US Army Corps of Engineers ®
St. Paul District

Appendix I: Structural Engineering

Section 206 Continuing Authorities Program (CAP) Detailed Project Report
Kinnickinnic River
Aquatic Ecosystem Restoration and Protection Project

May 2025

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Appendix I

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1 Structural Removal Quantities

Calculations for the concrete, reinforcement, and masonry quantities at Junction Falls and Powell Falls were made using available plan sets for each site. The available drawings were not comprehensive, and various assumptions and estimations had to be made for both locations. Efforts were made to keep any necessary estimations, to a reasonable degree, conservative. The measuring tool of Bluebeam Revu, which can derive length and size estimations based on the scale of a drawing sheet, was heavily utilized for the calculations at each site.

Neither site provided sufficient data on the concrete reinforcement to determine precise steel quantities. Accordingly, as estimate of 2% rebar by concrete volume was made to estimate the amount of rebar at each location. Concrete and masonry quantities were given in cubic yards, rounded to the nearest tenth, and rebar quantities were given in tons of steel, rounded to the nearest whole number.

1.1 Junction Falls Quantities

The plan sheets utilized for the Junction Falls estimate were prepared by Ayres Associates in 1990 for a rehabilitation project at the site. The plans focus on the areas that were to be rehabbed for that project. Many details for the remaining areas were not provided. The full calculations are included as Attachment I-1 to this Appendix. The plan sheets used for estimate are included as Attachment I-2.

1.1.1 Elements, Estimates, and Assumptions

The structural elements for the Junction Falls quantities included the primary spillway, the left and right abutments and wingwalls/retaining walls, the upstream parapet walls, the penstock, and the powerhouse building. The powerhouse building is comprised of a concrete base with a masonry section on top.

Notable estimates and assumption for the Junction Falls quantities include the following:

- For the abutments and wingwalls/retaining walls, an average width often had to be estimated as it was not clearly shown how far into the earthen embankments the elements extend.
- The depth of the upstream parapet walls had to be estimated as no values were provided in the plans.
- Most dimensions for the penstock had to be estimated, as only a very approximate cross section and layout is shown on the plans.
- No information was provided for the brick portion of the powerhouse building so all dimensions had to be estimated based on the values of the underlying concrete portion.
- There is an additional masonry building downstream of the powerhouse, approximately at the water level. No information was provided for this structure. A conservative estimate of 75% of the masonry quantity for the powerhouse was made for this structure.

1.1.2 Results

The structural quantities for Junction Falls were estimated to be 3,583.1 cubic yards of concrete, 471 tons of steel reinforcing, and 19.6 cubic yards of masonry. The results for the concrete, broken down by element, are summarized in **Table 1**, below.

Table 1: Junction Falls Concrete Quantities Summary

Element	Quantity ($yd.^3$)
Spillway	2192.1
Left Abutment/Wingwall	200.1
Right Abutment	685.0
Upstream Parapet Walls	101.6
Penstock	140.7
Right Retaining Wall	72.2
Powerhouse	191.4
Total	**3583.1**

1.2 Powell Falls Quantities

The plan sheets utilized for the Powell Falls estimate were developed by Ayres Associates for a 1992 rehabilitation at the site. Additionally, photos were used from a 2021 Decommissioning Plan also developed by Ayres Associates. The plans focus on the areas that were to be rehabbed for that project. Many details for the remaining areas were not provided. The full calculations are included as Attachment I-3 to this Appendix. The plan sheets used for estimate are included as Attachment I-4.

1.2.1 Elements, Estimates, and Assumptions

The structural elements for the Junction Falls quantities included the spillway, abutments, wingwalls, wasteway, intake bay, tailrace, and powerhouse.

Notable estimates and assumption for the Junction Falls quantities include the following:

- Cross sections of the right and left abutments are not shown on the plans. The abutments were conservatively assumed to have a rectangular cross section that extends out as far as the abutting spillway cross section.

- Cross sections of the wasteway wingwalls were not provided and had to be estimated.

- The upstream wasteway wingwall was not shown on any of the plan sheets. It was estimated from photos to be 75% of the volume of the downstream right wasteway wingwall.

- The layout of the floors on the downstream section of the powerhouse is difficult to assess from the given plans and photos. Conservative assumptions were made in the estimate of these concrete quantities.

- Assumptions had to be made when quantifying how much of the powerhouse walls are brick and how much of the walls are concrete blocks.

- The top and bottom elevations of the tailrace are not specified and had to be assumed.

- The abutment/retaining wall on the east side of the intake bay is not accounted for in the drawings. The length and thickness of this wall is not known, and sufficient photos are not available to make a proper estimate. To account for this structure and possible additional concrete features such as retaining walls not shown in the available drawings, an additional 30 cubic yards was added to the concrete estimate.

1.2.2 Results

The structural quantities for Junction Falls were estimated to be 1,354.1 cubic yards of concrete, 178 tons of steel reinforcing, and 14.0 cubic yards of masonry. The results for the concrete, broken down by element, are summarized in Table 2, below.

Table 2: Powell Falls Concrete Quantities Summary

Element	Quantity (yd.^{3})
Main Spillway and Abutments/Wingwalls	1012.7
Wasteway, Intake Bay, and Tailrace	177.7
Powerhouse	133.7
Miscellaneous Additional Concrete	30.0
Total	**1354.1**

2 Winter Street Bridge Concrete Footing Addition

There is concern that dewatering and removal of Junction Falls Dam may lead to scour of the Winter Street Bridge piers, which are located just upstream of the dam. Additional analysis on this potentiality is recommended for the Pre-construction, Engineering, and Design (PED) phase.

The as-built plans for Winter Street Bridge call out a 9-foot-thick foundation seal. In theory, this seal should provide a good contact between the rock and the bridge pier foundation. However, the condition of the seal and its effectiveness is currently unknown. It is assumed that the normal water level will be roughly one foot deep when the area is dewatered. After removal of Junction Falls Dam, sediment should be removed from around the bridge pier foundation and an inspection and an assessment of the conditions completed.

One possibility being considered is to add a triangular concrete wedge around the perimeter of the footing to improve the seal and protect the adjacent bedrock. The contractor would have to clear any remaining sediment away from the bridge footing before placing the concrete. After the concrete is added, rock scour protection would be placed above and around the triangular concrete wedge at the footing. A scour evaluation is recommended during the design phase to design scour protection at the Winter Street Bridge pier.

2.1 Concrete Addition Quantities

Calculations were completed to estimate the concrete and rebar quantities for the potential concrete addition at the Winter Street Bridge footing. An estimate of 2% rebar to concrete volume was made. These calculations can be found in Appendix Attachment I-5. Additionally, relevant as-built drawings for the bridge can be found in Appendix Attachment I-6.

2.1.1 Results

The calculations conservatively estimated a concrete quantity of 20 cubic yards and a rebar quantity of 2.6 tons for the Winter Street Bridge footing addition.

3 2021 Ayres Powell Falls Decommissioning Report

A decommissioning plan was prepared by Ayres Associates for Powell Falls and detailed in a 2021 report, written for the City of River Falls. The report details a removal and restoration plan for Powell Falls, including construction methodology, sequencing, and schedule. Annotated drawings from this report are attached to this appendix as Attachment I-7. The full report can be found at the following link:
https://www.rfmu.org/DocumentCenter/View/4316/Powell-Falls-Decommissioning-Plan_Ayres20210130

4 2017 Inter-Fluve Dam Removal Feasibility Report

A feasibility report was written by Inter-Fluve in 2017 for Friend of the Kinni regarding restoration of the Kinnickinnic River through dam removal. This report includes detailed proposals for dam access, dewatering, and removal for both Junction Falls and Powell Falls. These sections of the report are included as Attachment I-8 to this appendix.

5 List of Attachments

Attachment I-1: Junction Falls Quantity Calculations
Attachment I-2: Junction Falls Drawings
Attachment I-3: Powell Falls Quantity Calculations
Attachment I-4: Powell Falls Drawings
Attachment I-5: Winter Street Bridge Concrete Footing Addition Calculations
Attachment I-6: Winter Street Bridge Relevant Drawings
Attachment I-7: 2021 Ayres Powell Falls Decommissioning Report
Attachment I-8: Excerpt from 2017 Inter-Fluve Dam Removal Feasibility Report

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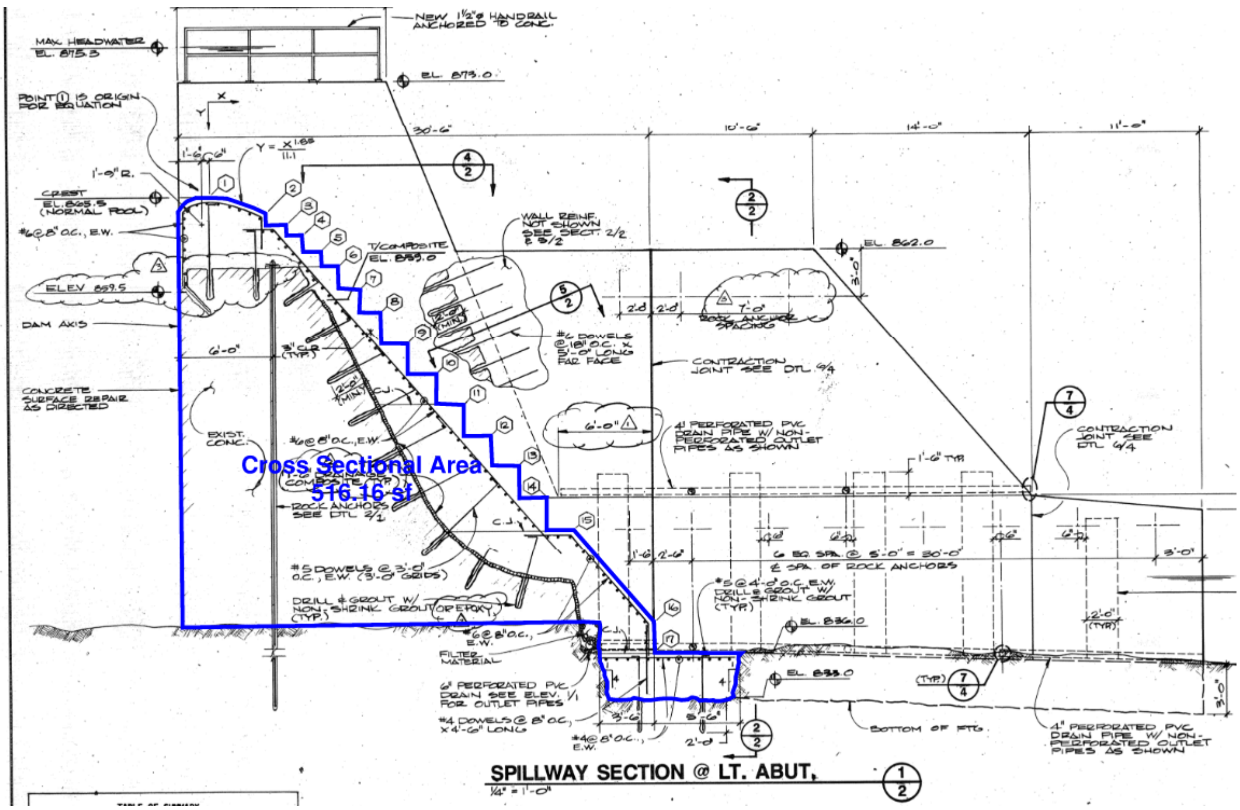
Attachment I-1: Junction Falls Quantity Calculations

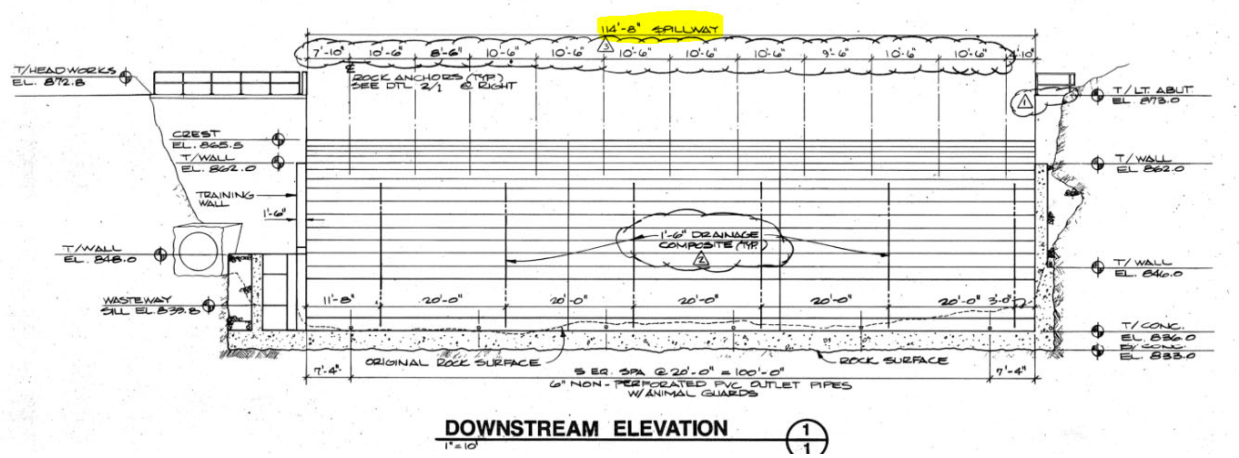
Section 206 Continuing Authorities Program (CAP) Detailed Project Report
Kinnickinnic River
Aquatic Ecosystem Restoration and Protection Project

Junction Falls Quantity Estimate Calculations

Concrete Quantities

Spillway



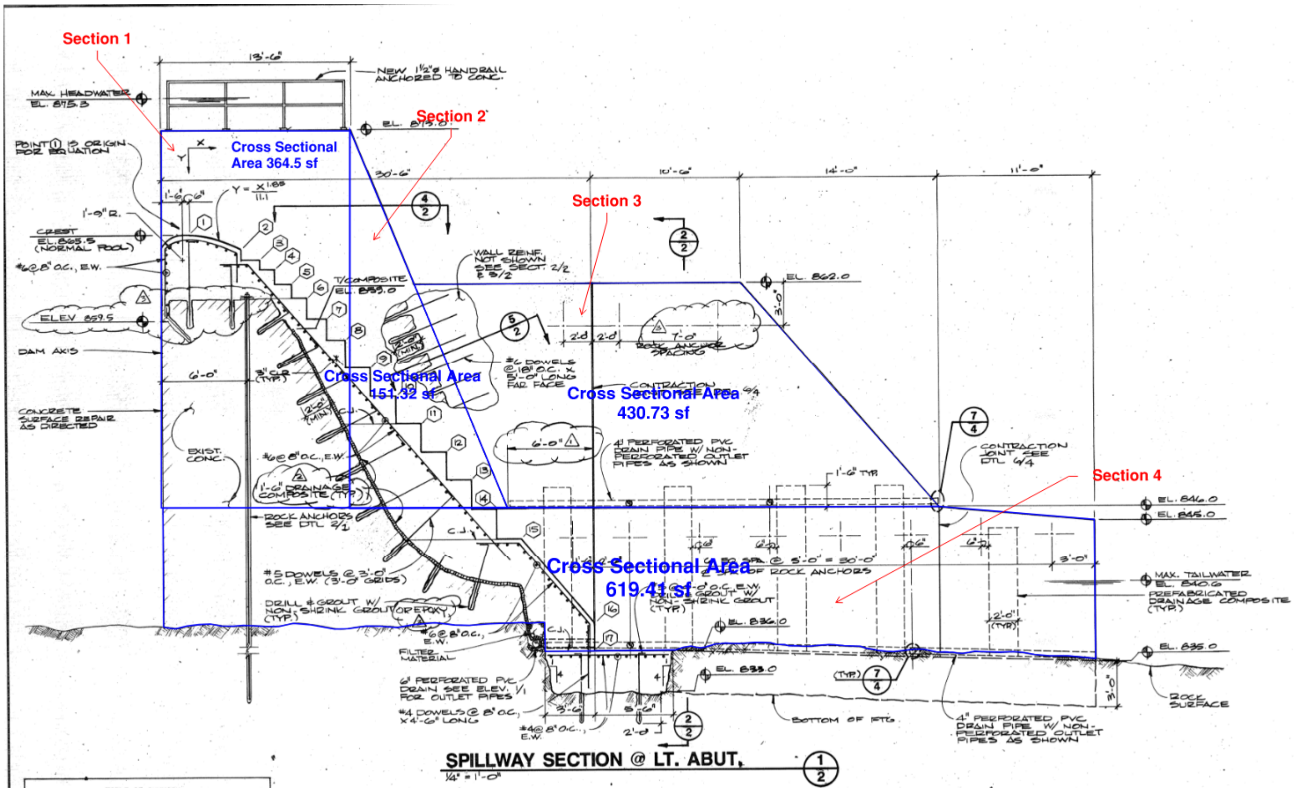


Spillway cross sectional area, estimated using Bluebeam Revu: 516.16 sf.

Length, given in downstream elevation view drawing: 114’-8” = 114.66 ft.

Volume = 516.16 sf x 114.66 ft. = 59186.3 cf = 2192.1 cy

Left Abutments/Wingwall/Retaining Wall



Section 1:

Cross Sectional Area (calculated using given widths and elevations) = 364.5 sf

Width of abutment varies. Estimate average of 4 feet.

Volume = 364.5 sf x 4 ft = 1485 cf = 54 cy

Section 2:

Cross Sectional Area, estimated using Bluebeam Revu set to scale of drawings = 151.32 sf

Width of abutment varies. Estimate average of 4.0 feet wide.

Volume = 151.32 x 4.0 ft = 605.28 cf = 22.4 cy

Section 3:

Cross Sectional Area, estimated using Bluebeam Revu set to scale of drawings = 430.73 sf

Upper Wingwall/retaining wall width given as 2 ft.

Volume = 430.73 sf x 2 ft = 861.46 cf = 31.9 cy

Section 4:

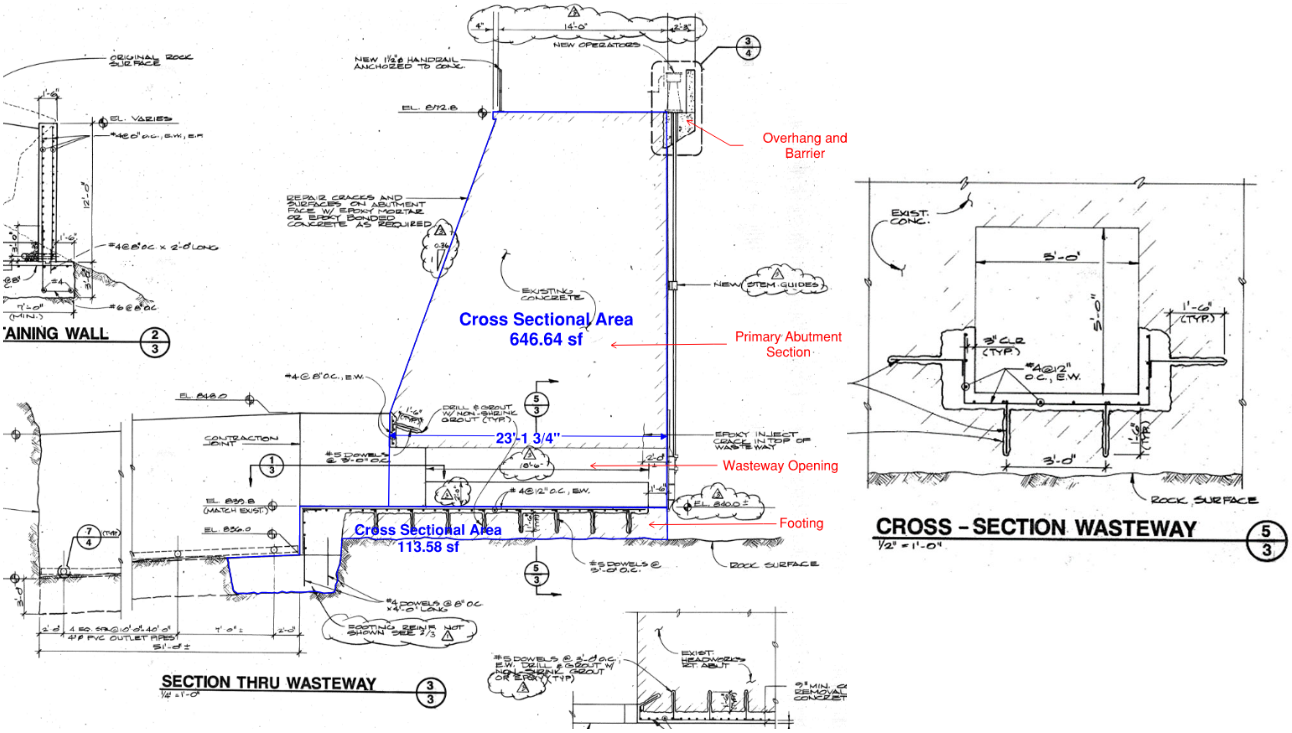
Cross Sectional Area, estimated using Bluebeam Revu set to scale of drawings = 619.41 sf

Lower Wingwall/retaining wall width varies. Estimate 4 ft. average.

Volume = 619.41 sf x 4 ft = 2477.6 cf = 91.8 cy

Total Left Abutment + Wingwall Concrete Estimate = 54 + 22.4 + 31.9 + 91.8 = 200.1 cy

<u>Right Abutment</u>



Primary Abutment Section:

Cross Sectional Area, estimated using Bluebeam Revu set to scale of drawings = 646.64 sf

Width of abutment variers, use approximate average width of 24.8 ft.

Volume = 646.64 x 24.8 ft = 16036.7 cf = 594.0 cy

Subtract out wasteway:

Cross Section = 5 ft x 5 ft = 25 sf

Length = 23.146 ft

Volume = 25 sf x 23.146 ft = 578.65 cf = 21.4 cy

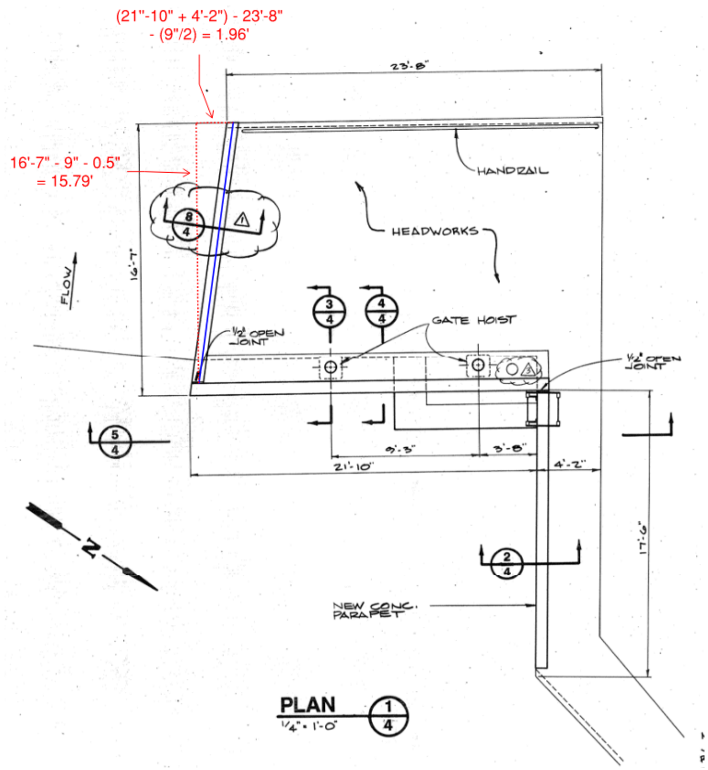
Primary Abutment Section Volume = 594 cy – 21.4 cy = 572.6 cy

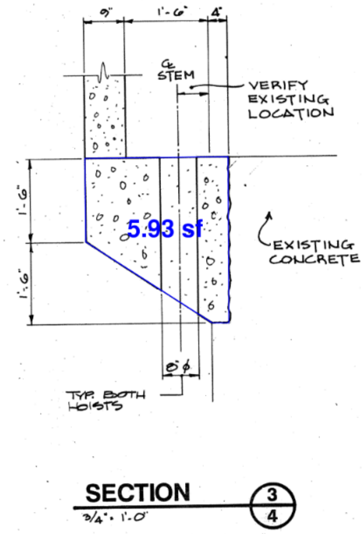
Footing:

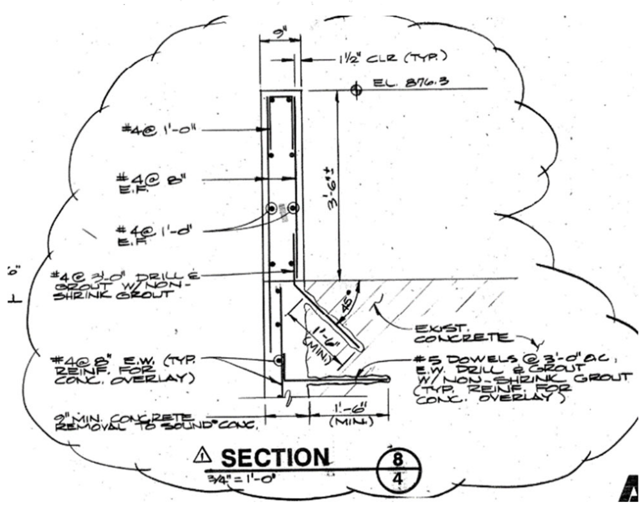
Cross Sectional Area, estimated using Bluebeam Revu set to scale of drawings = 113.58 sf

Width at primary abutment section = 24.8 ft.

Volume = 113.58 sf x 24.8 ft = 2817 cf = 104 cy







South Concrete Barrier:

Cross Sectional Area = 0.75 ft width x 3.5 ft height = 2.625 sf

Calculate Length: sqrt(1.96’^2 + 15.79’^2) = 15.91 ft

Volume = 2.625 sf x 15.91 ft = 41.76 cf = 1.5 cy

East Concrete Overhang and Barrier:

Overhang Cross Sectional Area, estimated using Bluebeam = 5.93 sf

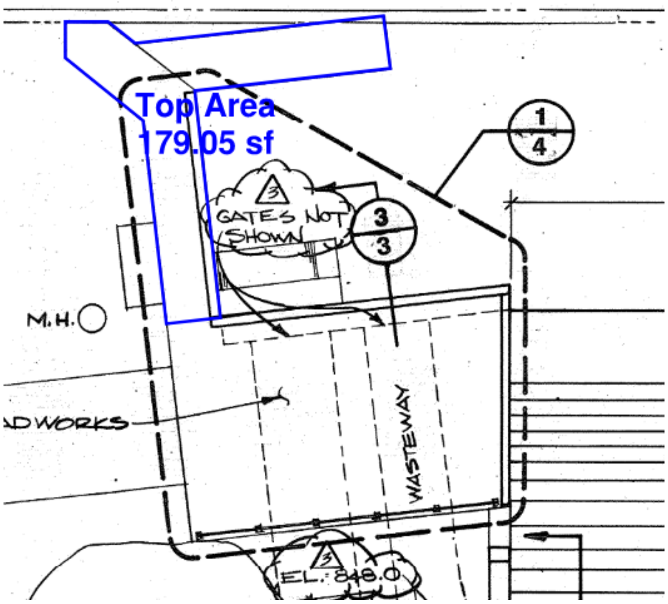
Barrier Cross Sectional Area = same as South Concrete Barrier = 2.625 sf

Length = 21’-10” = 21.83 ft

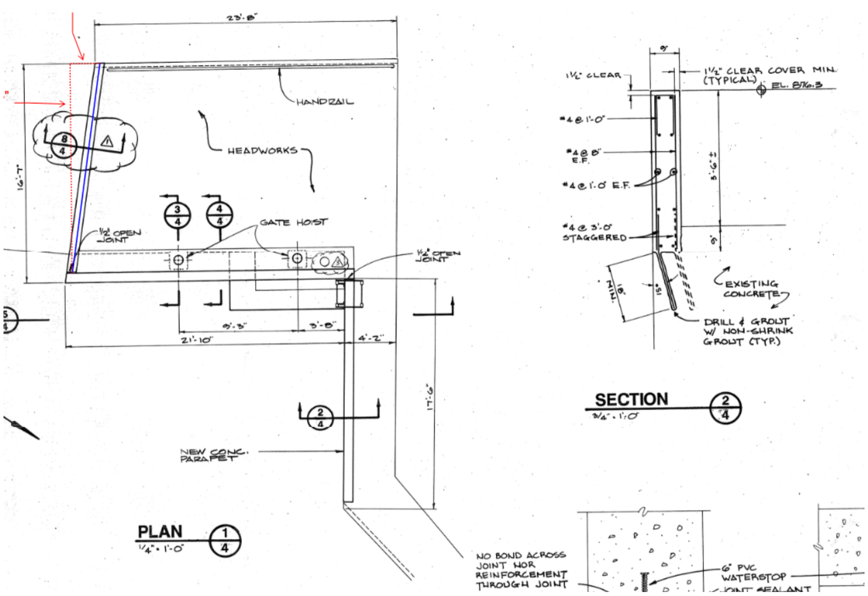
Volume = (5.93 sf + 2.625 sf) * 21.83 ft = 186.76 cf / 27 = 6.9 cy

Total Right Abutment Volume with barriers = 572.6 + 104 + 1.5 + 6.9 = 685.0 cy

Upstream Parapet Walls



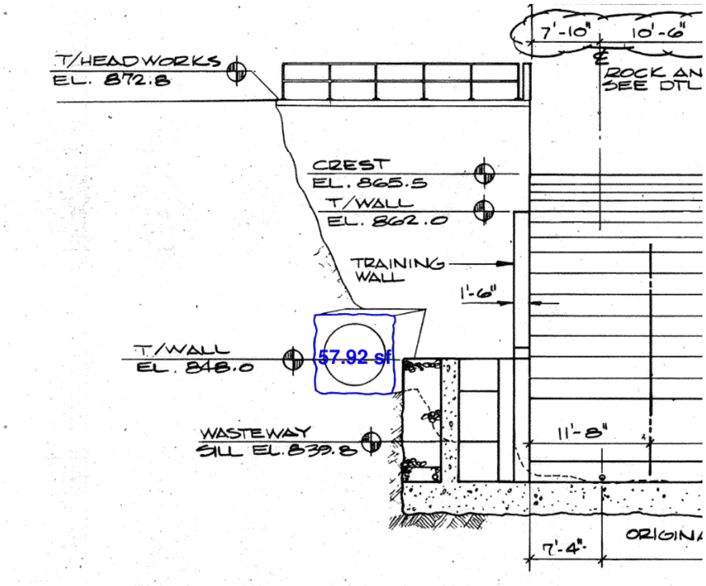
Upstream Parapet Wall:
Top Area (estimated using Bluebeam Revu) = 179.05 sf
Depth of wall not given. Estimate = 15 ft
Volume = 179.05 sf x 15 ft = 2685.75 cf = 99.5 cy

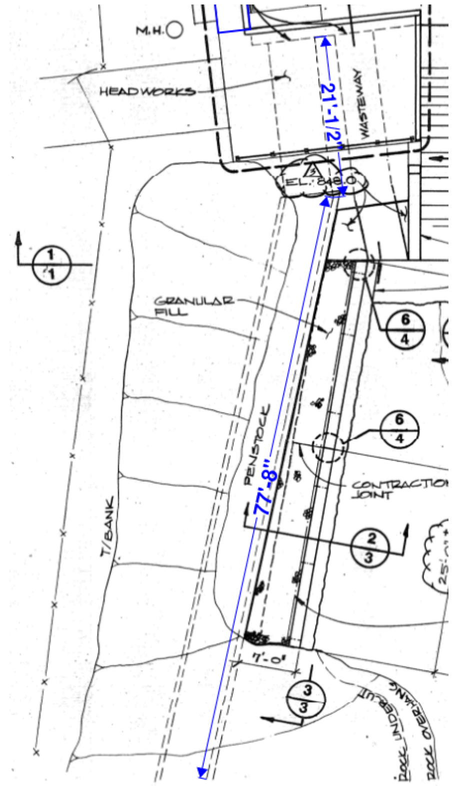


Upstream parapet wall barrier:
Cross Sectional Area = 0.75 ft x 4.25 ft = 3.19 sf
Length = 17.5 ft
Volume = 3.19 sf x 17.5 ft = 55.83 cf = 2.1 cy

Total Parapet Wall Volume = 99.5 cy + 2.1 cy = 101.6 cy

<u>Penstock</u>





Little information given for penstock.

Outside Concrete Cross Sectional Area (roughly estimated from Bluebeam Revu): 57.92 sf

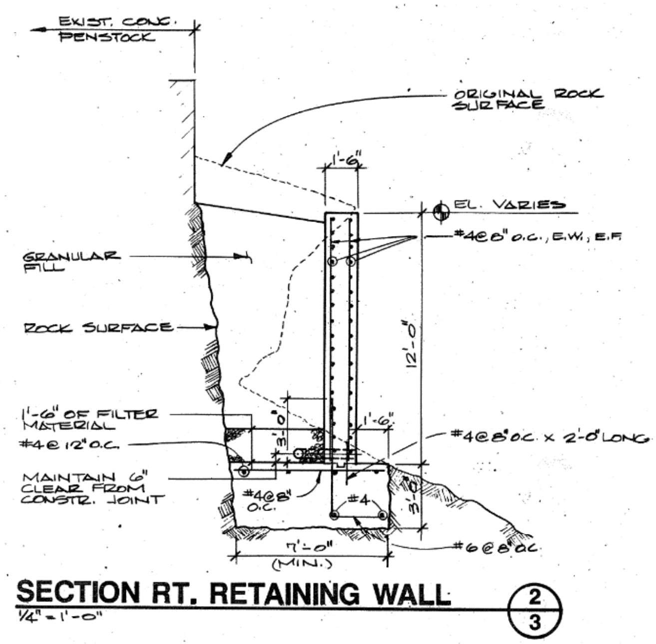
Inside Opening Cross Sectional Area: Inner diameter given as 5 ft., A = pi x 2.5^2 = 19.63 sf

Net Concrete Cross Sectional Area = 57.92 ft – 19.63 ft = 38.29 sf

Length (roughly estimated from Bluebeam Revu): 21.5 ft + 77.67 ft = 99.2 ft

Volume = 38.29 sf x 99.2 ft = 3798.4 sf / 27 = 140.7 cy

Right Retaining Wall



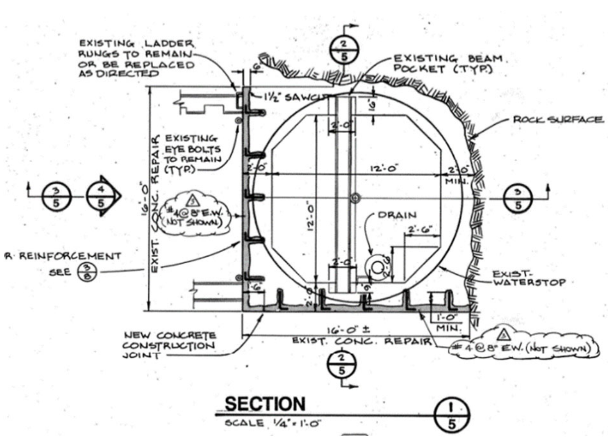
Cross Sectional Area: Top = 1.5 ft x 12 ft = 18 sf

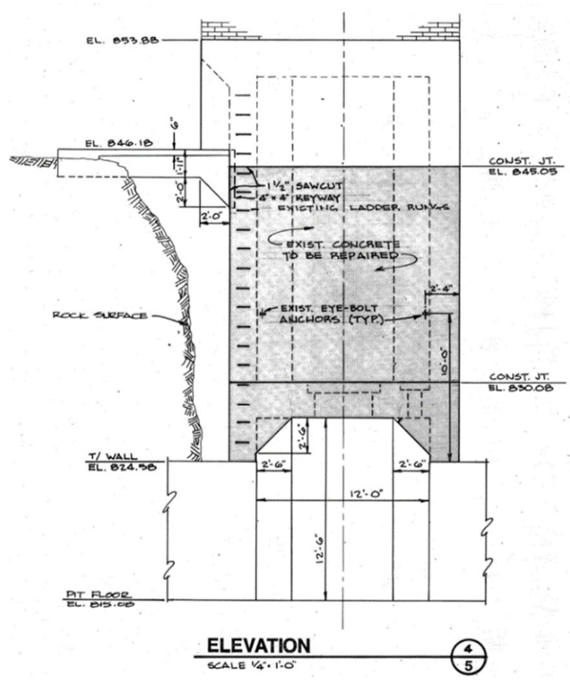
Bottom = 7 ft (minimum) x 3 ft = 21 sf

Length = given in plans = 50 ft

Volume = (18 sf + 21 sf) * 50 ft = 1950 cf = 72.2 cy

Powerhouse





Powerhouse footprint given as 16 ft. x 16 ft.

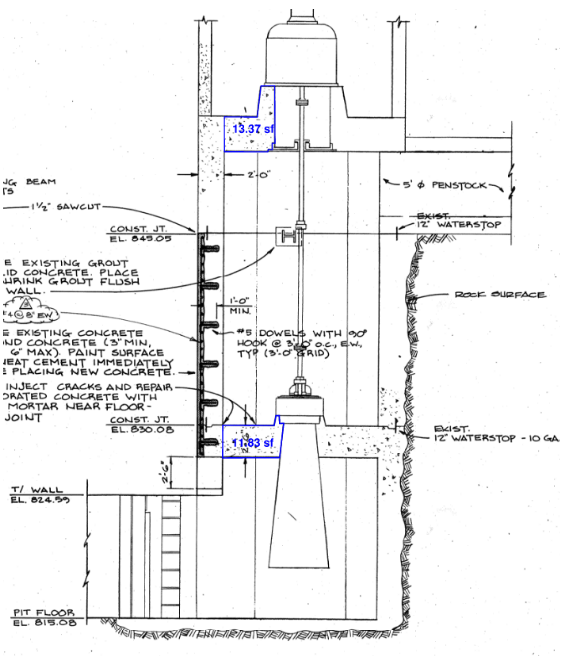
Width of walls given as 2 ft (minimum)
Height of concrete portion of building given as 38.8 ft
Cross Sectional Area of walls = 2*(16’ x 2’) + 2*[(16’-2’-2’) x 2’] = 112 sf
Volume of walls (neglecting openings) = 112 sf * 38.8 ft = 4345.6 sf = 160.9 cy

Outlet opening:
Calculate Cross Sectional Area with dimensions given in plans = (12.5’ x 12’) – 2*(0.5 x 2.5’ x 2.5’) = 143.75 sf
Width = 2 ft
Volume of opening = 143.75 sf x 2 ft = 287.5 cf = 10.6 cy

Penstock opening:
Given 5 ft diameter and 2 ft width
Volume = 2 ft x (pi x 2.5^2) = 39.26 cf = 1.5 cy

Subtract openings from wall volume = 160.9 cy – 10.6 cy – 1.5 cy = 148.8 cy

Base Concrete Area: 12 ft x 12 ft = 144 sf
Assume 2 ft thickness
Base concrete volume = 144 sf x 2 ft = 288 cf = 10.7 cy



SECTION
SCALE ¼"=1'-0"

Additional Powerhouse concrete:
Lower support cross sectional area (estimated using Bluebeam Revu): 11.83 sf x 2 = 23.66 sf
Length = 16 ft – 2*(2 ft wall width) = 12 ft

Volume = 23.66 sf x 12 ft = 283.92 cf = 10.5 cy

Upper support cross sectional area (estimated using Bluebeam Revu): 13.37 sf x 2 = 26.74 sf
Length = 16 ft – 2*(2 ft wall width) = 12 ft
Volume = 26.74 sf x 12 ft = 320.88 cf = 11.9 cy
Total additional powerhouse concrete = 10.5 cy + 11.9 cy = 22.4 cy

Roof over top of masonry appears to be concrete:
Assume 1 ft thickness
Volume = 16 ft x 16 ft x 1 ft = 256 cf / 27 = 9.5 cy

Total powerhouse concrete estimate = 148.8 cy + 10.7 cy + 22.4 cy + 9.5 cy = 191.4 cy

Concrete Quantities Summary
Spillway: 2192.1 cy
Left Abutment/Wingwall: 200.1 cy
Right Abutment: 685.0 cy
Upstream Parapet Walls: 101.6 cy
Penstock: 140.7 cy
Right Retaining Wall: 72.2 cy
Powerhouse: 191.4 cy

Total Junction Falls Concrete Estimate = 3583.1 cy

Rebar
Reinforcement details for the existing concrete in the drawing set is not provided. Accordingly, a detailed rebar steel estimate cannot be made. An estimate of 2% rebar volume by concrete will be made. Assume A615 steel.
Rebar Volume Estimate: 3583.1 cy x 2% = 71.66 cy
A615 Steel Unit Weight: 0.282 lb/in^3 = 13157 lb/yd^3
Rebar Weight Estimate = 71.66 cy x 13157 lb/yd^3 = 942857 lbs. = **471 tons**

Masonry

Powerhouse masonry estimate:

No dimensions given for top masonry portion of powerhouse

Assume 0.5 ft wall width, 10 ft height

16 ft x 16 ft dimensions

Cross Sectional Area of walls = 2*(16' x 0.5') + 2*[(16'-0.5'-0.5') x 0.5'] = 31 sf

Volume of walls (neglecting windows) = 31 sf * 10 ft = 310 cf = 11.5 cy

Assume cross sectional area of windows = 1.5 ft x 2.5 ft = 3.75 sf

Volume = 3.75 sf x 0.5 ft x 4 windows = 7.5 sf = 0.3 cy

Subtract wall openings:

Volume of walls = 11.5 cy – 0.3 cy = 11.2 cy

Additional river-level masonry structure (river-level):

The additional masonry structure located roughly river-level is not found in the drawings. The quantity of masonry for this structure was conservatively estimated to be 75% of the quantity for the powerhouse masonry section.

