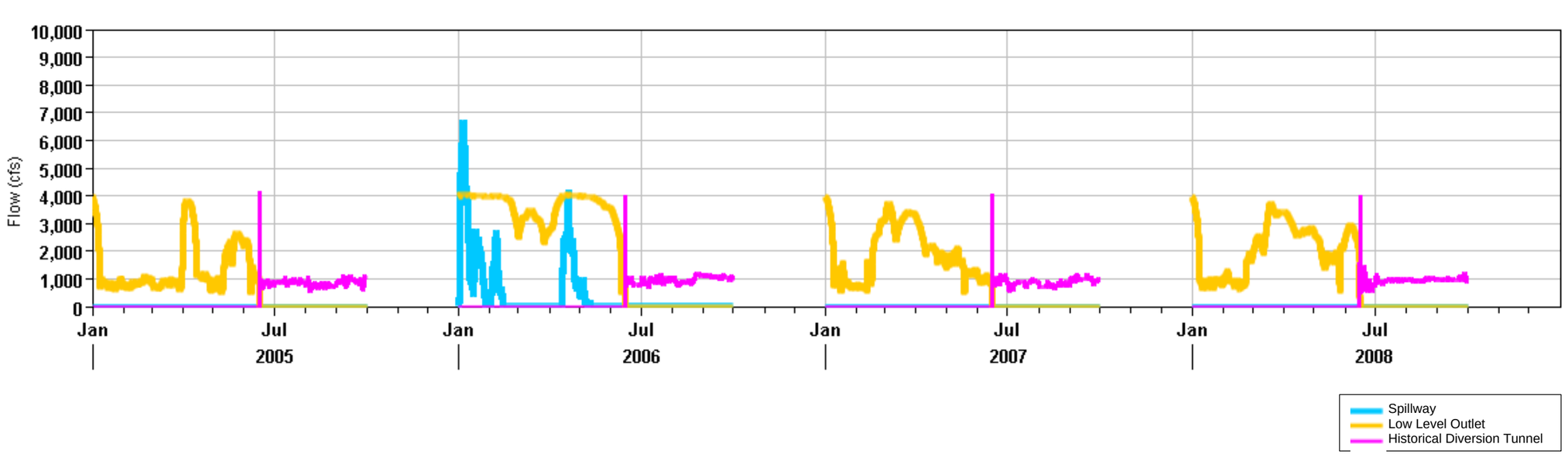


Figure 32: Copco No. 1 Gate Structure Outlet Flows for years 2005 through 2008

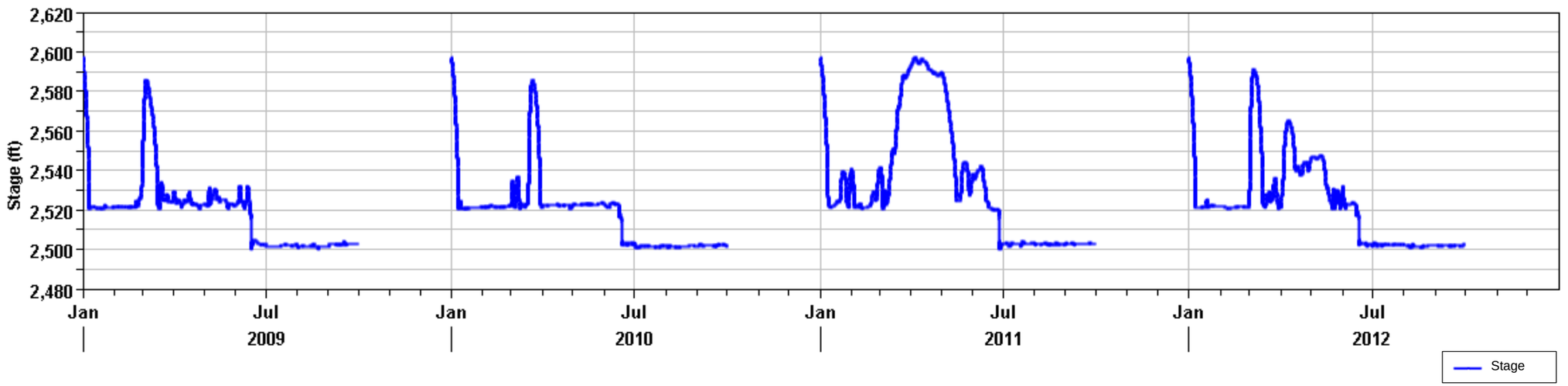


Figure 33: Copco No. 1 Drawdown Stage for years 2009 through 2012

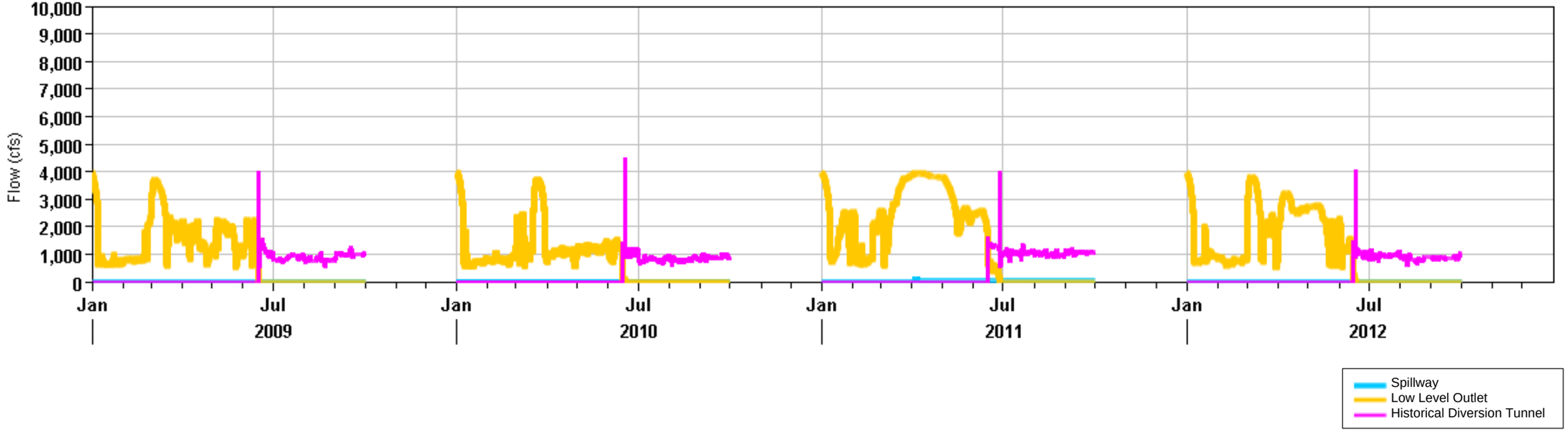


Figure 34: Copco No. 1 Gate Structure Outlet Flows for years 2009 through 2012

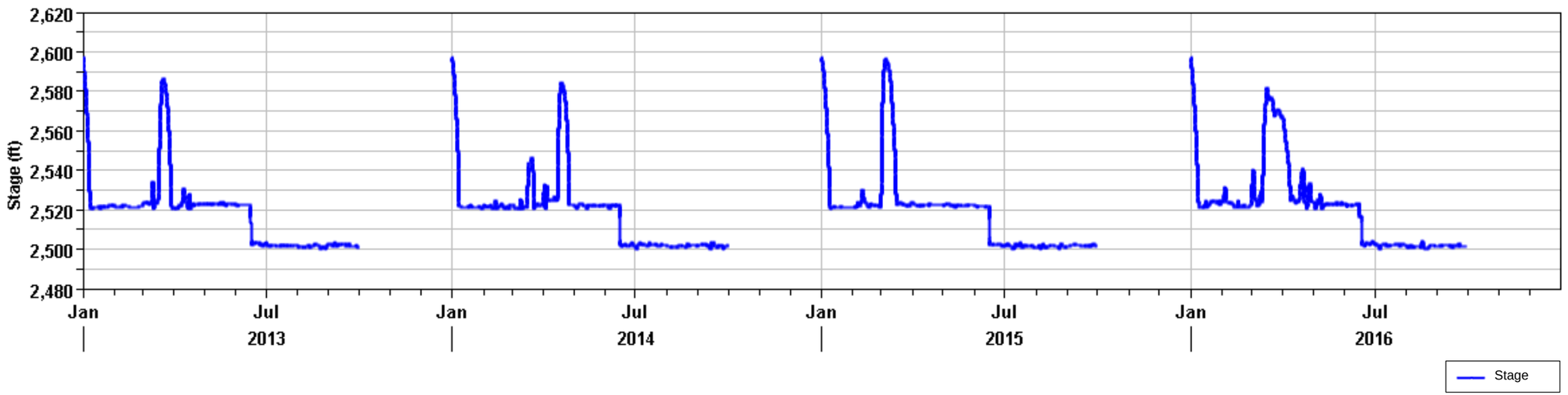


Figure 35: Copco No. 1 Drawdown Stage for years 2013 through 2016

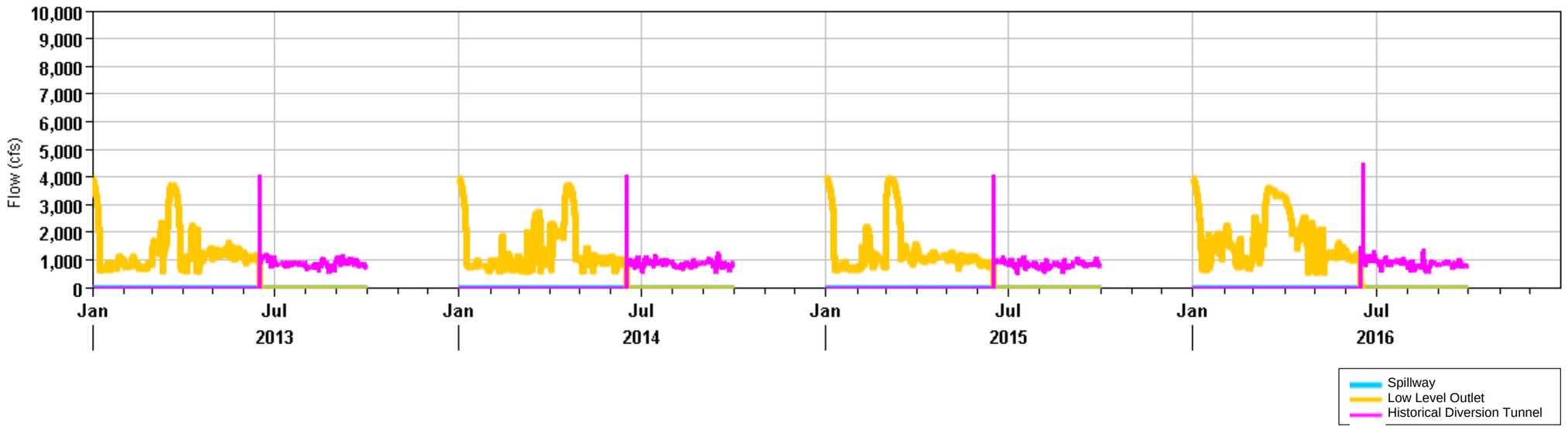


Figure 36: Copco No. 1 Gate Structure Outlet Flows for years 2013 through 2016

Drawdown Plots for Copco No. 2 Reservoir

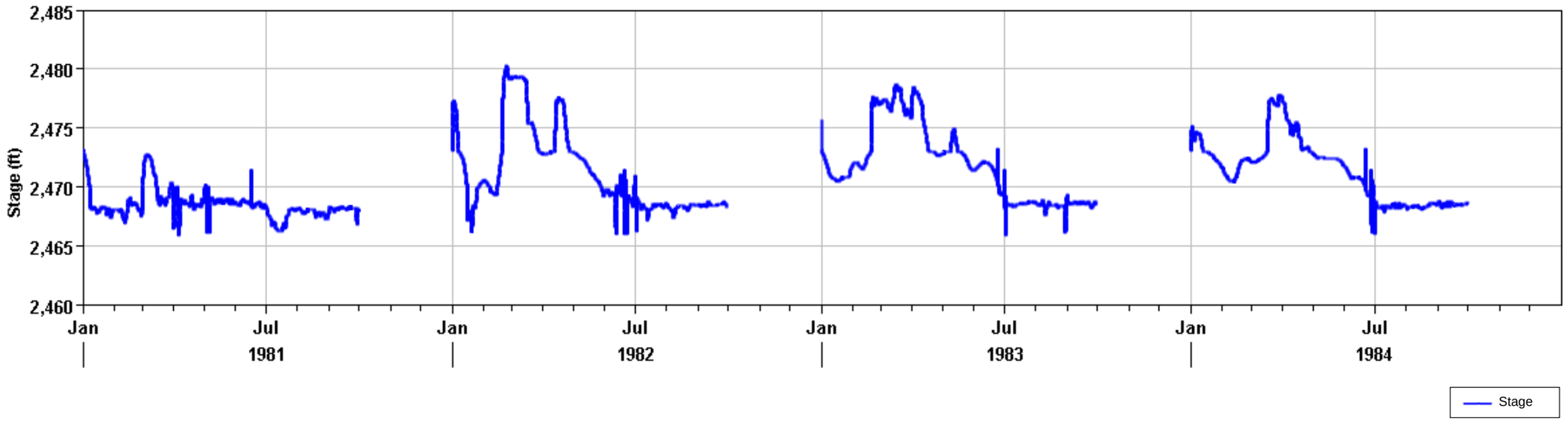


Figure 37: Copco No. 2 Drawdown Stage for years 1981 through 1984

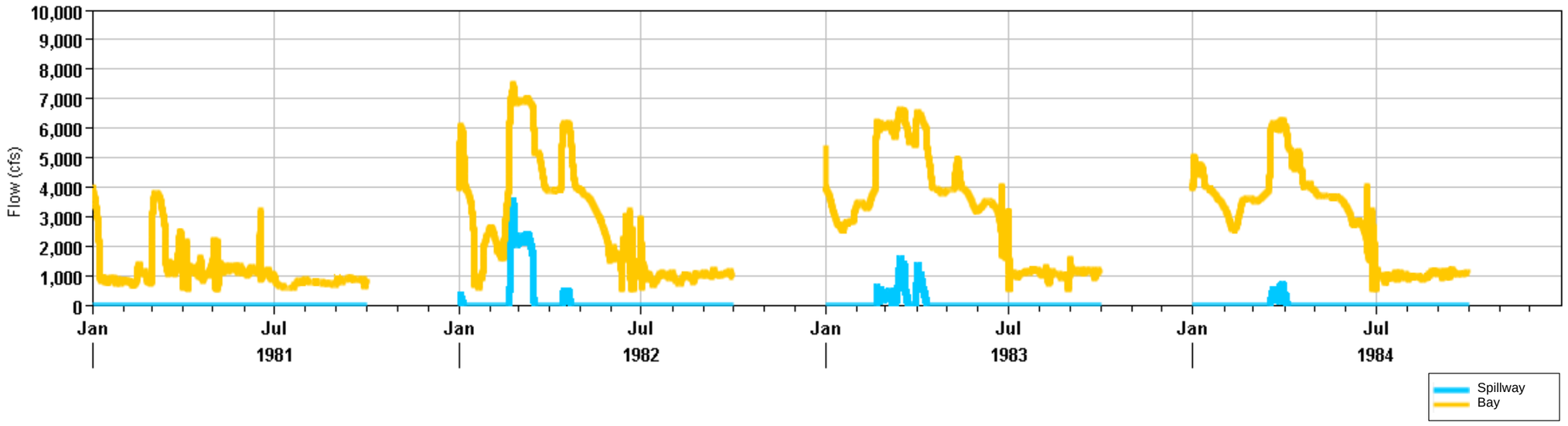


Figure 38: Copco No. 2 Gate Structure Outlet Flows for years 1981 through 1984

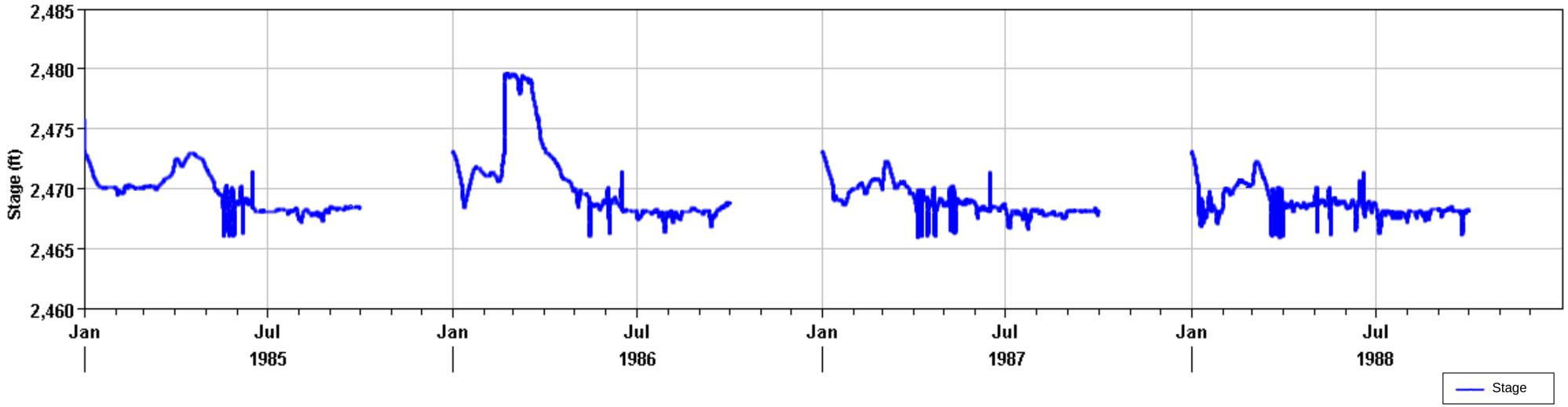


Figure 39: Copco No. 2 Drawdown Stage for years 1985 through 1988

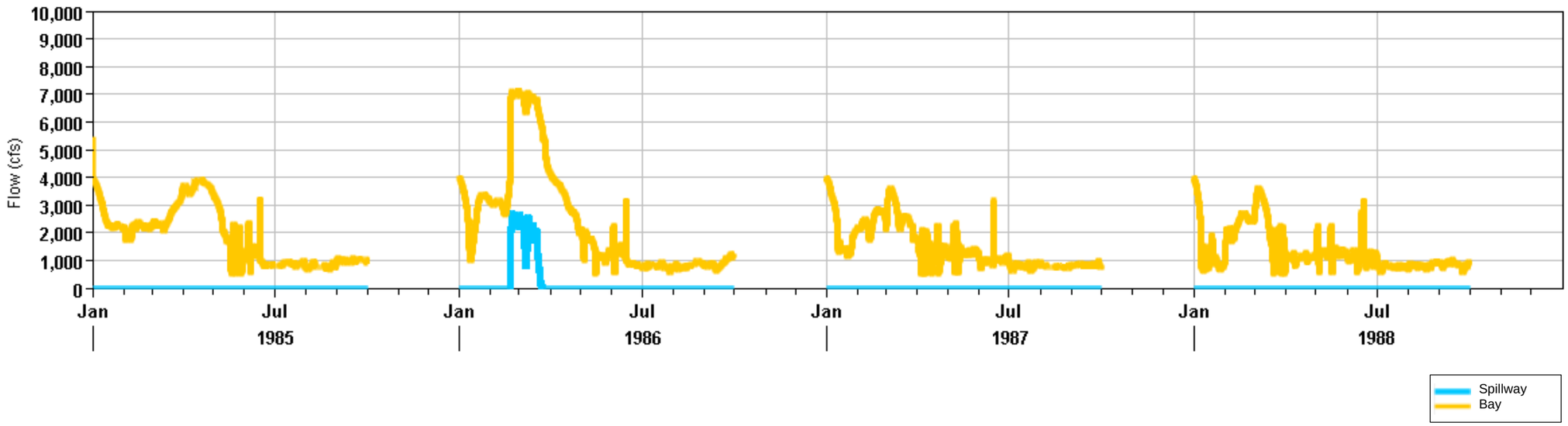


Figure 40: Copco No. 2 Gate Structure Outlet Flows for years 1985 through 1988

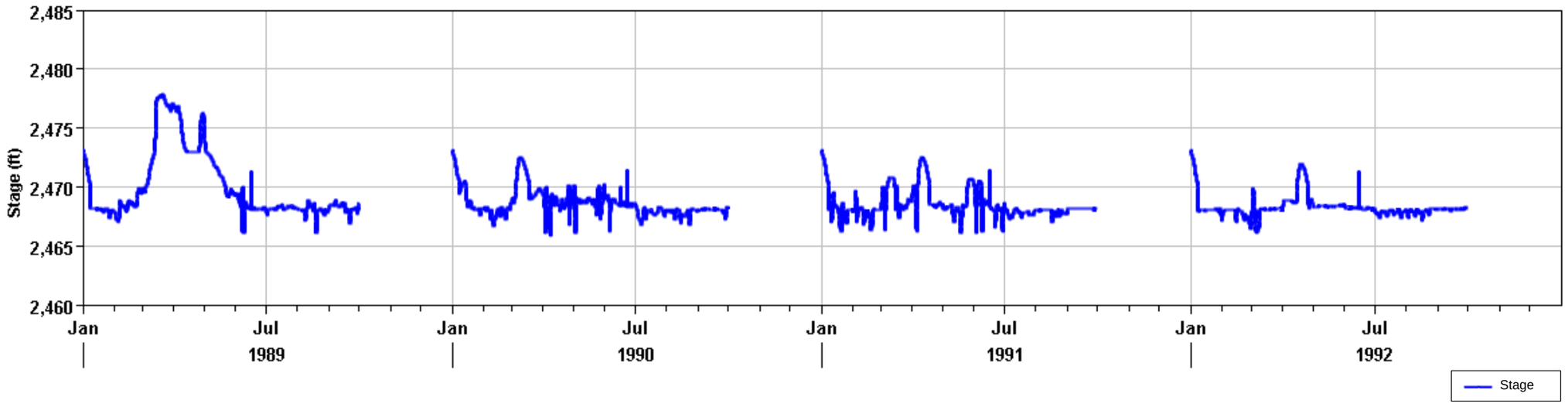


Figure 41: Copco No. 2 Drawdown Stage for years 1989 through 1992

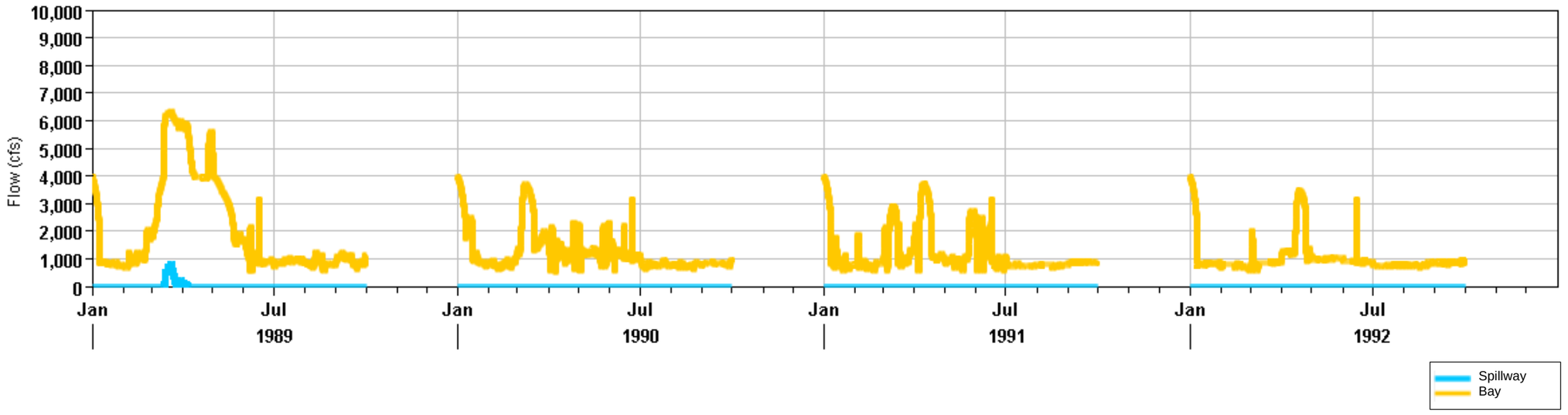


Figure 42: Copco No. 2 Gate Structure Outlet Flows for years 1989 through 1992

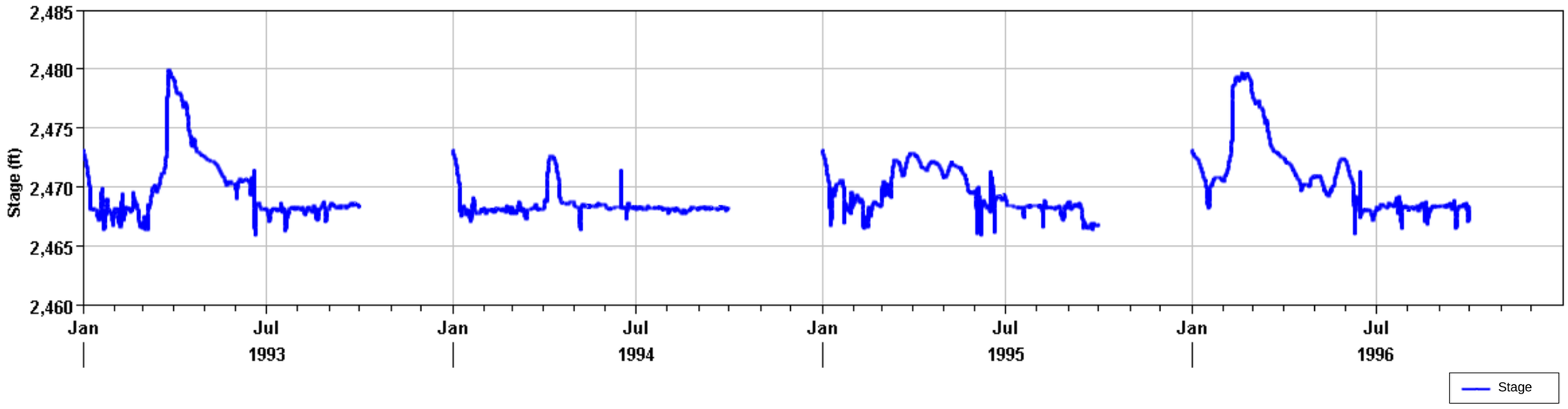