Additional masonry structure estimate: 75% x 11.2 cy = 8.4 cy

Total Masonry Estimate = 11.2 cy + 8.4 cy = 19.6 cy

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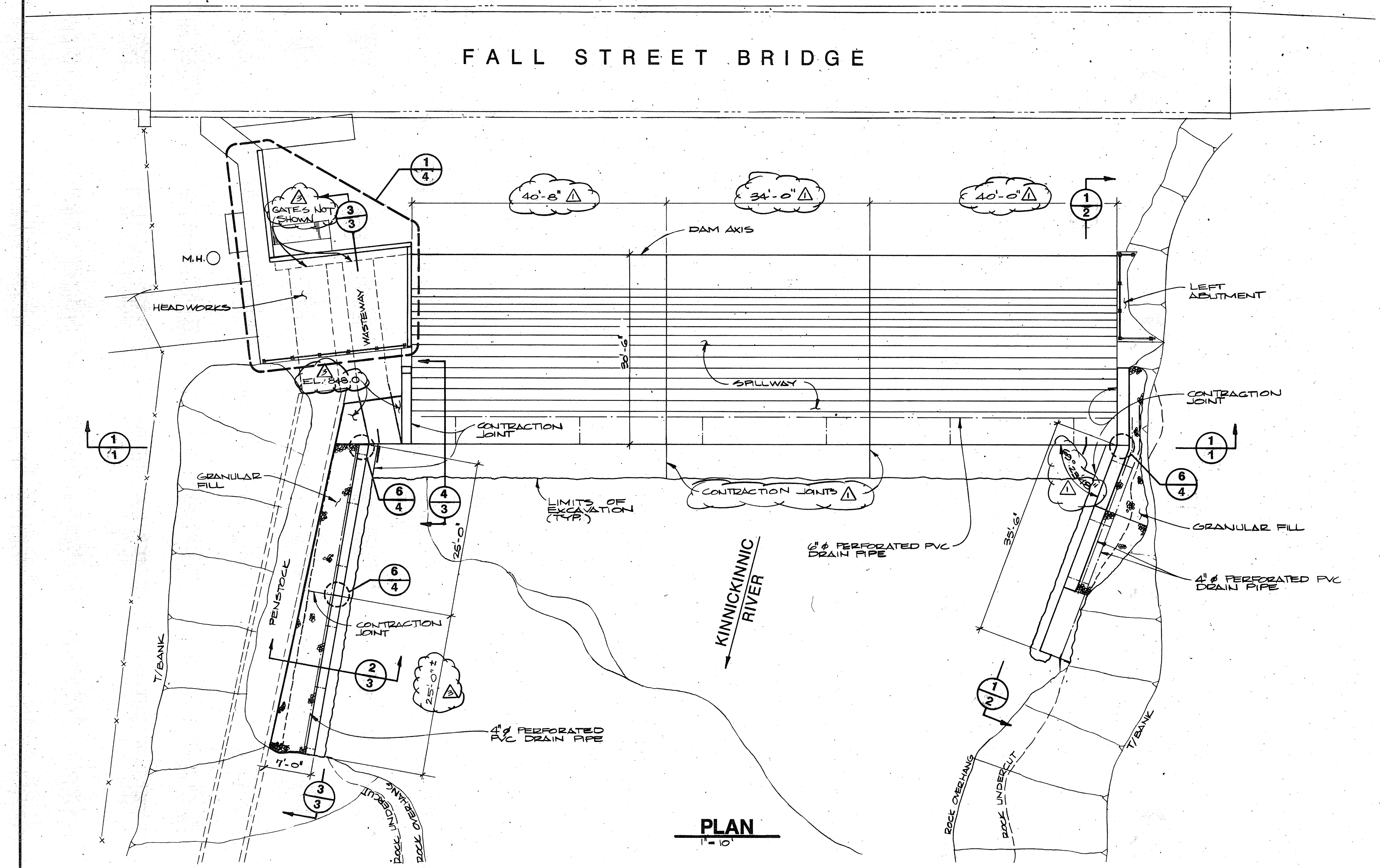
St. Paul District

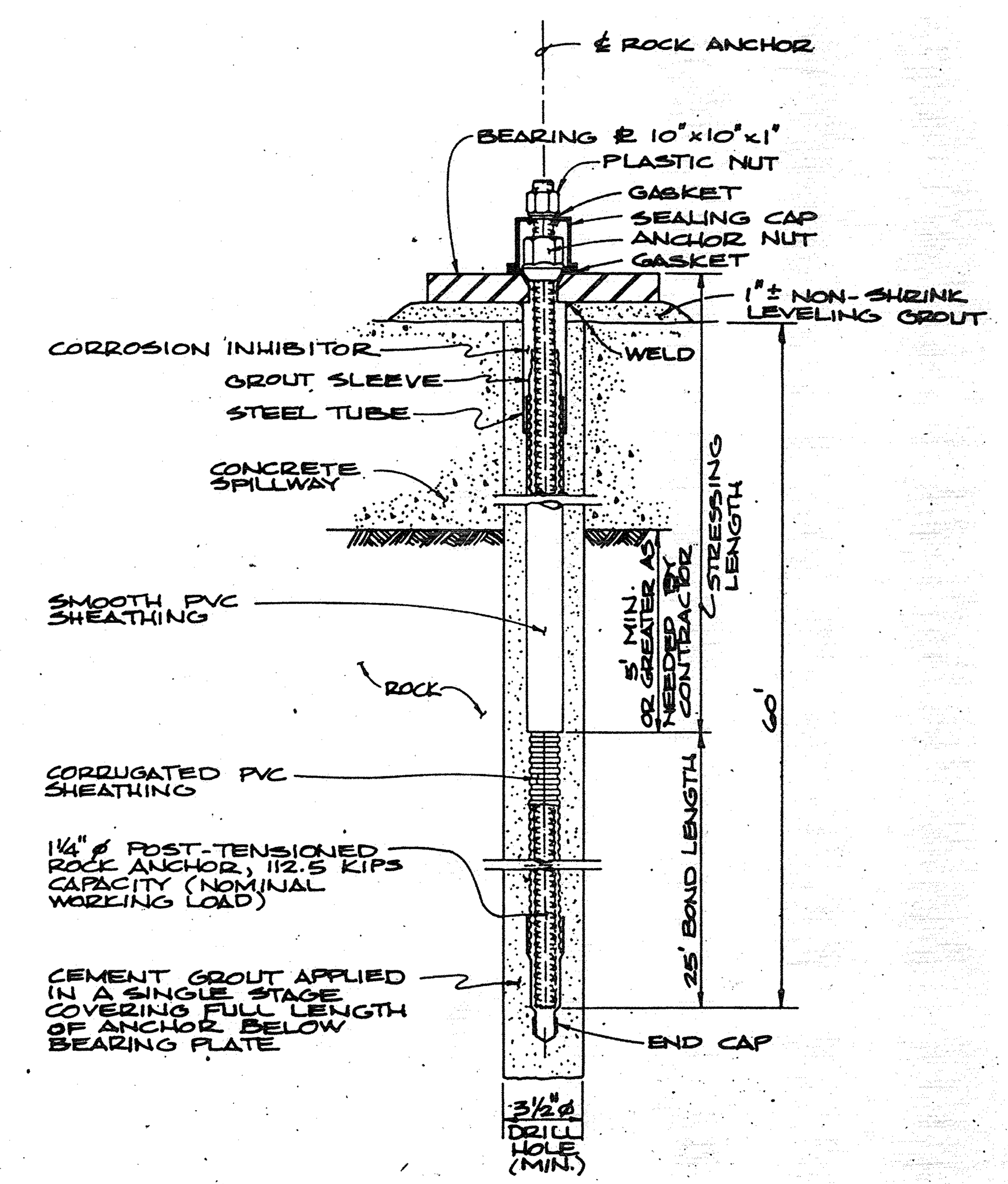
Attachment I-2: Junction Falls Drawings

Section 206 Continuing Authorities Program (CAP) Detailed Project Report
Kinnickinnic River
Aquatic Ecosystem Restoration and Protection Project

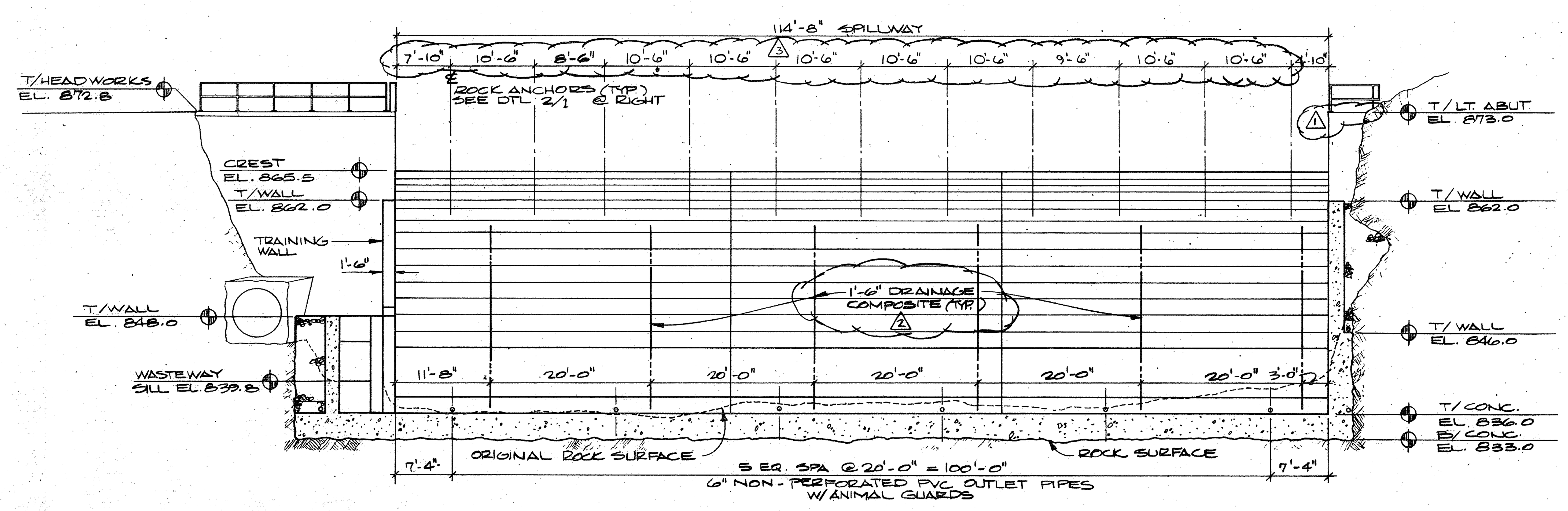


GENERAL NOTES

1. VERTICAL DATUM BASED ON USC&GS DISK (BM 411-A) MARKED "RAILROAD COMMISSION OF WIS." SET IN THE TOP OF THE HIGH POINT OF A ROCK LEDGE AT THE JUNCTION OF THE KINNICKINNIC AND SOUTH FORK ON THE LEFT BANK OF THE KINNICKINNIC AND THE RIGHT BANK OF THE SOUTH FORK, EL 867.176 FEET MSL.
2. EXISTING STRUCTURE DIMENSIONS DEVELOPED FROM DRAWINGS ENTITLED "PLAN OF UPPER CITY DAM ACROSS KINNICKINNIC RIVER OF RIVER FALLS, WIS.", SHEET 1 THROUGH 4, L.P. WOLFF-CONSULTING ENGINEER, GEO M. SHEPARD, ASSOCIATE, MAY 1920, ST. PAUL, MINN. AND "UPPER HYDROELECTRIC PLANT IMPROVEMENTS, PLANS AND DETAILS," HERMAN T. HAGESTAD, CONSULTING ENGINEER, AUG 1946, 2 SHEETS. STRUCTURAL DIMENSIONS AND ELEVATIONS MAY DIFFER FROM THOSE DRAWINGS BASED ON FIELD MEASUREMENTS TAKEN.
3. SECTION IDENTIFICATION — SECTION NUMBER / SHEET WHERE SECTION IS SHOWN.



TYPICAL ROCK ANCHOR DETAIL
NO SCALE



DOWNSTREAM ELEVATION
1" = 10'

3	REVISED 1/16/90	
2	REVISED 9/14/89	
1	REVISED 9/8/89	

This drawing is a part of the application for license made by the undersigned

this 6 day of April, 1990.

By: Jerry E. Wilkens

Jerry E. Wilkens, Mayor
City of River Falls, Wisconsin

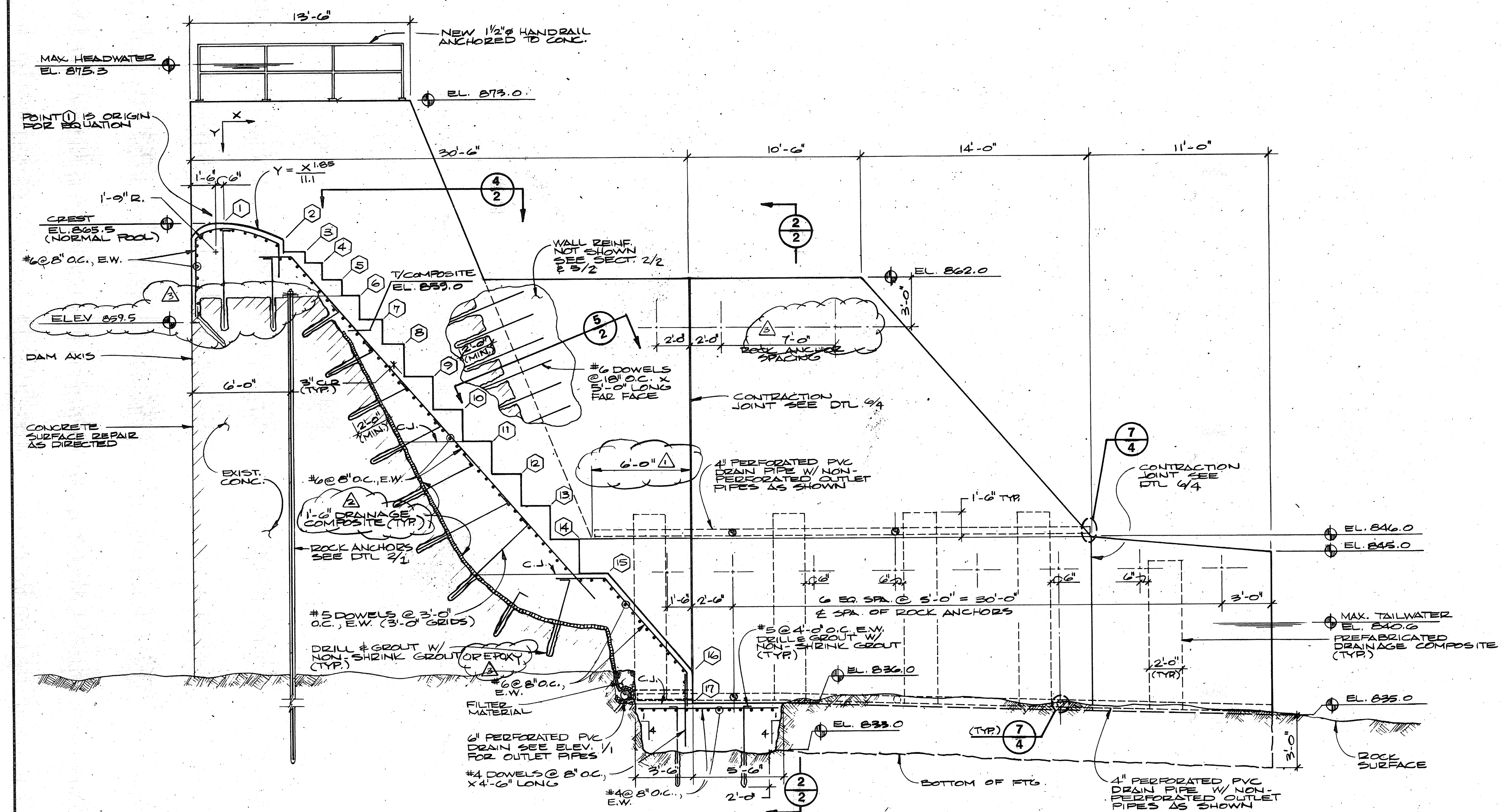
AYRES ASSOCIATES
Engineers / Architects
Planners / Surveyors
Owen Ayres & Associates Inc
Eau Claire, Wisconsin

EXHIBIT F-10 PROJECT NO. 10489 SHEET 1 OF 5

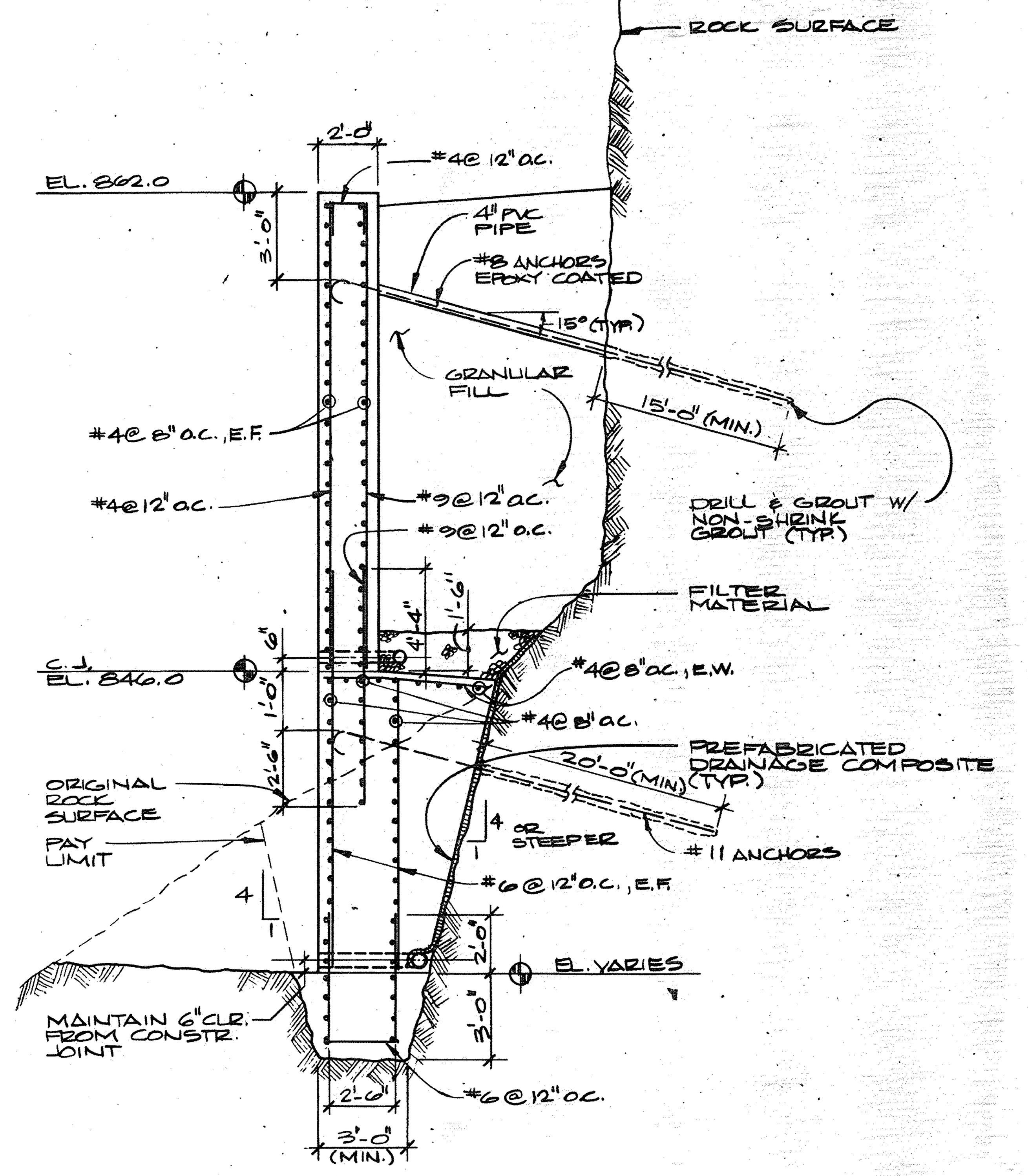
RIVER FALLS MUNICIPAL HYDROELECTRIC FACILITIES
CITY OF RIVER FALLS, WISCONSIN

JUNCTION FALLS DAM

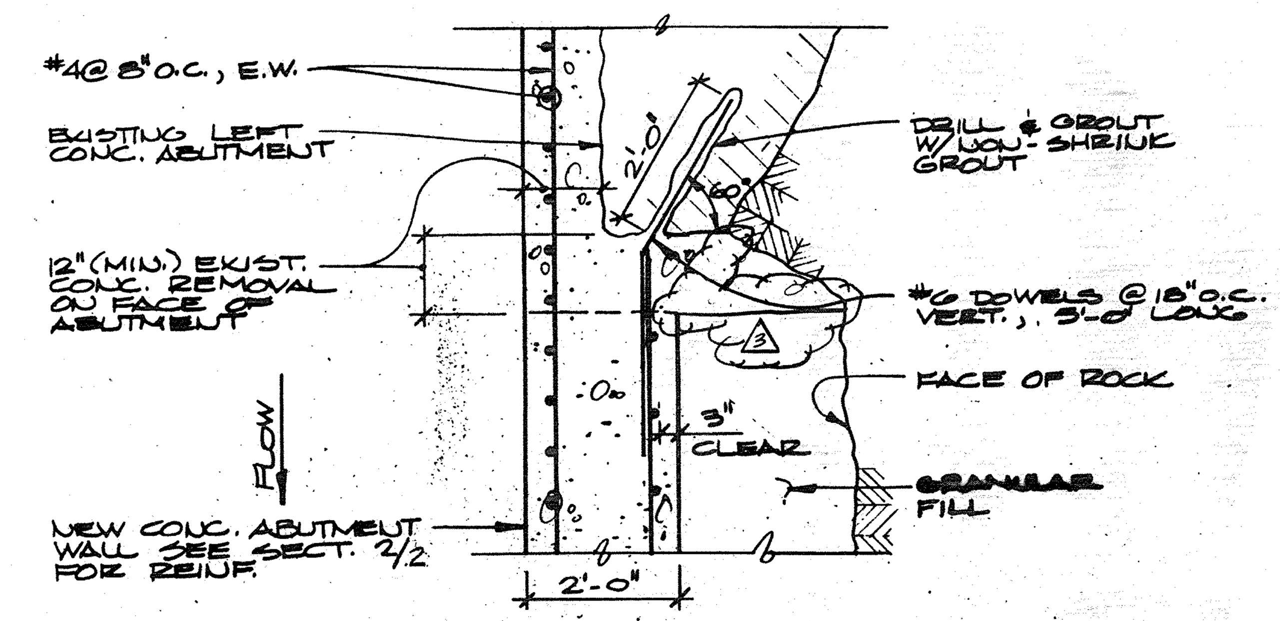
REHABILITATION
DAM PLAN & ELEVATION
SCALE: AS SHOWN



SPILLWAY SECTION @ LT. ABUT. (1/2)
1/4" = 1'-0"



LT. RETAINING WALL SECTION (2/2)
1/4" = 1'-0"



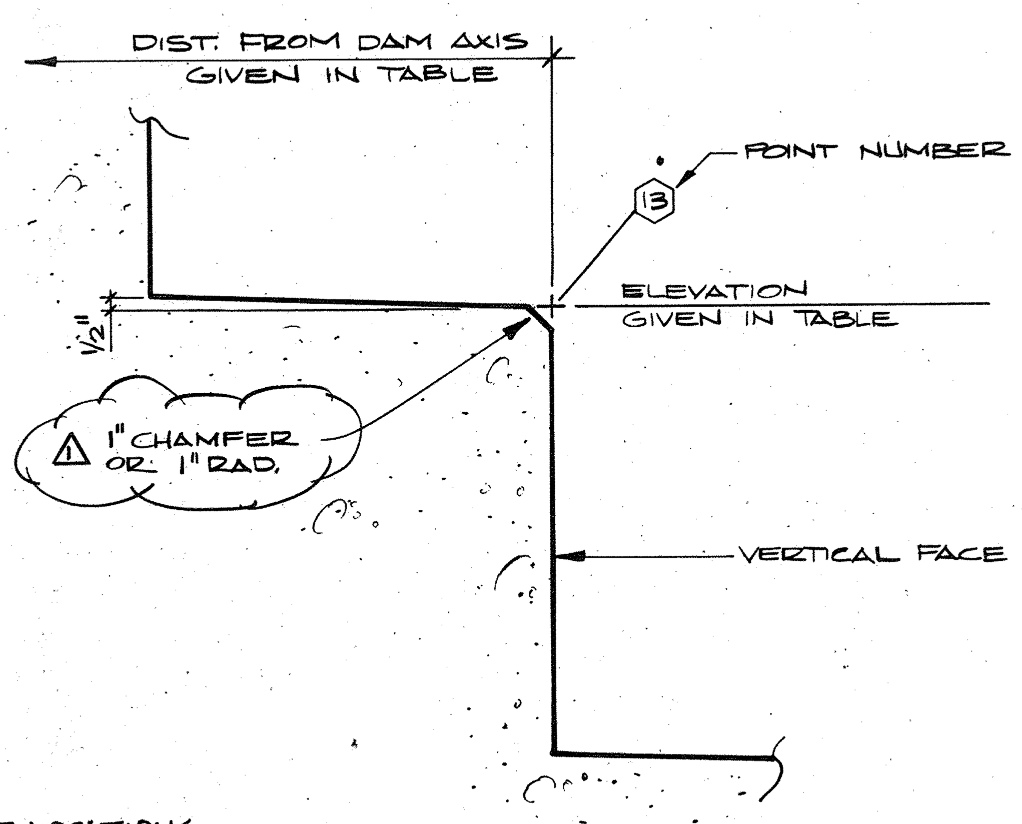
SECTIONAL PLAN

LEFT ABUTMENT WALL EXTENSION (5/2)
1/2" = 1'-0"

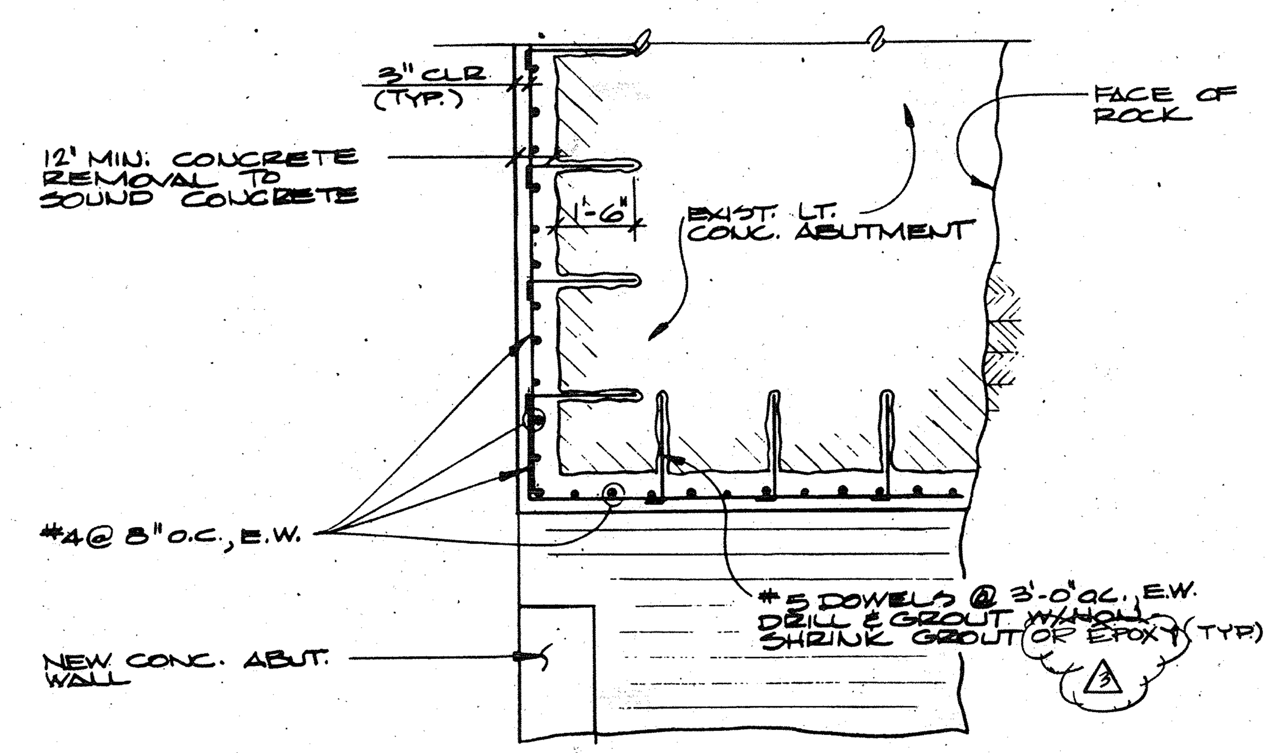
TABLE OF SUMMARY CREST DIMENSIONS

LOCATION	DISTANCE FROM DAM AXIS	ELEVATION
1	2'-0"	865.50
2	5'-8"	864.50
3	6'-11-1/2"	863.75
4	8'-0-1/2"	863.00
5	9'-2-3/4"	862.00
6	10'-3-1/2"	861.00
7	11'-8-1/4"	859.50
8	13'-0"	858.00
9	14'-9"	856.00
10	16'-6"	854.00
11	18'-3"	852.00
12	20'-0"	850.00
13	21'-9"	848.00
14	23'-6"	846.00
15	25'-3"	844.00
16	30'-6"	838.00
17	30'-6"	836.00

NOTE: FOR POINT LOCATIONS SEE DETAIL AT RIGHT



POINT LOCATION DETAIL (3/2)
1 1/2" = 1'-0"



SECTIONAL PLAN

LEFT ABUTMENT CONCRETE OVERLAY (4/2)
1/4" = 1'-0"

3	REVISED 1/16/90
2	REVISED 9/14/89
1	REVISED 9/8/89

This drawing is a part of the application for license made by the undersigned this 6 day of april, 1990.
By: Jerry E. Wilkens
Jerry E. Wilkens, Mayor
City of River Falls, Wisconsin

AYRES ASSOCIATES
Engineers / Architects
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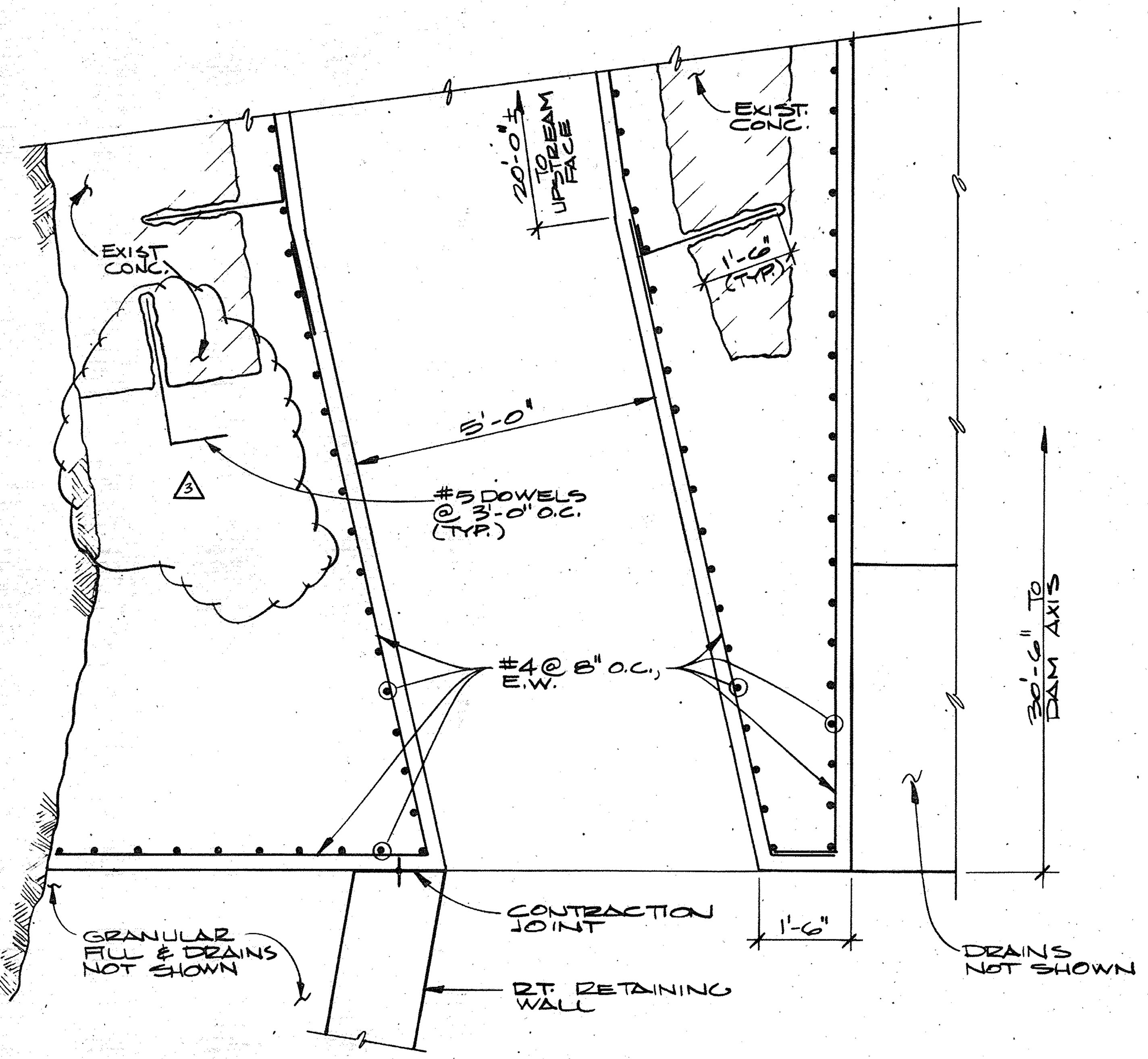
EXHIBIT F-11 PROJECT NO. 10489 SHEET 2 OF 5

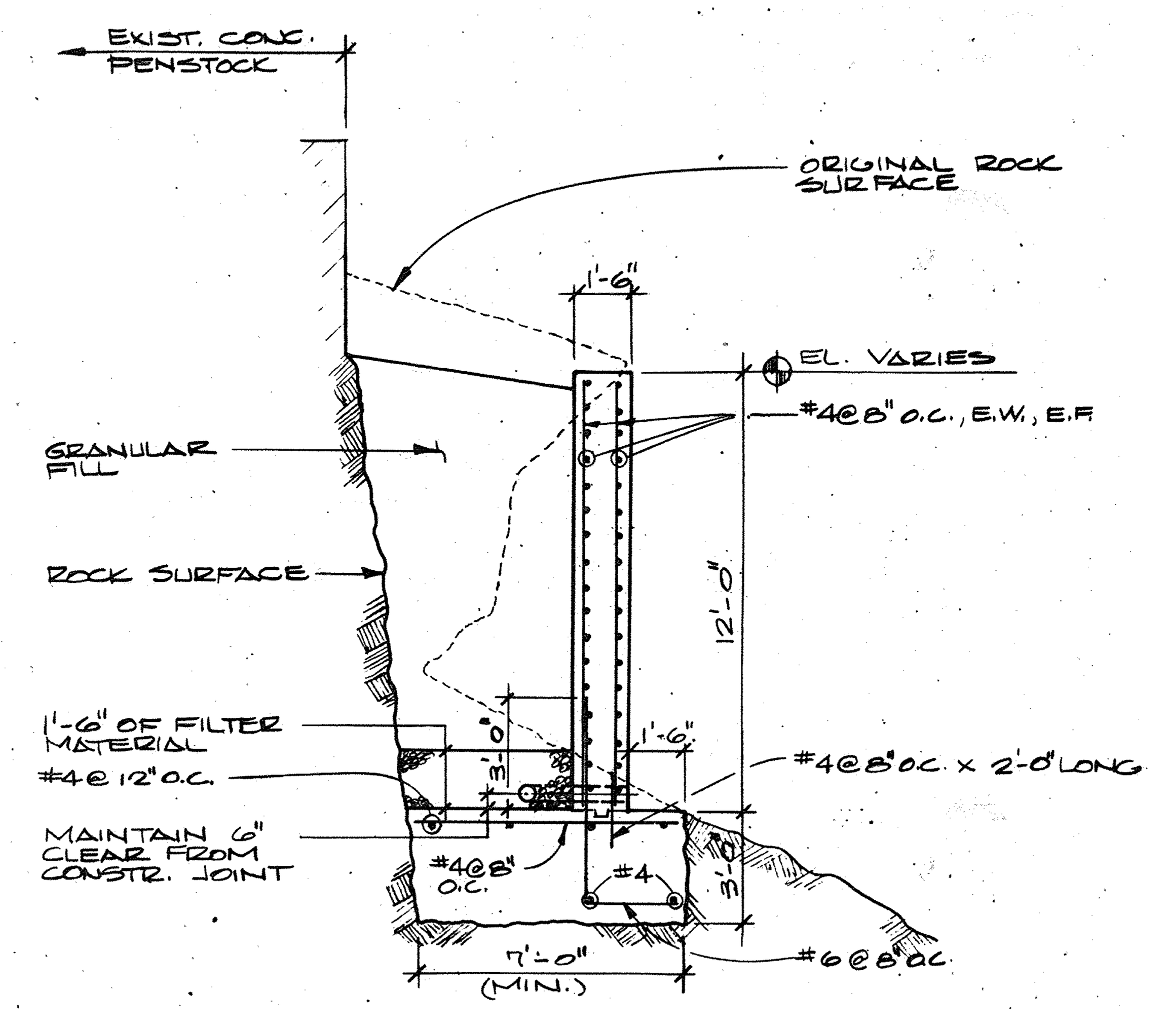
RIVER FALLS MUNICIPAL HYDROELECTRIC FACILITIES
CITY OF RIVER FALLS, WISCONSIN

JUNCTION FALLS DAM
REHABILITATION

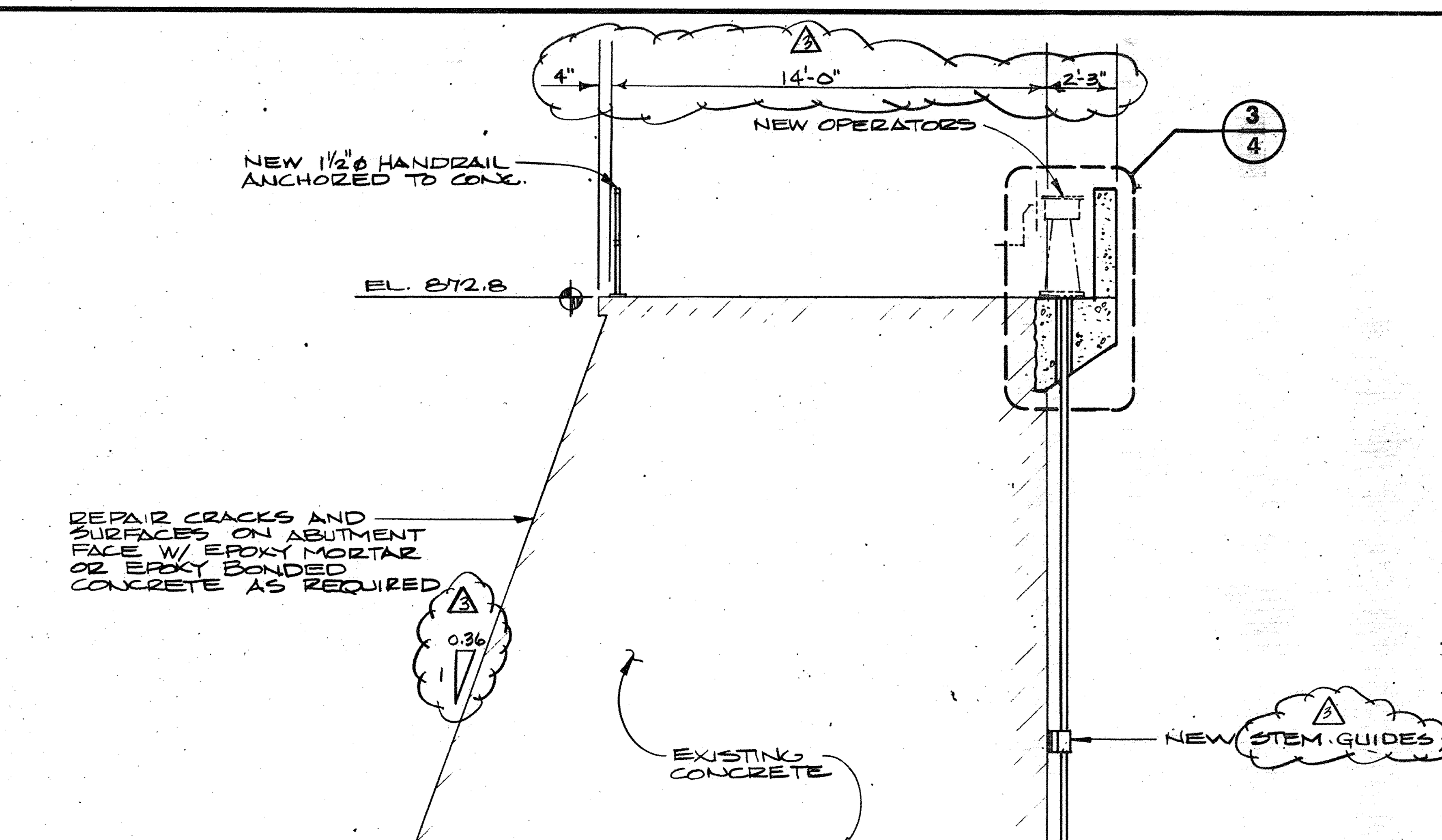
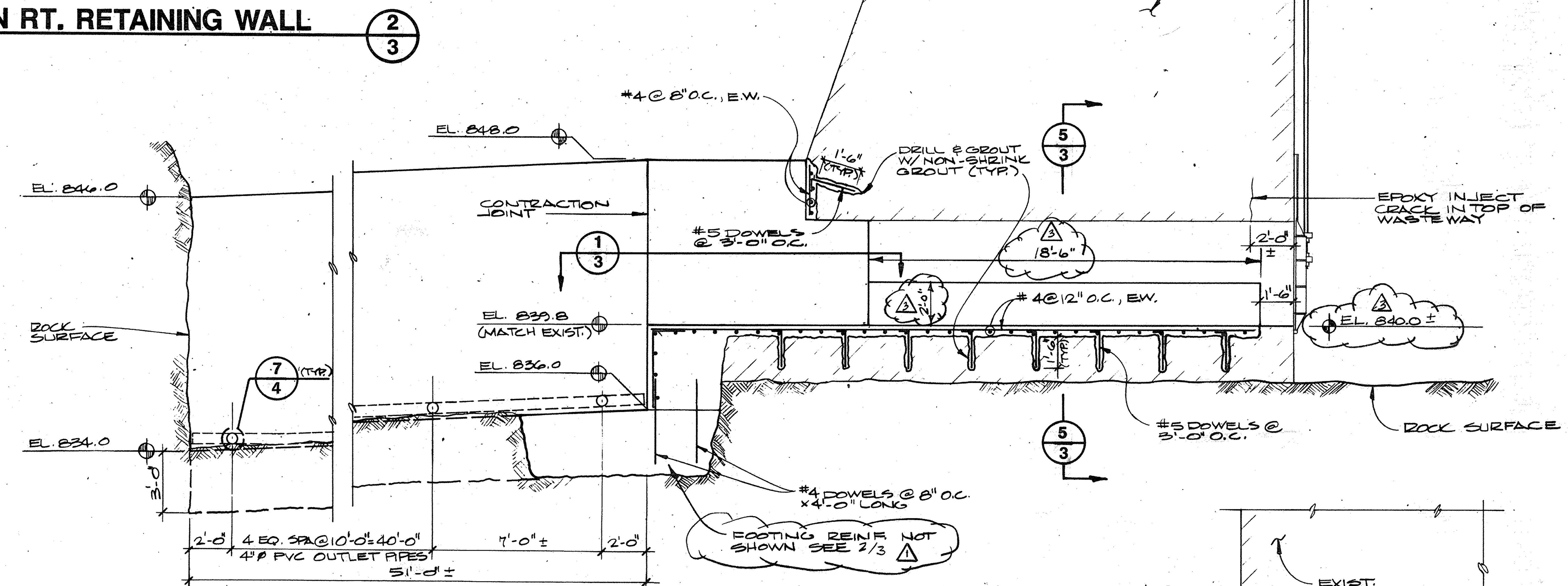
SPILLWAY & LEFT ABUTMENT
SCALE: AS SHOWN



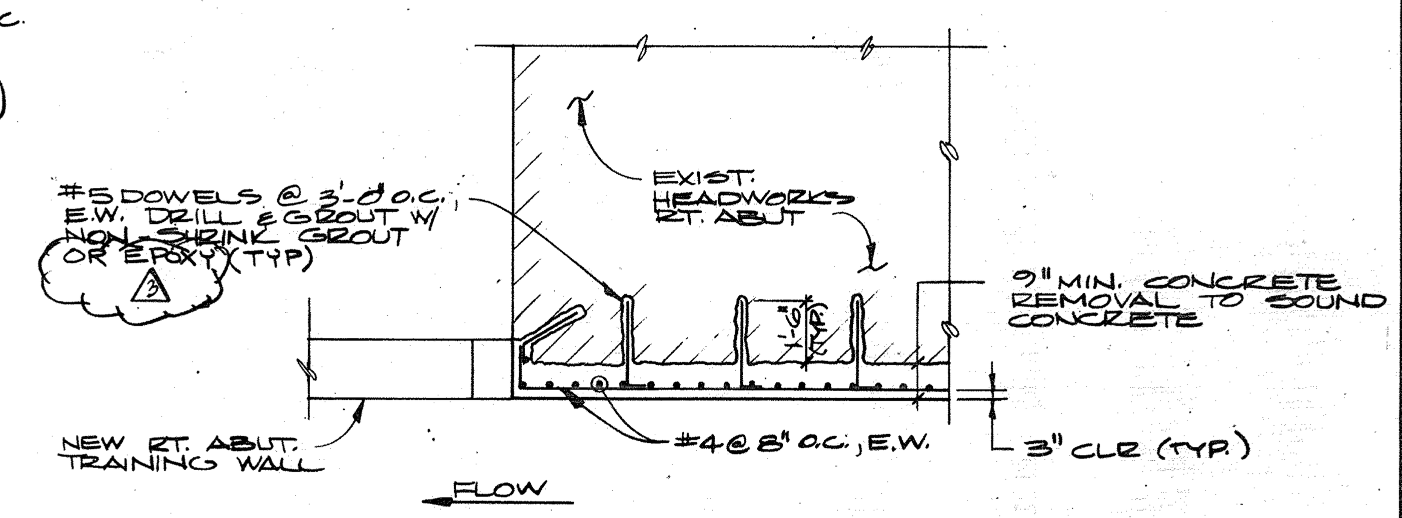
SECTIONAL PLAN @ WASTEWAY (1/3)
1/2" = 1'-0"



SECTION RT. RETAINING WALL (2/3)
1/4" = 1'-0"

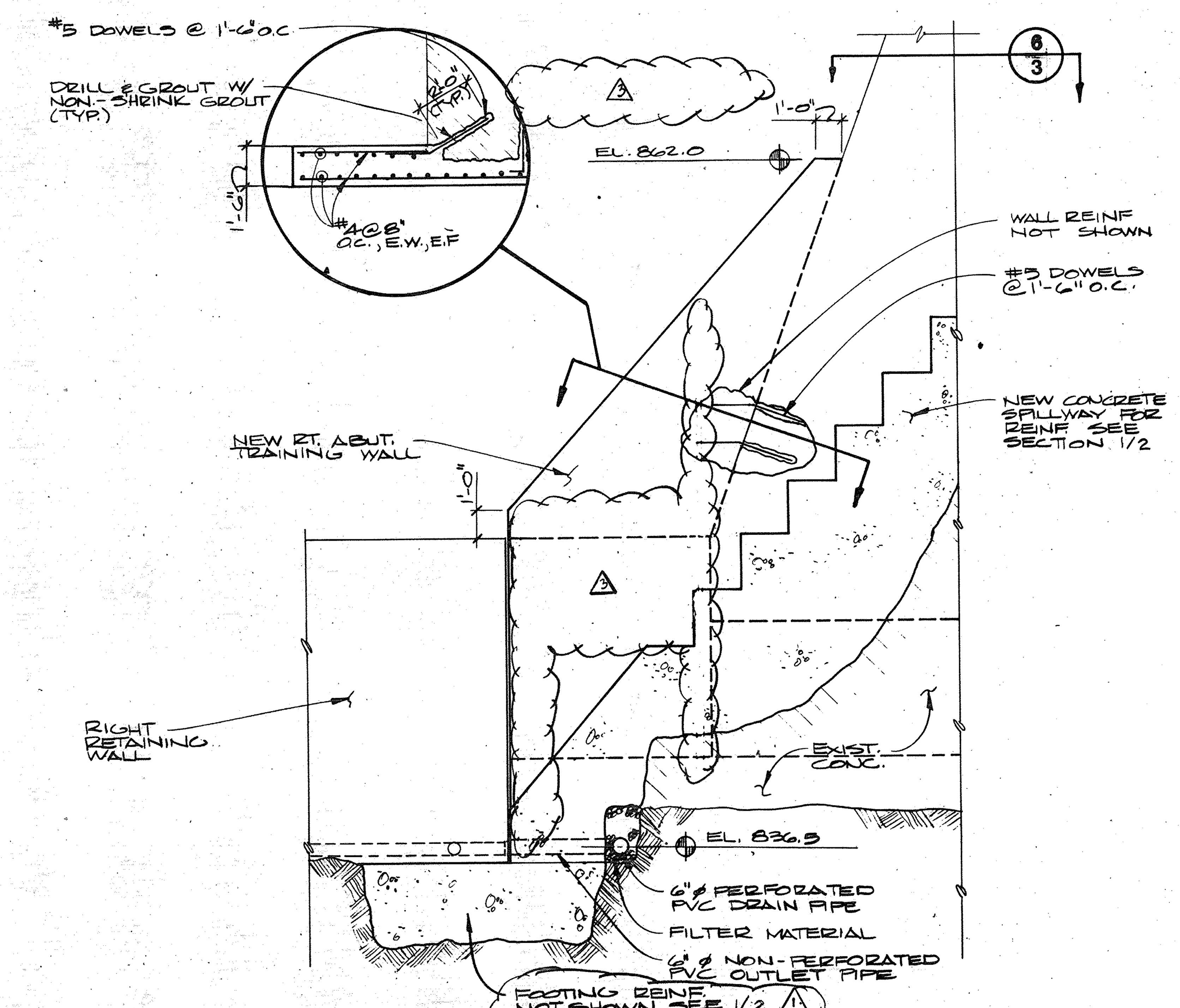



SECTION THRU WASTEWAY (3/3)
1/4" = 1'-0"

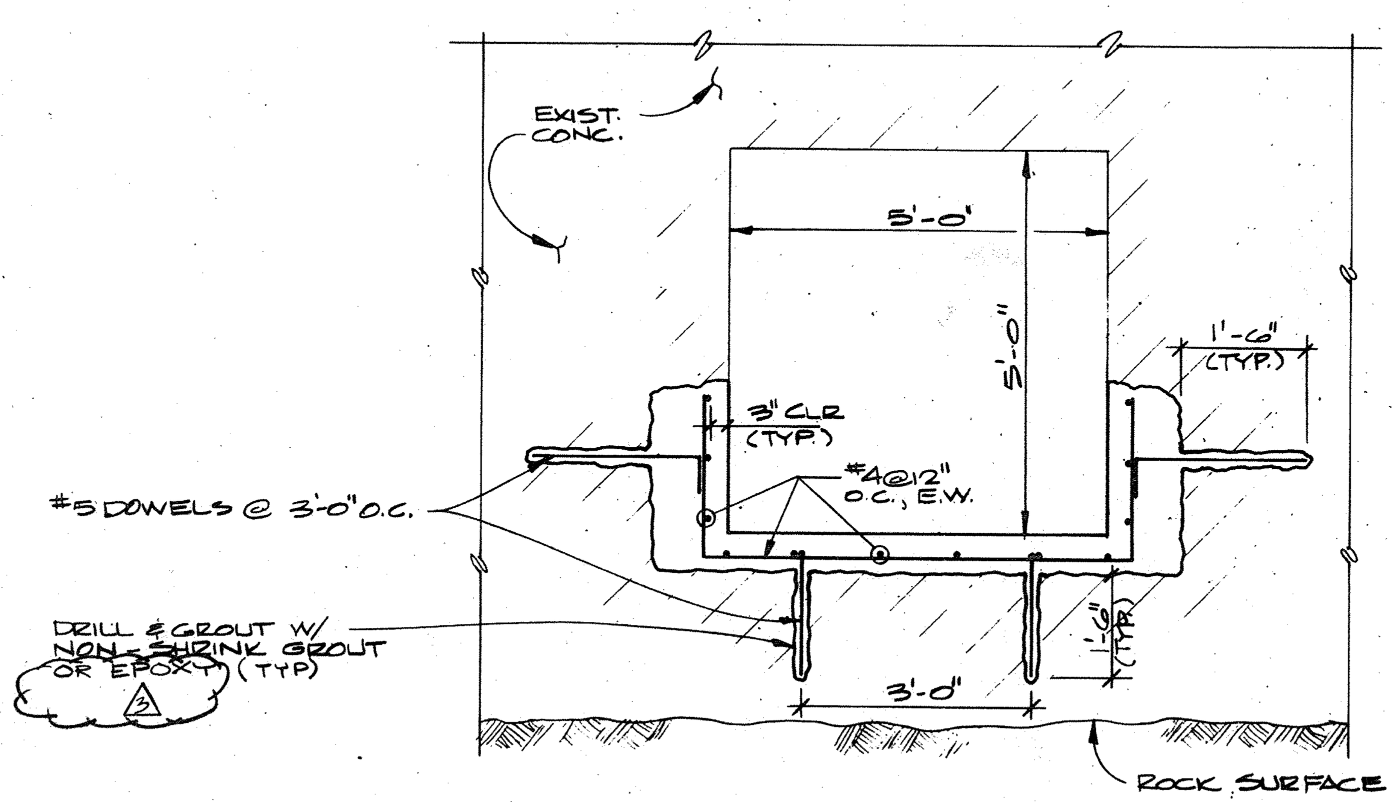


SECTIONAL PLAN

RIGHT ABUTMENT CONCRETE OVERLAY (6/3)



PARTIAL SPILLWAY SECTION (4/3)
1/4" = 1'-0"



CROSS-SECTION WASTEWAY (5/3)
1/2" = 1'-0"

3	REVISED 1/16/90
1	REVISED 8/9/89

This drawing is a part of the application for license made by the undersigned

this 6 day of April, 1990.

By: Jerry E. Wilkens

Jerry E. Wilkens, Mayor
City of River Falls, Wisconsin

AYRES ASSOCIATES
Engineers / Architects
Planners / Surveyors
Owen Ayres & Associates Inc
Eau Claire, Wisconsin

EXHIBIT F-12 PROJECT NO. 10489 SHEET 3 OF 5

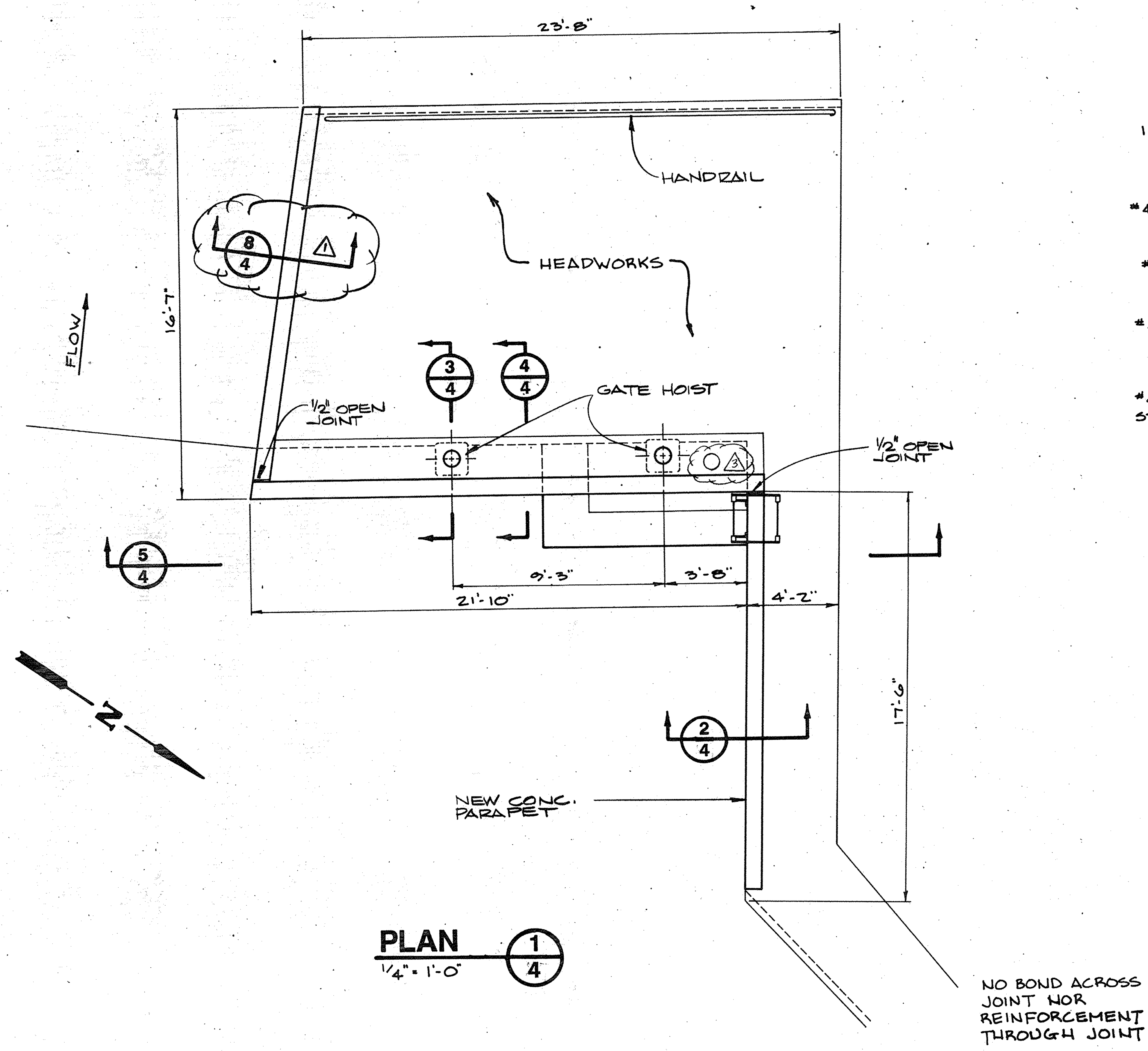
RIVER FALLS MUNICIPAL HYDROELECTRIC FACILITIES
CITY OF RIVER FALLS, WISCONSIN

JUNCTION FALLS DAM

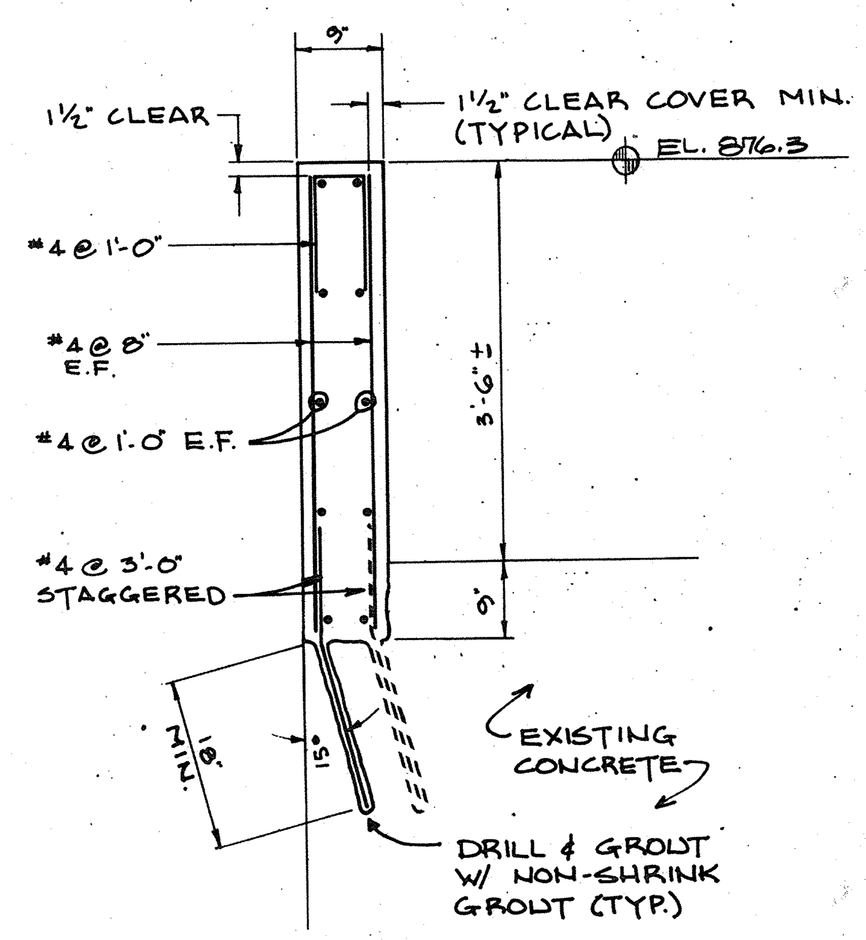
REHABILITATION

WASTEWAY & RIGHT ABUTMENT

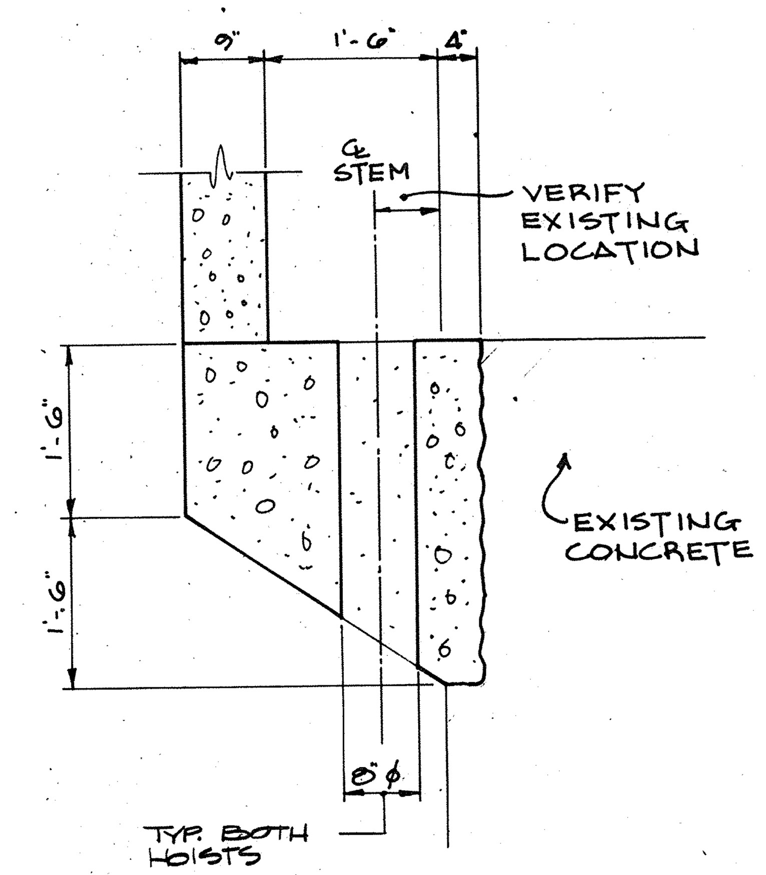
SCALE: AS SHOWN



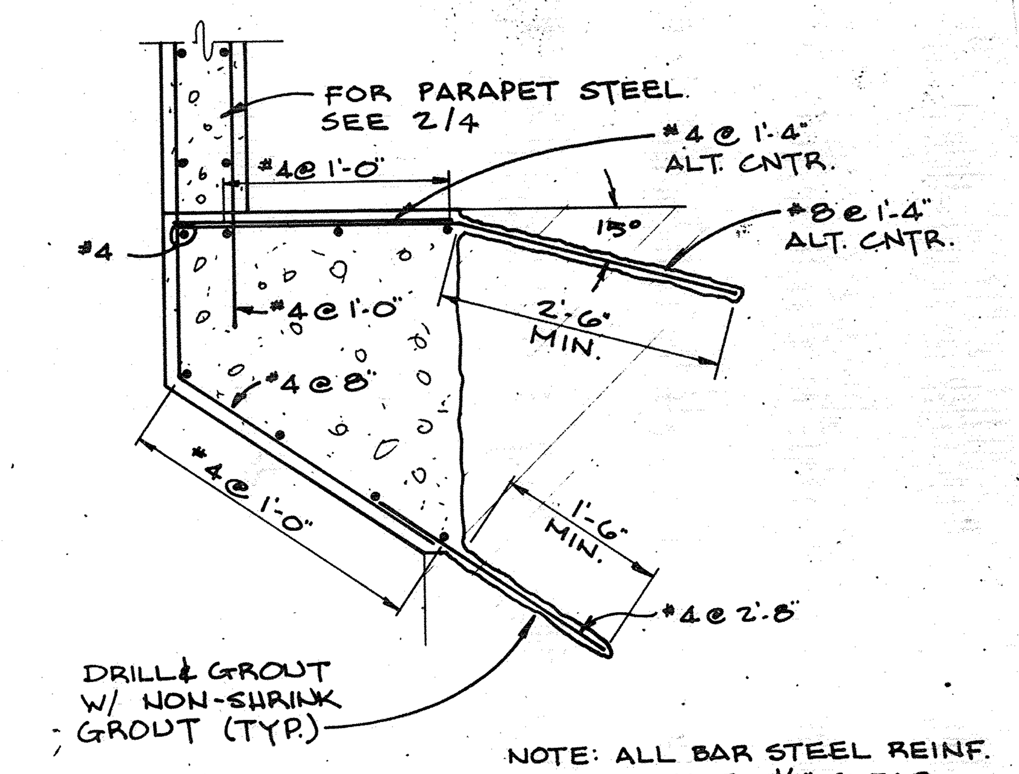
PLAN 1/4
1/4" = 1'-0"



SECTION 2/4
3/4" = 1'-0"

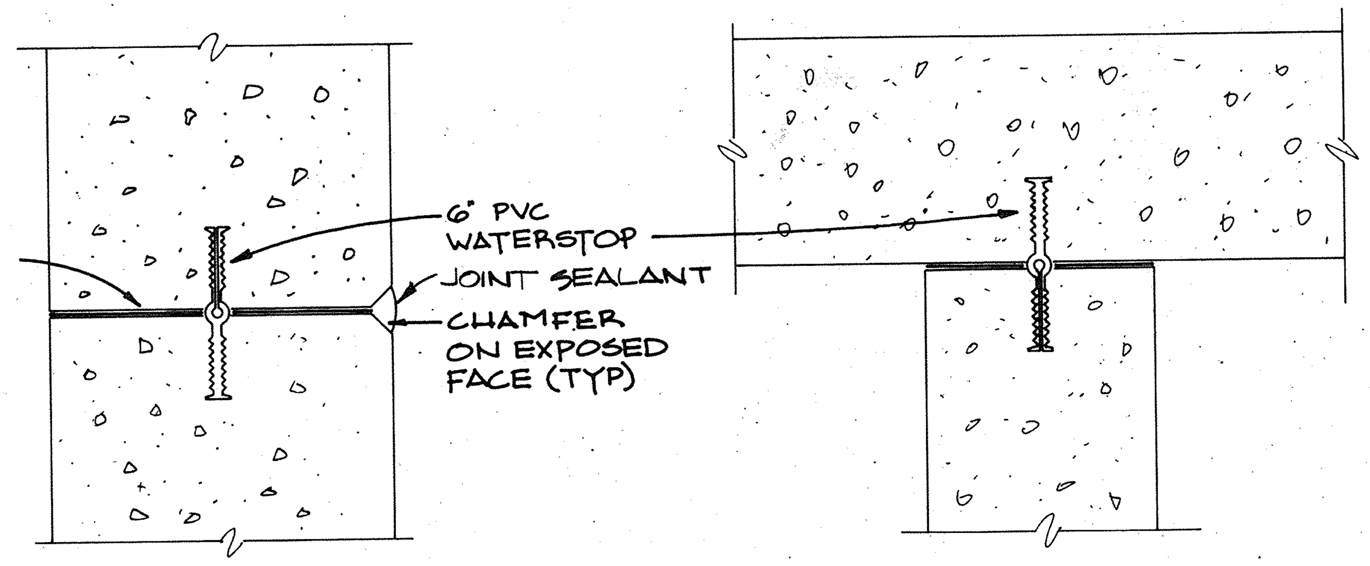


SECTION 3/4
3/4" = 1'-0"

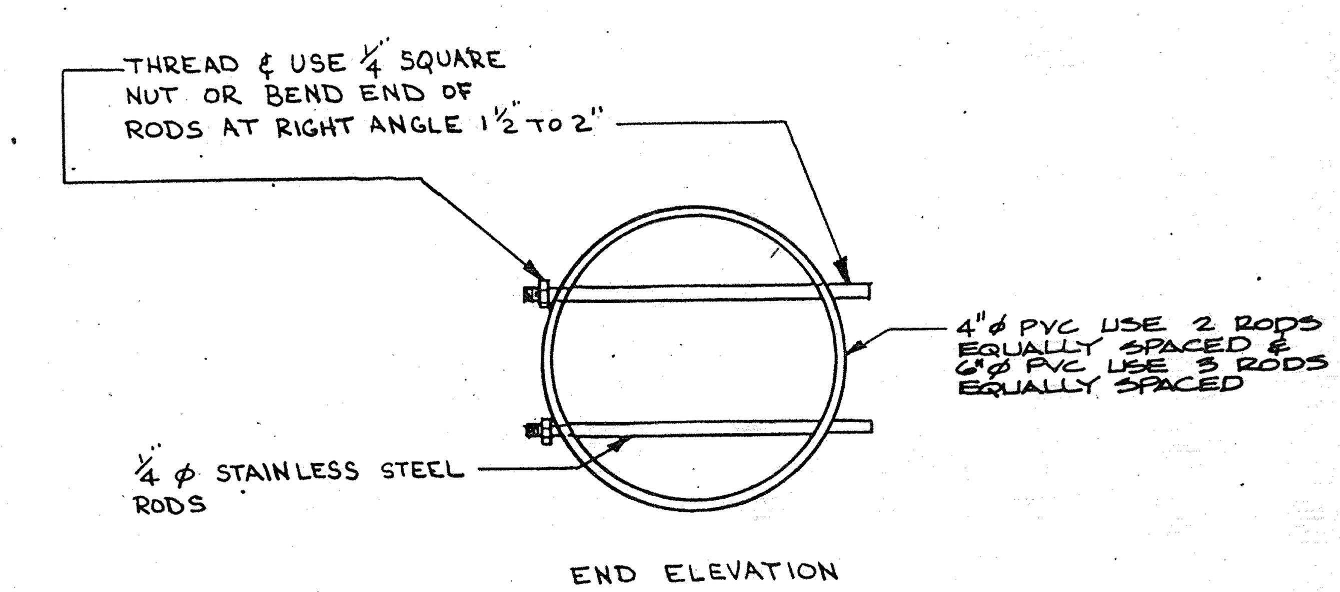


NOTE: ALL BAR STEEL REINF. TO HAVE 1 1/2" CLEAR COVER MIN.

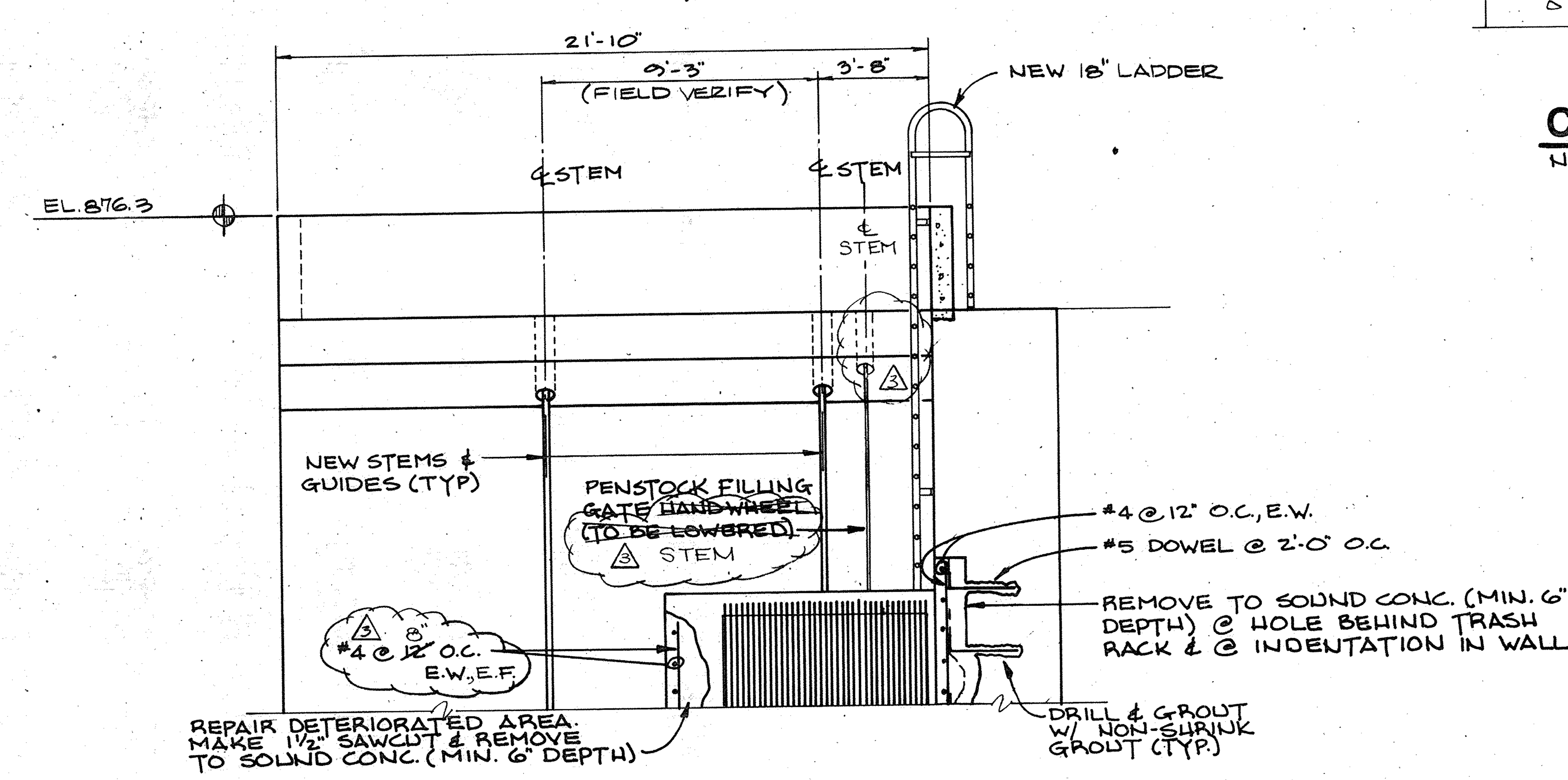
SECTION 4/4
3/4" = 1'-0"



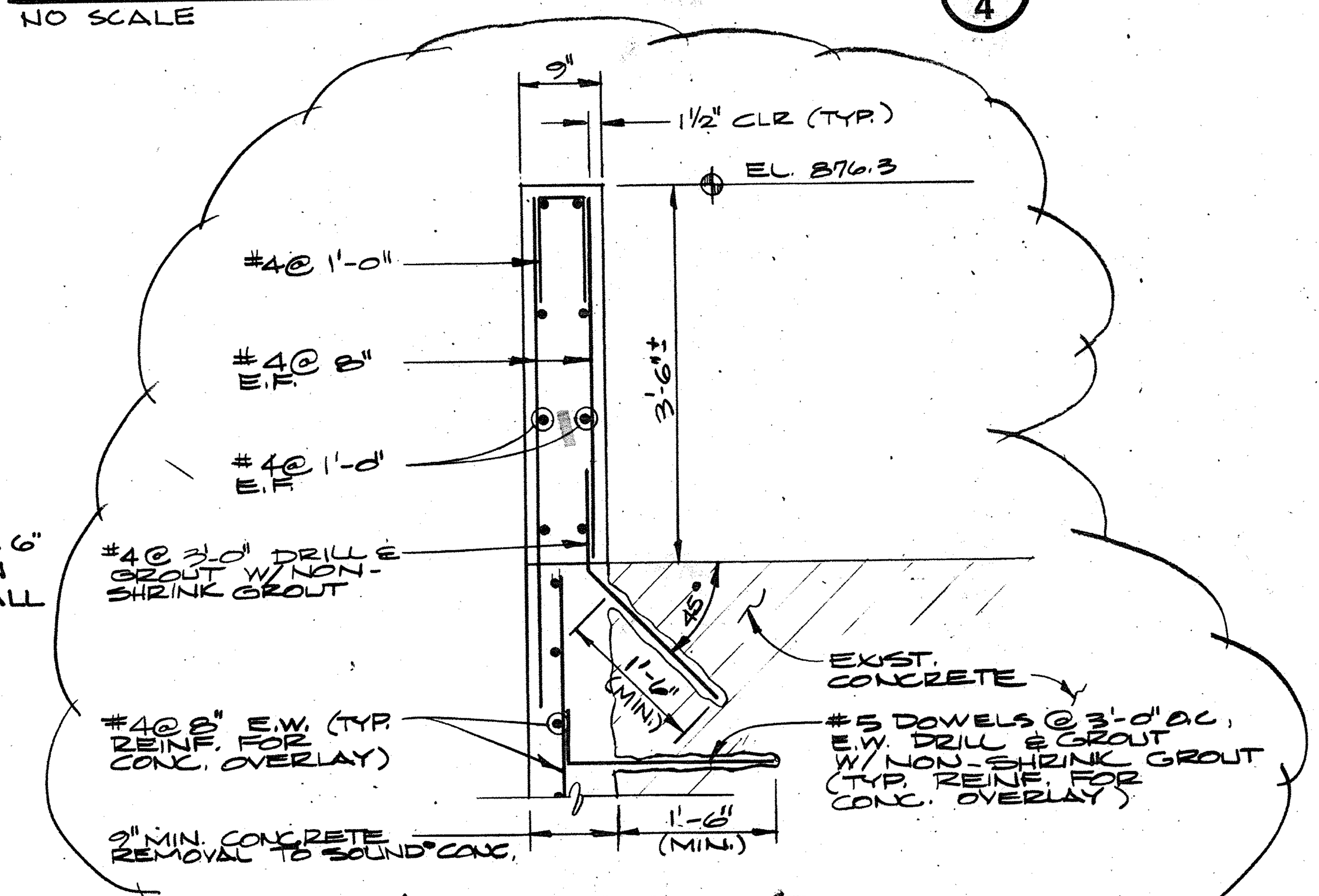
CONTRACTION JOINT DETAIL 6/4
NO SCALE



ANIMAL GUARD FOR DRAIN OUTLETS 7/4
NO SCALE



ELEVATION 5/4
1/4" = 1'-0"



△ **SECTION** 8/4
3/4" = 1'-0"

△2	REVISED 1/16/90
△	REVISED 9/8/89

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this 6 day of April, 1990.