Figure 43: Copco No. 2 Drawdown Stage for years 1993 through 1996

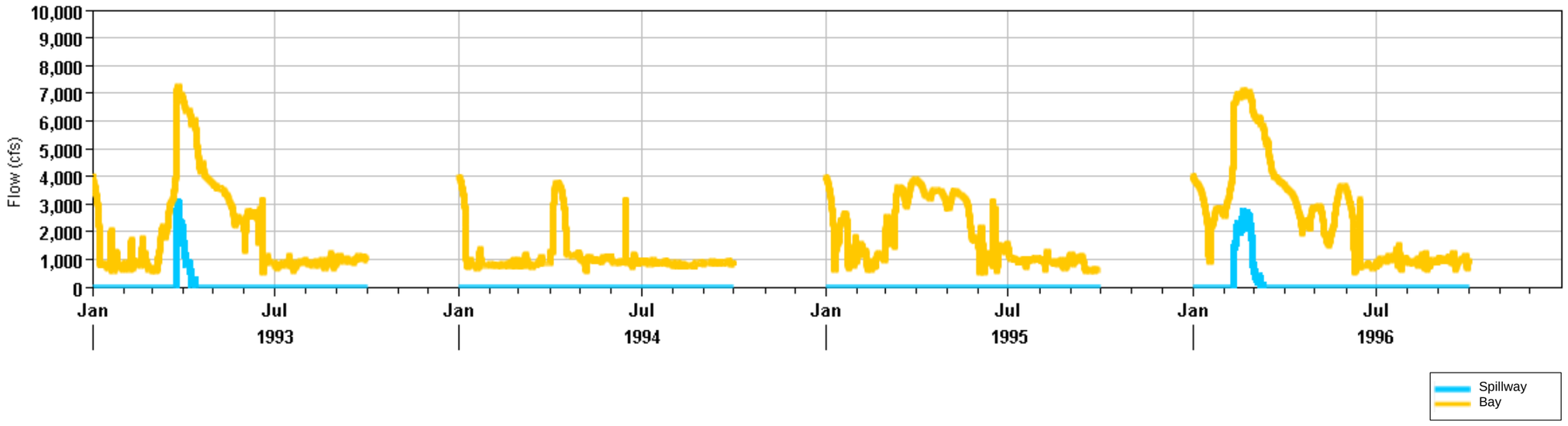


Figure 44: Copco No. 2 Gate Structure Outlet Flows for years 1993 through 1996

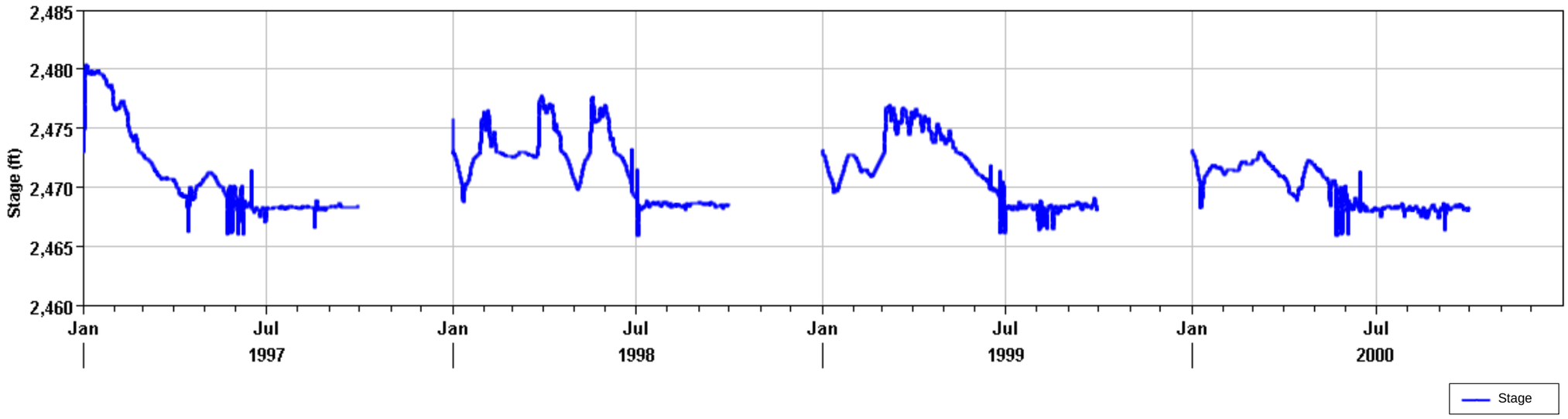


Figure 45: Copco No. 2 Drawdown Stage for years 1997 through 2000

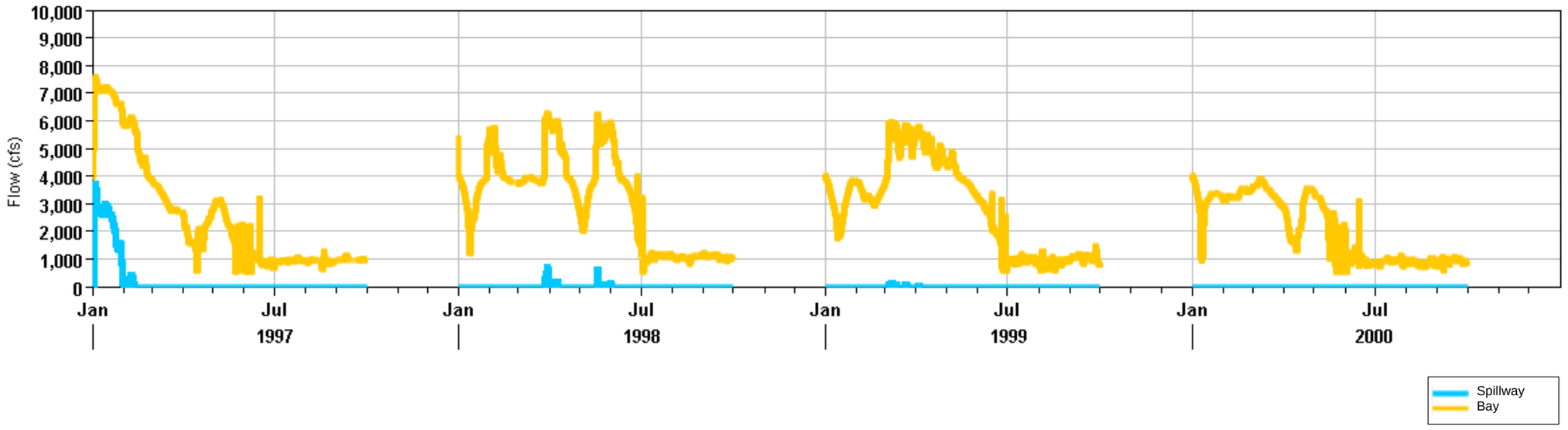


Figure 46: Copco No. 2 Gate Structure Outlet Flows for years 1997 through 2000

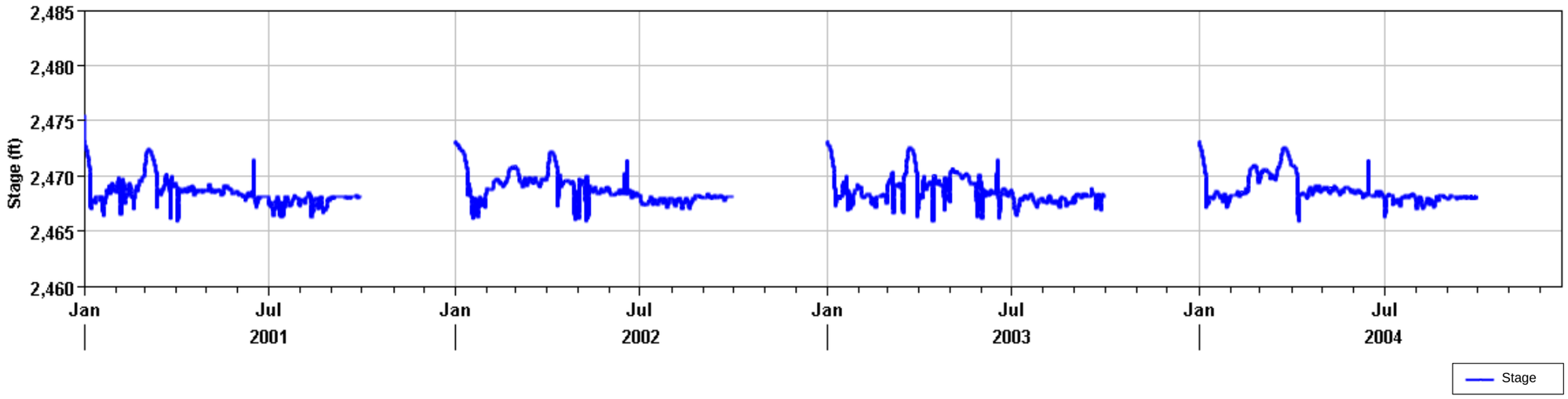


Figure 47: Copco No. 2 Drawdown Stage for years 2001 through 2004

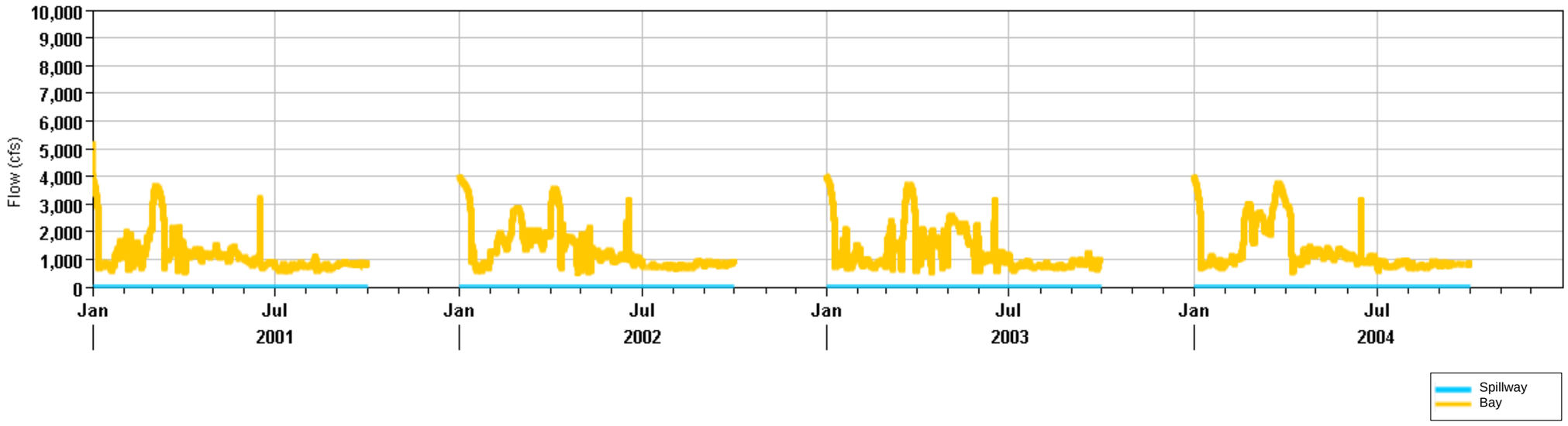


Figure 48: Copco No. 2 Gate Structure Outlet Flows for years 2001 through 2004

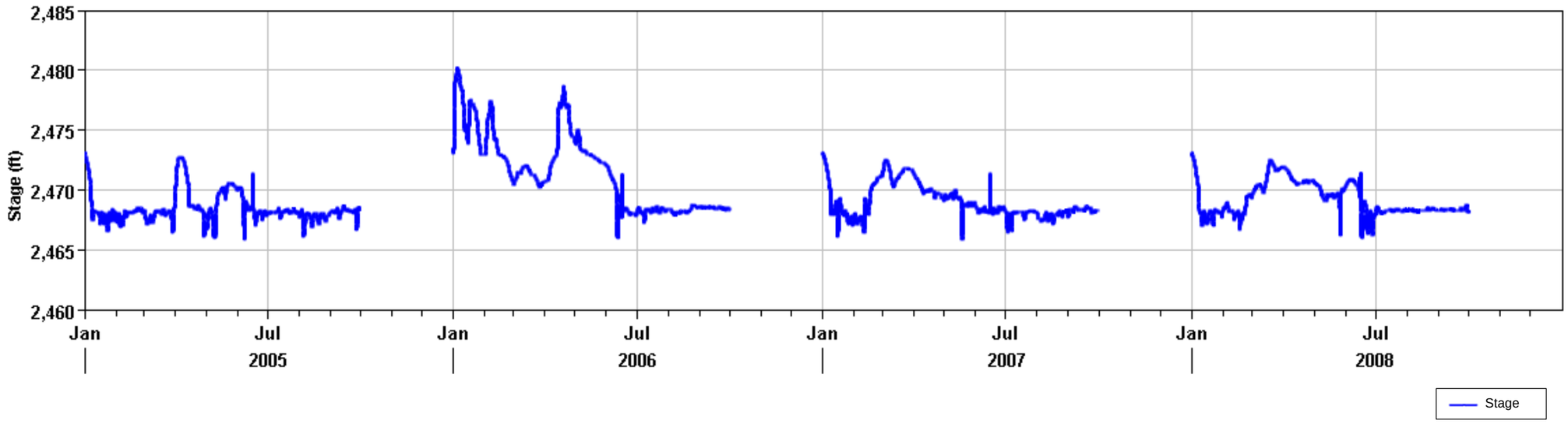


Figure 49: Copco No. 2 Drawdown Stage for years 2005 through 2008

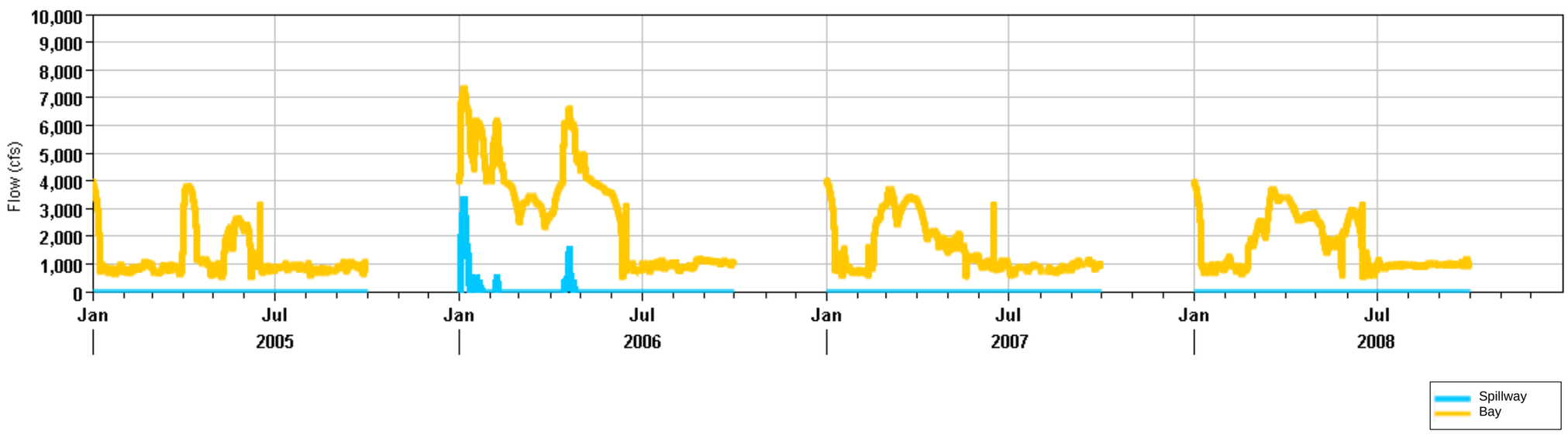


Figure 50: Copco No. 2 Gate Structure Outlet Flows for years 2005 through 2008

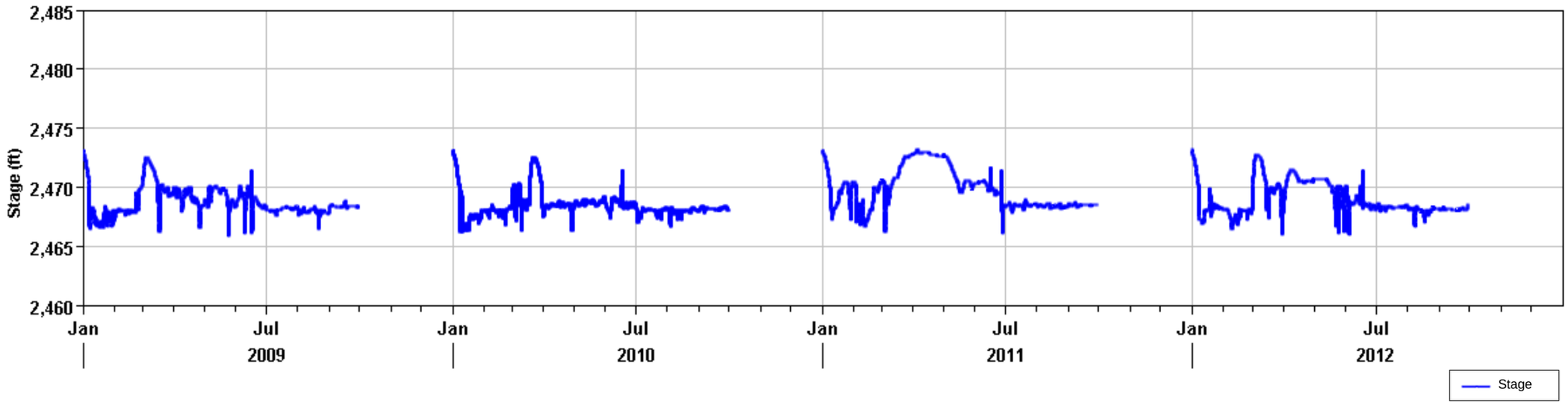


Figure 51: Copco No. 2 Drawdown Stage for years 2009 through 2012

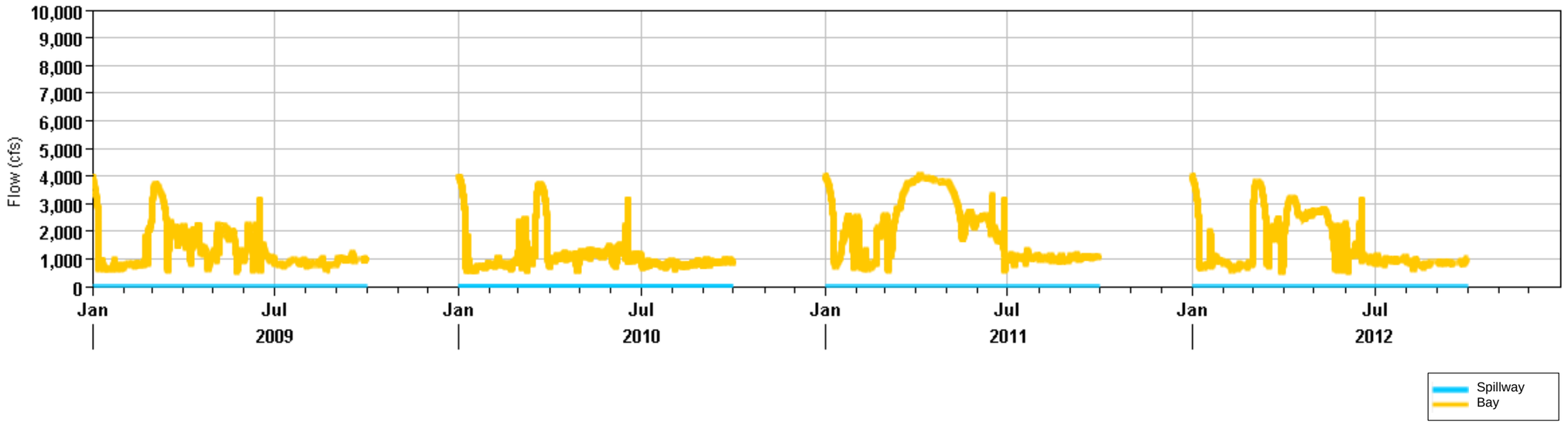


Figure 52: Copco No. 2 Gate Structure Outlet Flows for years 2009 through 2012

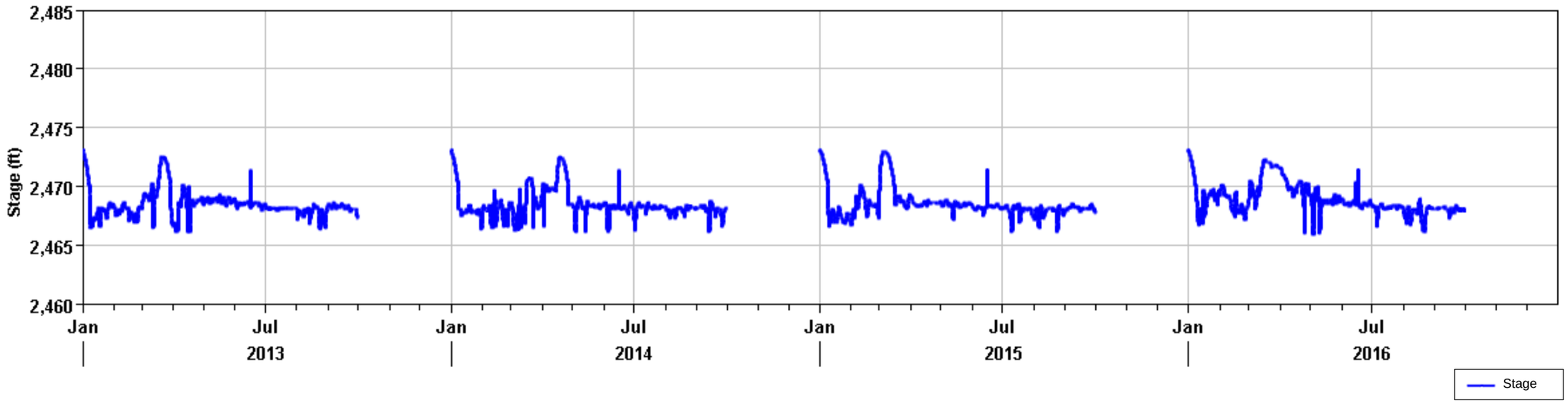


Figure 53: Copco No. 2 Drawdown Stage for years 2013 through 2016

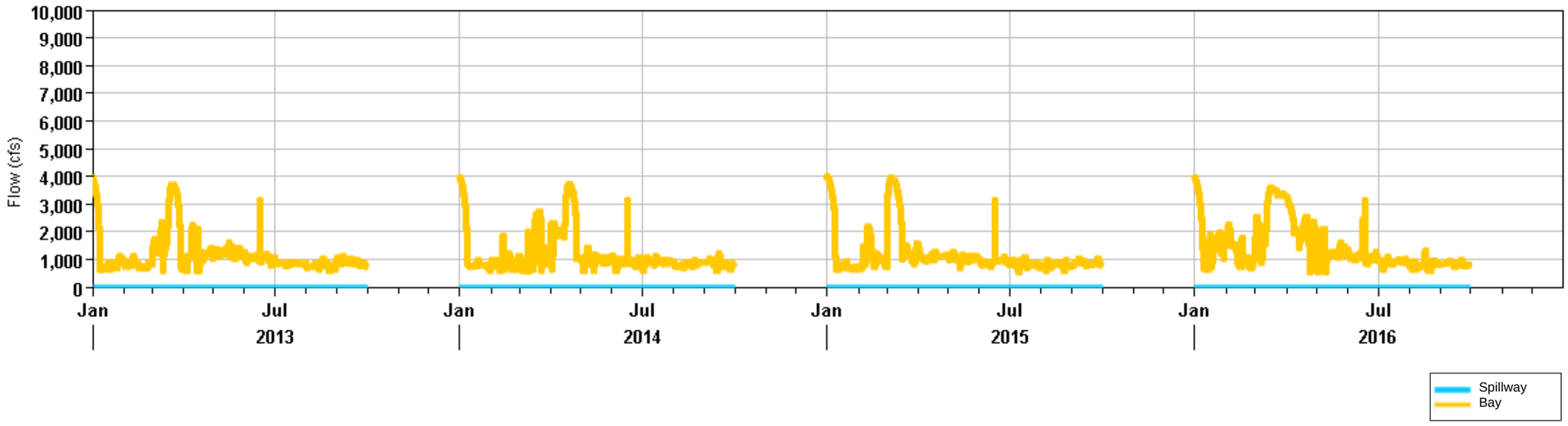


Figure 54: Copco No. 2 Gate Structure Outlet Flows for years 2013 through 2016

Drawdown Plots for Iron Gate Reservoir

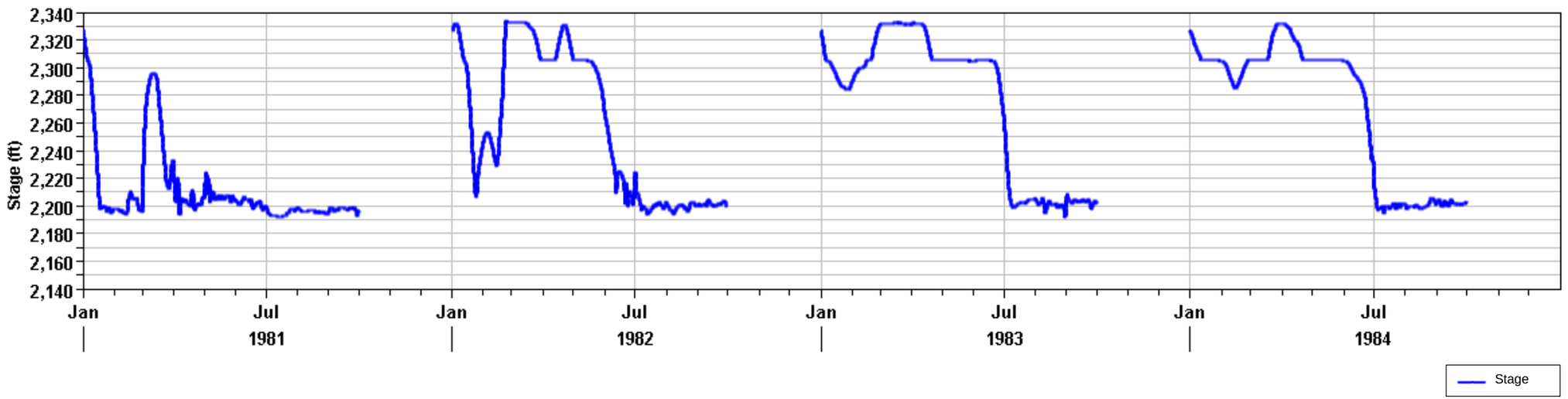


Figure 55: Iron Gate Drawdown Stage for years 1981 through 1984

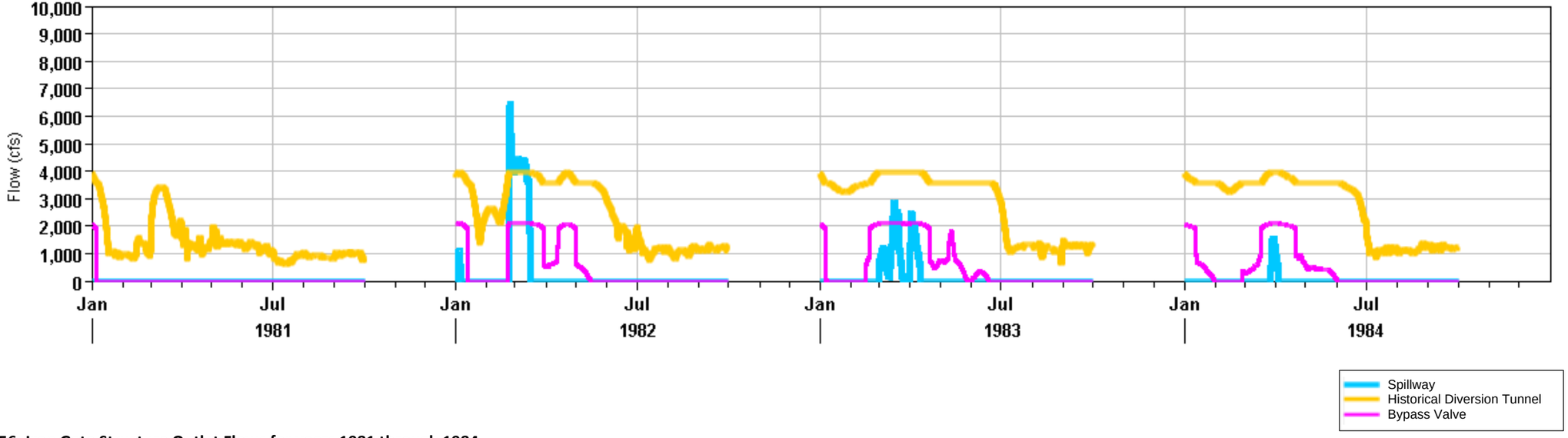


Figure 56: Iron Gate Structure Outlet Flows for years 1981 through 1984

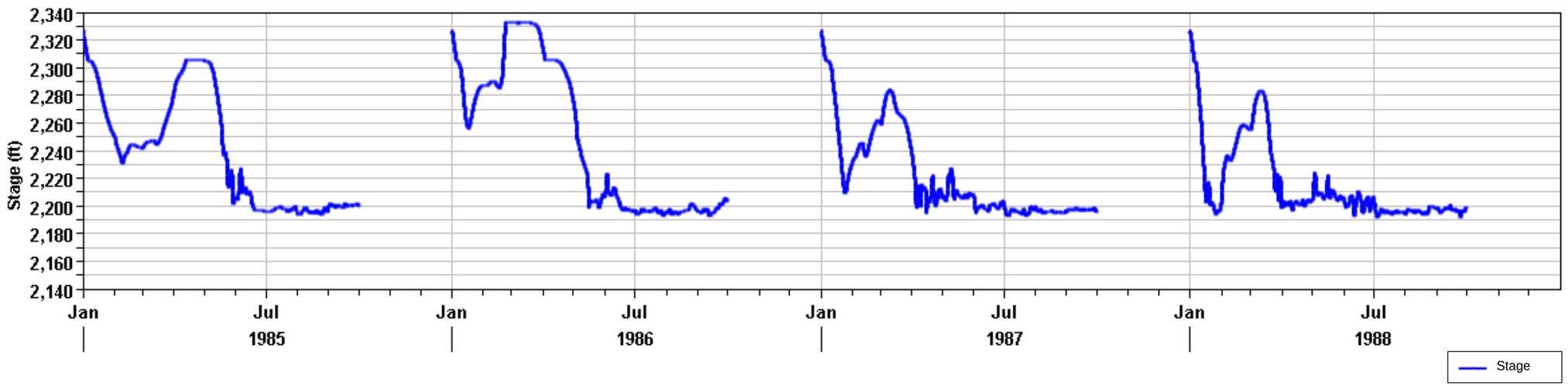


Figure 57: Iron Gate Drawdown Stage for years 1985 through 1988

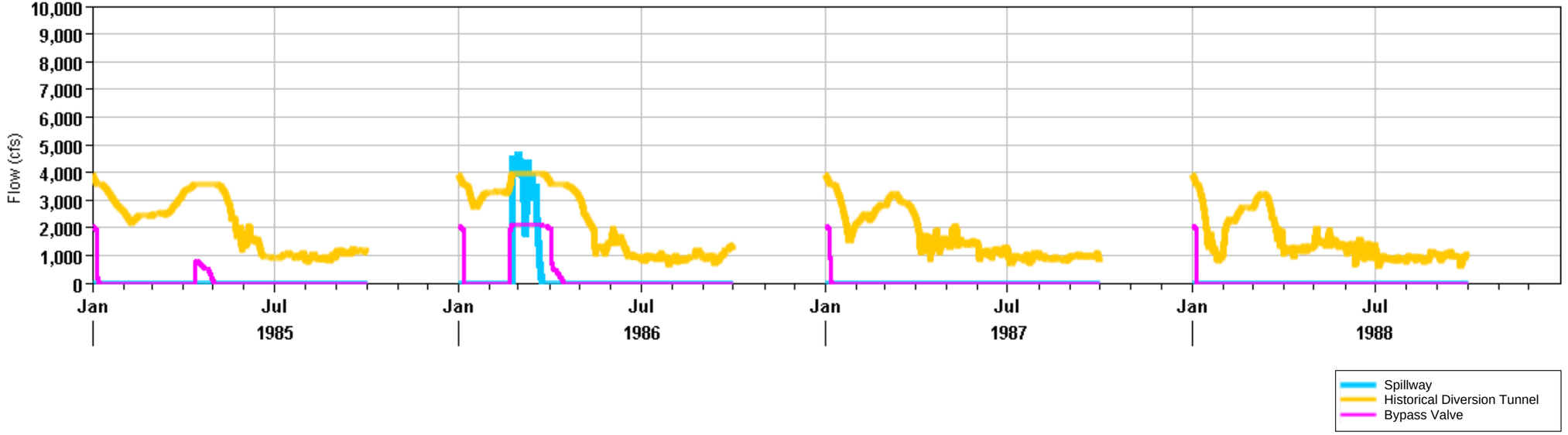


Figure 58: Iron Gate Structure Outlet Flows for years 1985 through 1988

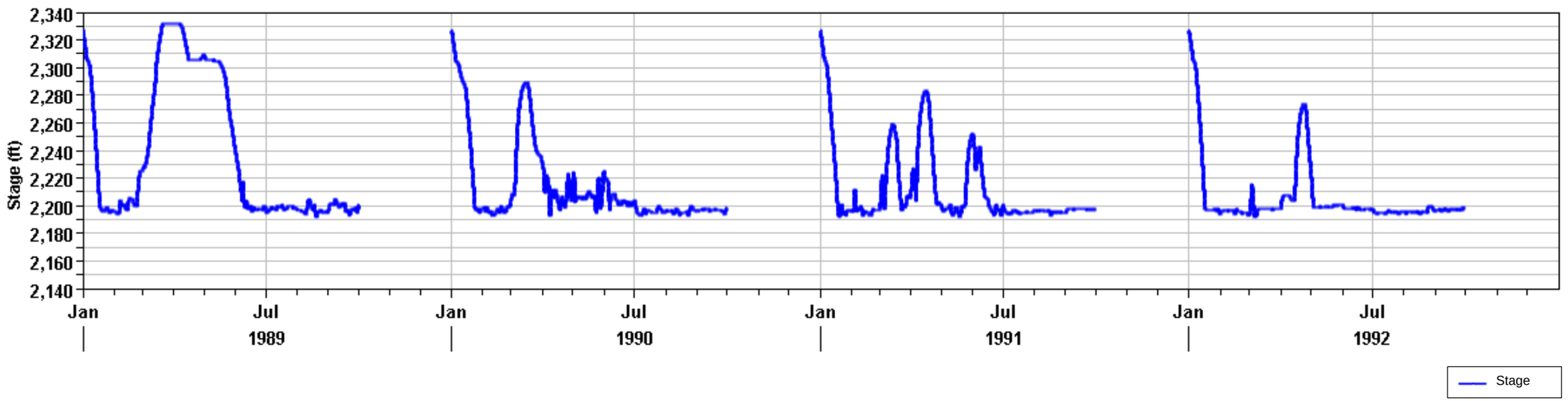


Figure 59: Iron Gate Drawdown Stage for years 1989 through 1992

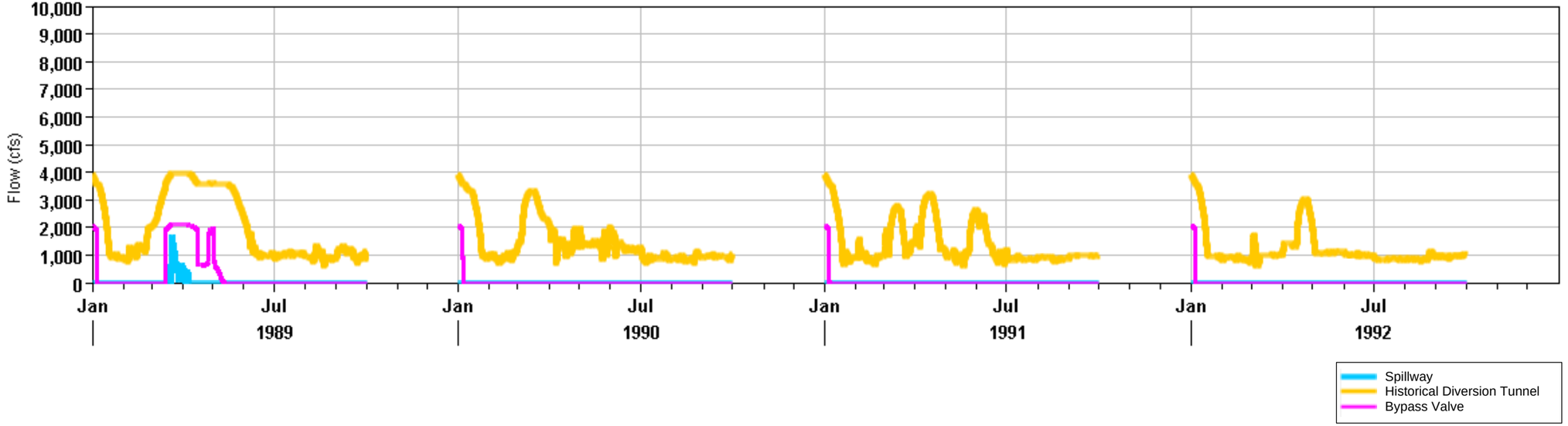


Figure 60 Iron Gate Structure Outlet Flows for years 1989 through 1992

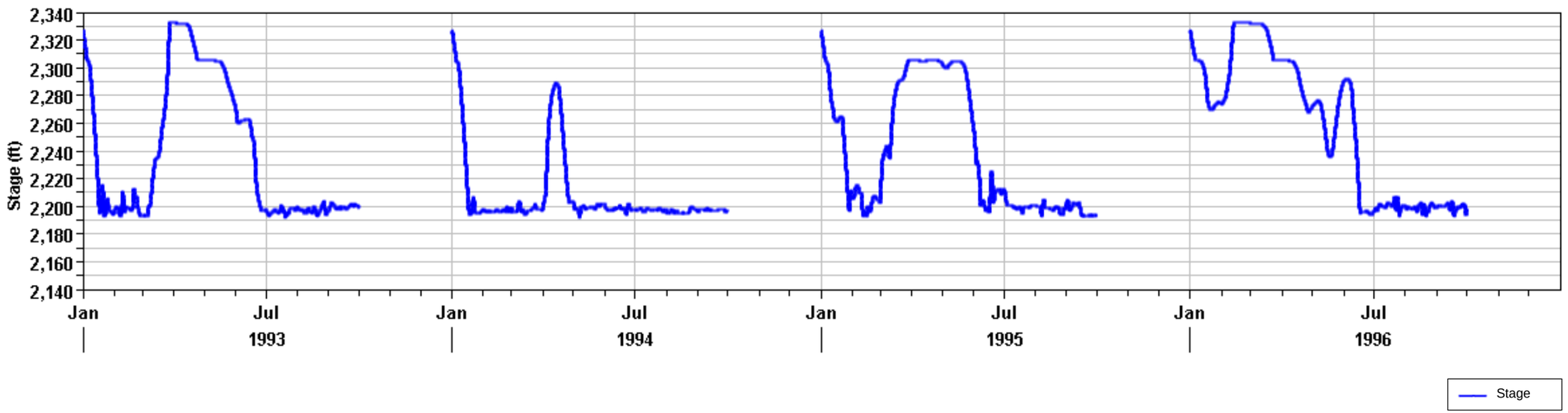


Figure 61: Iron Gate Drawdown Stage for years 1993 through 1996

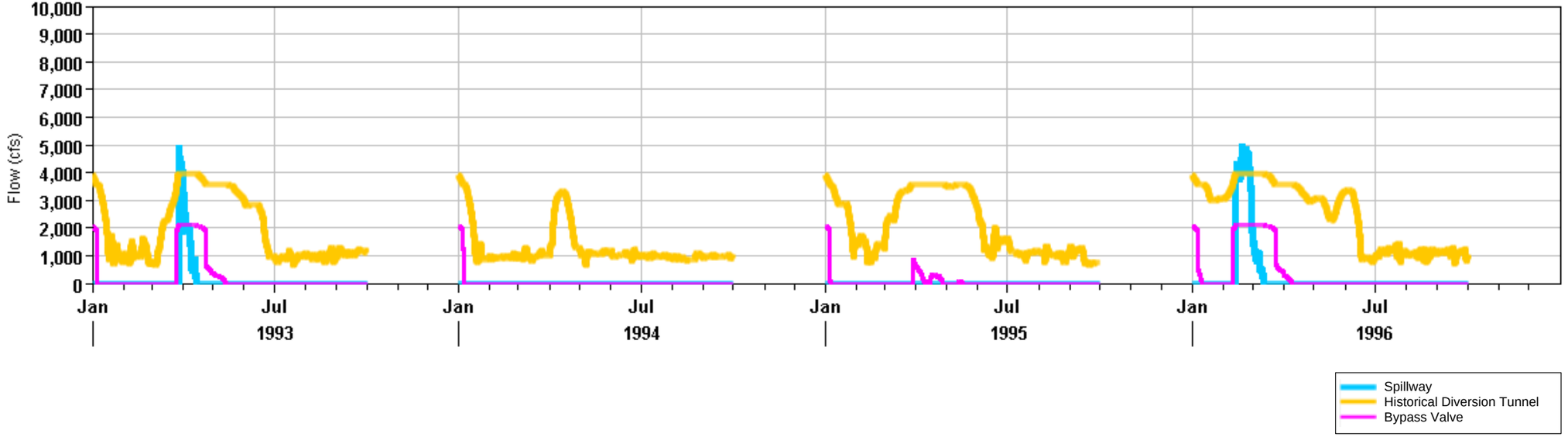


Figure 62: Iron Gate Structure Outlet Flows for years1993 through 1996

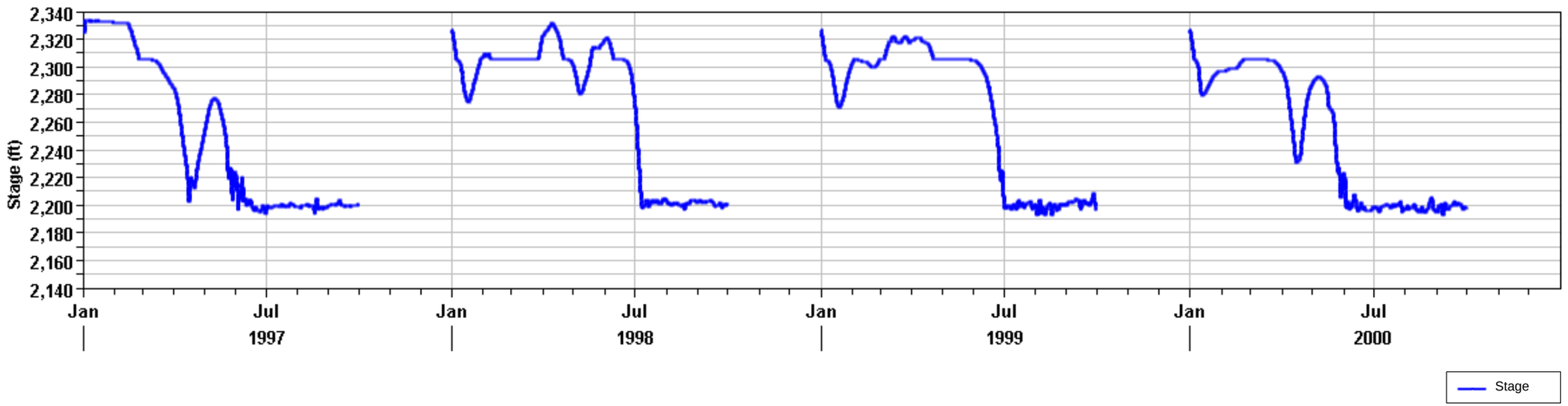


Figure 63: Iron Gate Drawdown Stage for years 1997 through 2000

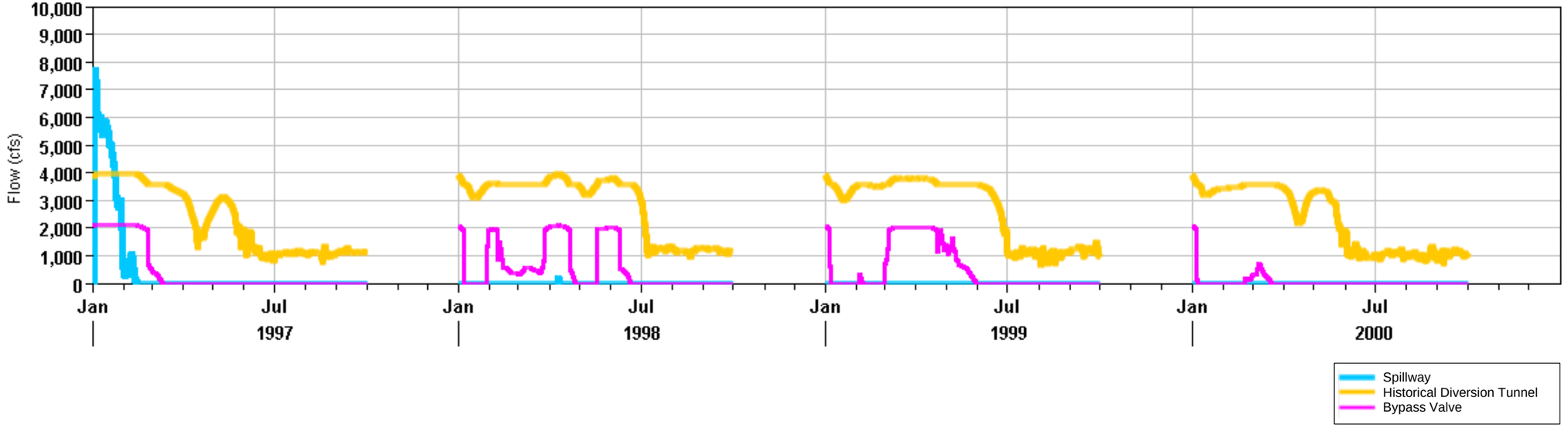


Figure 64: Iron Gate Structure Outlet Flows for years 1997 through 2000

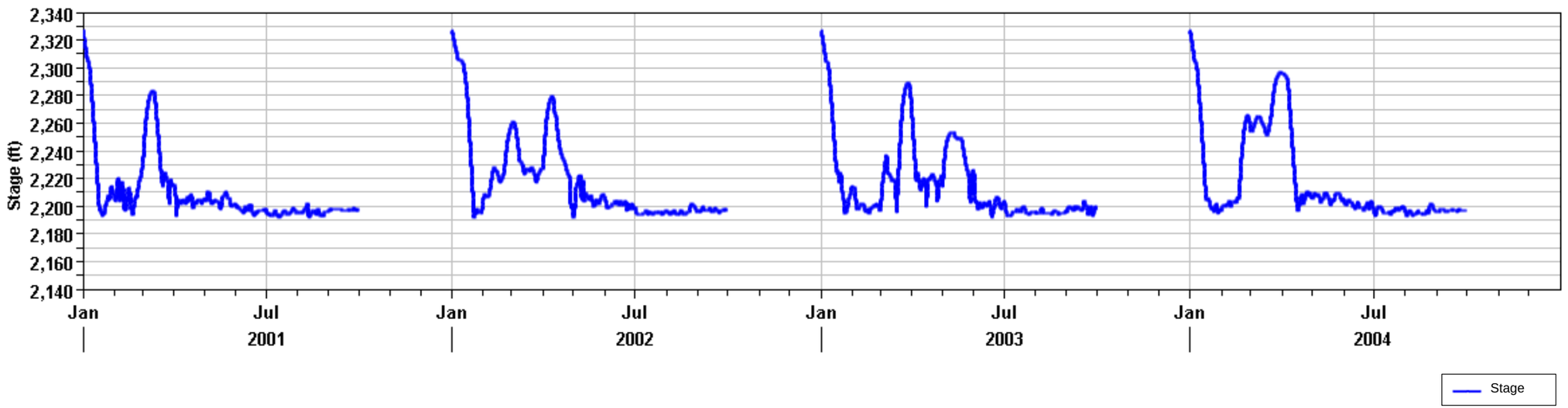


Figure 65: Iron Gate Drawdown Stage for years 2001 through 2004

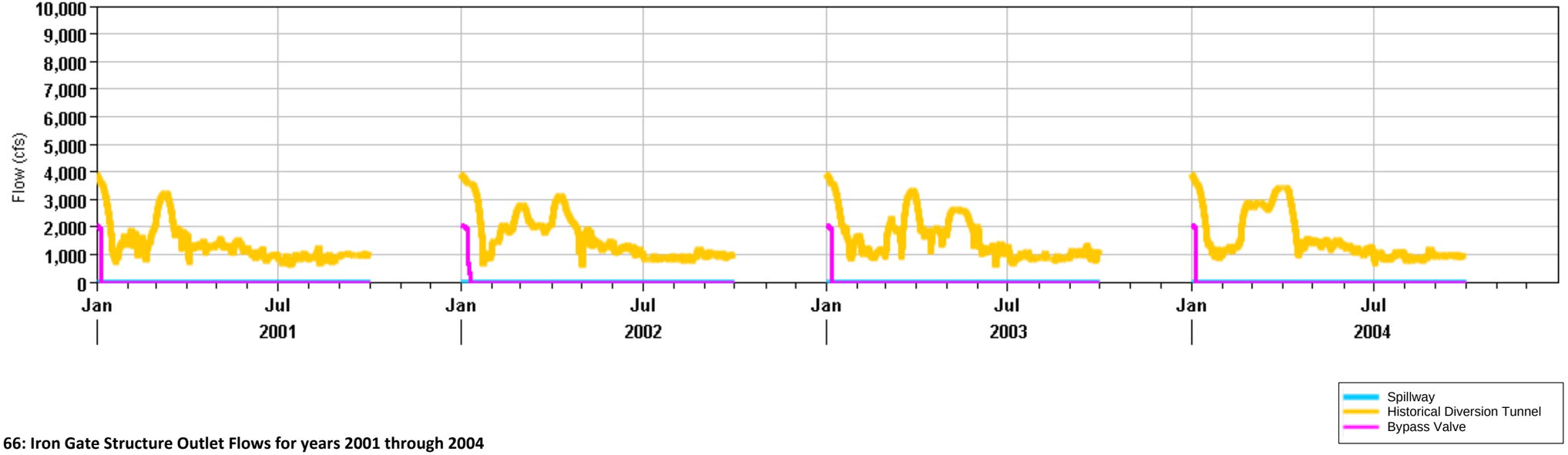


Figure 66: Iron Gate Structure Outlet Flows for years 2001 through 2004