By: Jerry E. Wilkens

Jerry E. Wilkens, Mayor
City of River Falls, Wisconsin

AYRES ASSOCIATES
Engineers / Architects
Planners / Surveyors
Owen Ayres & Associates Inc
Eau Claire, Wisconsin

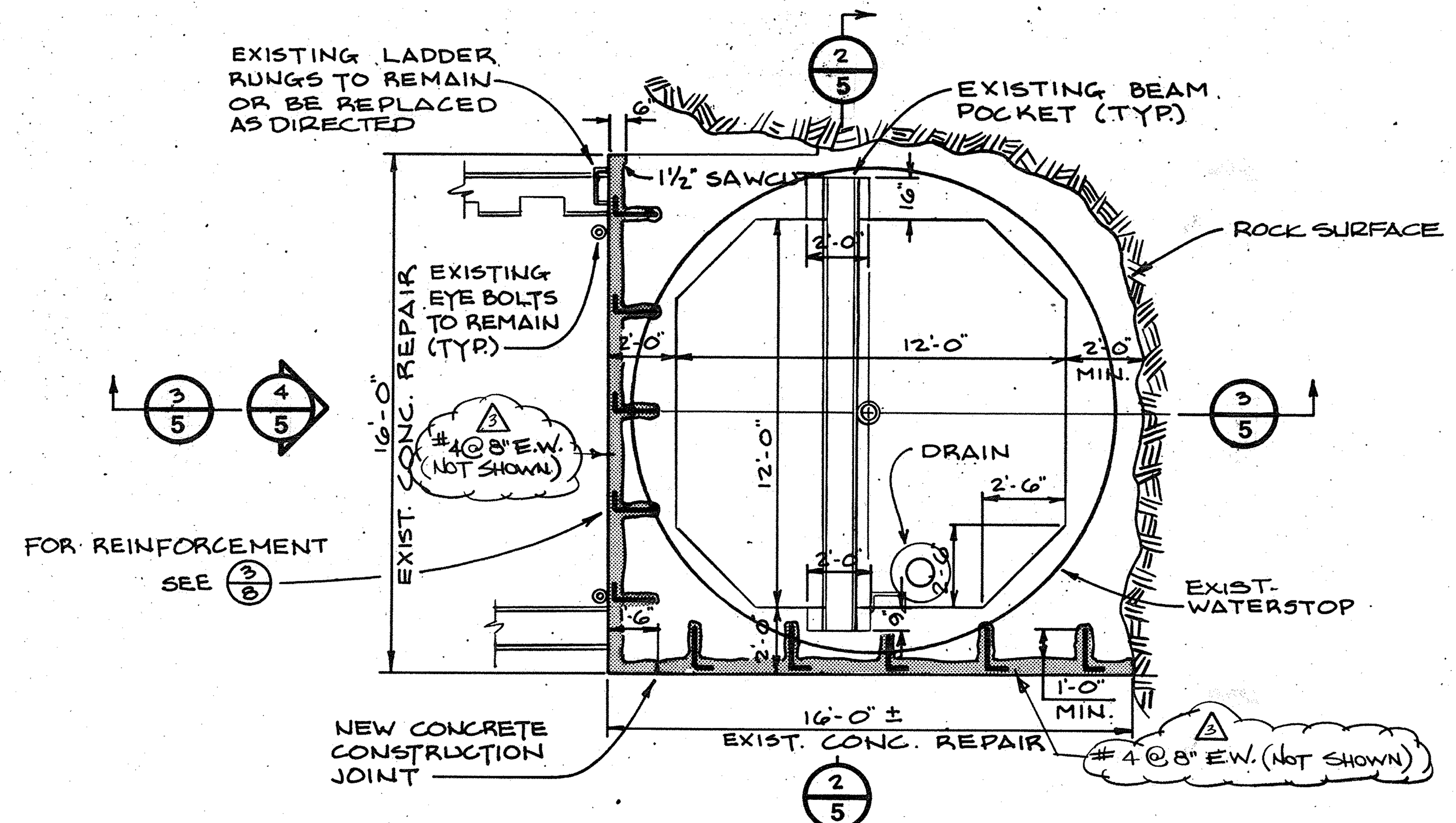
EXHIBIT F-13 PROJECT NO. 10489 SHEET 4 OF 5

RIVER FALLS MUNICIPAL HYDROELECTRIC FACILITIES
CITY OF RIVER FALLS, WISCONSIN

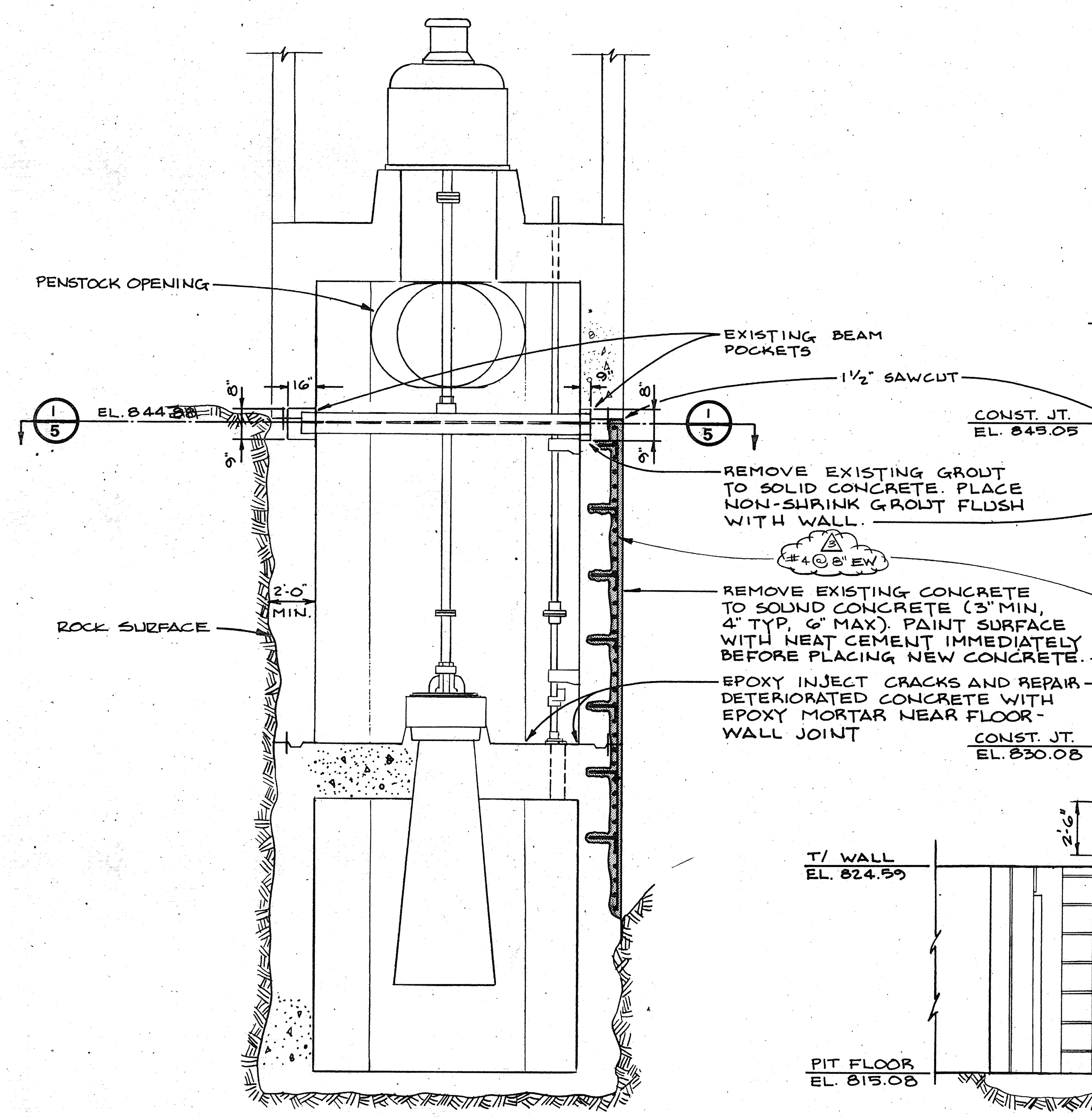
JUNCTION FALLS DAM

REHABILITATION
HEADWORKS & MISCELLANEOUS DETAILS

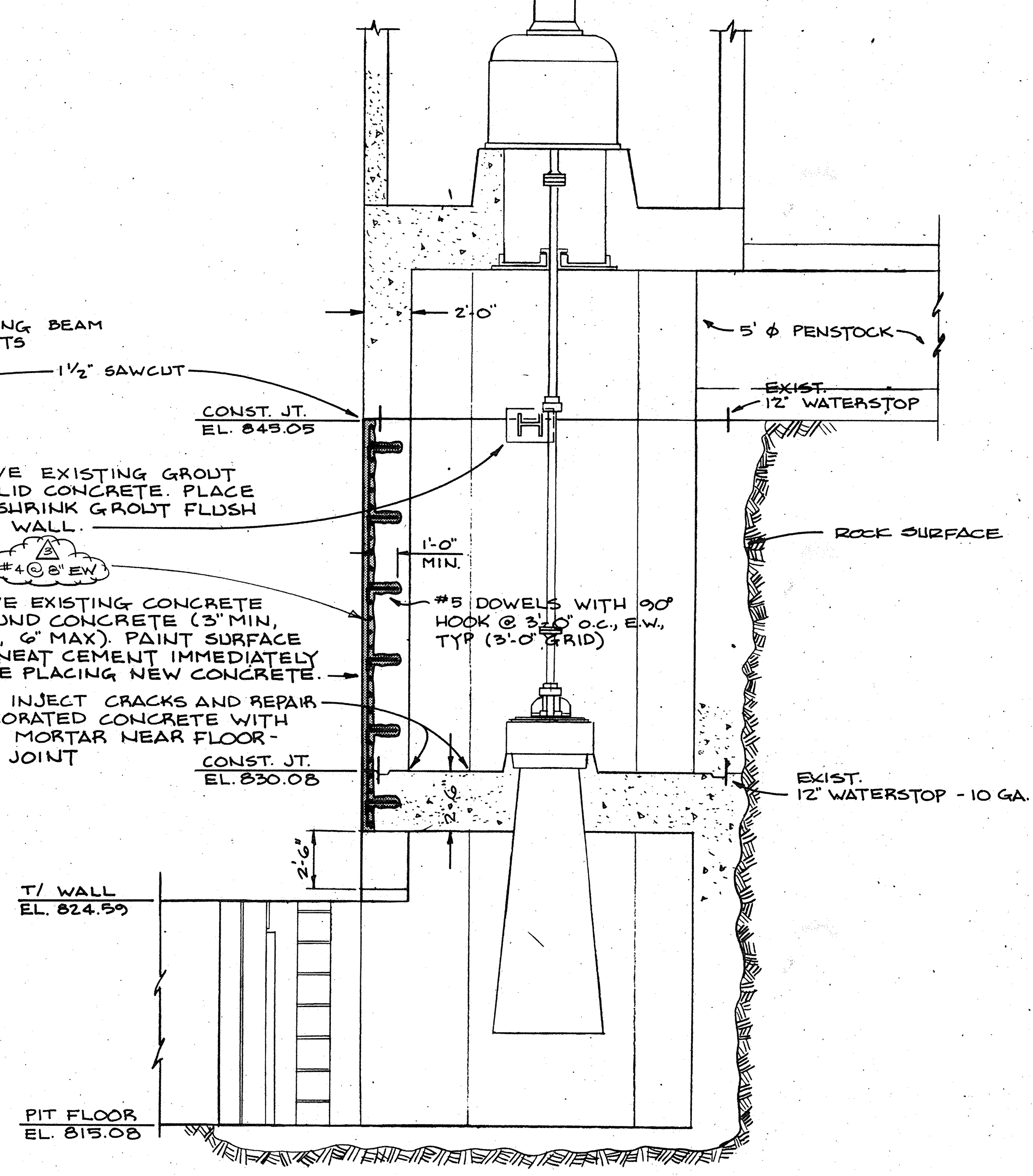
SCALE: AS SHOWN



SECTION 1/5
SCALE 1/4" = 1'-0"



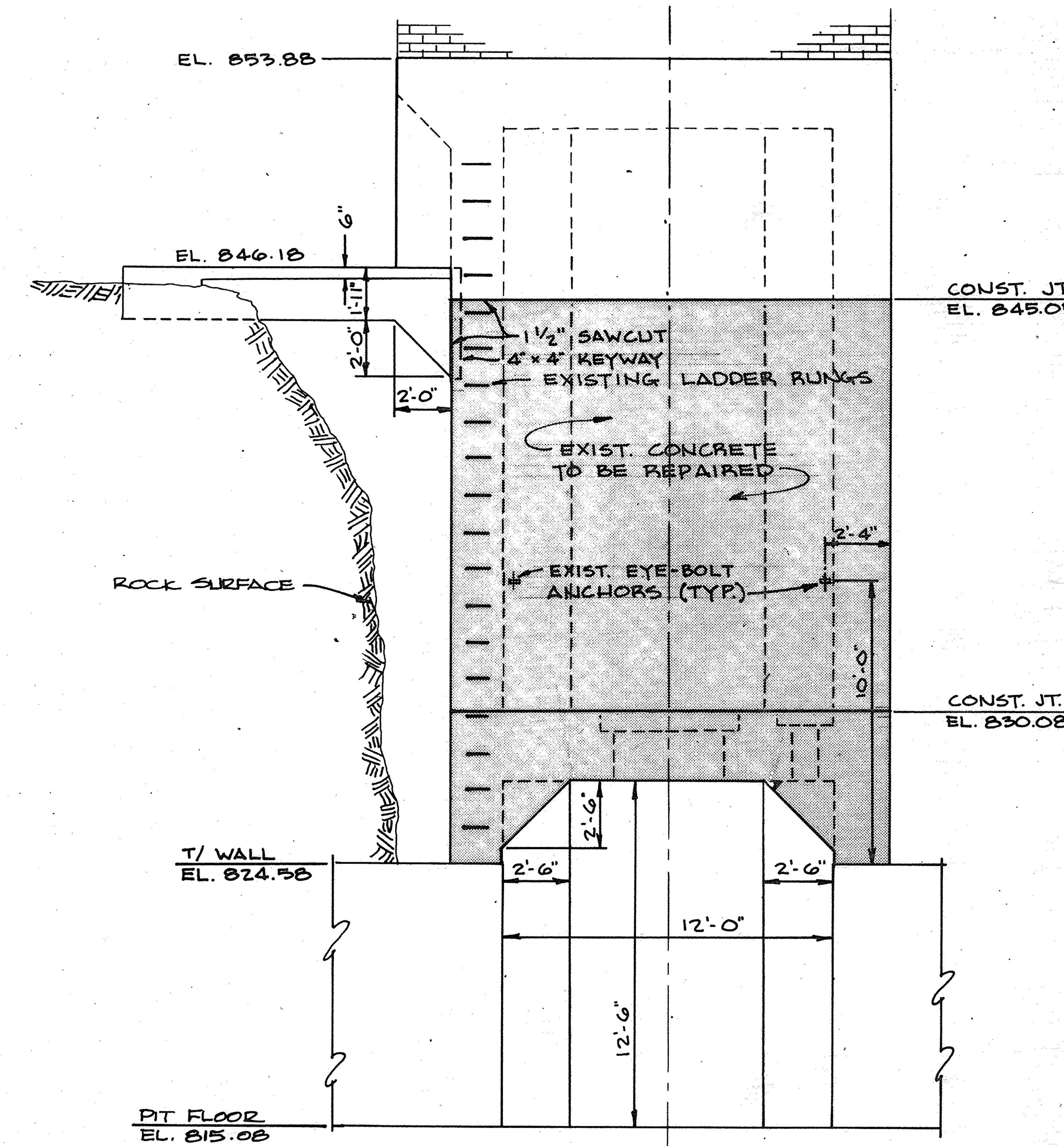
SECTION 2/5
SCALE 1/4" = 1'-0"



SECTION 3/5
SCALE 1/4" = 1'-0"

CONSTRUCTION NOTES:

1) CONTRACTOR TO REPAIR ONE SIDE OF POWERHOUSE BEFORE PROCEEDING WITH THE OTHER SIDE.
2) EXISTING CONCRETE REMOVAL NOT TO EXCEED A DEPTH OF 6"
3) REINFORCEMENT SHALL HAVE 2" CLEAR COVER
4) EXISTING REINFORCEMENT TO REMAIN OR BE REPLACED IN KIND USING SPLICES OR LAPS.
5) SHADED AREAS REPRESENT CONCRETE SURFACES TO BE REPAIRED.
6) EXISTING STRUCTURE DIMENSIONS DEVELOPED FROM DRAWINGS ENTITLED "UPPER HYDROELECTRIC IMPROVEMENTS, PLANS AND DETAILS," HERMAN T. NAGESTAD, CONSULTING ENGINEER, AUGUST 1946, 2 SHEETS. ADDITIONAL INFORMATION INCLUDING REINFORCEMENT DETAILS ARE SHOWN ON THESE DRAWINGS AND ARE AVAILABLE FOR THE CONTRACTOR'S USE. OWNER AND ENGINEER MAKE NO REPRESENTATION OR WARRANTY TO THE CONTRACTOR AS TO THE DRAWINGS ACCURACY OR THEIR USE BY THE CONTRACTOR.



ELEVATION 4/5
SCALE 1/4" = 1'-0"

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this 6 day of april, 1990.
By: Jerry E. Wilkens
Jerry E. Wilkens, Mayor
City of River Falls, Wisconsin

AYRES ASSOCIATES
Engineers / Architects
Planners / Surveyors
Owen Ayres & Associates Inc
Eau Claire, Wisconsin

EXHIBIT F-14 PROJECT NO. 10489 SHEET 5 OF 5

RIVER FALLS MUNICIPAL HYDROELECTRIC FACILITIES
CITY OF RIVER FALLS, WISCONSIN

JUNCTION FALLS DAM

REHABILITATION POWERHOUSE

△ REVISED 1/16/90

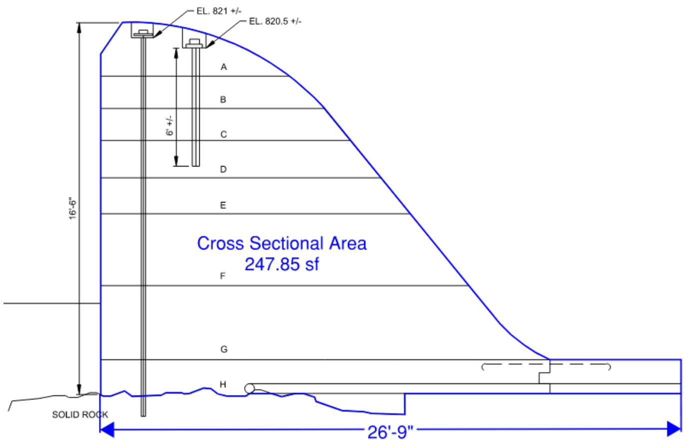
US Army Corps of Engineers ®
St. Paul District

Attachment I-3: Powell Falls Quantity Estimates

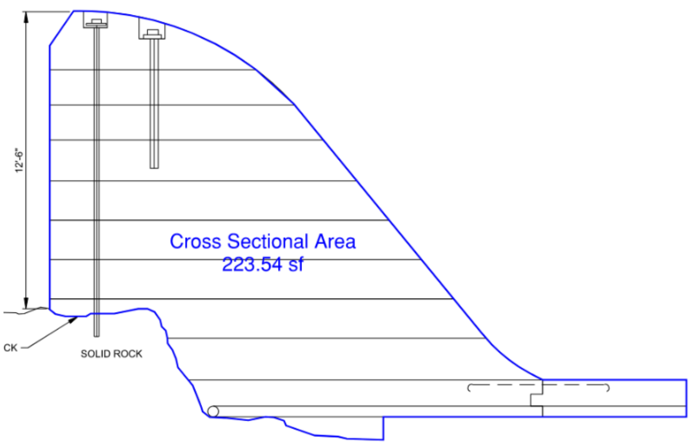
Section 206 Continuing Authorities Program (CAP) Detailed Project Report
Kinnickinnic River
Aquatic Ecosystem Restoration and Protection Project

Powell Falls Concrete Quantity Estimate

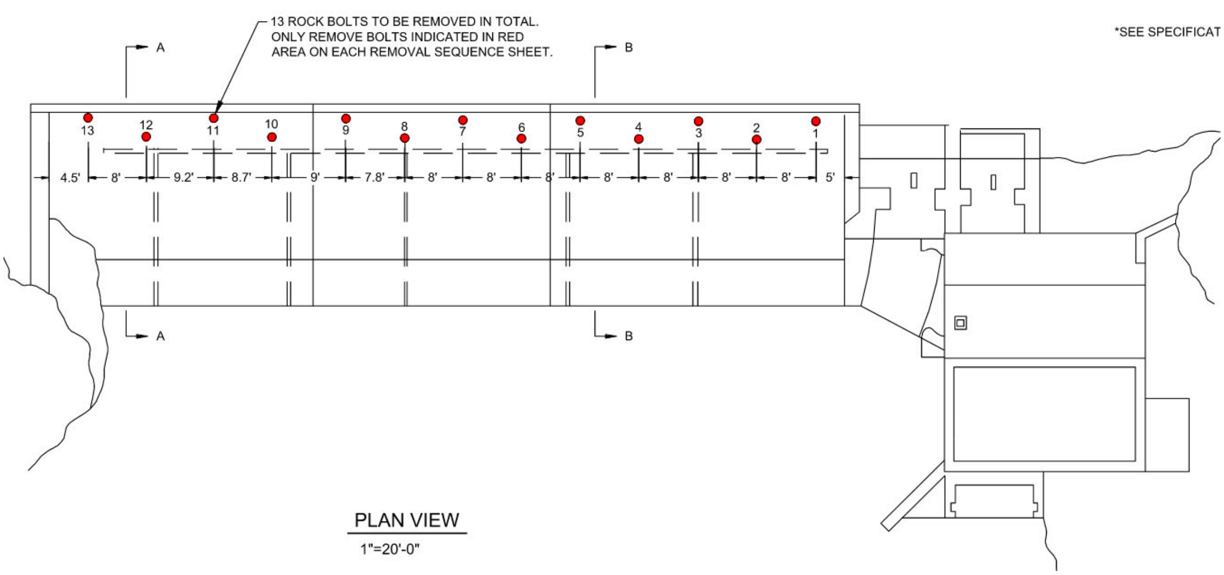
Spillway



SECTION A
1"=5'-0"



SECTION B
1"=5'-0"



PLAN VIEW
1"=20'-0"

Spillway Section A:

Cross Sectional Area (estimated using Bluebeam Revu): 247.85 sf

Length (taken from plans): 4.5+8+9.2+8.7+9+7.8+8+8+8 = 71.2 ft

Volume = 247.85 sf x 71.2 ft = 17646.92 sf = 653.6 cy

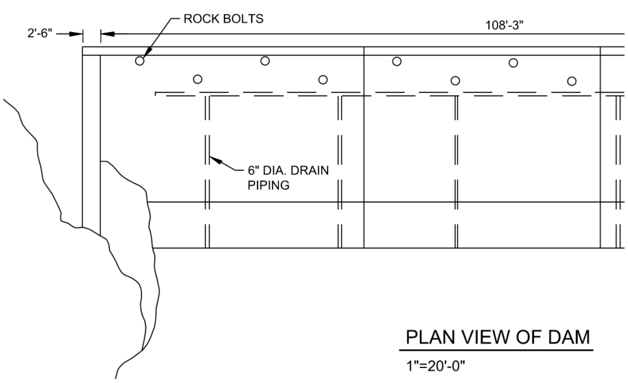
Spillway Section B:

Cross Sectional Area (estimated using Bluebeam Revu): 223.54 sf

Length (taken from plans): 8+8+8+8+5 = 37 ft.

Volume = 37 ft * 223.54 sf = 8270.98 = 306.3 cy

Right Main Spillway Abutment/Wingwall:



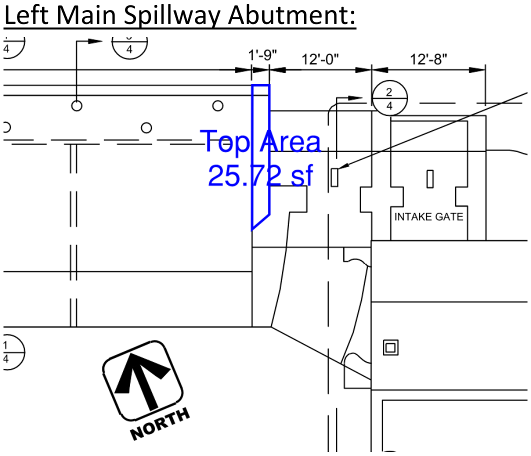
Width given as 2.5 ft. No other values given. Conservatively assume rectangular section with same height and width as main spillway, section A.

Height = 16.5 ft.

Length = 26.75 ft

Volume = 2.5 ft x 16.5 ft x 26.75 ft = 1103.4 cf = 40.9 cy

Left Main Spillway Abutment:



Top Area derived from drawings using Bluebeam Revu: 25.72 sf

Assume rectangular cross section with same height as main spillway, section B.

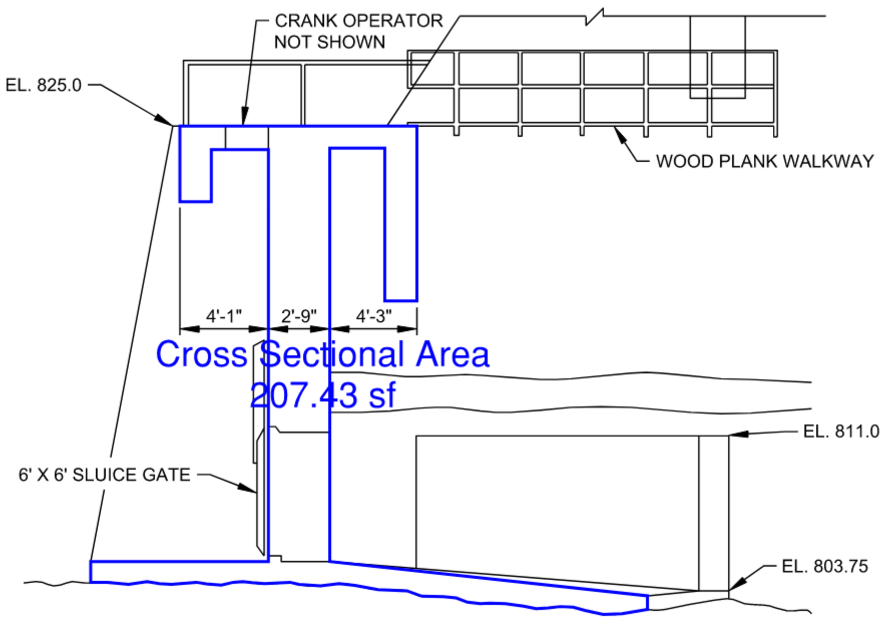
Height = 12.5 ft

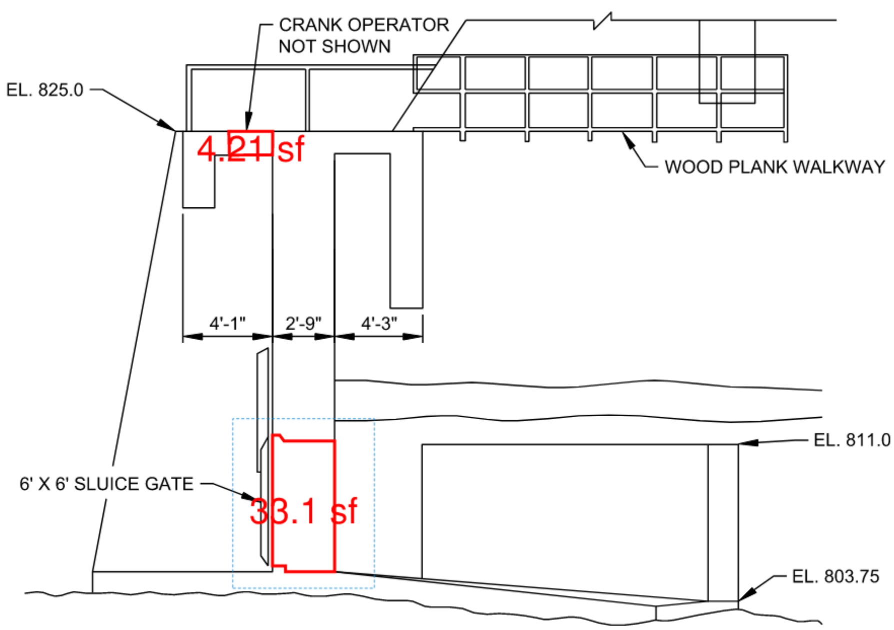
Volume = 25.72 sf x 12.5 ft = 321.5 cf = 11.9 cy

Concrete Total for Main Spillway and Abutments/Wingwalls:
Main Spillway Section A: 653.6 cy
Main Spillway Section B: 306.3 cy
Right Spillway Abutment/Wingwall: 40.9 cy
Left Spillway Abutment: 11.9 cy
Total: 1012.7 cy

Wasteway and Intake Bay

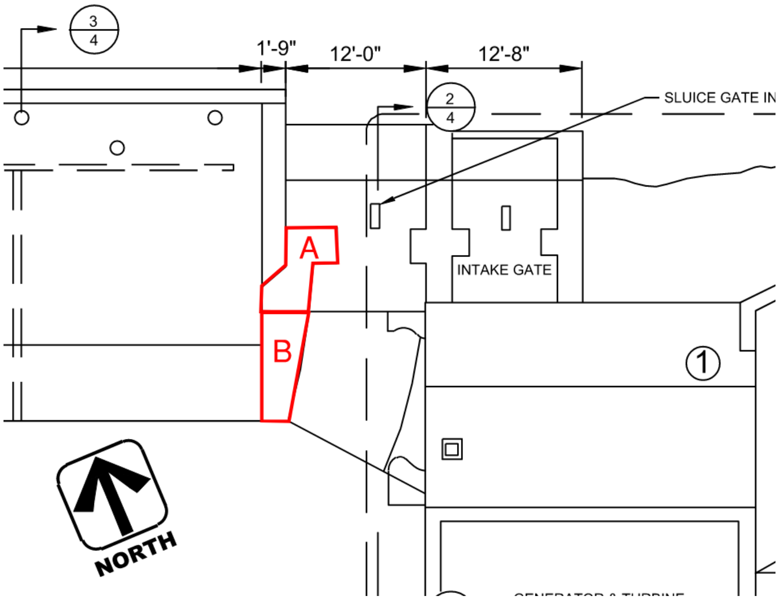
Wasteway face, walkway, and apron:



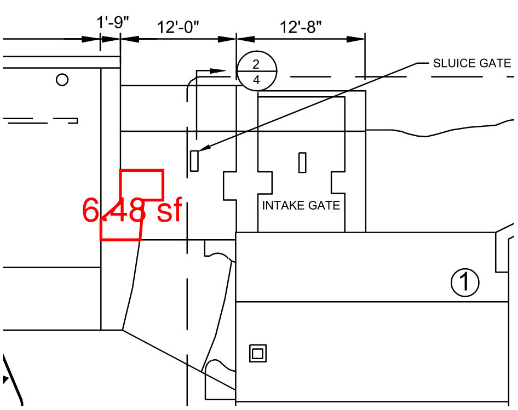


Total Cross-Sectional Area (estimated using Bluebeam Revu): 207.43 sf
Subtract gate opening and crank opening: 207.43 sf – 33.1 sf – 4.21 sf = 170.12 sf
Length of wasteway given in plans as 12 ft.
Volume = 170.12 sf x 12 ft = 2041.44 cf = 75.6 cy

Right Downstream Wasteway Wingwall:

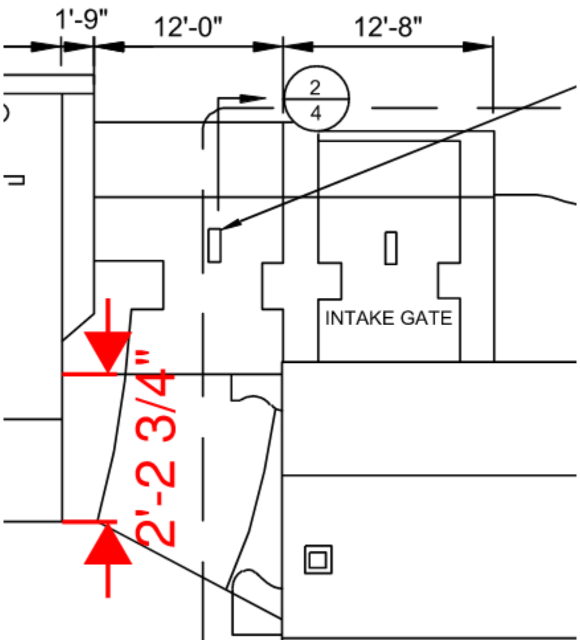


Section A:

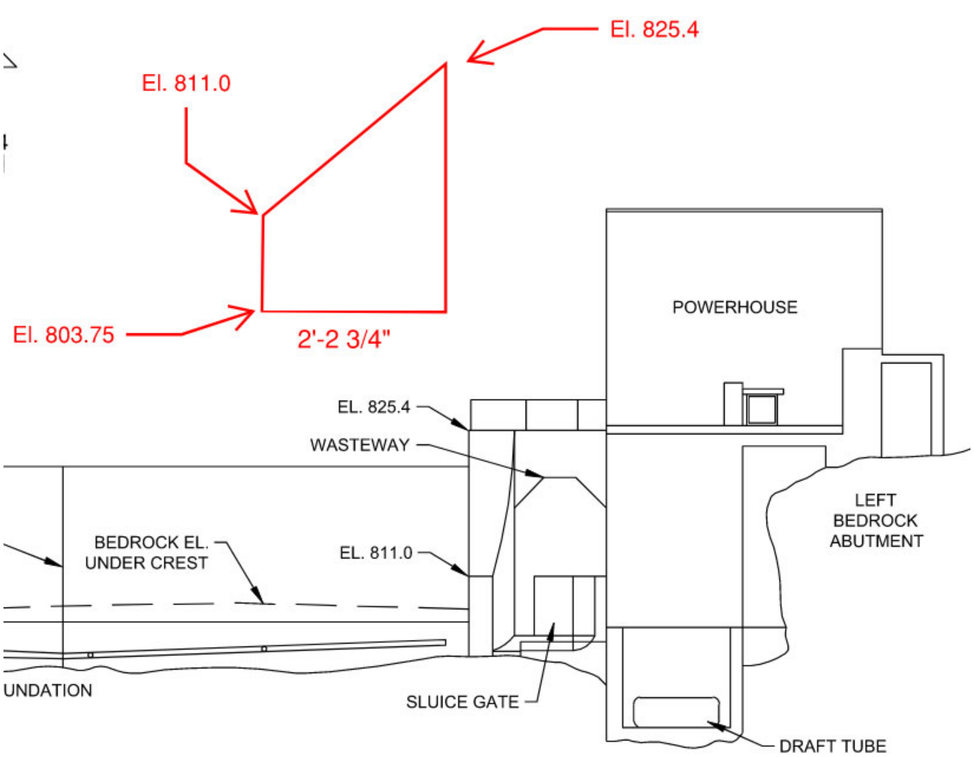


Top section area estimated using Bluebeam Revu: 6.48 sf
Conservatively assume rectangular cross section extending from wasteway elevation values of 803.75 to 825.0.
Height = 825.0 - 803.75 = 21.25 ft
Volume = 6.48 sf x 21.25 ft = 137.7 cf = 5.1 cy

Section B



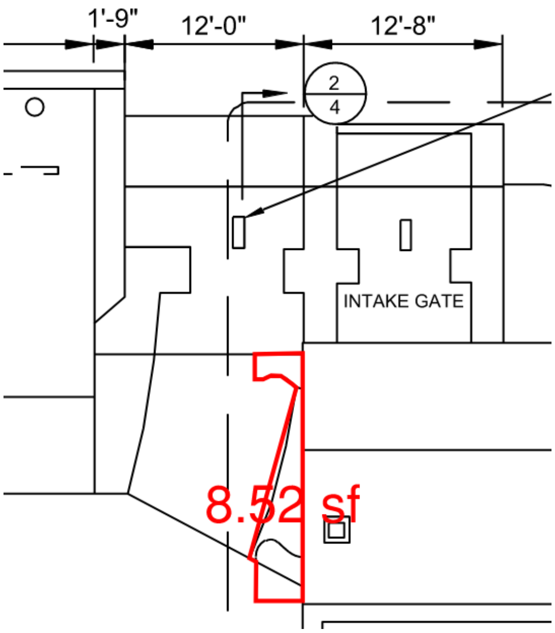
A rough side cross section was derived using an estimated length (2.23 ft) and the elevation values provided.