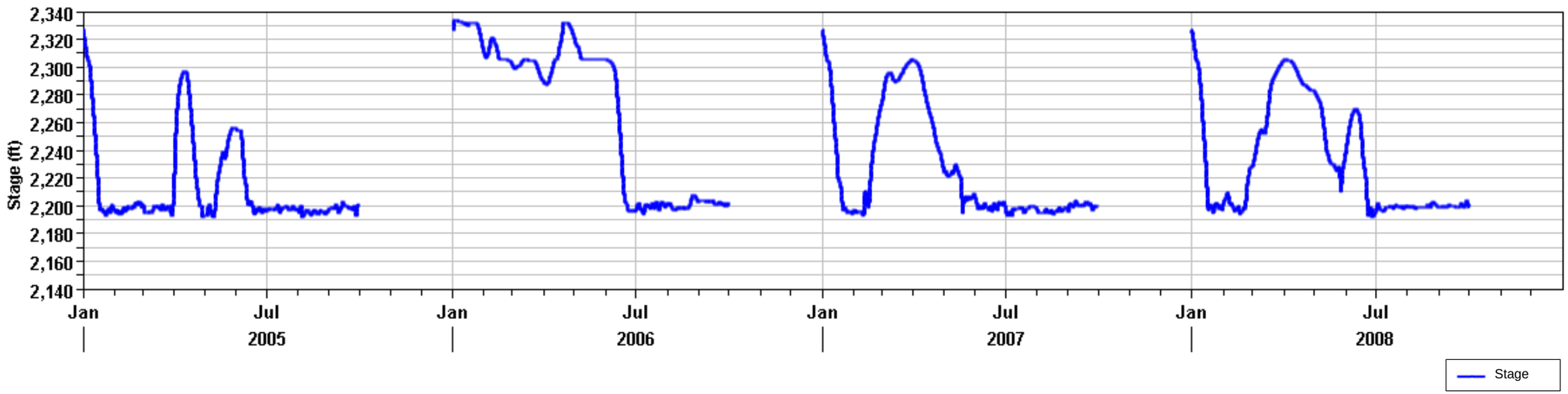


Figure 67: Iron Gate Drawdown Stage for years 2005 through 2008

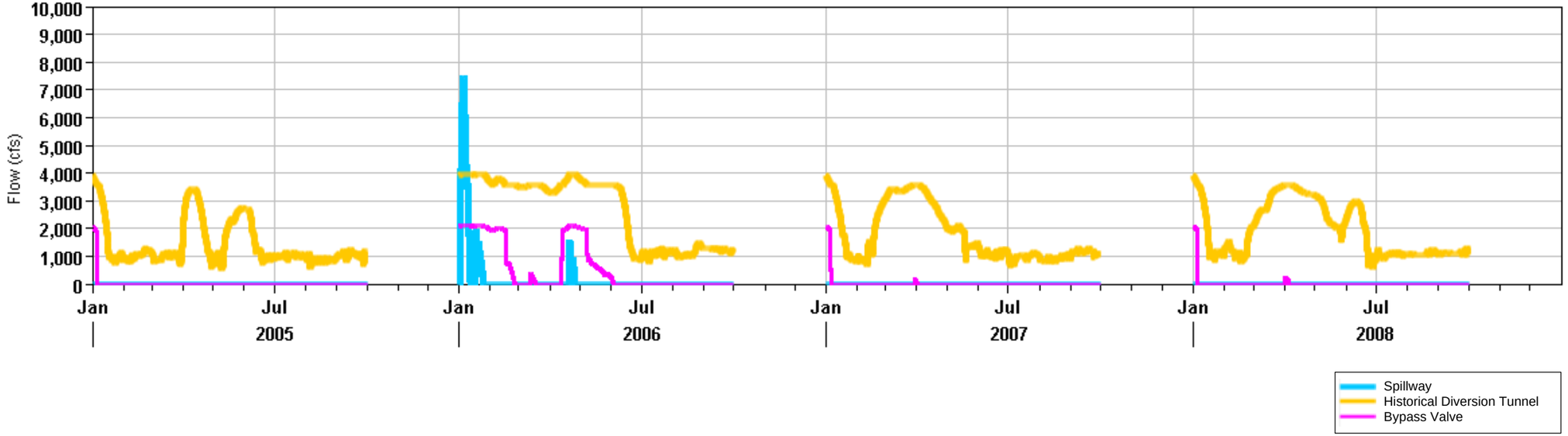


Figure 68: Iron Gate Structure Outlet Flows for years 2005 through 2008

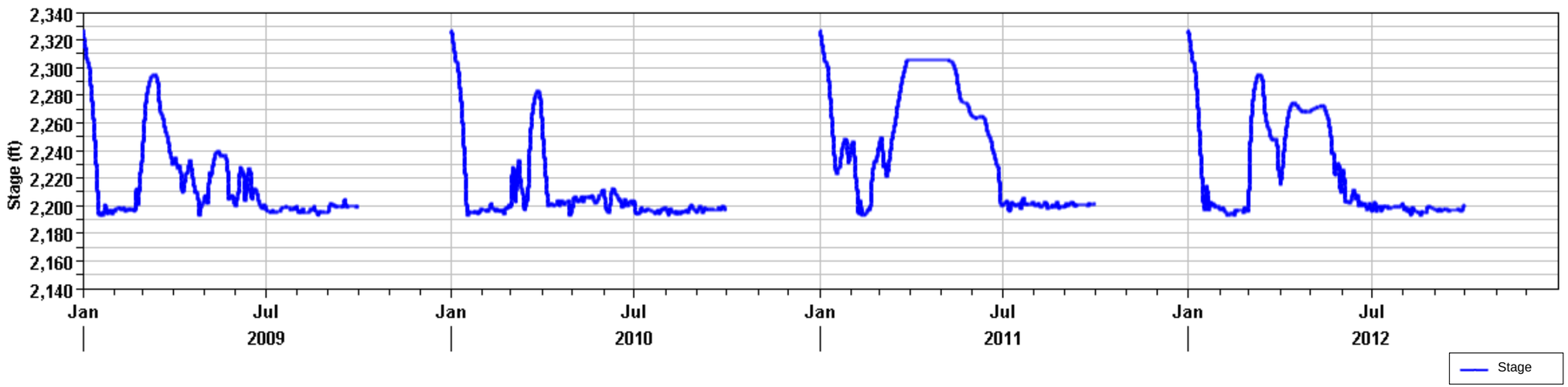


Figure 69: Iron Gate Drawdown Stage for years 2009 through 2012

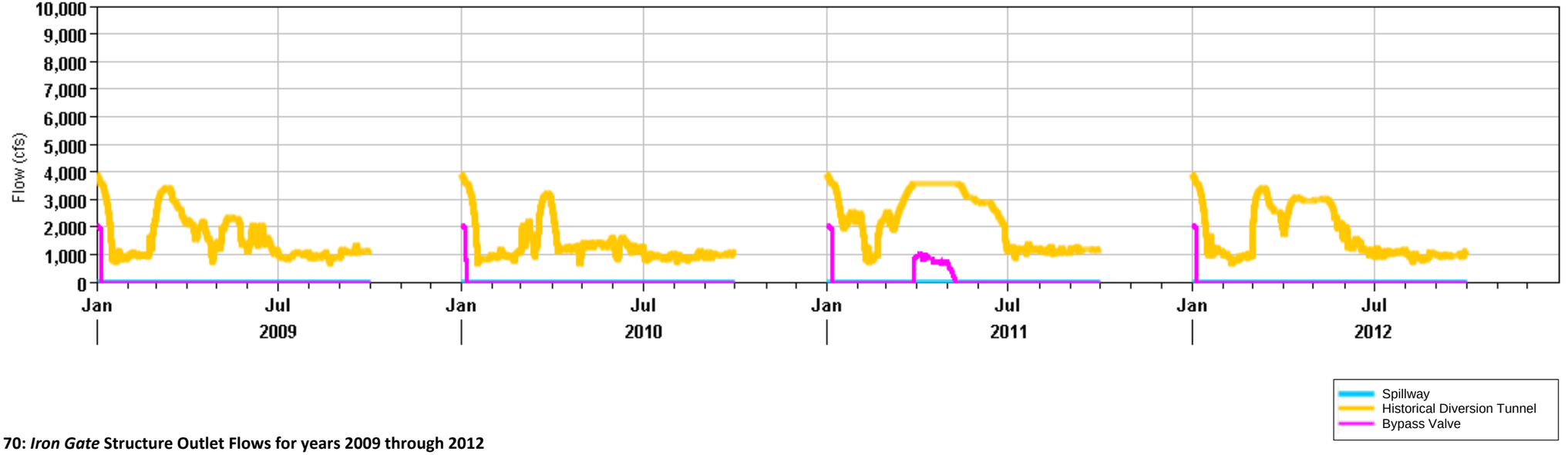


Figure 70: *Iron Gate* Structure Outlet Flows for years 2009 through 2012

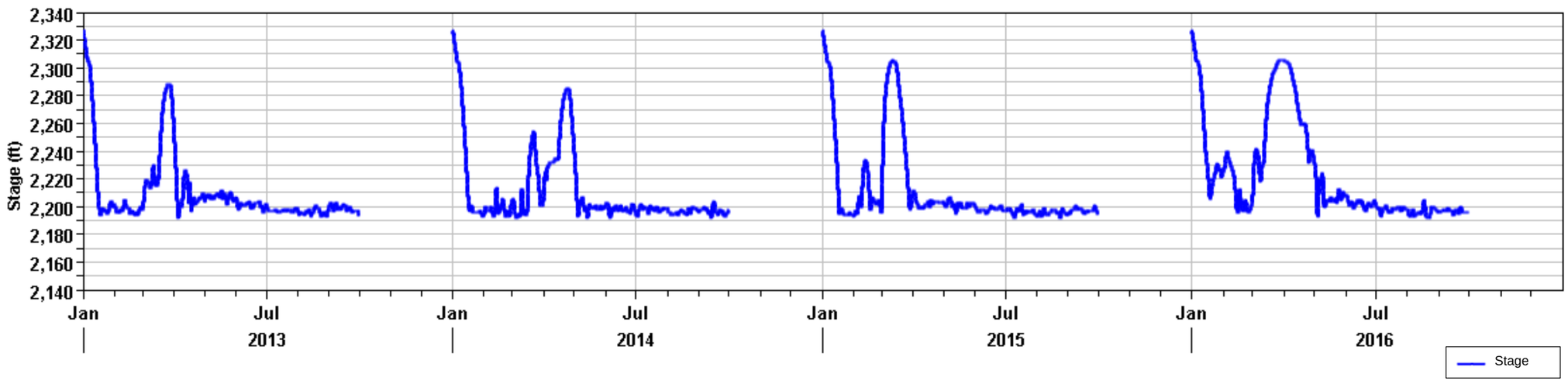


Figure 71: Iron Gate Drawdown Stage for years 2013 through 2016

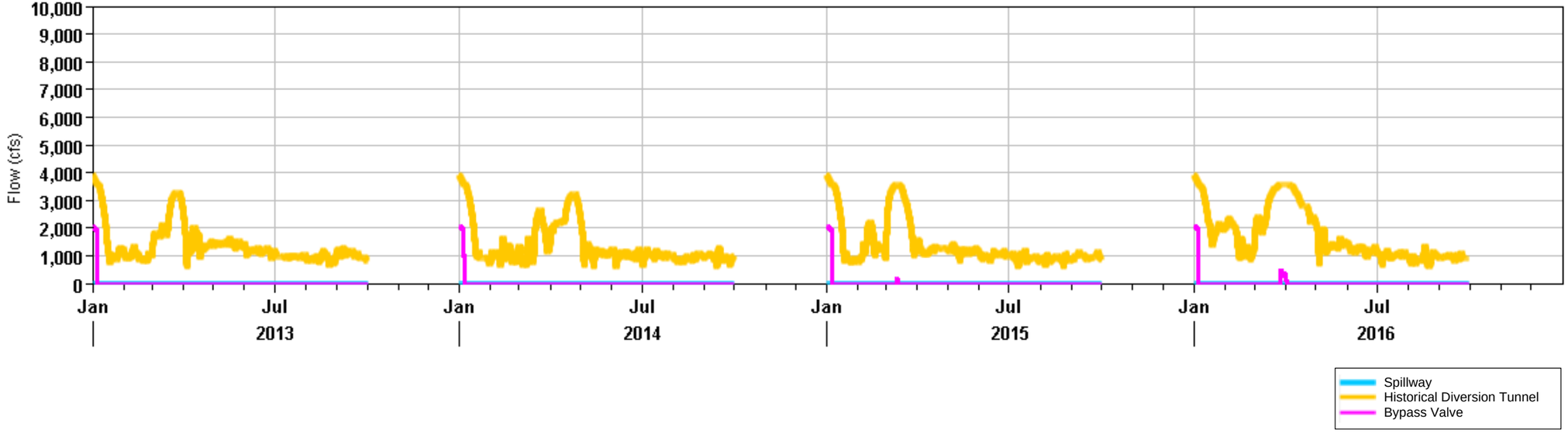
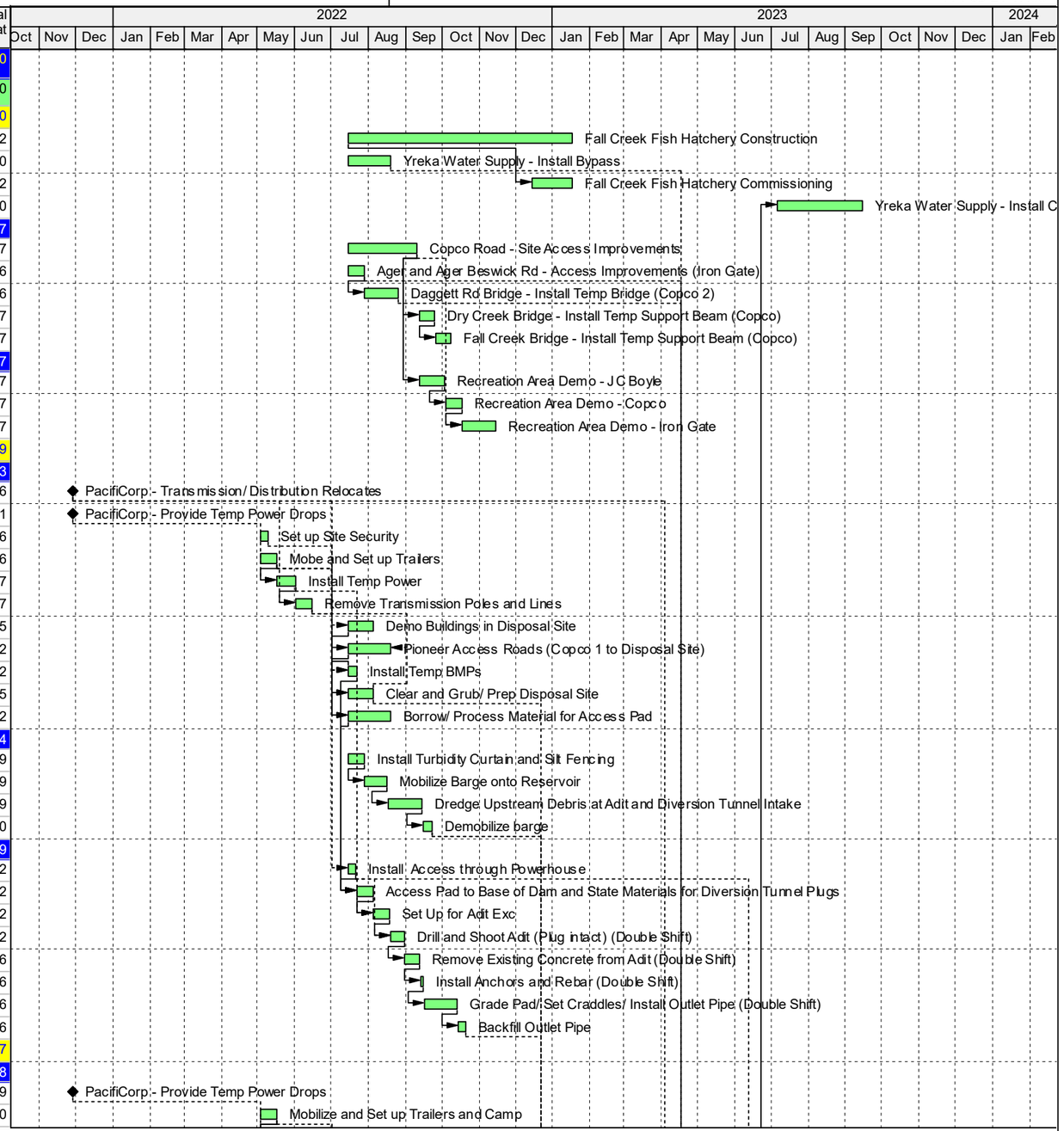


Figure 72: Iron Gate Structure Outlet Flows for years 2013 through 2016

Appendix C

Implementation Schedule

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Klamath River Reconstruction Project - Implementation Work Sc		356	29-Nov-21	16-Nov-23	0
PRE-DRAWDOWN YEAR		316	29-Nov-21	14-Sep-23	40
Project Wide		230	15-Jul-22	14-Sep-23	40
PW1104	Fall Creek Fish Hatchery Construction	153	15-Jul-22	16-Jan-23	152
PW1010	Yreka Water Supply - Install Bypass	30	15-Jul-22	19-Aug-22	250
PW1114	Fall Creek Fish Hatchery Commissioning	25	15-Dec-22	16-Jan-23	152
PW1184	Yreka Water Supply - Install Cut and Cover	60	06-Jul-23	14-Sep-23	40
Roads and Bridges		73	15-Jul-22	08-Oct-22	197