Cross Section Area: [(811.0-803.75) x 2.23] + ½*[2.23 x (825.4-811.0)] = 16.1675 = 32.22 sf
Estimate average width as 2 ft.
Volume = 32.22 sf x 2 ft = 64.4 cf = 2.4 cy

Total Right Wingwall Volume = 5.1 cy + 2.4 cy = 7.5 cy

<u>Left Downstream Wasteway Wingwall:</u>

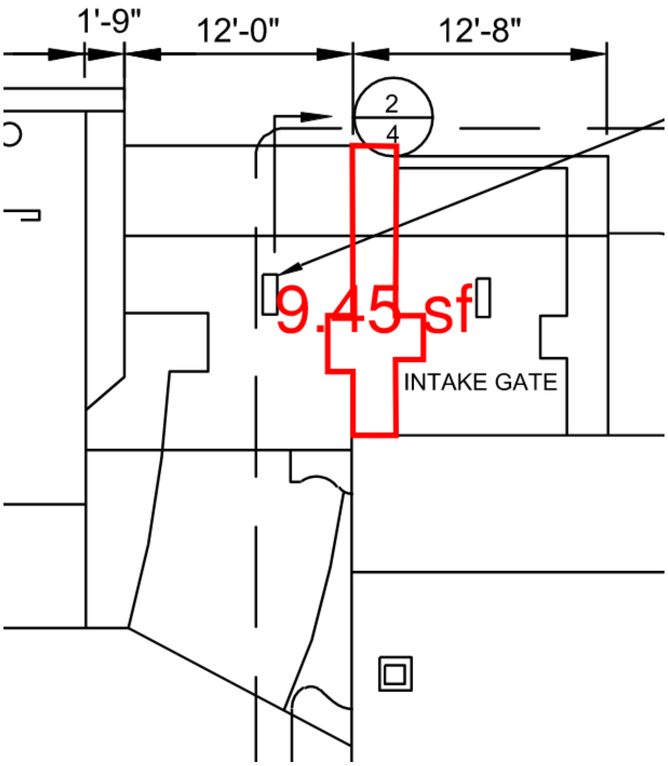


Top section estimated using Bluebeam Revu: 8.52 sf
Conservatively assume rectangular cross section extending from El 803.75 to El 811.0
Height = 811.0 – 803.75 = 7.25 ft
Volume = 8.52 sf x 7.25 ft = 61.77 cf = 2.3 cy

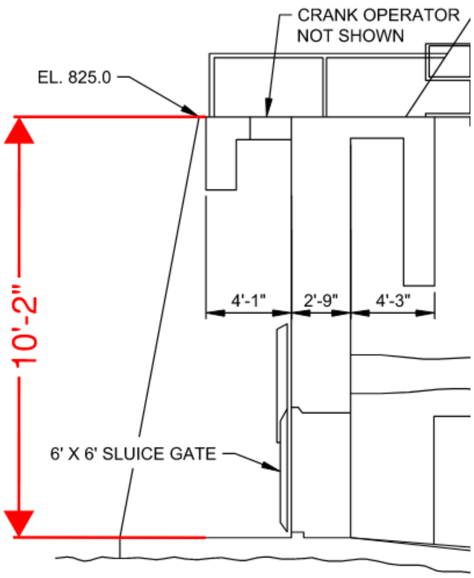
<u>Upstream Wasteway Wingwall</u>
Not shown on plans. Roughly outlined on photo below.

Estimated from photos to be 75% of the volume of the downstream right wasteway wingwall.
Estimated volume: 75% x 7.5 cy = 5.6 cy

<u>Pier between Wasteway and Intake Bay</u>

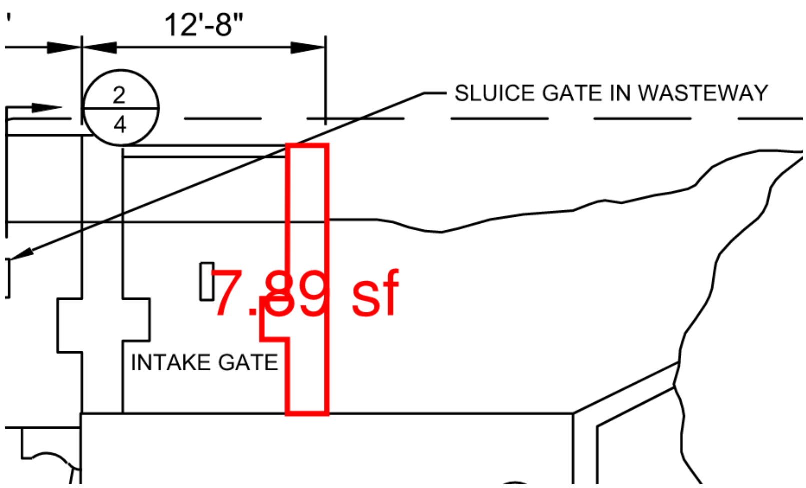


Top area estimate using Bluebeam Revu: 29.14 sf



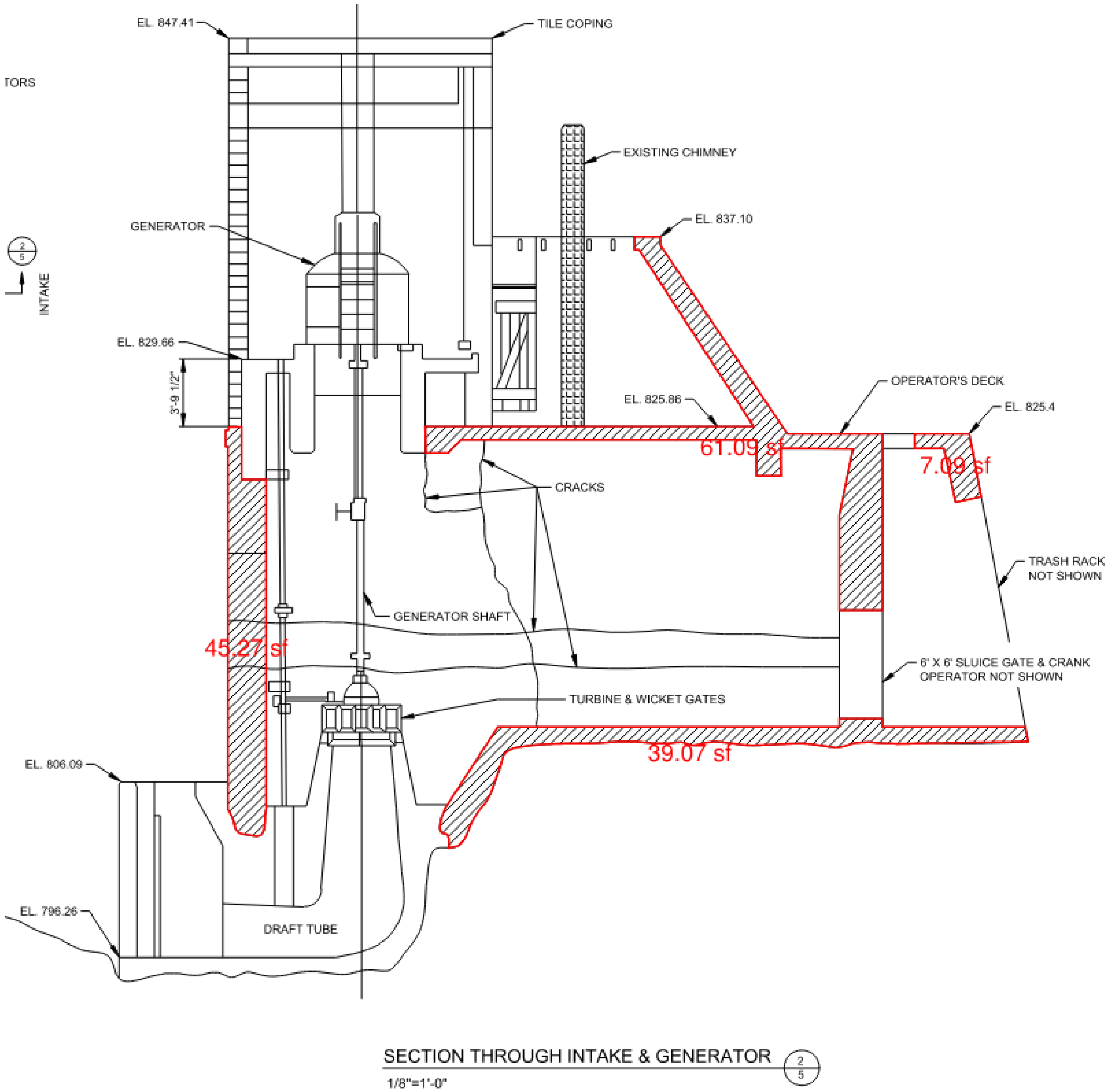
Assume rectangular cross section. Height estimated using Bluebeam Revu: 10’-2” = 10.17 ft
Volume = 29.14 sf x 10.17 ft = 296.35 cf = 11.0 cy

Left Pier of Intake Bay



Top area estimated using Bluebeam Revu: 7.89 sf
Assume same height as intermediate pier: 10.17 ft.
Volume = 7.89 sf x 10.17 ft = 80.24 cf = 3.0 cy

Intake Bay Faces, Walkway, and Apron



SECTION THROUGH INTAKE & GENERATOR

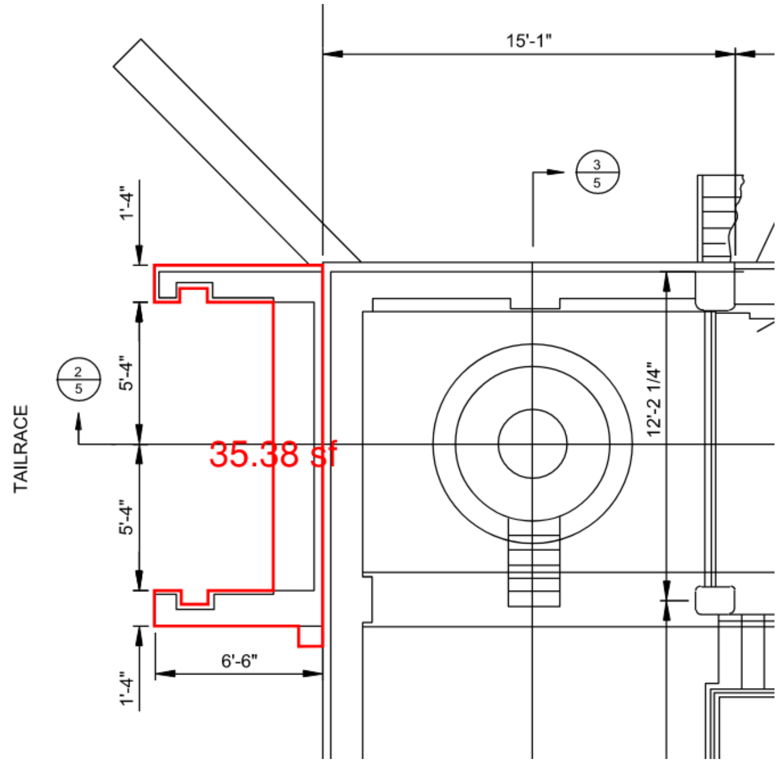
1/8"=1'-0"

Total cross sectional area estimate using Bluebeam Revu: 29.13 sf + 7.09 sf + 39.07 sf + 45.27 sf = 120.56 sf

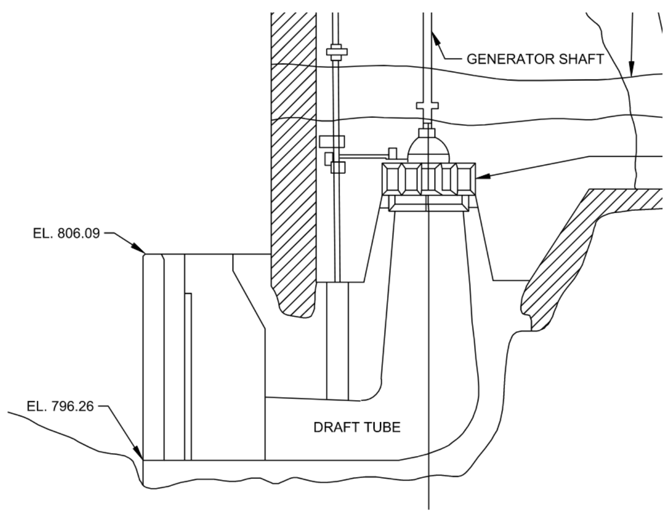
All of this cross section is assumed to run the given 12'-8" (12.75 ft) given width of the intake bay.

Volume = 120.56 sf x 12.75 ft = 1537.14 = 56.9 cy

Tailrace:



Cross sectional area estimated using Bluebeam Revu: 35.38 sf



Assume tailrace extends from El. 796.26 to El. 806.09

Height: 806.09-796.29 = 9.8 ft.

Volume Estimate: 35.38 sf x 9.8 ft = 346.72 cf = 12.8 cy

Total wasteway/intake bay and tailrace concrete:

Wasteway face, walkway, and apron: 75.6 cy

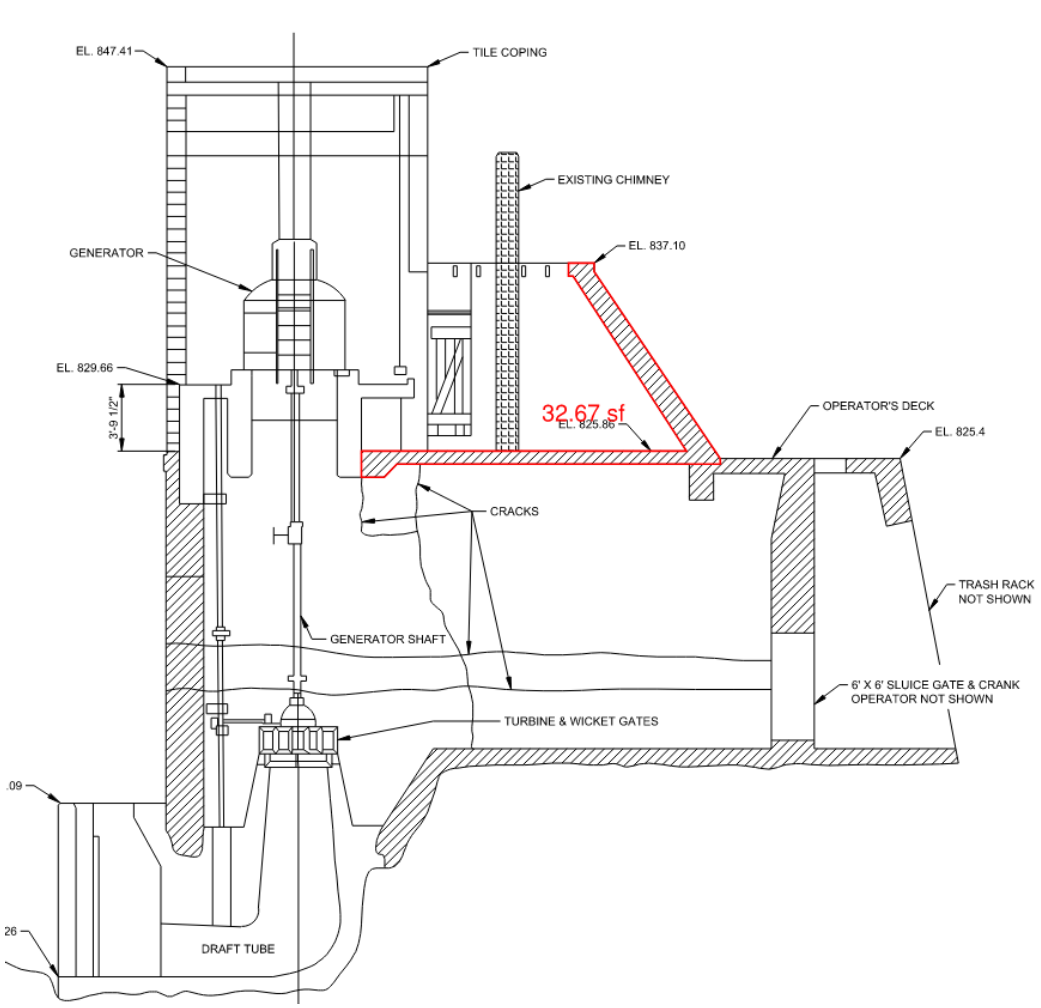
Right downstream wasteway wingwall: 7.5 cy

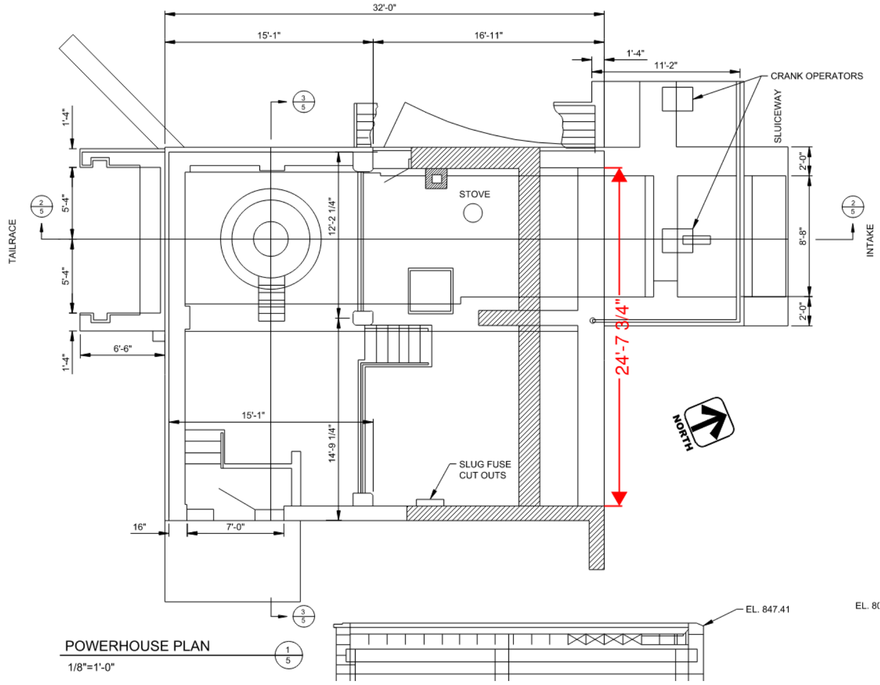
Left dowsntream wasteway wingwall: 2.3 cy

Upstream wasteway wingwall: 5.6 cy
Pier between Wateway and Intake Bay: 11.0 cy
Left pier of Intake Bay: 3.0 cy
Intake Bay Faces, Walkway, and Apron: 59.9 cy
Tailrace: 12.8 cy
Total: 177.7 cy

Powerhouse:
Note that roofs/ceilings are assumed to be composed of miscellaneous wood and steel members.

Upstream Side of Powerhouse
Floor and North Wall



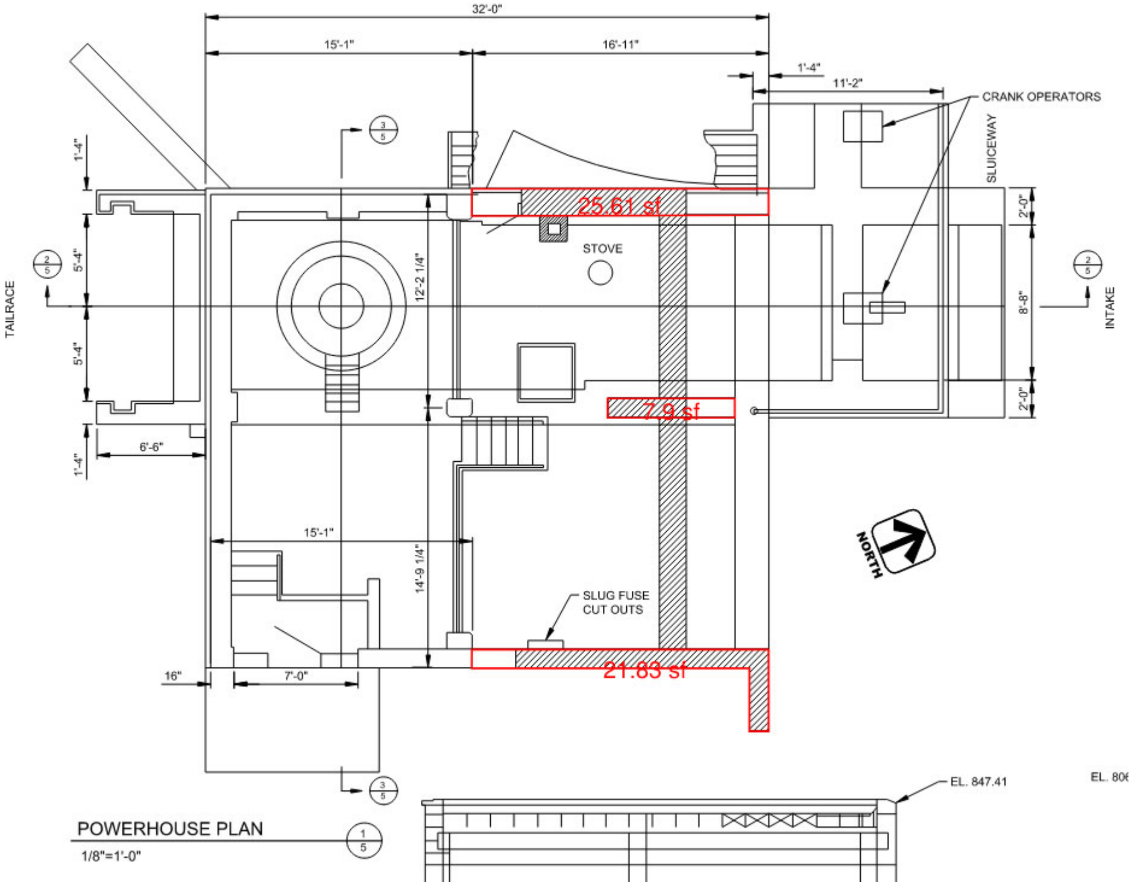


Floor and north wall cross section estimated using Bluebeam Revu: 32.67 sf

Length of wall and floor: 24’-7 3-4” = 24.65 ft.

Volume = 32.67 sf x 24.65 ft = 805.32 cf = 29.8 cy

East and West Walls and North Wall Support:



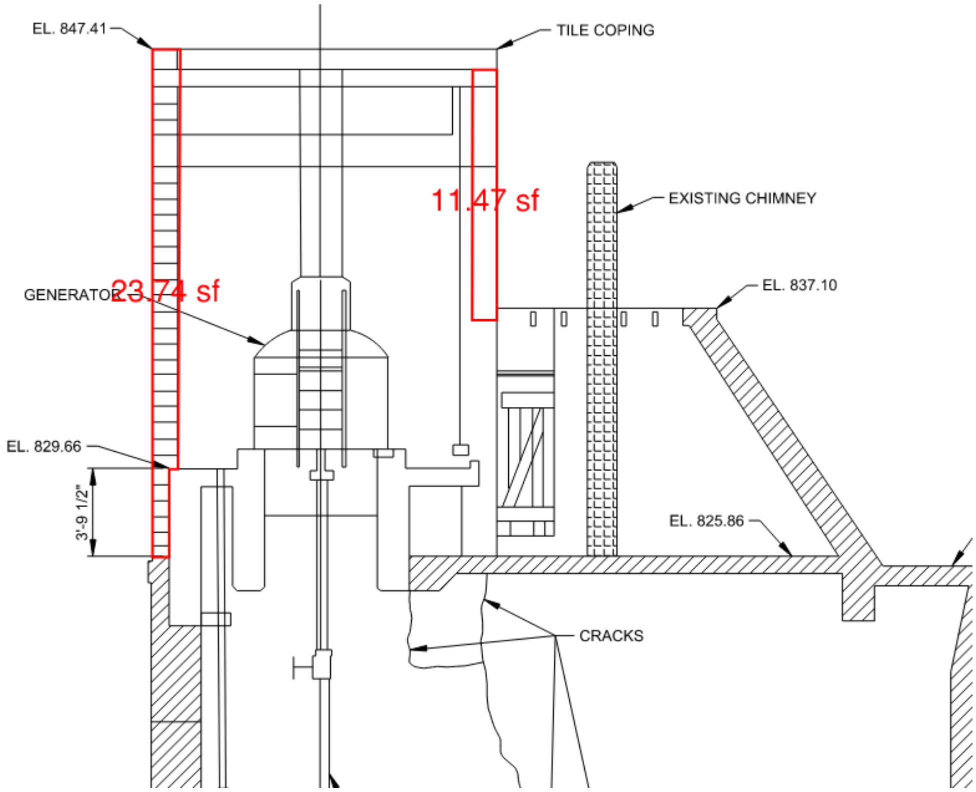
Top Section area estimated using Bluebeam Revu: 25.64 sf + 7.9 sf + 21.63 sf = 55.16 sf

Extend from Eleveation values given in Powerhouse Generator cross section: El. 825.4 to El. 837.10 = 11.7 ft

Volume = 55.16 sf x 11.7 ft = 645.37 cf = 23.9 cy

<u>Downstream Side of Powerhouse</u>

North and South Walls:

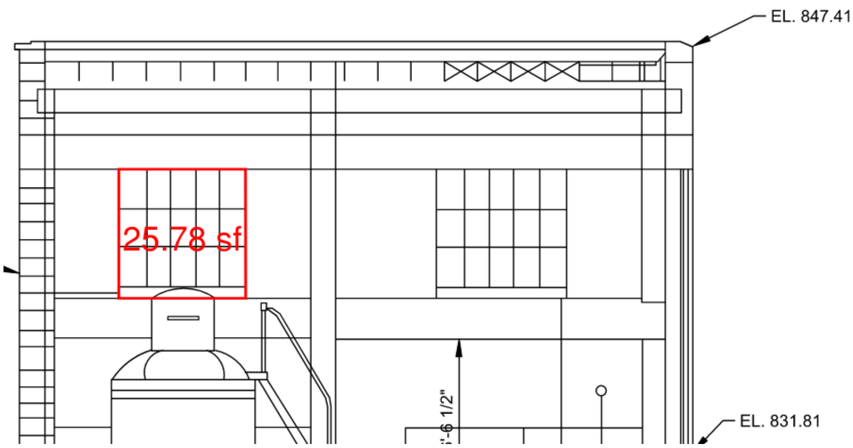


Cross sectional area estimated using bluebeam Revu: 23.74 sf + 11.47 sf = 35.21 sf

Assume same length as upstream north wall: 24'-7 3-4" = 24.65 ft.

Gross Volume: 35.21 sf x 24.65 ft = 867.93 cf = 32.1 cy

Subtract Windows (now boarded up)



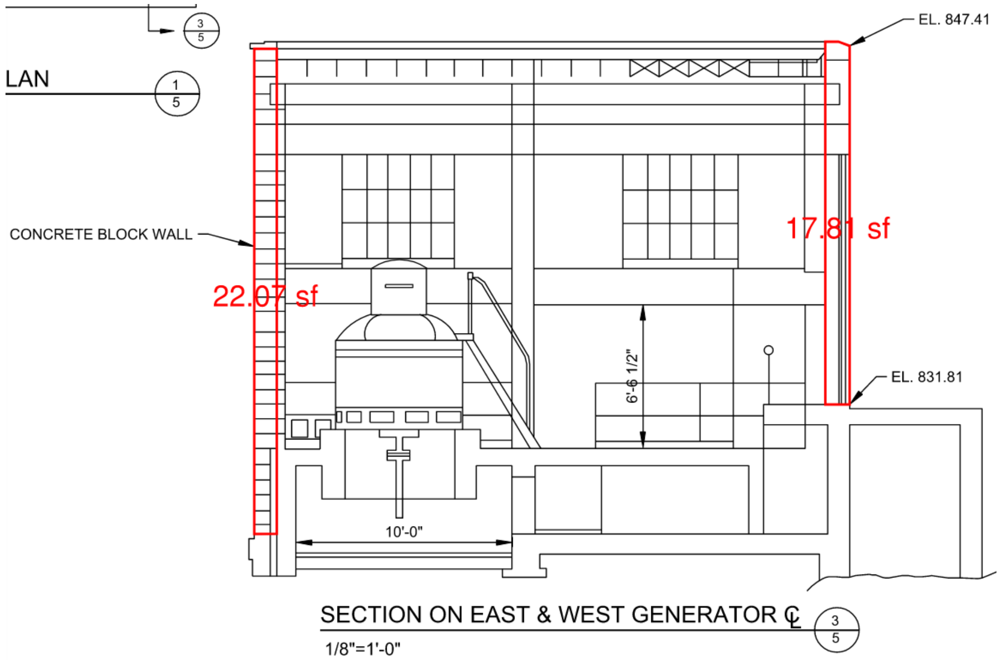
Area estimated using Bluebeam Revu: 25.78 sf x 2 windows = 51.56 sf

Assume 12" concrete blocks as called out for the south wall in the section view.

Volume: 51.56 sf x 1 ft = 51.56 cf = 1.9 cy

North and South Walls Net Volume: 32.1 cy – 1.9 cy = 30.2 cy

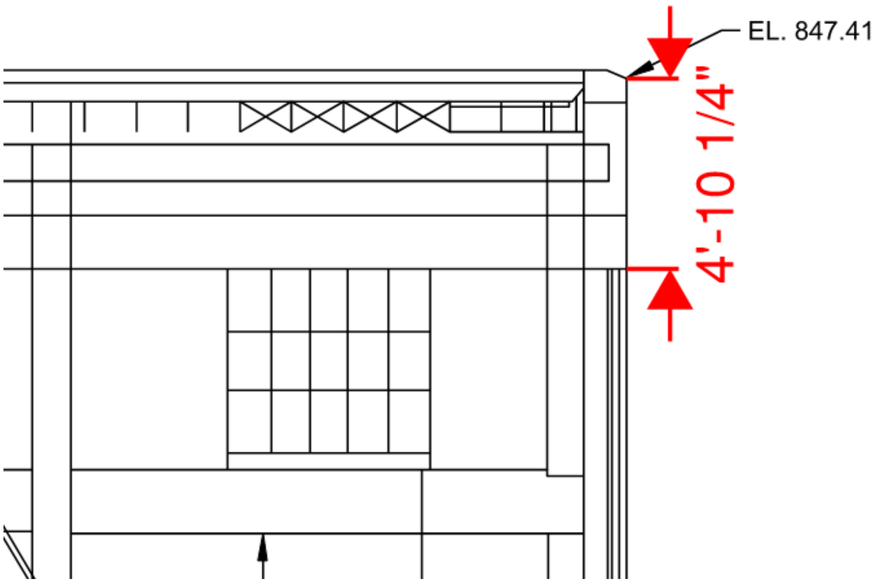
East and West Walls:



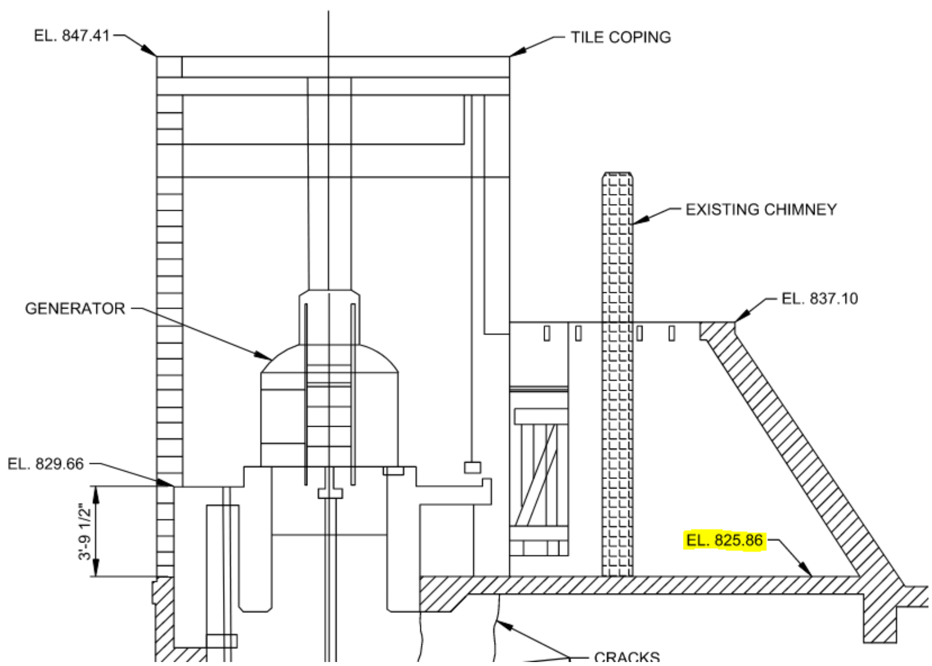
Cross sectional area estimated using Bluebeam Revu: 22.07 sf + 17.81 sf = 39.88 sf
Length provided in plan view: 15'-1" = 15.08 ft.
Volume: 39.88 sf x 15.08 ft. = 601.39 cf = 22.3 cy

Total gross volume of upstream side walls: 22.3 + 30.2 = 52.5 cy
Note that the columns and some of the surrounding material on the upstream half of the building is comprised of masonry bricks rather than concrete bricks. This masonry volume needs to be calculated and subtracted from the wall concrete quantities.

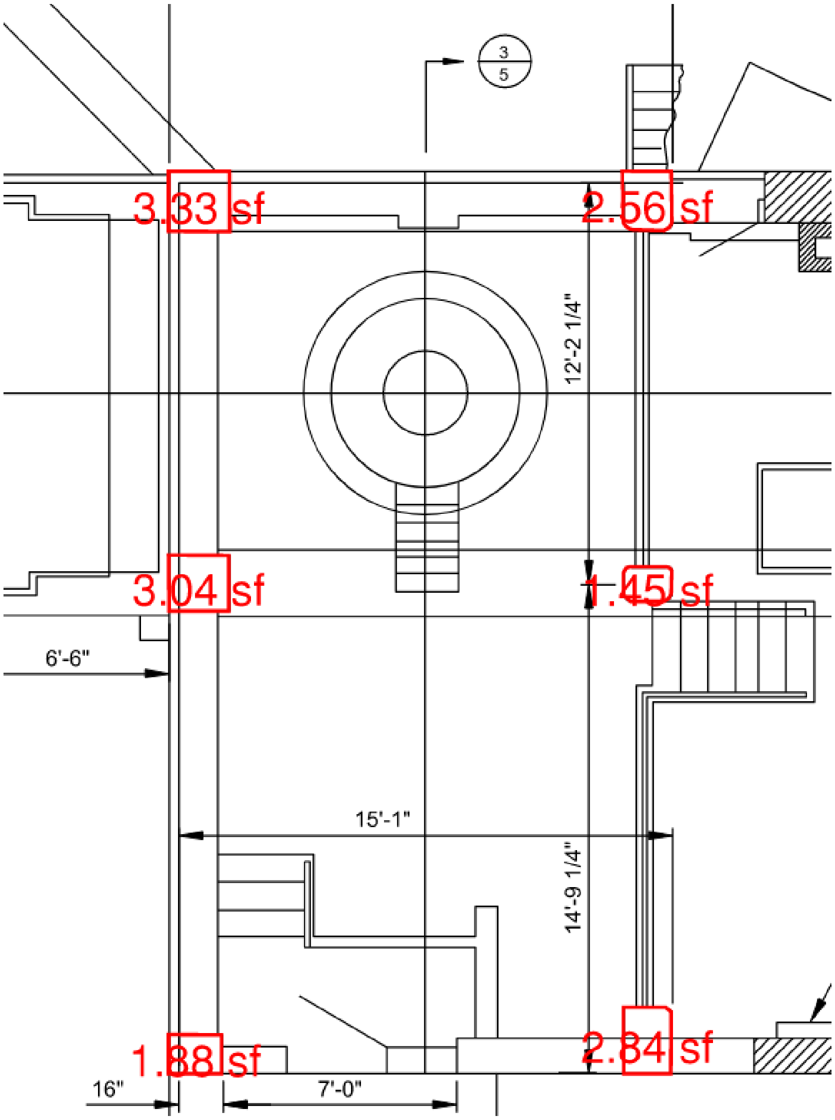
Note that the brick appears to extend up to the elevation of the top of the windows.



The top of the windows was estimated using Bluebeam Revu to be at El. 842.56



Using a bottom Elevation value of 825.86, the height of the masonry column sections was estimated: 842.56 – 825.86 = 16.7 ft.



Cross sectional area of columns estimated using Bluebeam Revu: 3.33 sf + 3.04 sf + 1.88 sf + 2.84 sf + 1.45 sf + 2.56 sf = 15.1 sf

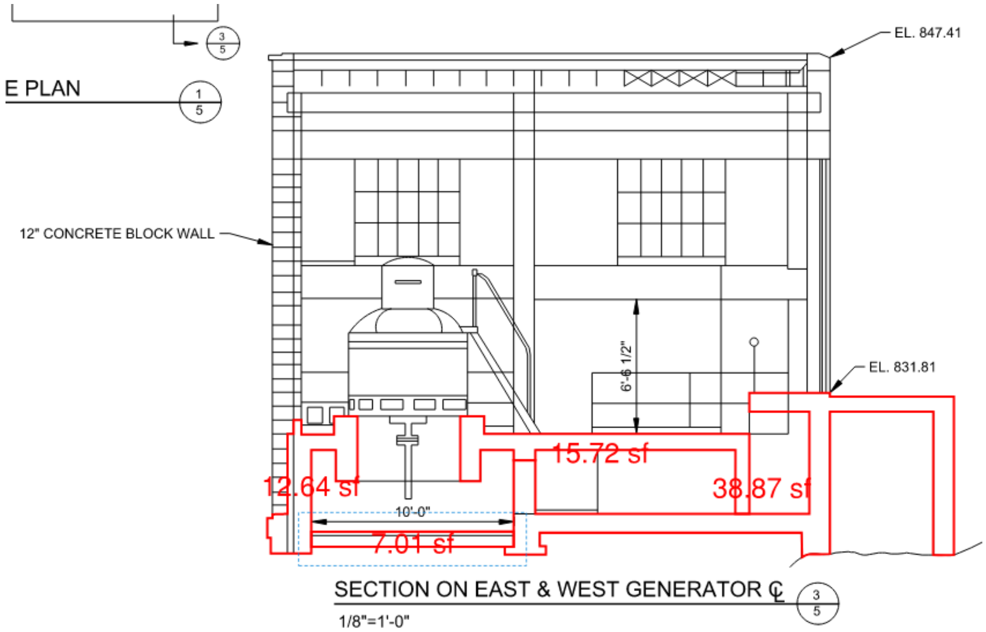
However, some of the material surrounding the columns also appears to be masonry bricks. To account for this, the cross-sectional area is to be increased (conservatively) by 50%

Cross Sectional Area: 15.1 sf * 150% = 22.65 sf

Estimated Masonry Volume: 22.65 sf x 16.7 ft = 378.26 cf = 14.0 cy

Estimated net volume of downstream concrete walls = 52.5 cy -14.0 cy = 38.5 cy

Concrete Floors



Section area of upstream concrete floors and outcropping estimated using Bluebeam Revu: 12.64 sf + 7.01 sf + 15.72 sf + 38.87 sf = 74.24 sf *(Note that this is a very conservative estimate)*

Length of upstream side, given in plan view: 15’-1” = 15.08 ft.

Estimated Volume: 74.24 sf x 15.08 ft. = 1119.54 cf = 41.5 cy

Total Powerhouse Concrete:

Upstream floor and north wall: 29.8 cy

Upstream east and west walls and north wall support: 23.9 cy

Downstream walls: 38.5 cy

Downstream Floors: 41.5 cy

Total: 133.7 cy

Miscellaneous Additional Structures:

The abutment/retaining wall on the east side of the intake bay is not accounted for in the drawings. The length and thickness of this wall is not known, and sufficient photos are not available to make a proper estimate. To account for this structure and possible additional concrete features such as retaining walls not shown in the available drawings, an additional 30 cubic yards will be added to the concrete estimate.

Concrete Quantities Summary

Main Spillway and Abutments/Wingwalls: 1012.7 cy
Wasteway, Intake Bay, and Tailrace: 177.7 cy
Powerhouse: 133.7 cy
Miscellaneous Additional Concrete: 30 cy
Total Concrete Estimate: 1354.1 cy

Rebar

Most rebar details are not provided in the drawings. An estimate of 2% rebar by concrete volume will be made.
Rebar Volume Estimate: 1354.1 cy x 2% = 27.1 cy
A615 Steel Unit Weight: 0.282 lb/in^3 = 13157 lb/yd^3

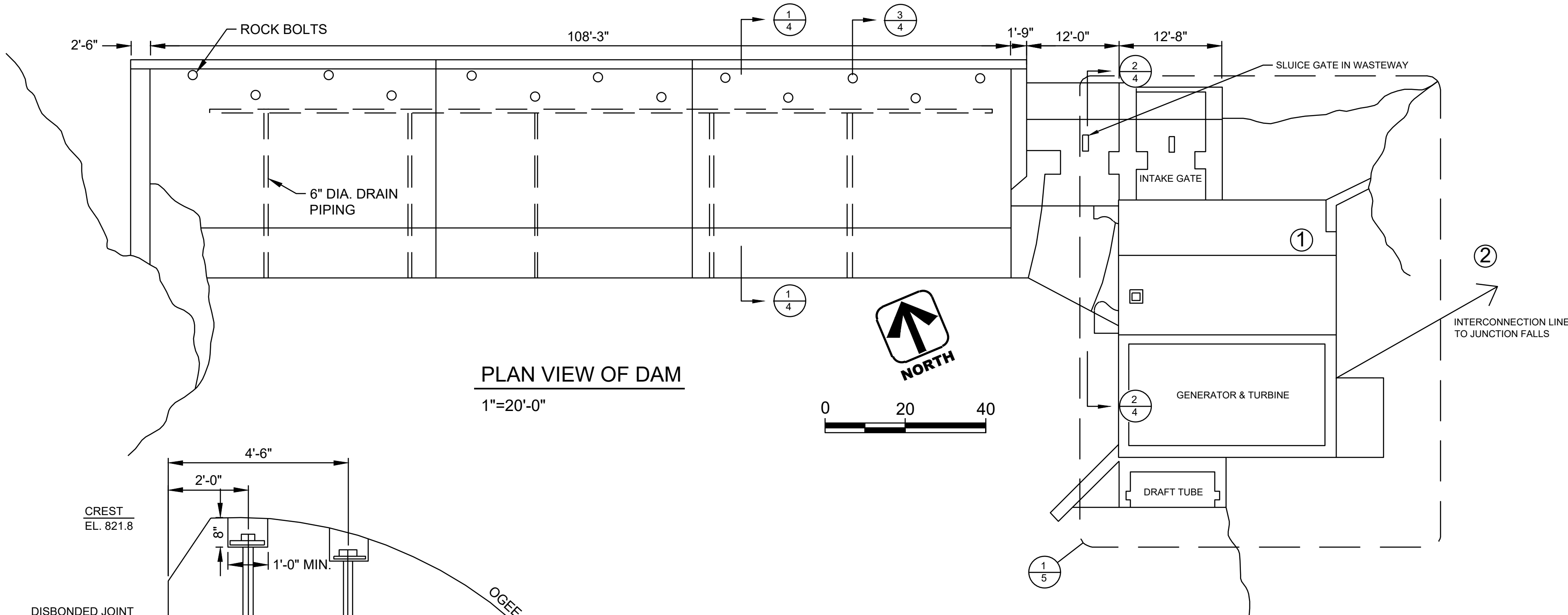
Rebar Weight Estimate = 27.1 cy x 13157 lb/yd^3 = 359555 lbs. = **178 tons**

<u>Masonry</u>
(Previously calculated)
14.0 cy

US Army Corps of Engineers®
St. Paul District

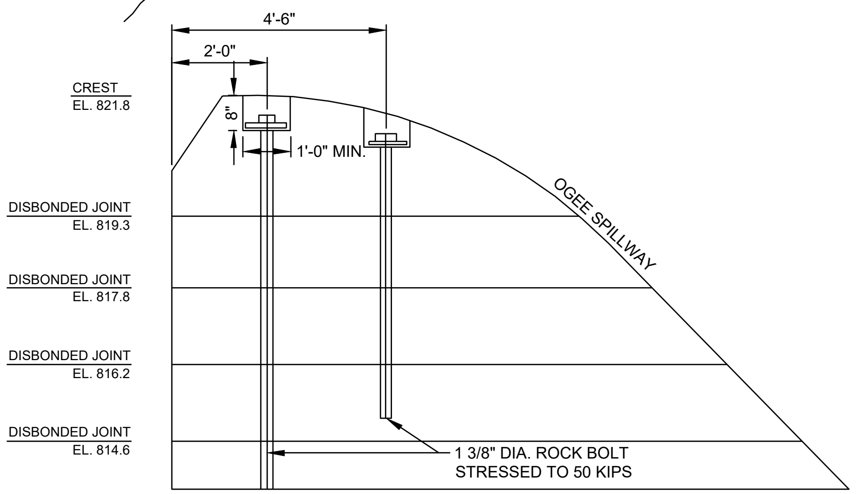
Attachment I-4: Powell Falls Drawings

Section 206 Continuing Authorities Program (CAP) Detailed Project Report
Kinnickinnic River
Aquatic Ecosystem Restoration and Protection Project



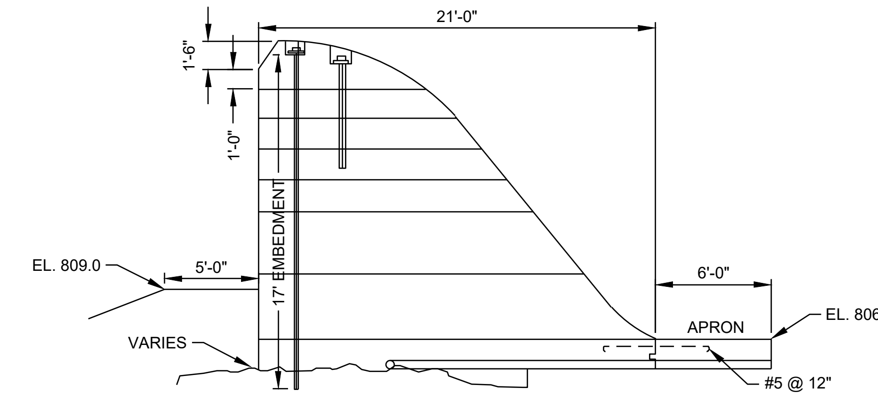
PLAN VIEW OF DAM

1"=20'-0"



ROCK BOLT DETAIL (3/4)

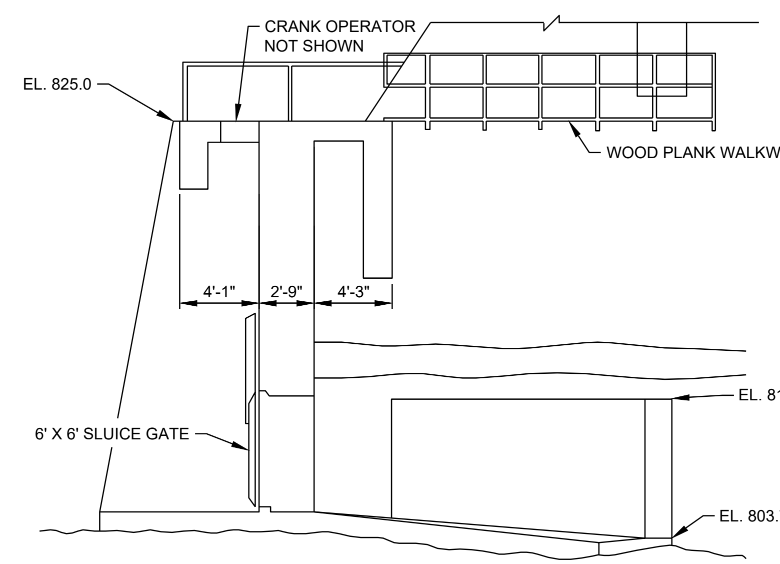
1"=2'-0"



SPILLWAY SECTION (1/4)

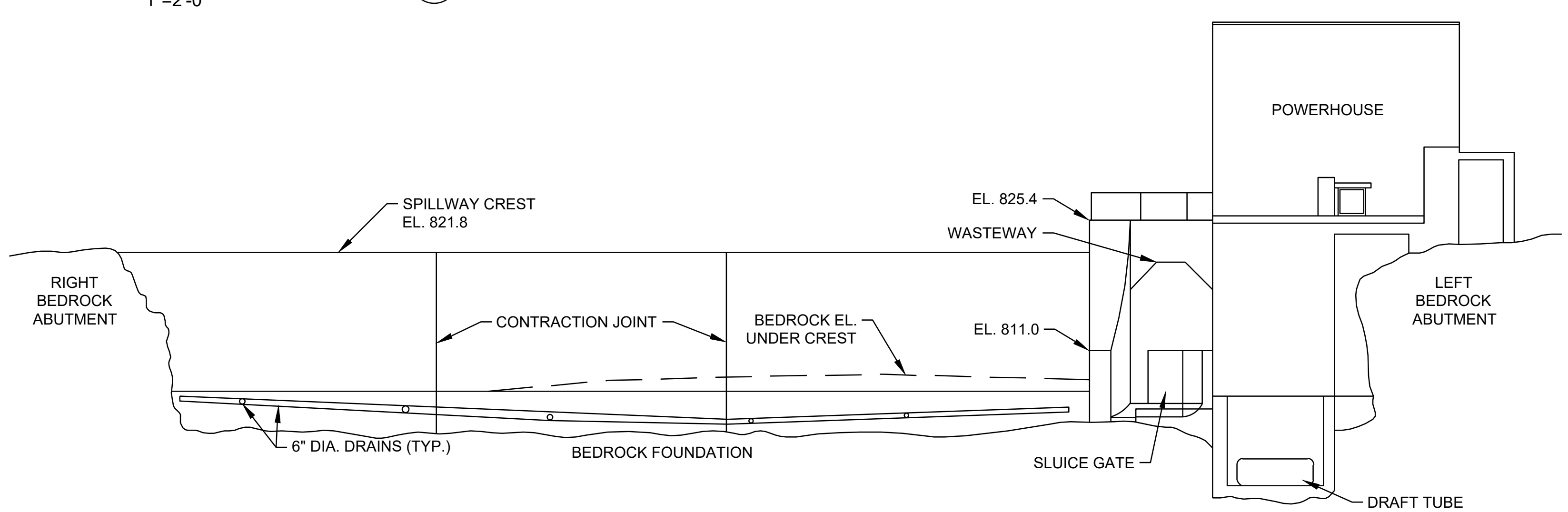
1"=5'-0"

1. PRIOR TO START OF PROJECT: RMFU TO REMOVE SLUG FUSE CUTOFFS TO DE-ENERGIZE GENERATOR AND CEASE GENERATION.
2. CITY TO ADD 2400 TO 240 V POLE TRANSFORMER WITH METER FOR CONTRACTOR CONNECTION.



WASTEWAY SECTION (2/4)

1"=5'-0"



DOWNSTREAM ELEVATION

1"=20'-0"

AA-Standard.stb 1/26/2021 I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\3 EXISTING SITE.dwg, Layout: 4 EXISTING CONDITIONS

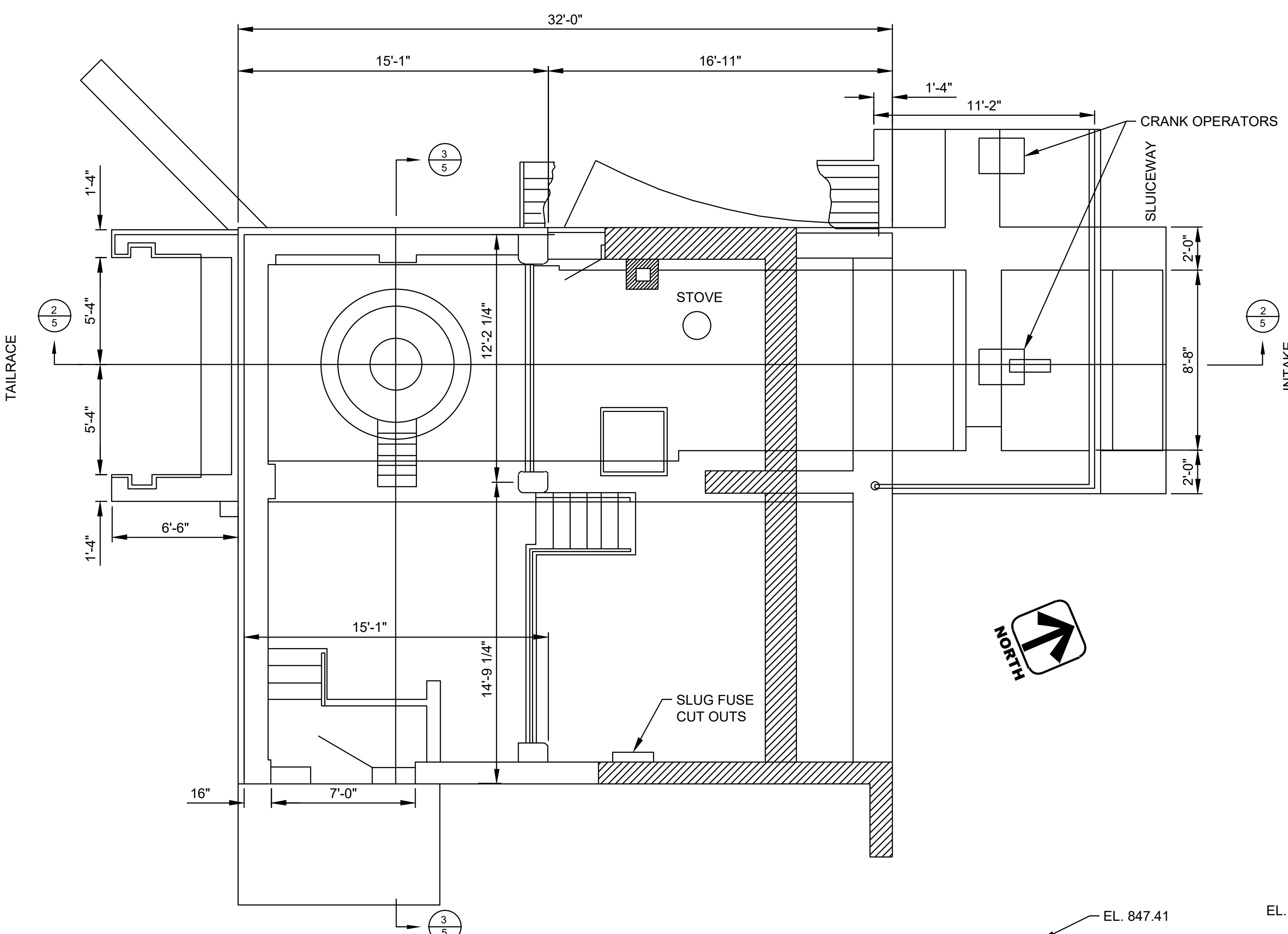
DES BY	PEH						
DR BY	ARR	PROJ NO	26-1155.00	NOT FOR CONSTRUCTION			
CHK BY	EF	DATE	JAN 11, 2021	NO	DATE	REVISION	NO / DATE / REVISION

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

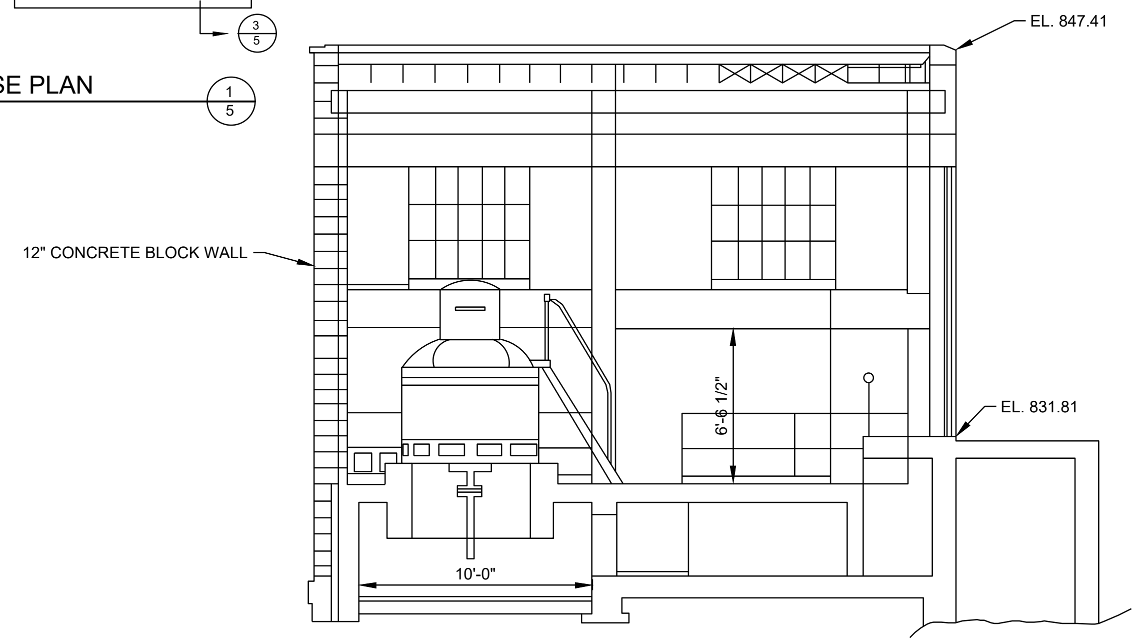
EXISTING CONDITIONS

SHEET NO. 4



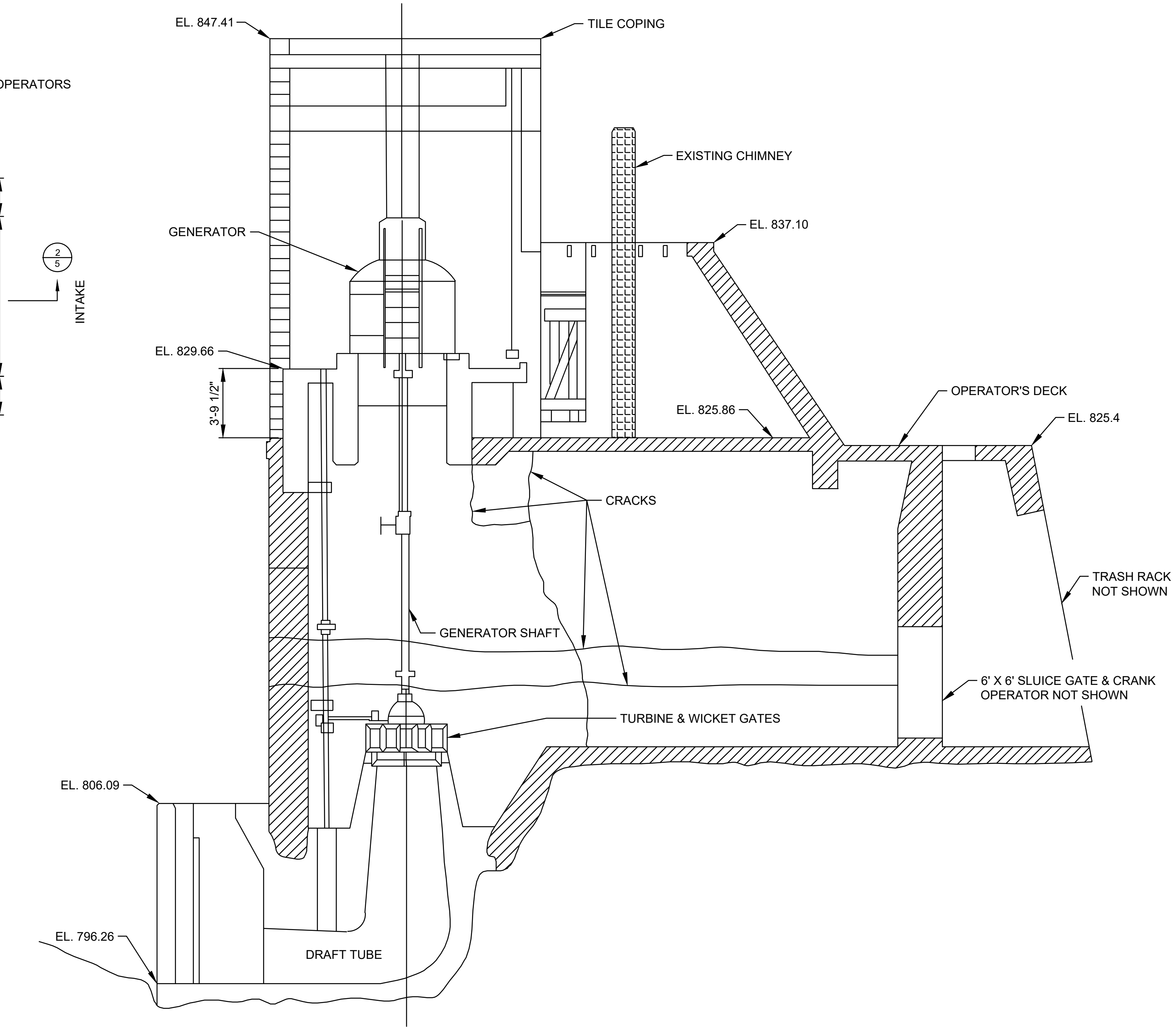
POWERHOUSE PLAN (1/5)

1/8"=1'-0"



SECTION ON EAST & WEST GENERATOR ℄ (3/5)

1/8"=1'-0"



SECTION THROUGH INTAKE & GENERATOR (2/5)

1/8"=1'-0"

0 4 8

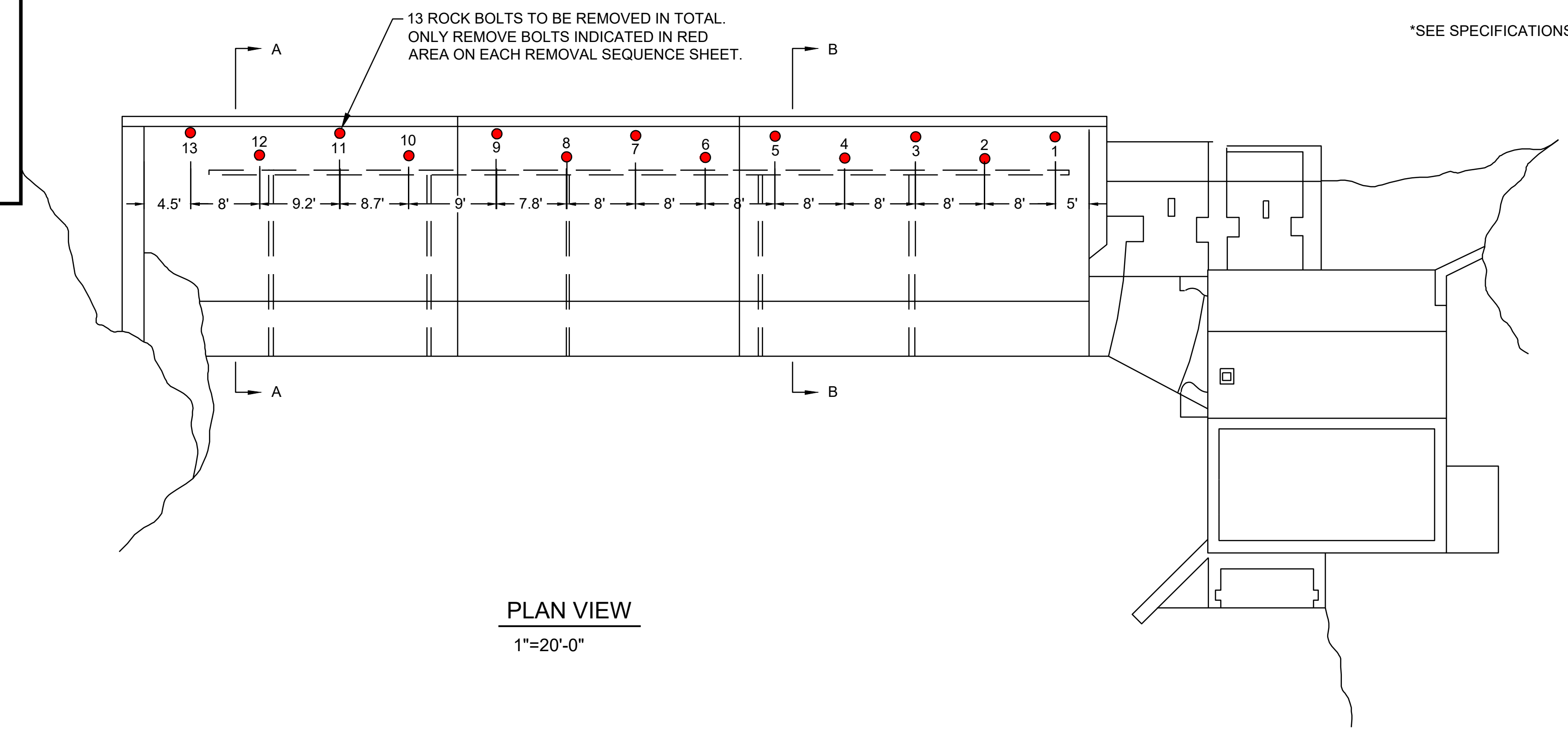
DES BY	PEH		NOT FOR CONSTRUCTION			POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	EXISTING POWERHOUSE CONDITIONS	SHEET NO. 5
DR BY	ARR	PROJ NO 26-1155.00							
CHK BY	EF	DATE JAN 11, 2021	NO / DATE / REVISION		NO / DATE / REVISION				

Rock Bolt	Crest EL	Bedock EL	Cored EL
1	821.80	807.97	806.22
3	821.81	808.56	806.81
5	821.83	808.16	805.16
7	821.81	807.64	805.64
9	821.82	805.97	804.32
11	821.81	806.35	805.31
13	821.80	807.40	805.59

*SEE SPECIFICATIONS FOR BOLT REMOVAL REQUIREMENTS.

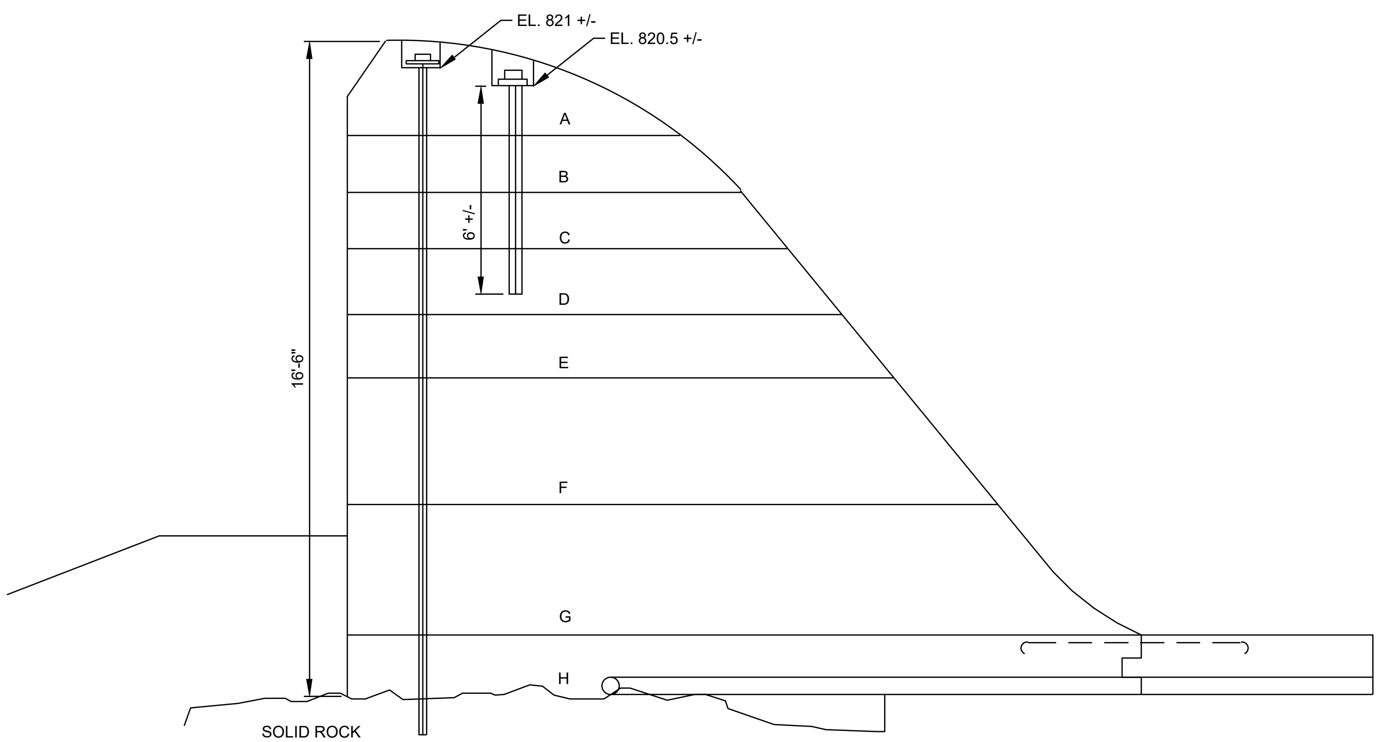
NORTH

0 150 300



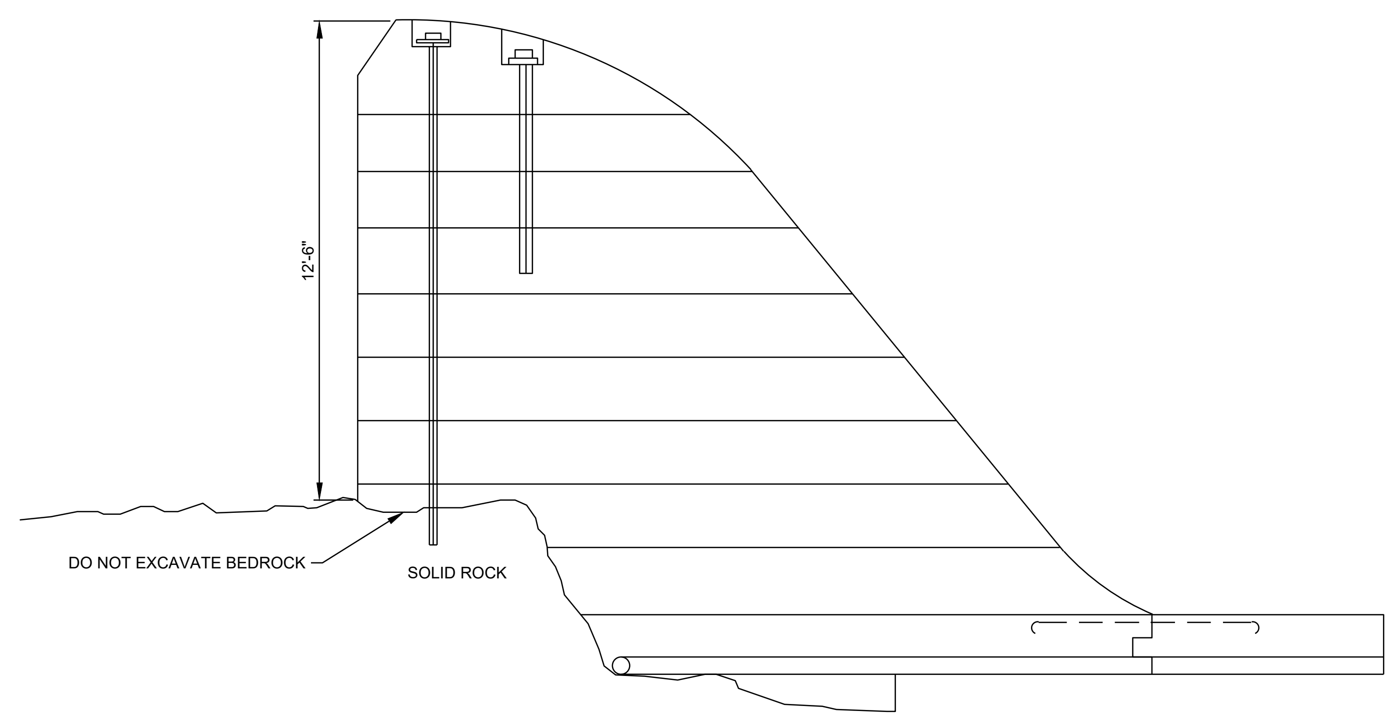
PLAN VIEW

1"=20'-0"



SECTION A

1"=5'-0"



SECTION B

1"=5'-0"

DES BY	PEH	NOT FOR CONSTRUCTION	POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	ROCK BOLT REMOVAL	SHEET NO. 19
DR BY	ARR	PROJ NO 26-1155.00				
CHK BY	EF	DATE JAN 11, 2021				

NO	DATE	REVISION

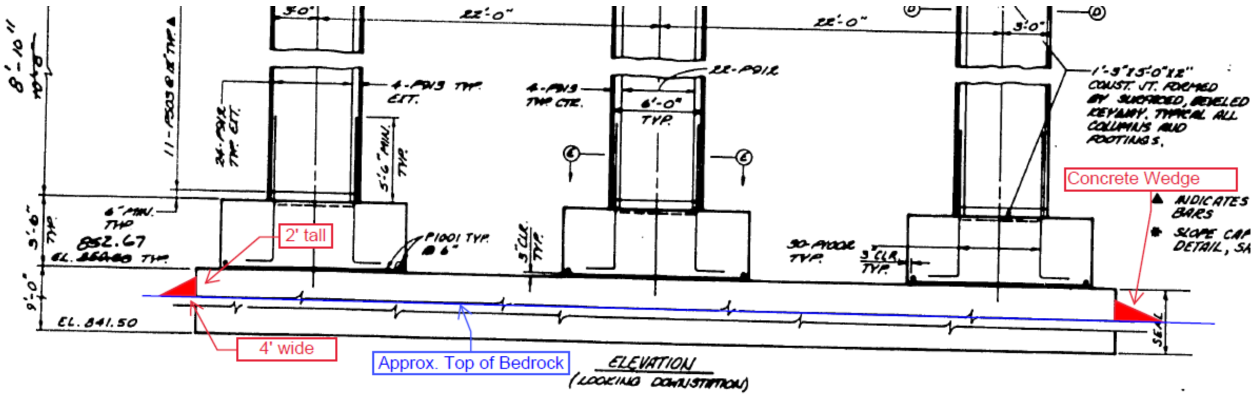
NO	DATE	REVISION

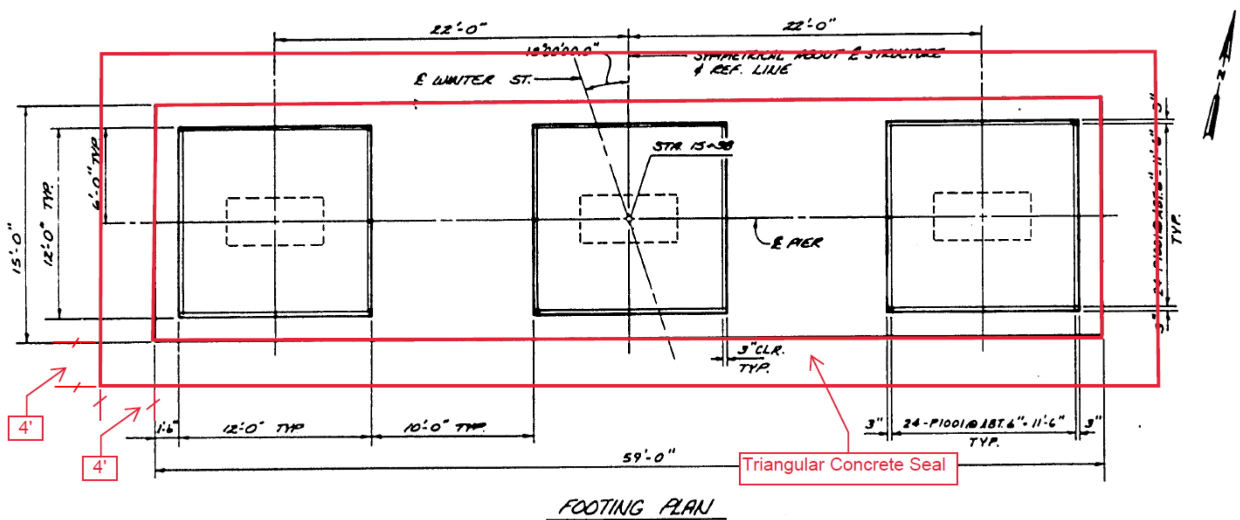
US Army Corps of Engineers ®
St. Paul District

Attachment I-5: Winter Street Bridge Concrete Footing Addition Calculations

Section 206 Continuing Authorities Program (CAP) Detailed Project Report
Kinnickinnic River
Aquatic Ecosystem Restoration and Protection Project

Winter Street Bridge Concrete Footing Addition Calculations





Concrete Quantity

Cross Sectional Area: ½ * 2' x 4' = 4 sf

Length: 59' x 2 + 15' x 2 = 128 ft

Volume of Concrete: 4 sf x 128 ft = 512 cf = 19.0 cy

Conservatively round up to 20 cy of concrete.