PW0044	Copco Road - Site Access Improvements	49	15-Jul-22	10-Sep-22	37
PW1003	Ager and Ager Beswick Rd - Access Improvements (Iron Gate)	12	15-Jul-22	28-Jul-22	56
PW1004	Daggett Rd Bridge - Install Temp Bridge (Copco 2)	24	29-Jul-22	25-Aug-22	56
PW1001	Dry Creek Bridge - Install Temp Support Beam (Copco)	12	12-Sep-22	24-Sep-22	197
PW1002	Fall Creek Bridge - Install Temp Support Beam (Copco)	12	26-Sep-22	08-Oct-22	197
Demo Recreation Sites		55	12-Sep-22	14-Nov-22	37
PW1008	Recreation Area Demo - J C Boyle	19	12-Sep-22	03-Oct-22	37
PW1020	Recreation Area Demo - Copco	12	04-Oct-22	17-Oct-22	37
PW1030	Recreation Area Demo - Iron Gate	24	18-Oct-22	14-Nov-22	37
Copco 1		169	29-Nov-21	20-Oct-22	9
Site Prep		116	29-Nov-21	19-Aug-22	53
CO12222	PacifiCorp - Transmission/ Distribution Relocates	0		29-Nov-21*	86
CO12240	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	181
CO10290	Set up Site Security	6	03-May-22	10-May-22	106
CO10062	Mobe and Set up Trailers	12	03-May-22	17-May-22	76
CO10600	Install Temp Power	12	17-May-22	01-Jun-22	77
CO10620	Remove Transmission Poles and Lines	12	01-Jun-22	15-Jun-22	77
CO10800	Demo Buildings in Disposal Site	18	15-Jul-22	05-Aug-22	65
CO10021	Pioneer Access Roads (Copco 1 to Disposal Site)	30	15-Jul-22	19-Aug-22	52
CO10040	Install Temp BMPs	6	15-Jul-22	22-Jul-22	52
CO10031	Clear and Grub/ Prep Disposal Site	18	15-Jul-22	05-Aug-22	65