Rebar Quantity

Estimate 2% rebar by concrete volume:

Rebar Volume Estimate: 20 cy x 2% = 0.4 cy

A615 Steel Unit Weight: 0.282 lb/in^3 = 13157 lb/yd^3

Rebar Weight Estimate = 0.4 cy x 13157 lb/yd^3 = 5262.8 lbs. = **2.6 tons**

US Army Corps of Engineers ®
St. Paul District

Attachment I-6: Winter Street Bridge Relevant Drawings

Section 206 Continuing Authorities Program (CAP) Detailed Project Report
Kinnickinnic River
Aquatic Ecosystem Restoration and Protection Project

STATE PROJECT	FEDERAL PROJECT	
	PROJECT	CONTRACT
1000-76-42	—	—

INDEX OF SHEETS

Sheet No.	1	Title
Sheet No.	2-2.4,3B	Typical Sections and Details
Sheet No.	3-3.3	Estimate of Quantities
Sheet No.	3A-3B	Miscellaneous Quantities
Sheet No.	4-4.1	Right of Way Plat
Sheet No.	5-5.4	Plan and Profile
Sheet No.	6-6.12	Standard Detail Drawings
Sheet No.	-	Sign Plates
Sheet No.	8 -8.2B	Structure Plans
Sheet No.	-	Computer Earthwork Data
Sheet No.	9-9.5	Cross Sections

TOTAL SHEETS = 66

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

PLAN OF PROPOSED IMPROVEMENT

WINTER STREET, CITY OF RIVER FALLS

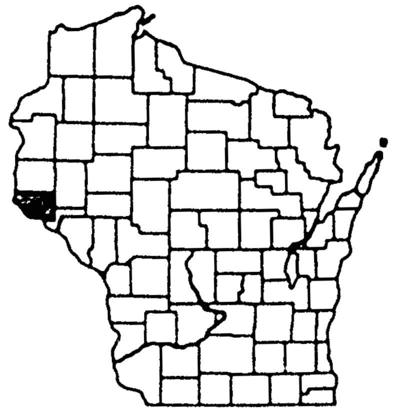
JUNCTION FALLS/KINNICKINNIC RIVER BRIDGE AND APPROACHES

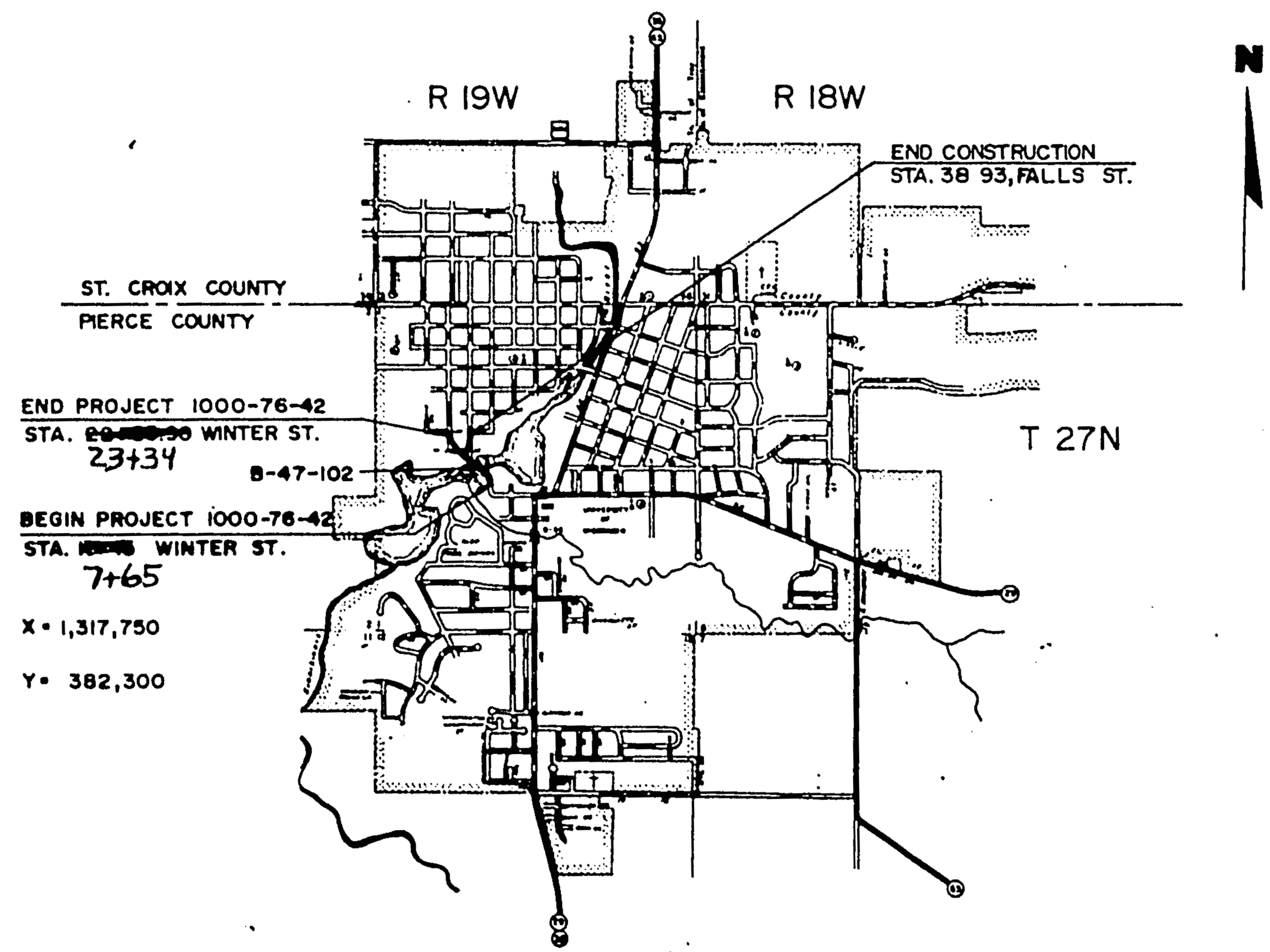
LOCAL STREET

PIERCE COUNTY

AS BUILT

STATE PROJECT NUMBER
1000-76-42





DESIGN DESIGNATION

A.D.T.	1991	=	2450
A.D.T.	2011	=	3200
D.H.V.	2011	=	600
D.	%	=	60-40
T.	%	=	4.0
V.	MPH	=	30
ESAL'S		=	350,400

CONVENTIONAL SIGNS

COUNTY LINE
CORPORATE LIMITS
PROPERTY LINE
LOT LINE
LIMITED EASEMENT
EXISTING RIGHT OF WAY
NEW RIGHT OF WAY
REFERENCE LINE
SLOPE INTERCEPT
ORIGINAL GROUND
MARSH OR ROCK PROFILE
CULVERT IN PLACE
CULVERT REQUIRED
CULVERT REQUIRED (Profile)

COMBUSTIBLE FLUIDS (UNDER PRESSURE)
UNDERGROUND UTILITIES
GAS — G —
ELECTRIC — E —
TELEPHONE — T —
SERVICE PEDESTAL
CABLE MARKER
POWER POLE
TELEPHONE POLE
RAILROADS
MARSH
WOODED AREA

LAYOUT

SCALE 0 1/2 MI.

TOTAL NET LENGTH OF CENTERLINE = 0.152 MI. PARTICIPATING URBAN
0.058 MI. NON-PARTICIPATING URBAN
0.210 MI. TOTAL

COORDINATE NOTE:
ALL COORDINATES ARE REFERENCED TO THE WISCONSIN COORDINATE SYSTEM CENTRAL ZONE AND SCALED FROM U.S.G.S. TOPOGRAPHIC MAP RIVER FALLS WEST WISCONSIN QUADRANGLE FOR IDENTIFICATION ONLY.

PLANS PREPARED BY
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

DONALD W. STERNA E-25405 MINNEAPOLIS MN — WISCONSIN PROFESSIONAL ENGINEER

DATE *Feb 27, 1991*

APPROVED FOR
CITY OF RIVER FALLS

3/21/91 DATE — MAYOR

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

Surveyor ____ District Checker BJF
Designer ____ C.O. Plan Examiner
District Supervisor CBL C.O. Coordinator RTR

APPROVED:
DATE: *4/4/91* — DISTRICT CHIEF DESIGN ENGINEER

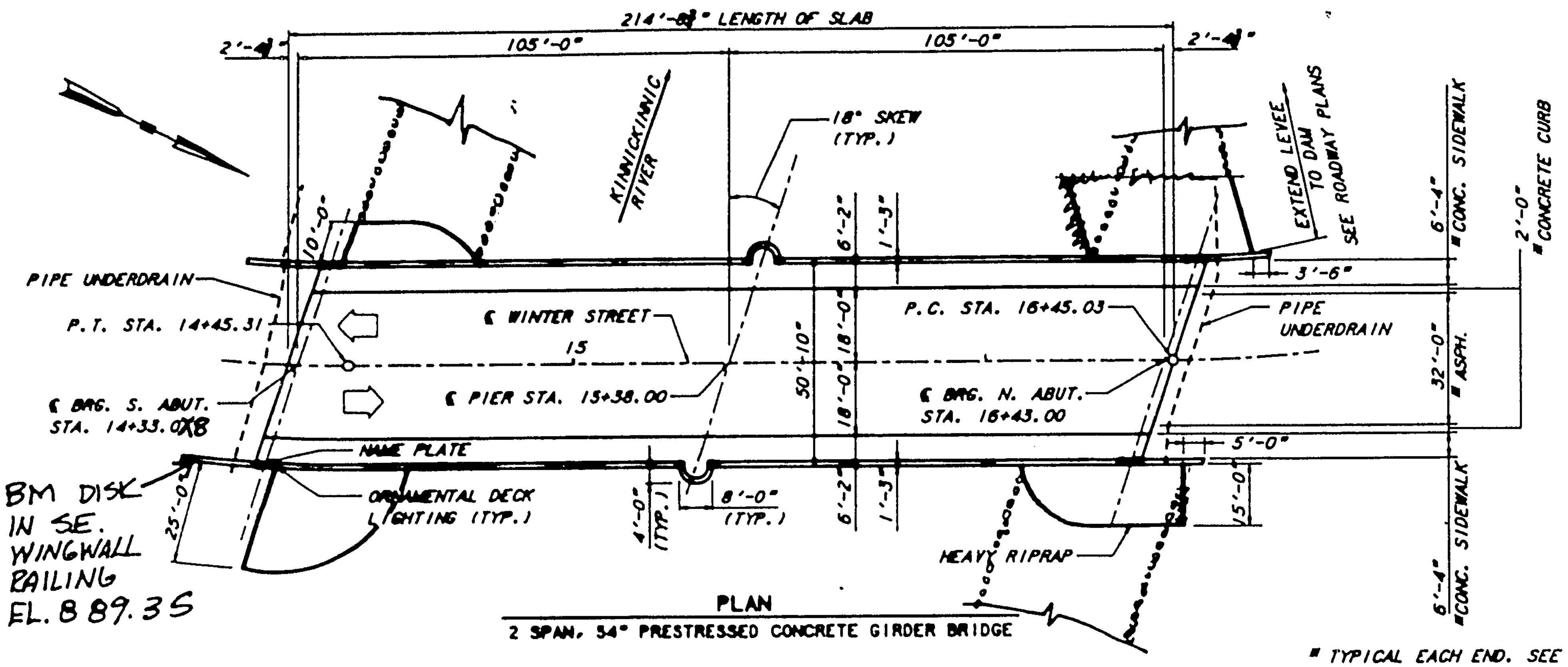
APPROVED:
DATE: *5/15/91* *Robert W. ...* — REGIONAL CHIEF ROAD DESIGN ENGINEER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION 5 WISCONSIN DIVISION

APPROVED:
DATE: ____ DIVISION ADMINISTRATOR

PIERCE 10-76-42

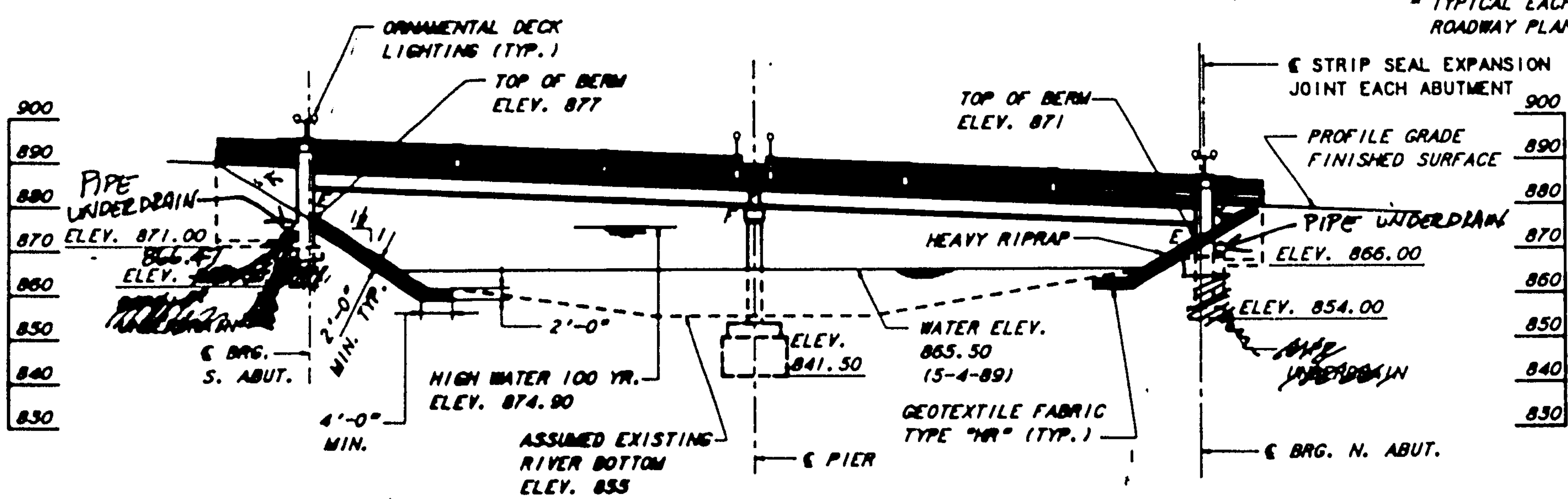
STATE PROJECT I.D.	SHEET NUMBER
1000-76-42	8.0



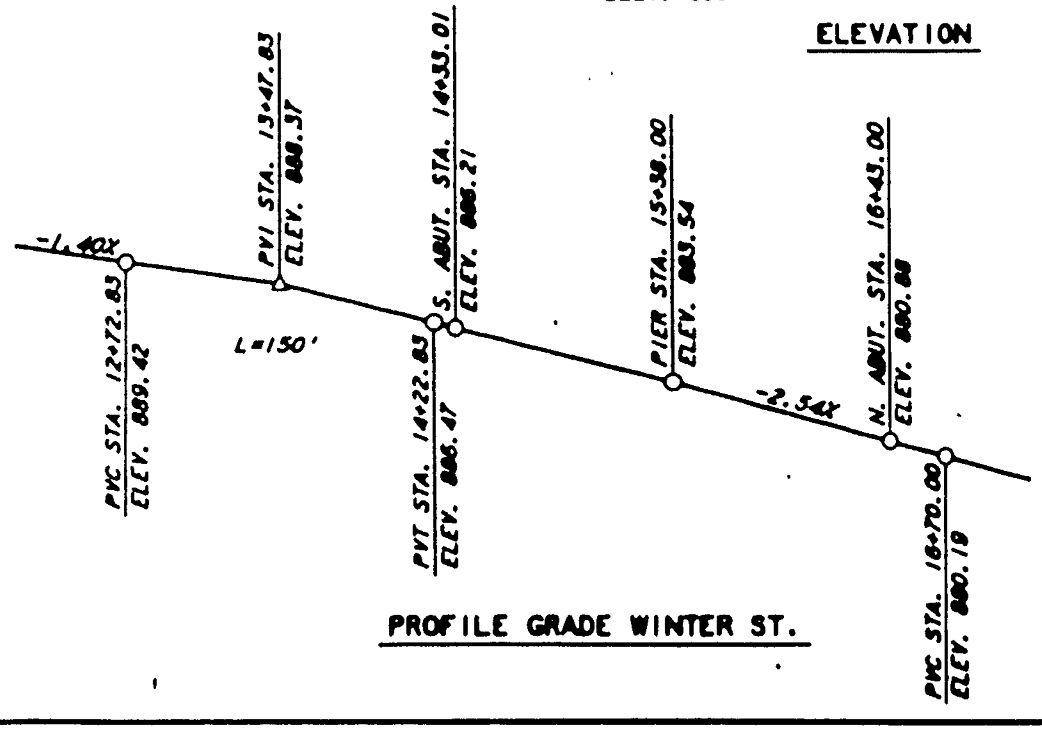
PLAN

2 SPAN, 54" PRESTRESSED CONCRETE GIRDER BRIDGE

* TYPICAL EACH END. SEE ROADWAY PLANS



ELEVATION



PROFILE GRADE WINTER ST.

℄ WINTER STREET CURVE DATA

CURVE 1		CURVE 2	
P.C.	= 12+02.10	P.C.	= 16+45.03
P.T.	= 14+45.31	P.T.	= 17+13.27
Δ	= 46°12'37.1"	Δ	= 12°57'58.3"
D	= 19°00'00.0"	D	= 19°00'00.0"
L	= 243.21	L	= 68.24'
T	= 128.66'	T	= 34.27'
R	= 301.56	R	= 301.56'

GENERAL NOTES:

DRAWINGS SHALL NOT BE SCALED.

THE SLOPE OF THE FILL IN FRONT OF THE ABUTMENTS SHALL BE COVERED WITH HEAVY RIPRAP TO THE EXTENT SHOWN ON THIS SHEET AND THE ABUTMENT DETAILS.

ALL DETAILS MATERIALS AND FABRICATION SHALL CONFORM TO THE STANDARD SPECIFICATION FOR ROAD AND BRIDGE CONSTRUCTION OF THE STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION, EDITION 1989, EXCEPT AS OTHERWISE NOTED.

ALL ELEVATIONS ARE REFERRED TO USGS DATUM.

NORMAL TEMPERATURE IS 45° F.

BEVEL EXPOSED EDGES OF EXPOSED CONCETE 1" UNLESS OTHERWISE NOTED.

BENDING DIMENSIONS FOR REINFORCEING BARS ARE OUT TO OUT.

THE FIRST DIGIT OF A THREE DIGIT BAR MARK OR THE FIRST TWO DIGITS OF A FOUR DIGIT BAR MARK INDICATES THE SIZE OF BAR.

REINFORCING BARS SHALL BE TAGGED SO THE THE STRUCTURE UNIT IN WHICH THEY ARE TO BE PLACED IS IDENTIFIED.

USE 2" CLEAR FOR ALL REINFORCEMENT UNLESS OTHERWISE NOTED.

THE TOP MAT OF REINFORCING BARS IN THE DECK SLAB, ALL MEDIAN AND PARAPET BARS ON THE BRIDGE AND WING WALLS AND BARS IN THE ABUTMENT PAVING NOTCH SHALL BE EPOXY COATED.

JOINT FILLER SHALL CONFORM TO AASHTO DESIGNATION N153, TYPE I, II AND III, OR AASHTO DEIGNATION M213.

THE FINISHED GRADE SECTION SHALL BE THE UPPER LIMITS OF "EXCAVATION FOR STRUCTURE."

AT ABUTMENTS ALL SPACES EXCAVATED BUT NOT OCCUPIED BY THE NEW STRUCTURE SHALL BE BACKFILLED WITH GRANULAR BACKFILL, GRADE I.

ELASTOMERIC BEARING PADS NEED NOT BE INDIVIDUALLY MOLDED PROVIDED THE CUTS ARE SMOOTH AND TRUE.

BRIDGE REMOVAL NOTES

THE EXISTING BRIDGE (P-47-714) IS A 179.5 FT. LONG SINGLE SPAN THROUGH STEEL TRUSS WITH A 23.3 FT. CLEAR WIDTH AND A 5.7 FT. SIDEWALK LOCATED WEST OF THE PROPOSED ALIGNMENT.

PLANS FOR THE EXISTING BRIDGE ARE AVAILABLE FOR INSPECTION AT:

WISCONSIN DEPARTMENT OF TRANSPORTATION, DISTRICT 6
718 W. CLAIREMONT AVENUE
EAU CLAIRE, WISCONSIN 54701

BENCH MARK

USC&GS DISK (BM 411-A MARKED "RAILROAD COMMISSION OF WIS." SET IN THE TOP OF THE HIGH POINT OF A ROCK LEDGE AT THE JUNCTION OF THE KINNICKINNIC AND THE SOUTH FORK ON THE LEFT BANK OF THE KINNICKINNIC AND THE RIGHT BANK OF THE SOUTH FORK, EL. 867.176 FEET MSL.

BRIDGE OFFICE CONTACT: DAVE BABLER
(608) 266-8486

No.	Date	Revisions	By

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

Structure B-47-102

WINTER STREET OVER KINNICKINNIC RIVER

County: PIERCE		City: RIVER FALLS	
Design Spec. AASHTO 1989		Load HS20	Const. Spec. 1989
Designed By MDS	Design Checked RMJ	Drawn By SEO	Plans Checked MDS

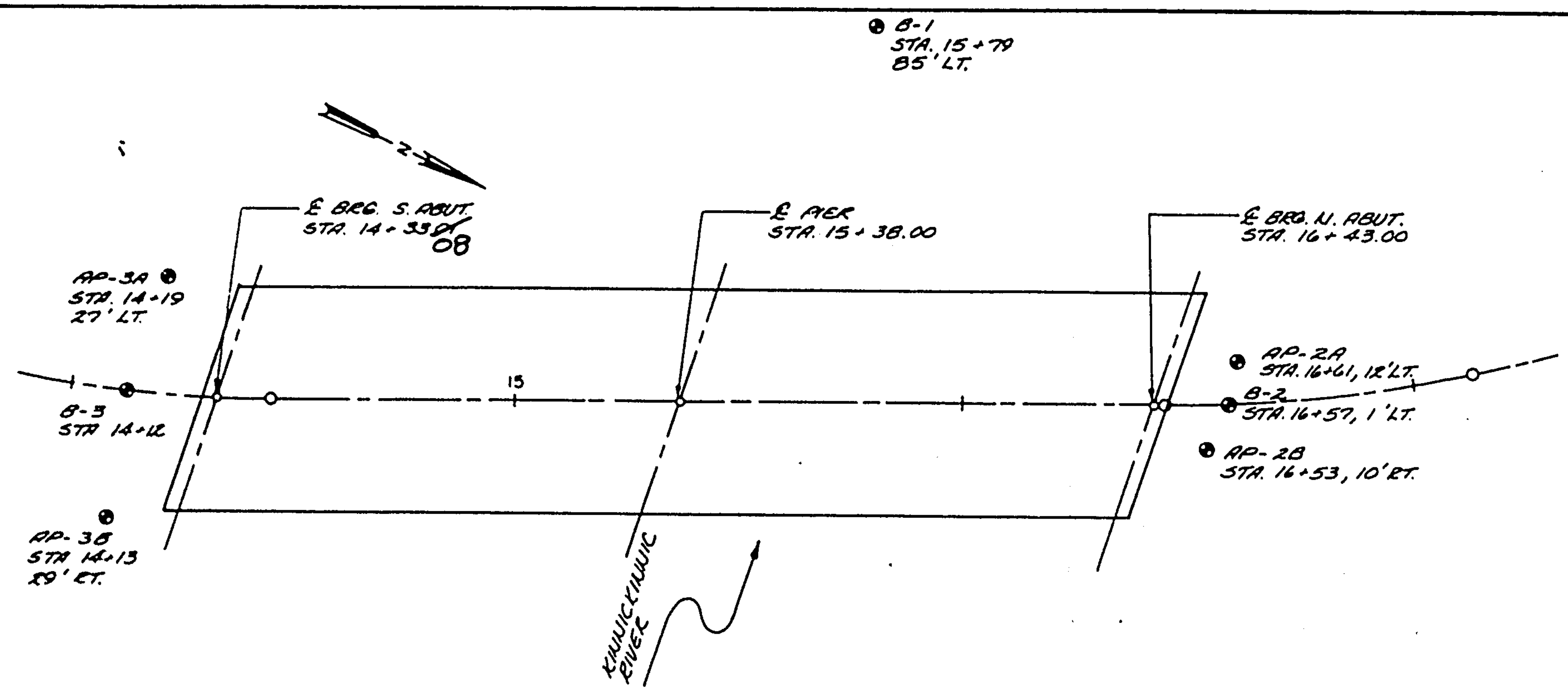
Approved [signature] 5/15/91
State Bridge Engineer — Date

GENERAL PLAN AND ELEVATION

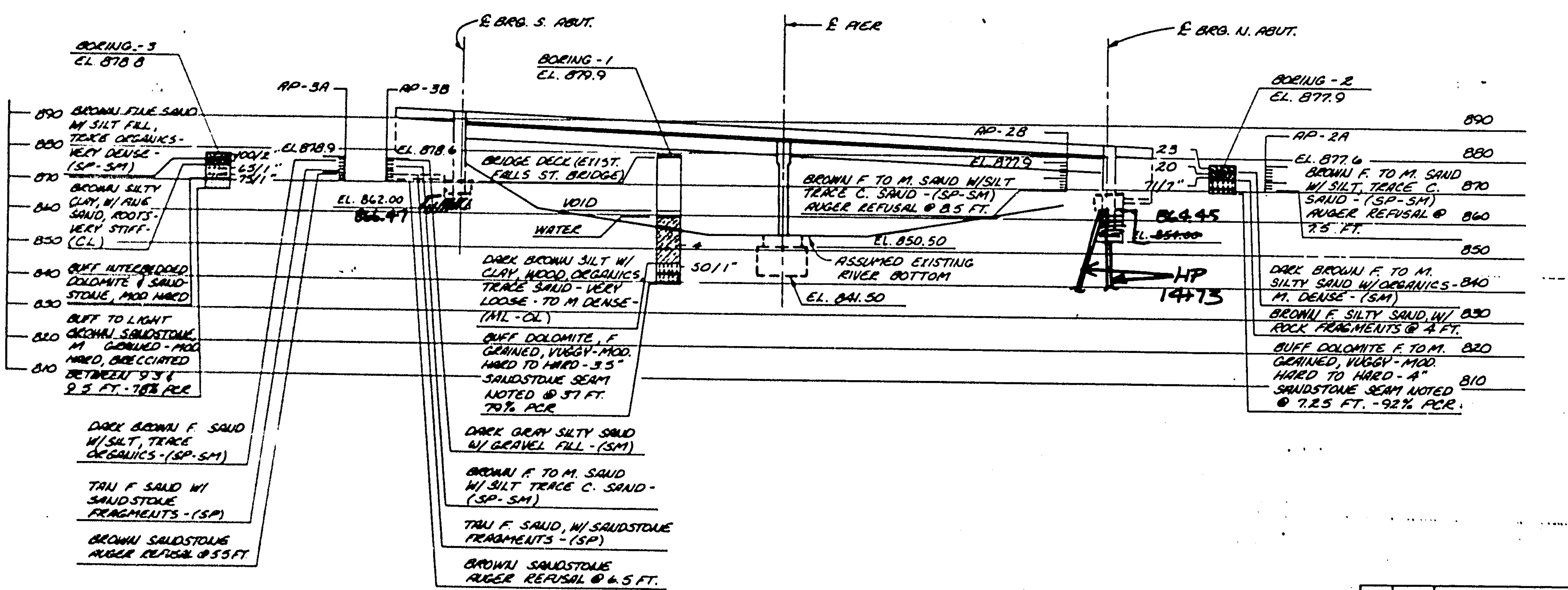
SHEET 1 OF 29

X83342

STATE PROJECT I.D.	SHEET NUMBER
1000-76-42	8.2



BORING LOCATION PLAN



LOG OF BORINGS

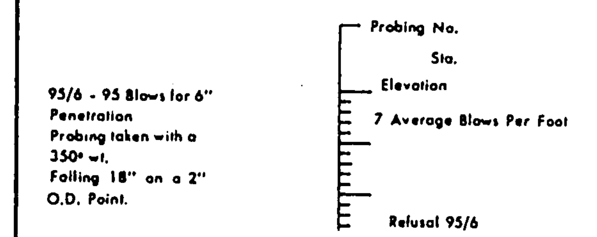
ABBREVIATIONS

F - Fine M - Medium C - Coarse
Ws - Weathered So - Sound

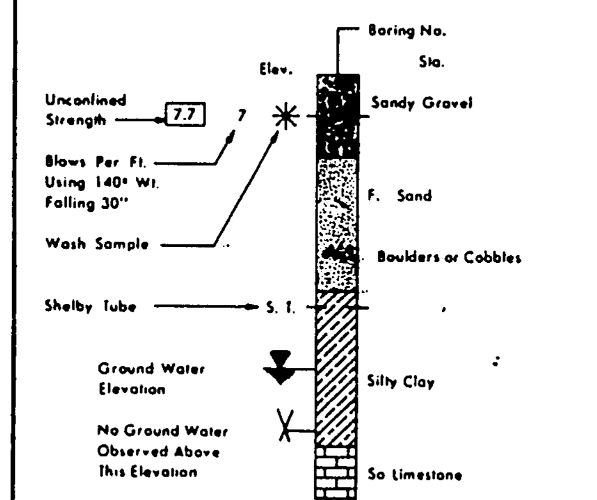
MATERIAL SYMBOLS

Topsoil, Silt, Sandstone, Sand, Peat, Limestone, Gravel, Clay, Igneous Rock

LEGEND OF PROBING



LEGEND OF BORING



Unless otherwise specified, the blows per foot at the locations indicated are based on driving a 2" O. D. x 1.4" I. D. split spoon sampler with a 140# hammer having a free fall of 30". The blow count is taken in undisturbed soil immediately below a cased or open hole eliminating side friction on the drive pipe.

SUBSURFACE EXPLORATION FOR FOUNDATION DESIGN AND BIDDERS INFORMATION

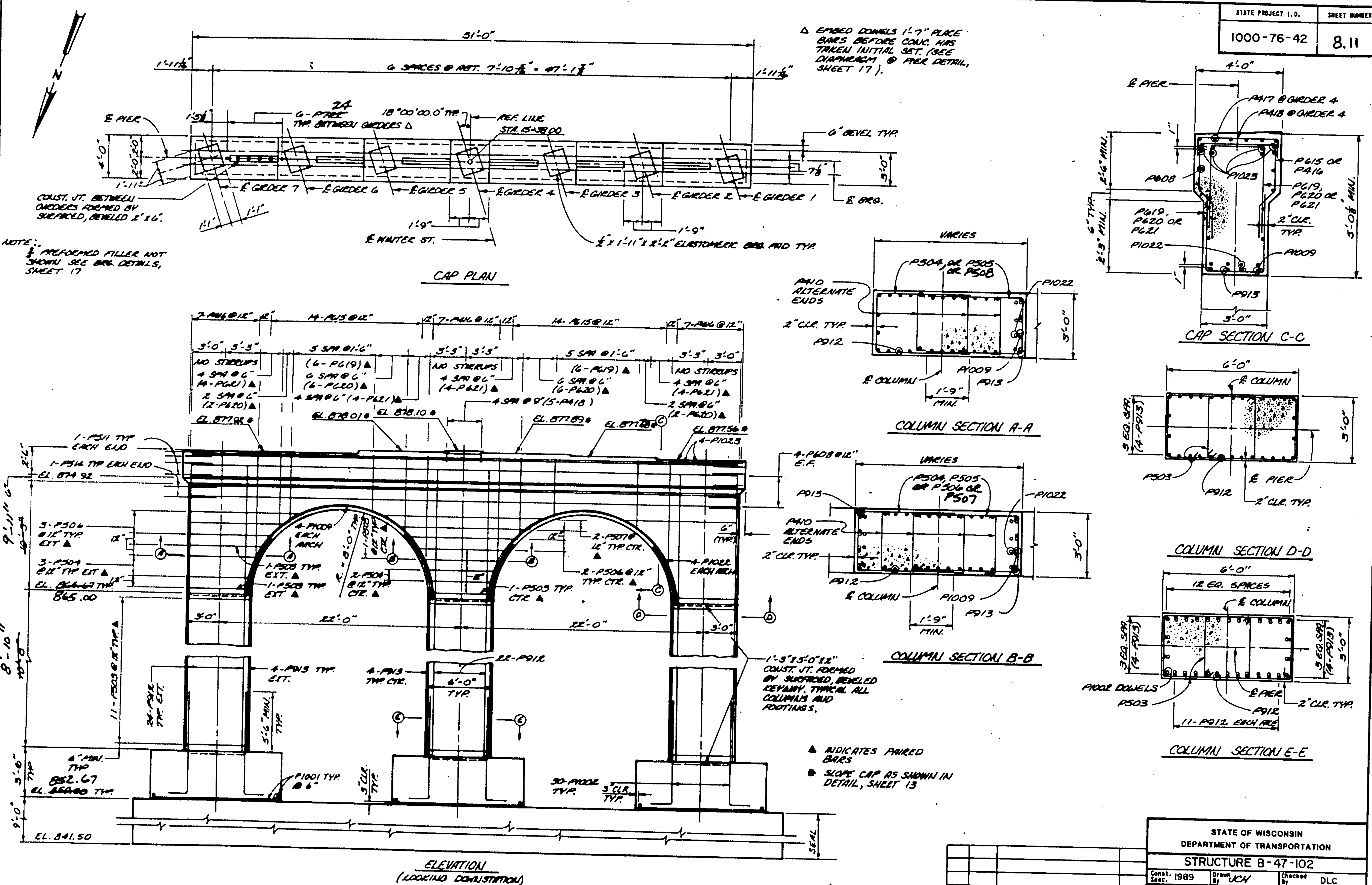
To obtain relative data concerning the character of material in and upon which the foundation might be built, borings and/or soundings were made at points approximately as indicated on this drawing. The data presented herein represents the findings of the subsurface explorations made. However, because the depths investigated are limited and the area of the borings and/or soundings is very small in relation to the entire area, the Division of Highways does not warrant conditions below the depths investigated or that the classification of material encountered in these investigations is necessarily typical of the entire site.

No.	Date	Revisions	By

HOWARD NEEDLES TAMMEN BERGENDOFF

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

STRUCTURE B-47-102		
Const. Spec. 1989	Drawn By JCH	Checked By MDS
SUBSURFACE EXPLORATION	SHEET 3 OF 29	X83342



STATE PROJECT I.D.	SHEET NUMBER
1000-76-42	8.11

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

STRUCTURE B-47-102

Const. Spec.	Drawn By	Checked By
1989	UCH	DLC

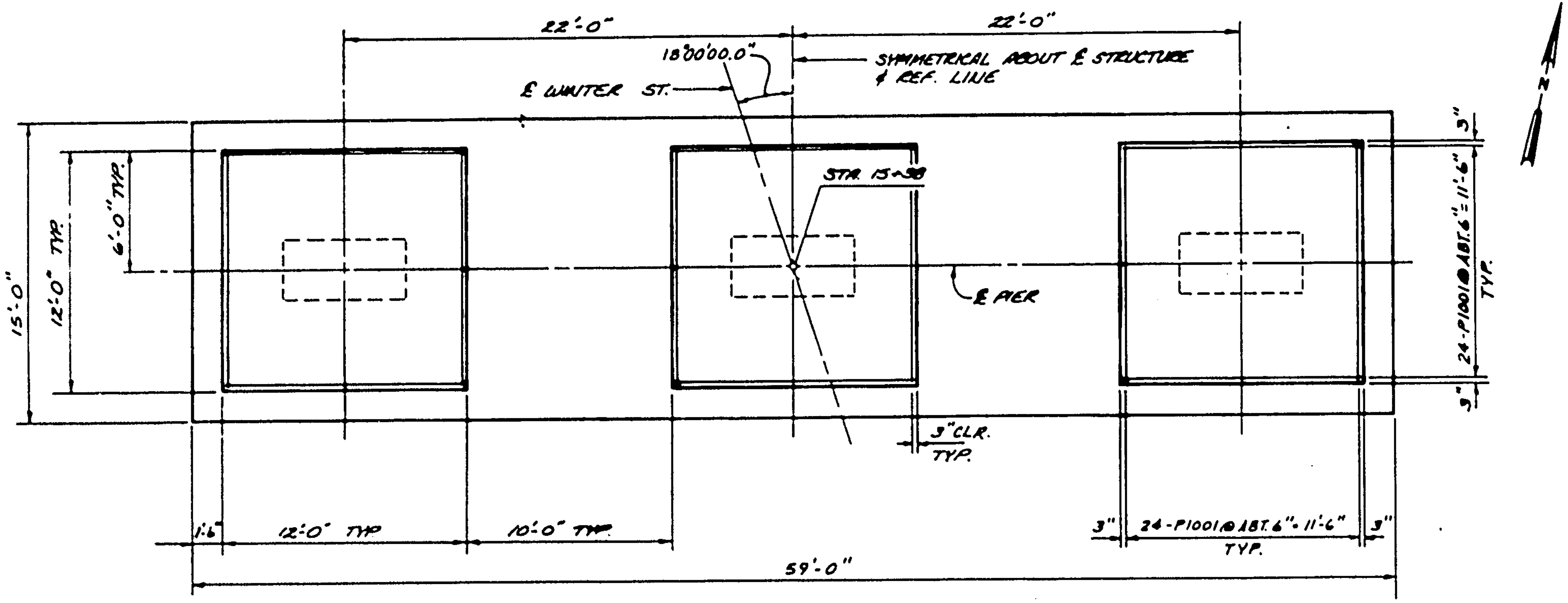
No.	Date	Revisions	By

HOWARD NEEDLES TAMMEN BERGENDOFF

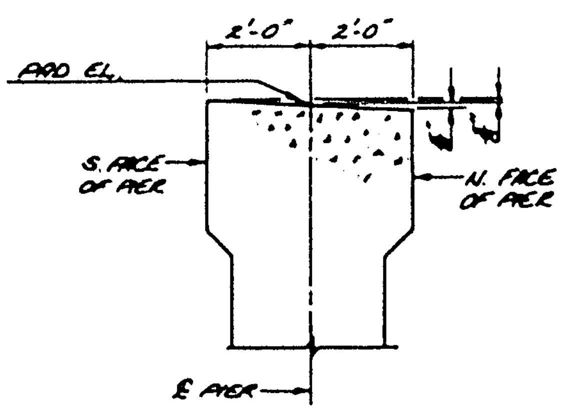
PIER REINFORCEMENT DETAILS

SHEET 12 OF 29

X83342



FOOTING PLAN

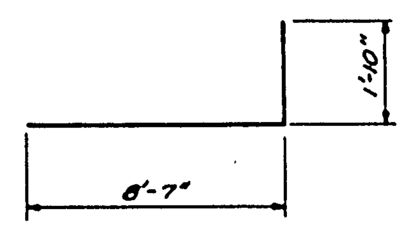


SLOPED CAP DETAIL

NOTES:
PAD ELEVATIONS GIVEN ARE FOR THE ℄ OF PIER.
MAKE BEAM SEATS PARALLEL TO GRADE AS SHOWN IN SLOPED CAP DETAIL.

MAXIMUM DESIGN FOUNDATION PRESSURE IS 8.1 TONS/SQ.FT..

BILL OF REINFORCEMENT – PIER							
BAR MARK	COAT	NO. REQ'D	LENGTH	BEND	CUT DIAG.	BUN-DLE	LOCATION
P1001		144	11' - 6"				FOOTING
P1002		90	10' - 5"				FOOTING DOWELS
P503		72	14' - 2"				COLUMN TIES
P504		16	11' - 0"				COLUMN TIES
P505		6	12' - 0"				COLUMN TIES
P506		16	15' - 2"				COLUMN TIES
P507		4	20' - 2"				COLUMN TIES
P608		8	49' - 6"				CAP
P1009		8	25' - 10"				CAP
P410		70	3' - 7"				COLUMN TIES
P511		8	8' - 8"				END OF CAP
P912		74	22' - 0"				COLUMN VERTICALS
P913		16	16' - 1"				COLUMN VERTICALS
P514		4	6' - 8"				END OF CAP
P615		28	12' - 7"				CAP
P416		21	12' - 7"				CAP
P417		6	5' - 2"				GIRDER 4 SEAT
P418		5	5' - 8"				GIRDER 4 SEAT
P619		24 ~~18~~	11' - 4"				CAP STIRRUP
P620		32 ~~16~~	12' - 2"				CAP STIRRUP
P621		32 ~~16~~	15' - 4"				CAP STIRRUP
P1022		8	26' - 5"				CAP
P1023		8	50' - 6"				CAP
P724		36	3'-2"				DIAPH. (PIER)



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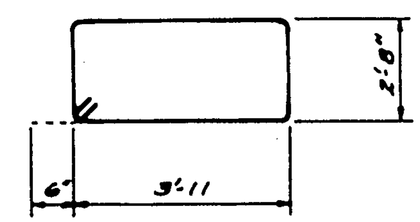

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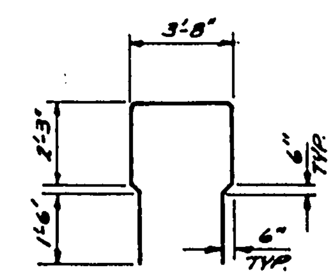
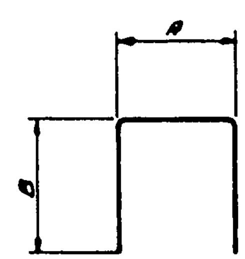


P615, P416

MARK	A	B
P504	2'-8"	4'-2"
P505	3'-8"	4'-8"
P506	2'-8"	6'-5"
P507	3'-8"	8'-9"
P511	3'-8"	2'-6"
P514	2'-8"	2'-0"
P417	3'-2"	1'-0"
P418	3'-8"	1'-0"
P619	2'-8"	[illegible]
P620	2'-8"	[illegible]
P621	2'-8"	[illegible]

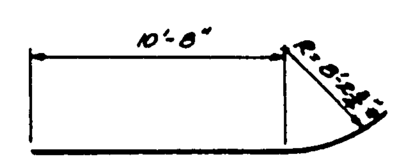


P504, P505, P506, P507, P511, P514
P417, P418, P619, P620, P621

MARK	R
P1009	8'-2[illegible]"
P1022	8'-5"

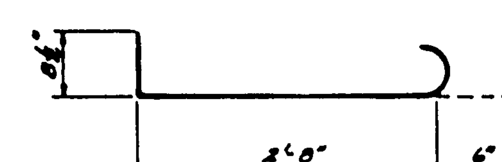
* INSIDE RADIUS

P1009, P1022



* INSIDE RADIUS

P913



P410

No.	Date	Revisions	By

HOWARD NEEDLES TAMMEN BERGENDOFF

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

STRUCTURE B-47-102

Const. Spec. 1989	Drawn By JCH	Checked By DLC

PIER FOOTING & BILL OF REINF.