CO10700	Borrow/ Process Material for Access Pad	30	15-Jul-22	19-Aug-22	52
Upstream Work		58	15-Jul-22	22-Sep-22	34
CO10030	Install Turbidity Curtain and Silt Fencing	12	15-Jul-22	28-Jul-22	39
CO10010	Mobilize Barge onto Reservoir	16	29-Jul-22	16-Aug-22	39
CO10210	Dredge Upstream Debris at Adit and Diversion Tunnel Intake	24	17-Aug-22	14-Sep-22	39
CO10052	Demobilize barge	6	15-Sep-22	22-Sep-22	120
Downstream Work		83	15-Jul-22	20-Oct-22	9
CO10034	Install Access through Powerhouse	6	15-Jul-22	21-Jul-22	52
CO16010	Access Pad to Base of Dam and State Materials for Diversion Tunnel Plugs	12	22-Jul-22	04-Aug-22	52
CO10380	Set Up for Adit Exc	12	05-Aug-22	18-Aug-22	52
CO10071	Drill and Shoot Adit (Plug intact) (Double Shift)	10	19-Aug-22	30-Aug-22	52
CO10340	Remove Existing Concrete from Adit (Double Shift)	10	31-Aug-22	12-Sep-22	96
CO10360	Install Anchors and Rebar (Double Shift)	3	13-Sep-22	15-Sep-22	96
CO10451	Grade Pad/ Set Craddles/ Install Outlet Pipe (Double Shift)	23	16-Sep-22	13-Oct-22	96
CO11010	Backfill Outlet Pipe	6	14-Oct-22	20-Oct-22	96
Copco 2		159	29-Nov-21	08-Oct-22	197
Access/Site Work		106	29-Nov-21	08-Aug-22	168
CO20521	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	409
CO20491	Mobilize and Set up Trailers and Camp	12	03-May-22	17-May-22	110



Klamath River Reconstruction Project - Implementation Work Schedule - 100% DCD 2022 Start

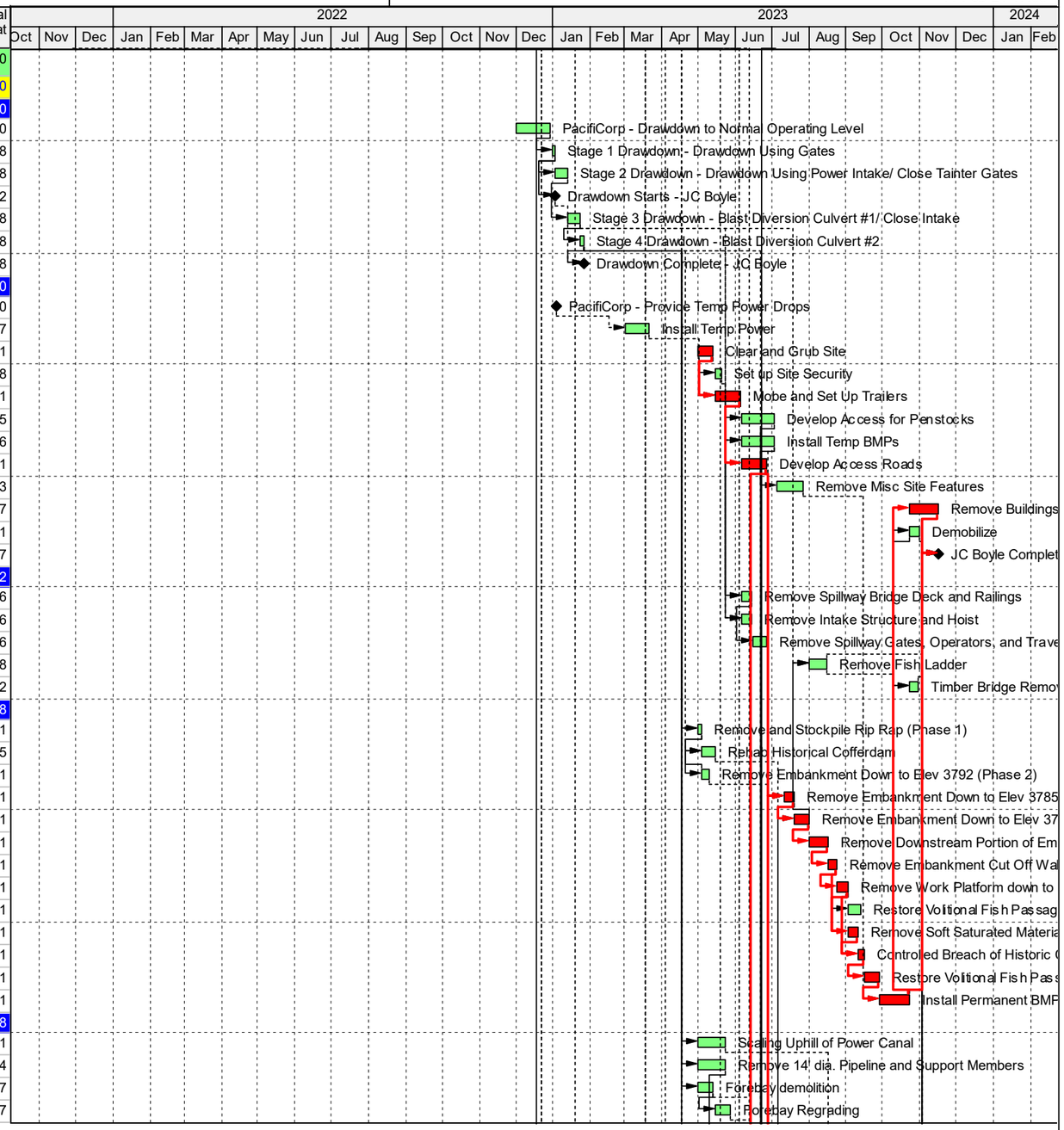
11-Feb-21 17:53

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
CO20011	Install Temp BMPs	10	17-May-22	28-May-22	110
CO20501	Install Temp Power	10	17-May-22	28-May-22	226
CO20013	Prep Site and Clear and Grub	10	15-Jul-22	27-Jul-22	72
CO20012	Set Up Staging Areas	18	15-Jul-22	05-Aug-22	145
CO20014	Pioneer Access Roads	10	27-Jul-22	08-Aug-22	72
Dam Removal		53	08-Aug-22	08-Oct-22	197
Dry Period #1		25	08-Aug-22	06-Sep-22	203
CO2001	Dry Up Reservoir	1	08-Aug-22	08-Aug-22	79
CO2008	Remove Right Retaining Wall (Double Shift)	2	08-Aug-22	10-Aug-22	147
CO2026	Remove Existing Cofferdam (Double Shift)	5	08-Aug-22	13-Aug-22	223
CO2007	Remove Tainter Gates, Bridge Deck, Hoists (Double Shift)	6	09-Aug-22	15-Aug-22	142
CO2011	Demo Concrete Spillway (Double Shift)	6	09-Aug-22	15-Aug-22	142
CO20541	Refill Reservoir	18	16-Aug-22	06-Sep-22	142
Dry Period #2		28	07-Sep-22	08-Oct-22	197
CO20481	Dry Up Reservoir	1	07-Sep-22	07-Sep-22	79
CO20401	Close Caterpillar Gate	1	08-Sep-22	08-Sep-22	142
CO2004	CIP Plug for Caterpillar Gate (Double Shift)	1	09-Sep-22	09-Sep-22	197
CO20411	Demo and Remove Intake Structure (Double Shift)	3	10-Sep-22	13-Sep-22	197
CO2013	Regrade Right Bank, Remove Access Road, and Grade Area (Double Shift)	6	10-Sep-22	16-Sep-22	216
CO2002	Backfill Intake Structure with Rip Rap (Double Shift)	2	14-Sep-22	15-Sep-22	217
CO20391	Restore Volitional Fish Channel (Downstream of Dam) (Double Shift)	4	14-Sep-22	17-Sep-22	197
CO20551	Refill Reservoir	18	19-Sep-22	08-Oct-22	197
Iron Gate		178	29-Nov-21	25-Nov-22	151
Access/ Site Work		111	29-Nov-21	12-Aug-22	218
IG4000	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	182
IG2130	Set Up Site Security	6	03-May-22	10-May-22	287
IG0067	Mobe and Setup Trailers	19	03-May-22	24-May-22	68
IG0064	Install Temp BMPs	16	25-May-22	13-Jun-22	268
IG3280	Install Temp Power	16	25-May-22	13-Jun-22	70
IG2140	Install Piping at Fish Facilities	25	15-Jul-22	12-Aug-22	155
IG0051	Build Access Road to Diversion Tunnel and Holding Tanks	18	15-Jul-22	04-Aug-22	27
IG0065	Prep Site and Set Up Staging Areas	16	15-Jul-22	03-Aug-22	227
IG3290	Decommission Holding Ponds	12	15-Jul-22	28-Jul-22	33
Pre-Drawdown Modifications		74	05-Aug-22	25-Nov-22	0
Tunnel Linning		74	05-Aug-22	25-Nov-22	0
IG3050	Mobe Equipment and Set-up	10	05-Aug-22	16-Aug-22	27
IG0001	Close and Secure Hinged Blind Flange	5	17-Aug-22	22-Aug-22	27
IG3060	Demo Weir and Stop Logs/ Water Pump Down (Double Shift)	2	23-Aug-22	24-Aug-22	27
IG3070	Tunnel Inspection Scaling/ Vent/ Utilities/ Temp Support (Double Shift)	10	25-Aug-22	06-Sep-22	27
IG3080	Demo Existing Invert Concrete (double shift)	4	07-Sep-22	10-Sep-22	27
IG3090	Install Anchors for Walls/ invert (double shift)	4	12-Sep-22	15-Sep-22	27
IG3100	Mud Mat (Double Shift)	2	16-Sep-22	17-Sep-22	27
IG3110	Invert Rebar (Double Shift)	2	19-Sep-22	20-Sep-22	27
IG3120	Invert Concrete (Double Shift)	5	21-Sep-22	26-Sep-22	27
IG3130	Wall Rebar (Double Shift)	4	30-Sep-22	04-Oct-22	30
IG0013	Wall Concrete (Double Shift)	14	05-Oct-22	21-Oct-22	30
IG0028	Install Vent Lines (Double Shift)	22	22-Oct-22	17-Nov-22	30
IG3260	Remove Blind Flange (Double Shift)	6	18-Nov-22	25-Nov-22	30

Actual Work
Remaining Work
Critical Remaining Work
Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

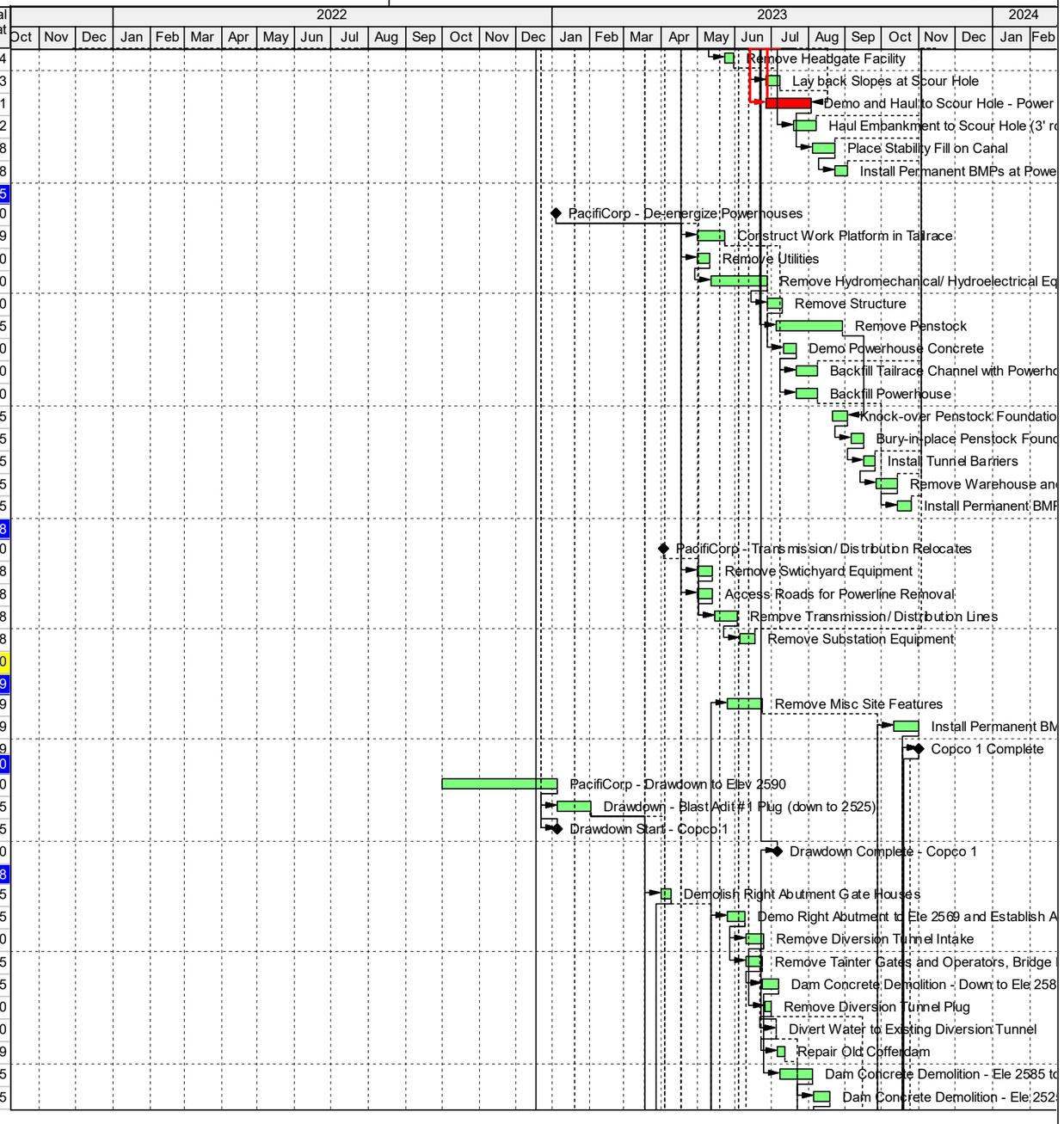
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
DRAWDOWN YEAR		204	01-Oct-22	16-Nov-23	0
JC Boyle		178	01-Dec-22	16-Nov-23	0
Drawdown		0	01-Dec-22	27-Jan-23	0
JCB1180	PacifiCorp - Drawdown to Normal Operating Level	20	01-Dec-22*	29-Dec-22	0
JCB0017	Stage 1 Drawdown - Drawdown Using Gates	2	01-Jan-23	03-Jan-23	48
JCB1220	Stage 2 Drawdown - Drawdown Using Power Intake/ Close Tainter Gates	10	03-Jan-23	13-Jan-23	48
JCB0082	Drawdown Starts - JC Boyle	0	03-Jan-23		72
JCB1230	Stage 3 Drawdown - Blast Diversion Culvert #1/ Close Intake	10	13-Jan-23	23-Jan-23	48
JCB0019	Stage 4 Drawdown - Blast Diversion Culvert #2	4	23-Jan-23	27-Jan-23	48
JCB1050	Drawdown Complete - JC Boyle	0		27-Jan-23	48
Access/ Site Work		178	03-Jan-23	16-Nov-23	0
JCB1270	PacifiCorp - Provide Temp Power Drops	0		03-Jan-23*	0
JCB1260	Install Temp Power	18	01-Mar-23*	21-Mar-23	47
JCB0057	Clear and Grub Site	12	01-May-23*	13-May-23	1
JCB1060	Set up Site Security	6	15-May-23	20-May-23	18
JCB0056	Mobe and Set Up Trailers	18	15-May-23	05-Jun-23	1
JCB1070	Develop Access for Penstocks	24	06-Jun-23	03-Jul-23	5
JCB0051	Install Temp BMPs	24	06-Jun-23	03-Jul-23	6
JCB0052	Develop Access Roads	18	06-Jun-23	26-Jun-23	1
JCB1190	Remove Misc Site Features	20	05-Jul-23	27-Jul-23	53
JCB1200	Remove Buildings and Storage Sheds at Dam	20	23-Oct-23	16-Nov-23	37
JCB0059	Demobilize	7	23-Oct-23	31-Oct-23	1
JCB0081	JC Boyle Complete	0		16-Nov-23	37
Dam/Intake/Spillway Removal		122	06-Jun-23	30-Oct-23	2
JCB0014	Remove Spillway Bridge Deck and Railings	8	06-Jun-23	14-Jun-23	106
JCB0012	Remove Intake Structure and Hoist	8	06-Jun-23	14-Jun-23	116
JCB0015	Remove Spillway Gates, Operators, and Traveling Hoist	10	15-Jun-23	26-Jun-23	106
JCB0005	Remove Fish Ladder	13	01-Aug-23	16-Aug-23	58
JCB0013	Timber Bridge Removal	6	23-Oct-23	30-Oct-23	2
Embankment Removal		146	01-May-23	23-Oct-23	8
JCB0006	Remove and Stockpile Rip Rap (Phase 1)	3	01-May-23*	03-May-23	51
JCB0003	Rehab Historical Cofferdam	10	04-May-23*	15-May-23	55
JCB1240	Remove Embankment Down to Elev 3792 (Phase 2)	6	04-May-23*	10-May-23	51
JCB0020	Remove Embankment Down to Elev 3785 (Phase 3)	8	11-Jul-23	20-Jul-23	1
JCB1120	Remove Embankment Down to Elev 3775.7 (Phase 4)	10	20-Jul-23*	01-Aug-23	1
JCB1130	Remove Downstream Portion of Embankment down to Bedrock Elev 3738 (Phase	14	01-Aug-23	17-Aug-23	1
JCB0007	Remove Embankment Cut Off Wall	6	17-Aug-23	24-Aug-23	1
JCB1170	Remove Work Platform down to Bedrock (Phase 7)	8	24-Aug-23	02-Sep-23	1
JCB1000	Restore Volitional Fish Passage (Downstream of Historic Cofferdam)	8	02-Sep-23	13-Sep-23	41
JCB1140	Remove Soft Saturated Material	6	02-Sep-23	11-Sep-23	1
JCB0009	Controlled Breach of Historic Cofferdam (down to 3740.7)	5	11-Sep-23	16-Sep-23	1
JCB1150	Restore Volitional Fish Passage (Upstream of Embamkment)	10	16-Sep-23	28-Sep-23	1
JCB1210	Install Permanent BMPs	20	28-Sep-23	23-Oct-23	1
Power Canal Removal		106	01-May-23	02-Sep-23	48
JCB1090	Scaling Uphill of Power Canal	20	01-May-23	23-May-23	61
JCB0024	Remove 14' dia. Pipeline and Support Members	20	01-May-23	23-May-23	114
JCB0029	Forebay demolition	12	01-May-23	13-May-23	37
JCB1010	Forebay Regrading	12	15-May-23	27-May-23	47



Actual Work
Remaining Work
Critical Remaining Work
Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

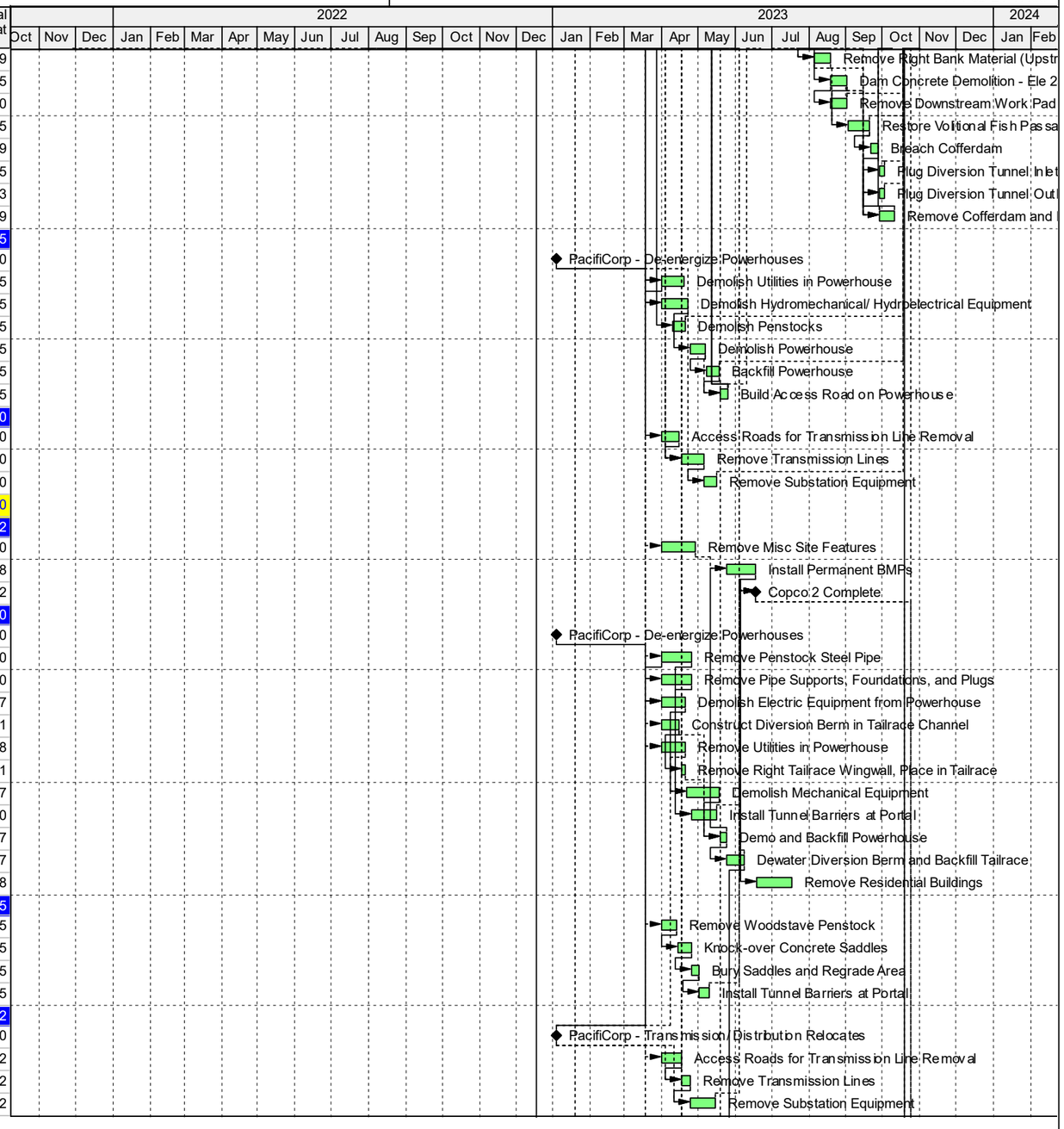
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
JCB0026	Remove Headgate Facility	5	24-May-23	30-May-23	114
JCB0040	Lay back Slopes at Scour Hole	10	27-Jun-23	08-Jul-23	23
JCB0027	Demo and Haul to Scour Hole - Power Canal Downhill Wall	32	27-Jun-23	03-Aug-23	1
JCB0031	Haul Embankment to Scour Hole (3' rock cover)	15	20-Jul-23	07-Aug-23	72
JCB0028	Place Stability Fill on Canal	16	04-Aug-23	22-Aug-23	48
JCB1100	Install Permanent BMPs at Power Canal and Scour Hole	10	23-Aug-23	02-Sep-23	48
Powerhouse and Penstock Removal		173	03-Jan-23	25-Oct-23	5
JCB1040	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
JCB0034	Construct Work Platform in Tailrace	20	01-May-23	23-May-23	99
JCB0043	Remove Utilities	10	01-May-23*	11-May-23	60
JCB0044	Remove Hydromechanical/ Hydroelectrical Equipment	39	12-May-23	27-Jun-23	60
JCB1020	Remove Structure	10	28-Jun-23	10-Jul-23	60
JCB0022	Remove Penstock	48	05-Jul-23	29-Aug-23	5
JCB0041	Demo Powerhouse Concrete	10	11-Jul-23	21-Jul-23	60
JCB0038	Backfill Tailrace Channel with Powerhouse Concrete and Excavated Alluvial Materi	15	22-Jul-23	08-Aug-23	70
JCB0025	Backfill Powerhouse	15	22-Jul-23	08-Aug-23	60
JCB0023	Knock-over Penstock Foundations	12	21-Aug-23	02-Sep-23	5
JCB0032	Bury-in-place Penstock Foundations	10	05-Sep-23	15-Sep-23	5
JCB0033	Install Tunnel Barriers	8	16-Sep-23	25-Sep-23	5
JCB1030	Remove Warehouse and Buildings	15	26-Sep-23	13-Oct-23	5
JCB1250	Install Permanent BMP	10	14-Oct-23	25-Oct-23	5
Transmission/Distribution		64	03-Apr-23	17-Jun-23	98
JCB1110	PacifiCorp - Transmission/ Distribution Relocates	0		03-Apr-23*	0
JCB0036	Remove Swtichyard Equipment	12	01-May-23*	13-May-23	98
JCB0100	Access Roads for Powerline Removal	12	01-May-23*	13-May-23	98
JCB0042	Remove Transmission/ Distribution Lines	17	15-May-23	03-Jun-23	98
JCB0045	Remove Substation Equipment	12	05-Jun-23	17-Jun-23	98
Copco 1		204	01-Oct-22	31-Oct-23	0
Access/Site Work		132	26-May-23	31-Oct-23	39
CO11000	Remove Misc Site Features	24	26-May-23	23-Jun-23	129
CO11020	Install Permanent BMPs	18	11-Oct-23	31-Oct-23	39
CO10064	Copco 1 Complete	0		31-Oct-23	39
Drawdown		104	01-Oct-22	06-Jul-23	40
CO10018	PacifiCorp - Drawdown to Elev 2590	32	01-Oct-22*	04-Jan-23	0
CO10003	Drawdown - Blast Adit #1 Plug (down to 2525)	10	04-Jan-23	01-Feb-23	15
CO10063	Drawdown Start - Copco 1	0	04-Jan-23		15
CO10260	Drawdown Complete - Copco 1	0	06-Jul-23		40
Dam Removal		160	01-Apr-23	10-Oct-23	18
CO10005	Demolish Right Abutment Gate Houses	6	01-Apr-23	08-Apr-23	65
CO10004	Demo Right Abutment to Ele 2569 and Establish Access	12	26-May-23	09-Jun-23	35
CO10072	Remove Diversion Tunnel Intake	13	10-Jun-23	24-Jun-23	40
CO10002	Remove Tainter Gates and Operators, Bridge Deck and Piers	12	10-Jun-23	23-Jun-23	35
CO10250	Dam Concrete Demolition - Down to Ele 2585	10	24-Jun-23	07-Jul-23	35
CO10240	Remove Diversion Tunnel Plug	6	26-Jun-23	01-Jul-23	40
CO10331	Divert Water to Existing Diversion Tunnel	1	05-Jul-23	05-Jul-23	40
CO10400	Repair Old Cofferdam	6	06-Jul-23	12-Jul-23	79
CO11300	Dam Concrete Demolition - Ele 2585 to Elev 2525	24	08-Jul-23	04-Aug-23	35
CO10300	Dam Concrete Demolition - Ele 2525 to Elev 2511	12	05-Aug-23	18-Aug-23	35



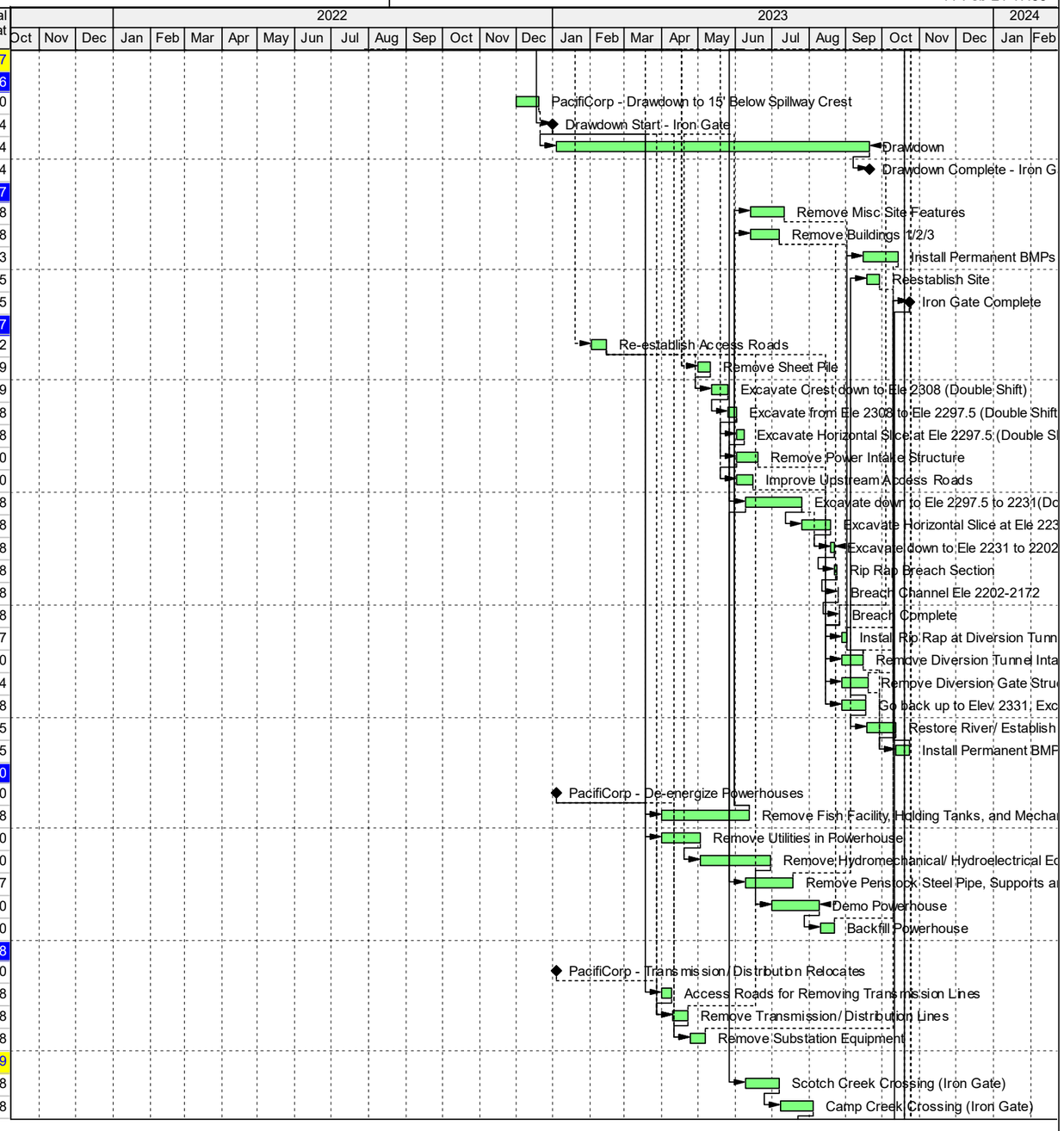
Actual Work
Remaining Work
Critical Remaining Work
◆ Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

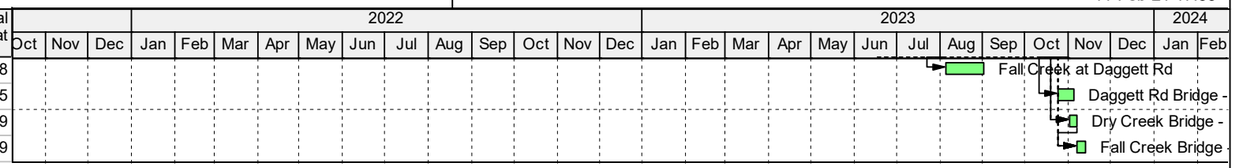
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
CO10341	Remove Right Bank Material (Upstream of Dam)	12	05-Aug-23	18-Aug-23	59
CO11200	Dam Concrete Demolition - Ele 2511 to Ele 2472	12	19-Aug-23	01-Sep-23	35
CO10017	Remove Downstream Work Pad and Pipe	12	19-Aug-23	01-Sep-23	70
CO10371	Restore Volitional Fish Passage Channel (Downstream of Historical Cofferdam)	15	02-Sep-23	20-Sep-23	35
CO11800	Breach Cofferdam	6	21-Sep-23	27-Sep-23	39
CO11030	Plug Diversion Tunnel Inlet	4	28-Sep-23	02-Oct-23	45
CO10019	Plug Diversion Tunnel Outlet	4	28-Sep-23	02-Oct-23	63
CO10351	Remove Cofferdam and Historical Construction, Volitional Fish Passage Upstream	10	28-Sep-23	10-Oct-23	39
Powerhouse and Penstock Removal		46	03-Jan-23	25-May-23	35
CO12230	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
CO10051	Demolish Utilities in Powerhouse	15	01-Apr-23	19-Apr-23	35
CO10053	Demolish Hydromechanical/ Hydroelectrical Equipment	18	01-Apr-23	22-Apr-23	35
CO10006	Demolish Penstocks	10	10-Apr-23	20-Apr-23	65
CO10007	Demolish Powerhouse	12	24-Apr-23	06-May-23	35
CO10022	Backfill Powerhouse	10	08-May-23	18-May-23	35
CO10390	Build Access Road on Powerhouse	6	19-May-23	25-May-23	35
Transmission/Distribution		38	01-Apr-23	16-May-23	140
CO10220	Access Roads for Transmission Line Removal	12	01-Apr-23	15-Apr-23	140
CO10054	Remove Transmission Lines	17	17-Apr-23	05-May-23	140
CO10055	Remove Substation Equipment	9	06-May-23	16-May-23	140
Copco 2 (Could Happen as Early as Pre-Drawdown Year)		88	03-Jan-23	17-Jul-23	90
Site		66	01-Apr-23	17-Jun-23	152
CO20421	Remove Misc Site Features	24	01-Apr-23*	28-Apr-23	160
CO20441	Install Permanent BMPs	20	25-May-23	17-Jun-23	138
CO2081	Copco 2 Complete	0		17-Jun-23	152
Powerhouse and Penstock Removal		88	03-Jan-23	17-Jul-23	90
CO20531	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
CO20190	Remove Penstock Steel Pipe	20	01-Apr-23*	25-Apr-23	140
CO20110	Remove Pipe Supports, Foundations, and Plugs	20	01-Apr-23	25-Apr-23	140
CO20051	Demolish Electric Equipment from Powerhouse	16	01-Apr-23*	20-Apr-23	97
CO20112	Construct Diversion Berm in Tailrace Channel	12	01-Apr-23*	15-Apr-23	121
CO20471	Remove Utilities in Powerhouse	15	01-Apr-23*	20-Apr-23	98
CO20010	Remove Right Tailrace Wingwall, Place in Tailrace	4	17-Apr-23	20-Apr-23	121
CO20053	Demolish Mechanical Equipment	24	21-Apr-23	18-May-23	97
CO20111	Install Tunnel Barriers at Portal	18	26-Apr-23	16-May-23	140
CO20113	Demo and Backfill Powerhouse	5	19-May-23	24-May-23	97
CO20114	Dewater Diversion Berm and Backfill Tailrace	12	25-May-23	08-Jun-23	97
CO20431	Remove Residential Buildings	24	19-Jun-23	17-Jul-23	138
Wood Stave Penstock Removal		33	01-Apr-23	10-May-23	145
CO2014	Remove Woodstave Penstock	10	01-Apr-23*	13-Apr-23	145
CO2016	Knock-over Concrete Saddles	10	14-Apr-23	25-Apr-23	145
CO2017	Bury Saddles and Regrade Area	5	26-Apr-23	01-May-23	145
CO2018	Install Tunnel Barriers at Portal	8	02-May-23	10-May-23	145
Transmission/Distribution		36	03-Jan-23	15-May-23	142
CO20511	PacifiCorp - Transmission/ Distribution Relocates	0		03-Jan-23*	0
CO20230	Access Roads for Transmission Line Removal	12	01-Apr-23*	17-Apr-23	142
CO20052	Remove Transmission Lines	6	17-Apr-23	24-Apr-23	142
CO20054	Remove Substation Equipment	18	24-Apr-23	15-May-23	142



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Iron Gate		171	01-Dec-22	23-Oct-23	7
Drawdown		142	01-Dec-22	19-Sep-23	36
IG2000	PacifiCorp - Drawdown to 15' Below Spillway Crest	16	01-Dec-22*	20-Dec-22	0
IG0040	Drawdown Start - Iron Gate	0	01-Jan-23		14
IG0003	Drawdown	218	03-Jan-23	19-Sep-23	84
IG2110	Drawdown Complete - Iron Gate	0		19-Sep-23	84
Access/Site Work		111	13-Jun-23	23-Oct-23	7
IG1000	Remove Misc Site Features	24	13-Jun-23	11-Jul-23	108
IG0050	Remove Buildings 1/2/3	20	13-Jun-23	07-Jul-23	88
IG1020	Install Permanent BMPs	24	15-Sep-23	13-Oct-23	53
IG3160	Reestablish Site	10	18-Sep-23	28-Sep-23	65
IG0070	Iron Gate Complete	0		23-Oct-23	45
Embankment Removal		171	01-Feb-23	23-Oct-23	7
IG0033	Re-establish Access Roads	12	01-Feb-23*	14-Feb-23	112
IG0021	Remove Sheet Pile	10	01-May-23*	11-May-23	39
IG4030	Excavate Crest down to Ele 2308 (Double Shift)	12	12-May-23*	25-May-23	39
IG0022	Excavate from Ele 2308 to Ele 2297.5 (Double Shift)	5	26-May-23*	01-Jun-23	38
IG4040	Excavate Horizontal Slice at Ele 2297.5 (Double Shift)	6	02-Jun-23	08-Jun-23	38
IG3230	Remove Power Intake Structure	15	02-Jun-23	19-Jun-23	100
IG2150	Improve Upstream Access Roads	12	02-Jun-23	15-Jun-23	100
IG0024	Excavate down to Ele 2297.5 to 2231(Double Shift)	38	09-Jun-23*	25-Jul-23	38
IG4050	Excavate Horizontal Slice at Ele 2231(Double Shift)	21	26-Jul-23*	18-Aug-23	38
IG0025	Excavate down to Ele 2231 to 2202 (Double Shift)	2	19-Aug-23*	21-Aug-23	38
IG3190	Rip Rap Breach Section	3	22-Aug-23	24-Aug-23	38
IG4010	Breach Channel Ele 2202-2172	1	25-Aug-23	25-Aug-23	38
IG4020	Breach Complete	1	26-Aug-23	26-Aug-23	38
IG0080	Install Rip Rap at Diversion Tunnel Intake Structure	5	28-Aug-23	01-Sep-23	87
IG0004	Remove Diversion Tunnel Intake Structure	15	28-Aug-23	14-Sep-23	40
IG0020	Remove Diversion Gate Structure	18	28-Aug-23	18-Sep-23	64
IG3270	Go back up to Elev 2331, Exc Elev 2331 to 2164 (Remaining Embankment)	17	28-Aug-23	16-Sep-23	38
IG3210	Restore River/ Establish Volitional Fish Passage	20	18-Sep-23	11-Oct-23	45
IG3200	Install Permanent BMPs	10	12-Oct-23	23-Oct-23	45
Powerhouse/ Fish Facility Removal (Could Happen as Early as January Drawdown Year)		118	03-Jan-23	21-Aug-23	60
IG3020	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
IG0007	Remove Fish Facility, Holding Tanks, and Mechanical	60	01-Apr-23	12-Jun-23	88
IG0061	Remove Utilities in Powerhouse	26	01-Apr-23	02-May-23	60
IG0062	Remove Hydromechanical/ Hydroelectrical Equipment	50	03-May-23	30-Jun-23	60
IG0031	Remove Penstock Steel Pipe, Supports and Foundations	32	09-Jun-23	18-Jul-23	67
IG0032	Demo Powerhouse	32	01-Jul-23	09-Aug-23	60
IG0036	Backfill Powerhouse	10	10-Aug-23	21-Aug-23	60
Transmission/Distribution		30	03-Jan-23	06-May-23	148
IG3010	PacifiCorp - Transmission/ Distribution Relocates	0		03-Jan-23*	0
IG0210	Access Roads for Removing Transmission Lines	6	01-Apr-23	08-Apr-23	118
IG0054	Remove Transmission/ Distribution Lines	12	10-Apr-23	22-Apr-23	118
IG0063	Remove Substation Equipment	12	24-Apr-23	06-May-23	148
Project Wide		131	09-Jun-23	13-Nov-23	39
PW0042	Scotch Creek Crossing (Iron Gate)	24	09-Jun-23	07-Jul-23	98
PW1074	Camp Creek Crossing (Iron Gate)	24	08-Jul-23	04-Aug-23	98



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
PW1174	Fall Creek at Daggett Rd	24	05-Aug-23	01-Sep-23	98
PW1051	Daggett Rd Bridge - Remove Temp Bridge (Copco 2)	11	24-Oct-23	04-Nov-23	45
PW1054	Dry Creek Bridge - Remove Temp Bridge Support (Copco 1)	5	01-Nov-23	06-Nov-23	39
PW1053	Fall Creek Bridge - Remove Temp Bridge Support (Copco 1)	5	07-Nov-23	13-Nov-23	39



Appendix D

Consultation Record

Consultation Record

Reservoir Drawdown and Diversion Plan				
Sub-Plan	**Agency**	**Date of Agency Plan Submittal**	**Agency Comments Received Date**	**Date of Call to Resolve Agency Comments**
Oregon Reservoir Drawdown and Diversion Plan	Oregon Department of Environmental Quality	January 20,2021	February 5, 2021	February 5,2021
	Oregon Department of Fish and Wildlife	January 20,2021	February 6, 2021	February 5,2021
California Reservoir Drawdown and Diversion Plan	California State Waterboard	January 20,2021	February 4, 2021	February 5,2021
	California Department of Fish and Wildlife	January 20,2021	Pending	February 5,2021
California Slope Stability and Monitoring Plan	California State Waterboard	January 20,2021	February 5, 2021	February 5,2021
	California Department of Fish and Wildlife	January 20,2021	Pending	February 5,2021