SHEET 13 OF 29

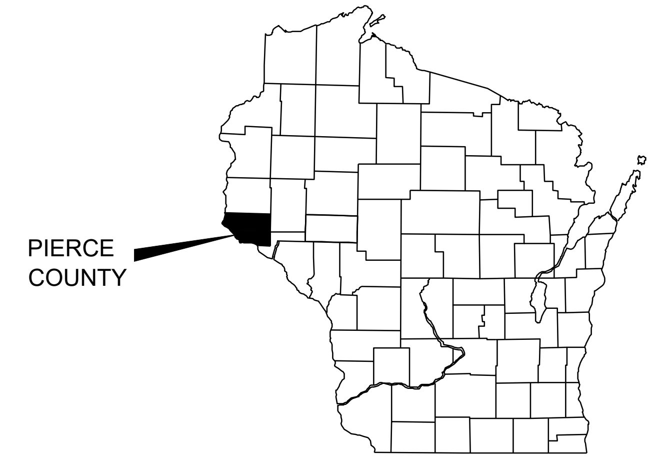
X83342

US Army Corps of Engineers ®
St. Paul District

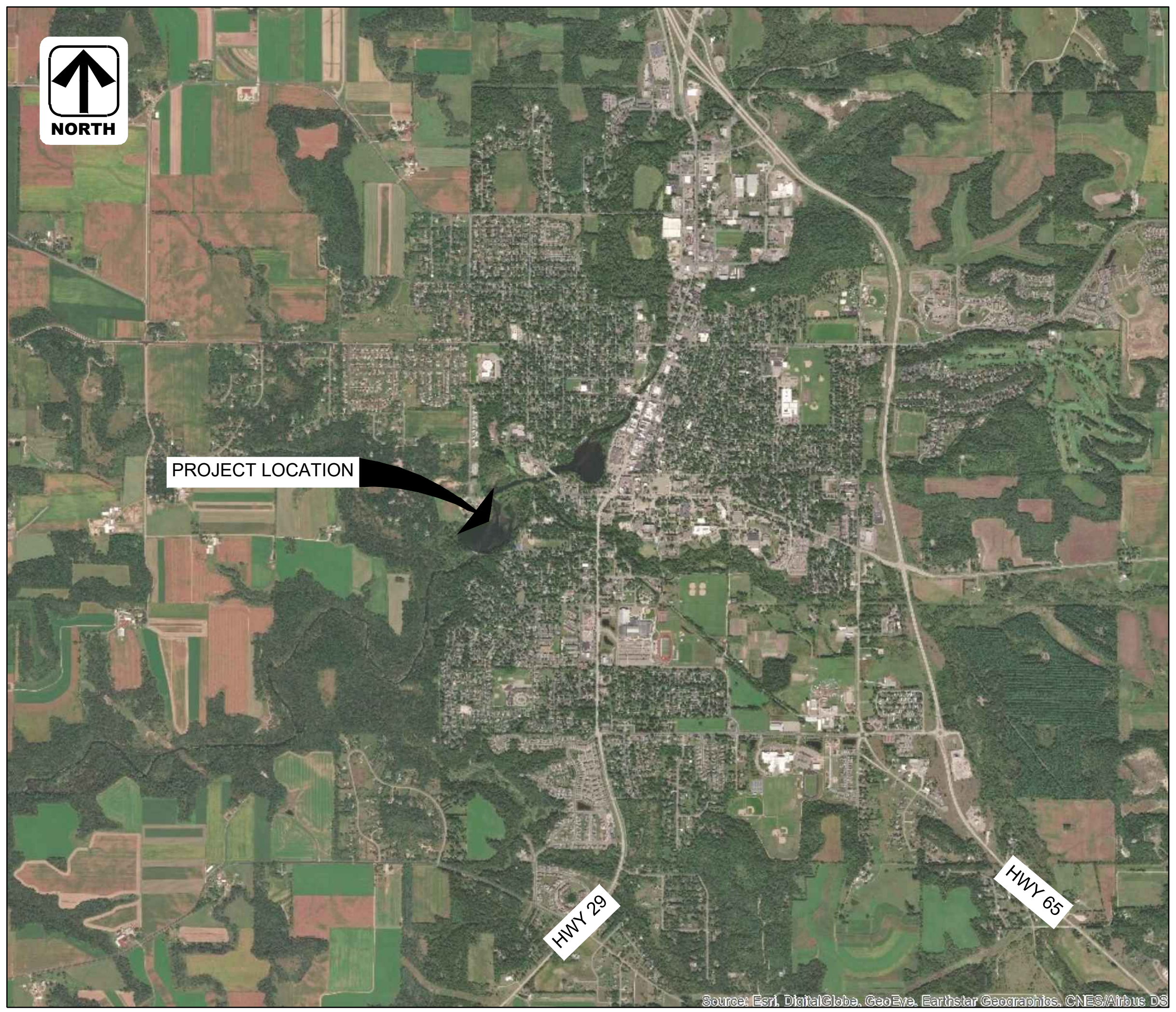
Attachment I-7: 2021 Ayres Powell Falls Decommissioning Report

Section 206 Continuing Authorities Program (CAP) Detailed Project Report
Kinnickinnic River
Aquatic Ecosystem Restoration and Protection Project

RIVER FALLS DECOMMISSIONING PLAN
CITY OF RIVER FALLS
JAN 2021 UPDATED STUDY REPORT



COUNTY MAP



CITY OF RIVER FALLS

UTILITY CONTACTS

RIVER FALLS PUBLIC WORKS
MIKE STIFTER, DIRECTOR
222 LEWIS STREET
RIVER FALLS, WI 54000
(715) 426-3406

RIVER FALLS MUNICIPAL UTILITIES
KEVIN WESTHUIS, UTILITY DIRECTOR
222 LEWIS STREET
RIVER FALLS, WI 54000
(715) 426-3442

ST CROIX GAS
415 S. SECOND STREET
RIVER FALLS, WI 54000
(715) 425-6177

TDS TELECOM
STEVE JAKUBIEC
10 COLLEGE AVE, SUITE 218A
APPLETON, WI 54911
(920) 882-4166

CHARTER COMMUNICATIONS
JEFF KULAF
853 MCINTOSH STREET
PO BOX 1818
WAUSAU, WI 54402
(715) 301-4075
MOBILE (715) 302-1483

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SHEET INDEX

DES BY PEH		NOT FOR CONSTRUCTION						POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	TITLE SHEET	SHEET NO. 1
DR BY ARR	PROJ NO 26-1155.00									
CHK BY EF	DATE JAN 11, 2021	NO	DATE	REVISION	NO	DATE	REVISION			

AA-Standard.stb
1/26/2021
I:\26\TRO\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\River Falls Title.dwg, Layout: 1 TITLE SHEET

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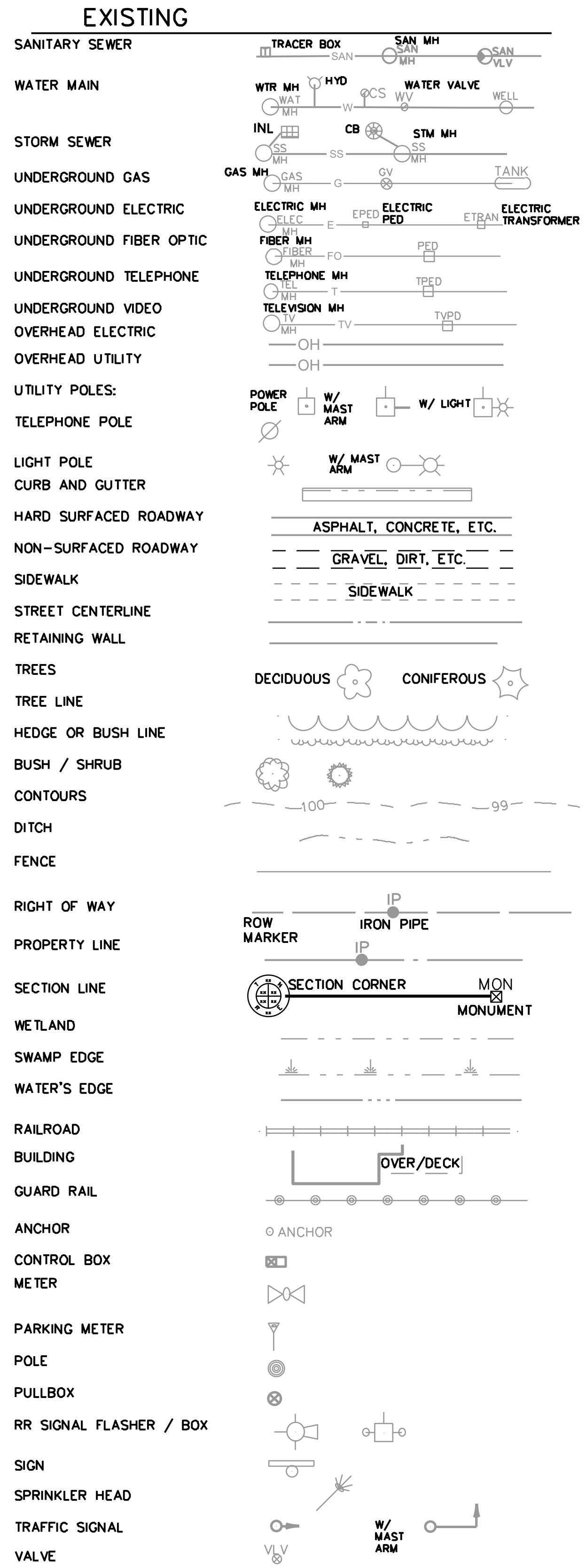

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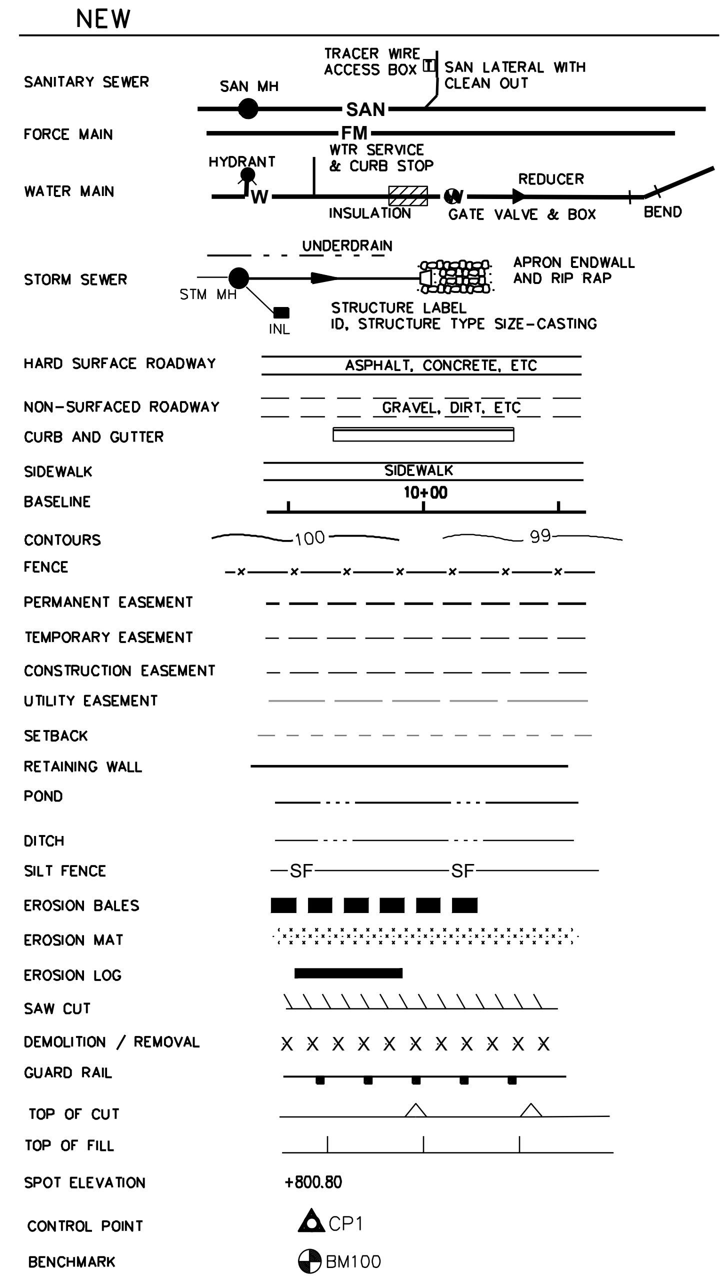

AB	ANCHOR BOLT
ABV	ABOVE
ADJ	ADJUST
AFF	ABOVE FINISHED FLOOR
AL	ALUMINUM
ALT	ALTERNATE WITH
ALT/	ALTERNATE
APPROX	APPROXIMATE
ASPH	ASPHALT
AUTO	AUTOMATIC
AVE	AVENUE
@	AT
B CRS	BASE COURSE
BC	BACK OF CURB
BD	BOARD
BEL	BELOW
BETWN	BETWEEN
BF	BACK FACE
BFV	BUTTERFLY VALVE
BIT	BITUMINOUS
BLD	BLIND
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BLVD	BOULEVARD
BM	BENCHMARK
BO	BREAKOFF
BRG	BEARING
BRK	BRICK
BS	BACK OF SIDEWALK
BTM	BOTTOM
BV	BALL VALVE
℄	BASELINE
B/	BOTTOM OF
C&G	CURB AND GUTTER
CB	CATCH BASIN
CF	CUBIC FOOT
CHKD P	CHECKERED PLATE
CI	CAST IRON
CJ	CONTROL JOINT
CL / ℄	CENTERLINE
CHL	CHLORINE
CLG	CEILING
CLR	CLEAR
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONST JT	CONSTRUCTION JOINT
CONT	CONTINUOUS
CONTR	CONTRACTOR
CONTR JT	CONTRACTION JOINT
COR	CORNER
CP	CONTROL POINT
CPLG	COUPLING
CRS	COURSE
CSP	CORRUGATED STEEL PIPE
CTG	CASTING
CTH	COUNTY TRUNK HIGHWAY
CULV	CULVERT
CV	CHECK VALVE
CW	COLD WATER
CY	CUBIC YARD
DEFL	DEFLECTION
DEG / °	DEGREE
DF	DRINKING FOUNTAIN
DI	DUCTILE IRON
DIA	DIAMETER
DIM	DIMENSION
DISCH	DISCHARGE
DN	DOWN
DP	DEPTH
DR	DOOR
DTL	DETAIL
DW	DRIVEWAY
DWG	DRAWING
E	EAST
EA	EACH
EF	EACH FACE
EFF	EFFLUENT
EJ	EXPANSION JOINT
EL	ELEVATION
ELB	ELBOW
ELEC	ELECTRICAL
EQ	EQUAL
EQUIP	EQUIPMENT
ER	END OF RADIUS
EST	ESTIMATE
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
EX	EXISTING
EXH	EXHAUST
EXP	EXPANSION
EXT	EXTERIOR
FD	FLOOR DRAIN
FDN	FOUNDATION
FERT	FERTILIZER
F-F	FACE TO FACE
FGL	FIBERGLASS
FIN	FINISHED
FL	FLOWLINE
FLG	FLANGED
FLR	FLOOR
FM	FORCE MAIN
FN	FENCE
FT (')	FOOT
FTG	FOOTING
FUT	FUTURE
G	GAS
GA	GAGE
GAR	GARAGE
GEN	GENERAL
GRD	GRADE, GROUND
GV	GATE VALVE
GRAV	GRAVEL
GW	GROUNDWATER
HB	HOSE BIB
HM	HOLLOW METAL
HORZ	HORIZONTAL
HSE	HOUSE
HT	HEIGHT
HW	HOT WATER
HWR	HOT WATER RETURN
HYD	HYDRANT
ID	INSIDE DIAMETER
IF	INSIDE FACE
IN (")	INCHES
INCL	INCLUDE
INF	INFLUENT
INL	INLET
INSUL	INSULATION
INT	INTERIOR
INV	INVERT
IP	IRON PIPE
IPS	IRON PIPE SIZE
JT	JOINT
KGV	KNIFE GATE VALVE
LAB	LABORATORY
LAV	LAVATORY
LC	LENGTH OF CURVE
LF	LINEAL FEET
LG	LENGTH
LOC	LOCATION
LP	LIGHT POLE
LR	LONG RADIUS
LS	LUMP SUM
LT	LEFT
MAS	MASONRY
MAX	MAXIMUM
MECH	MECHANICAL
MFG	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MP	MID POINT
MTL	MATERIAL
N	NORTH
NF	NEAR FACE
NIC	NOT IN CONTRACT
NO	NUMBER
NOM	NOMINAL
NPW	NON-POTABLE WATER
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OE	OVERHEAD ELECTRIC
OF	OUTSIDE FACE
OH	OVERHEAD
OPG	OPENING
OT	OVERHEAD TELEPHONE
PC	POINT OF CURVE
PE	PRIVATE ENTRANCE
PED	PEDESTAL
PERF	PERFORATE
PI	POINT OF INTERSECTION
PKG	PARKING
P	PLATE
PL	PLACE
PL ℄	PROPERTY LINE
PP	POWER POLE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENCY
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PW	POTABLE WATER
%	PERCENT
QTY	QUANTITY
RAD	RADIUS
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RD	ROOF DRAIN
RDWY	ROADWAY
RED	REDUCER
REF	REFERENCE
REINF	REINFORCING
REM	REMOVE
REPL	REPLACE
REQD	REQUIRED
REV	REVISED
RM	ROOM
RR	RAILROAD
RT	RIGHT
RW	RIGHT OF WAY
S	SOUTH
SAN	SANITARY
SAMH	SANITARY MANHOLE
SCH	SCHEDULE
SEC	SECTION
SF	SQUARE FOOT
SHT	SHEET
SIM	SIMILAR
SL	SLOPE
SPA	SPACE
SPEC	SPECIFICATION
SQ	SQUARE
SS	STAINLESS STEEL
SSMH	STORM SEWER MANHOLE
ST	STREET
STD	STANDARD
STH	STATE TRUNK HIGHWAY
STL	STEEL
STM	STORM
STP	SEWAGE TREATMENT PLANT
SURF	SURFACE
SW	SIDEWALK
SWR	SEWER
SY	SQUARE YARD
SYS	SYSTEM
T&B	TOP & BOTTOM
TC	TOP OF CURB
TELE	TELEPHONE
THK	THICKNESS
THRU	THROUGH
TP	TELEPHONE POLE
TYP	TYPICAL
T/	TOP OF
UG	UNDERGROUND GAS
UE	UNDERGROUND ELECTRICAL
UNEXC	UNEXCAVATED
UNO	UNLESS NOTED OTHERWISE
USH	UNITED STATES HIGHWAY
UT	UNDERGROUND TELEPHONE
UV	UNDERGROUND VIDEO
V	VALVE
V&B	VALVE & BOX
VAR	VARIABLE
VER	VERTICAL
VC	VERTICAL CURVE
W	WEST
W/	WITH
W/O	WITHOUT
WD	WIDTH
WM	WATER MAIN
WS	WATER SURFACE
WTP	WATER TREATMENT PLANT
WTR	WATER
WWF	WELDED WIRE FABRIC
WWM	WOVEN WIRE MESH
WWTP	WASTEWATER TREATMENT PLANT

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I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\River Falls Title.dwg, Layout: 2 LEGEND

DES BY	PEH			NO	DATE	REVISION	NO	DATE	REVISION
DR BY	ARR	PROJ NO	26-1155.00						
CHK BY	EF	DATE	JAN 11, 2021						

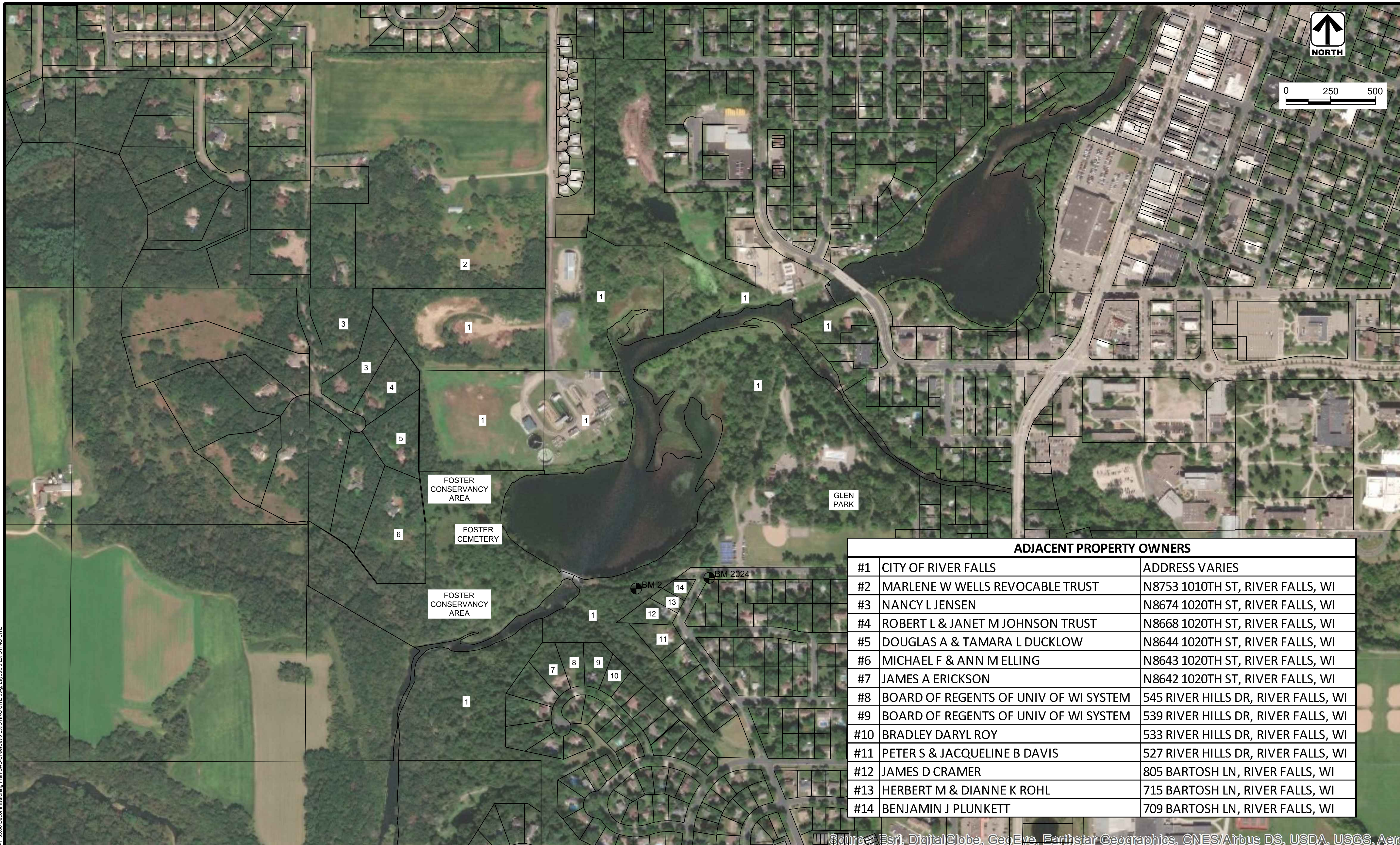
~~NOT FOR CONSTRUCTION~~

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

LEGEND

SHEET NO. 2



ADJACENT PROPERTY OWNERS		
#1	CITY OF RIVER FALLS	ADDRESS VARIES
#2	MARLENE W WELLS REVOCABLE TRUST	N8753 1010TH ST, RIVER FALLS, WI
#3	NANCY L JENSEN	N8674 1020TH ST, RIVER FALLS, WI
#4	ROBERT L & JANET M JOHNSON TRUST	N8668 1020TH ST, RIVER FALLS, WI
#5	DOUGLAS A & TAMARA L DUCKLOW	N8644 1020TH ST, RIVER FALLS, WI
#6	MICHAEL F & ANN M ELLING	N8643 1020TH ST, RIVER FALLS, WI
#7	JAMES A ERICKSON	N8642 1020TH ST, RIVER FALLS, WI
#8	BOARD OF REGENTS OF UNIV OF WI SYSTEM	545 RIVER HILLS DR, RIVER FALLS, WI
#9	BOARD OF REGENTS OF UNIV OF WI SYSTEM	539 RIVER HILLS DR, RIVER FALLS, WI
#10	BRADLEY DARYL ROY	533 RIVER HILLS DR, RIVER FALLS, WI
#11	PETER S & JACQUELINE B DAVIS	527 RIVER HILLS DR, RIVER FALLS, WI
#12	JAMES D CRAMER	805 BARTOSH LN, RIVER FALLS, WI
#13	HERBERT M & DIANNE K ROHL	715 BARTOSH LN, RIVER FALLS, WI
#14	BENJAMIN J PLUNKETT	709 BARTOSH LN, RIVER FALLS, WI

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I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\3 EXISTING SITE.dwg, Layout: 3 EXISTING SITE

DES BY PEH
DR BY ARR
CHK BY EF
PROJ NO 26-1155.00
DATE JAN 11, 2021

NOT FOR CONSTRUCTION

NO	DATE	REVISION

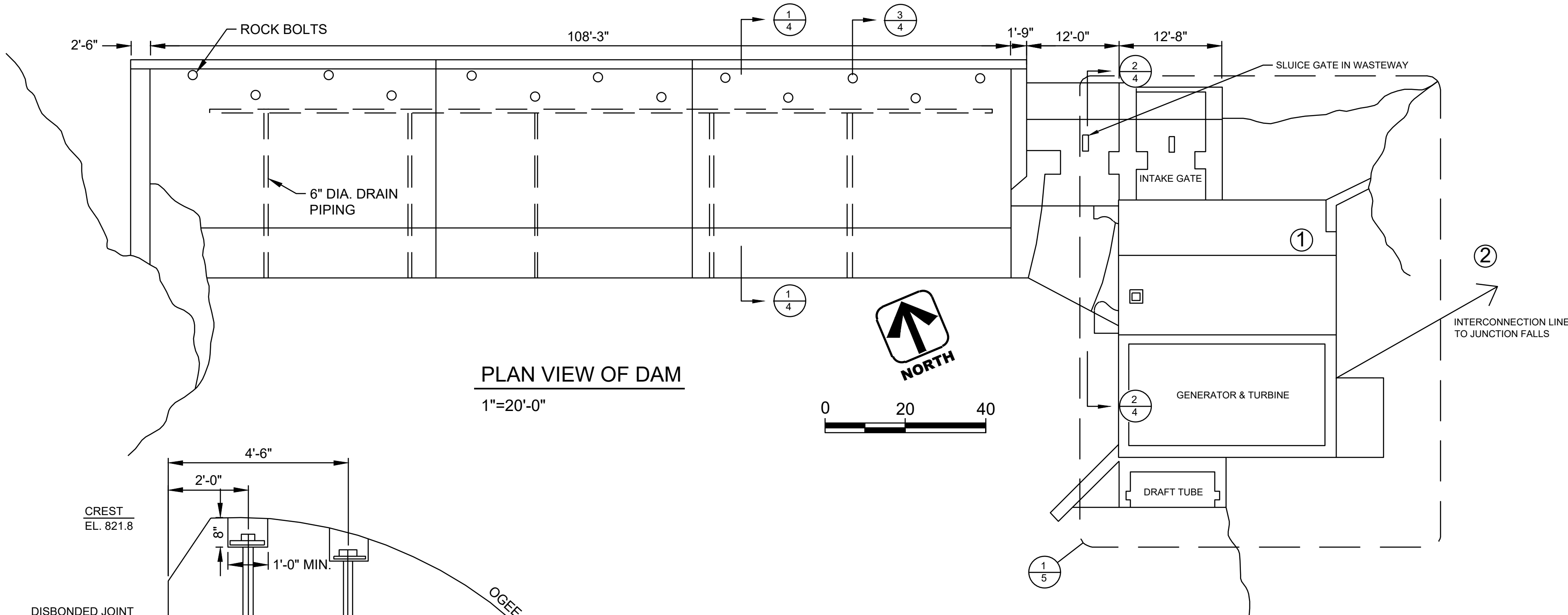
NO	DATE	REVISION

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

EXISTING SITE

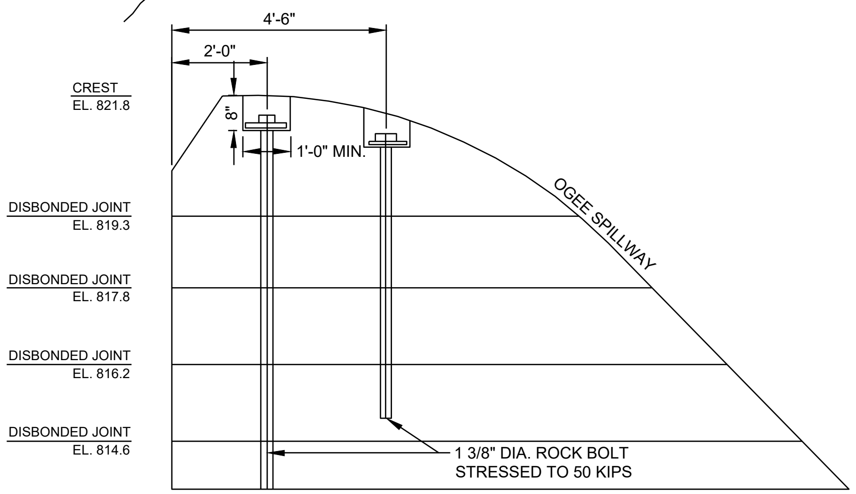
SHEET NO. 3



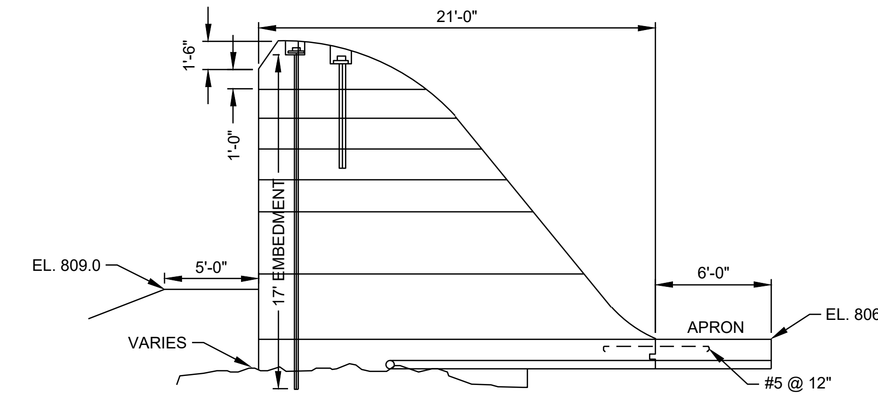
PLAN VIEW OF DAM
1"=20'-0"

① PRIOR TO START OF PROJECT: RMFU TO REMOVE SLUG FUSE CUTOFFS TO DE-ENERGIZE GENERATOR AND CEASE GENERATION.

② CITY TO ADD 2400 TO 240 V POLE TRANSFORMER WITH METER FOR CONTRACTOR CONNECTION.



ROCK BOLT DETAIL
1"=2'-0"



SPILLWAY SECTION
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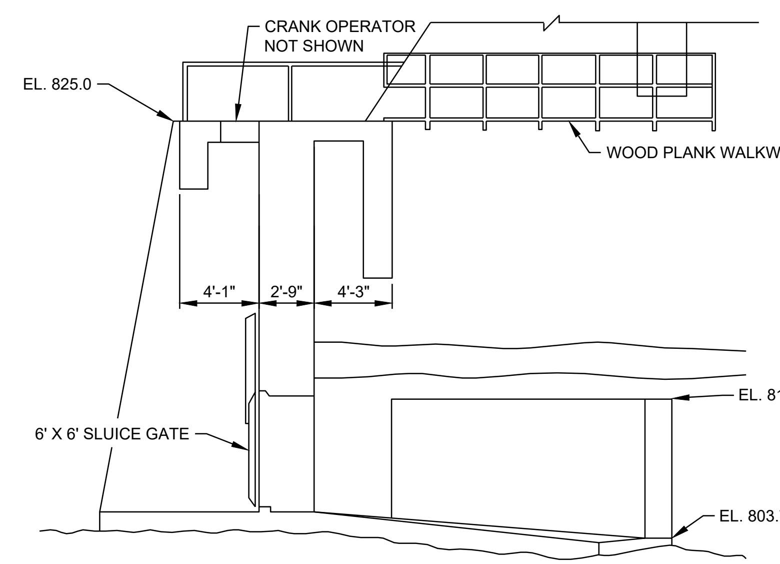

WASTEWAY SECTION
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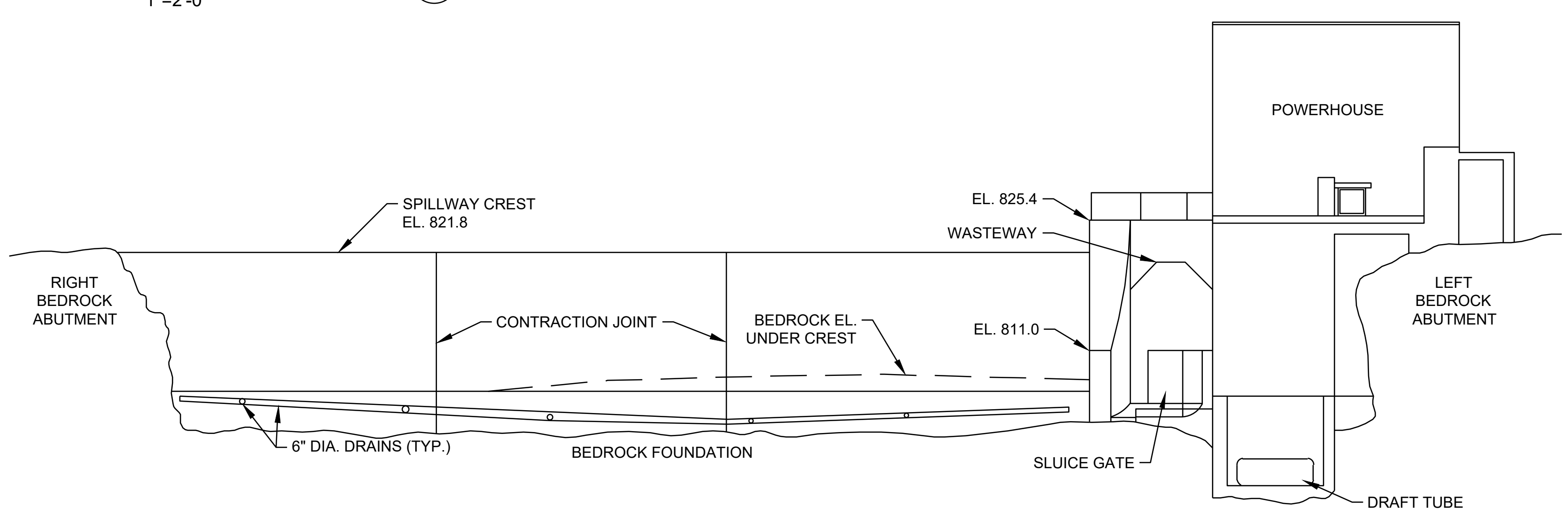
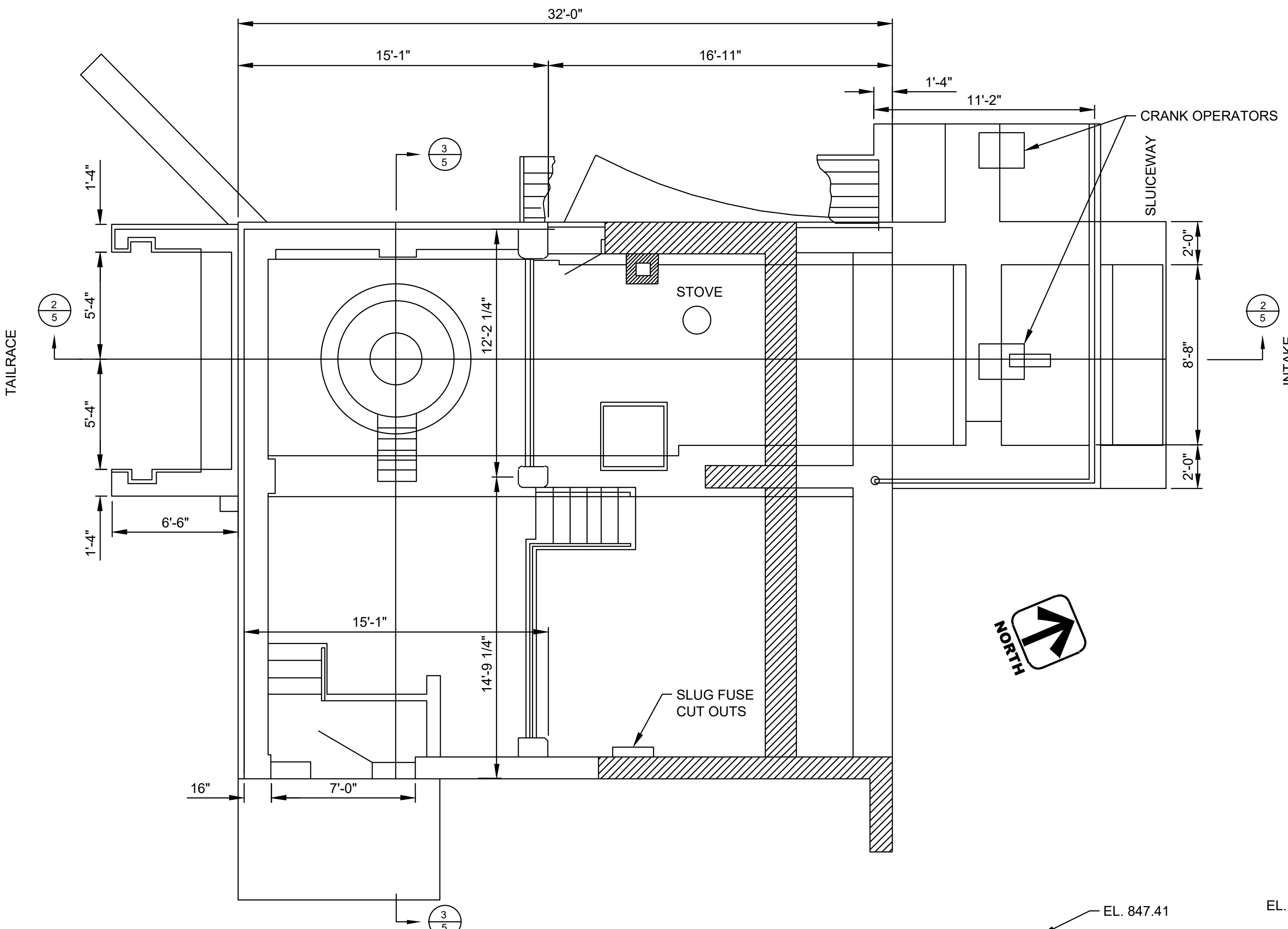


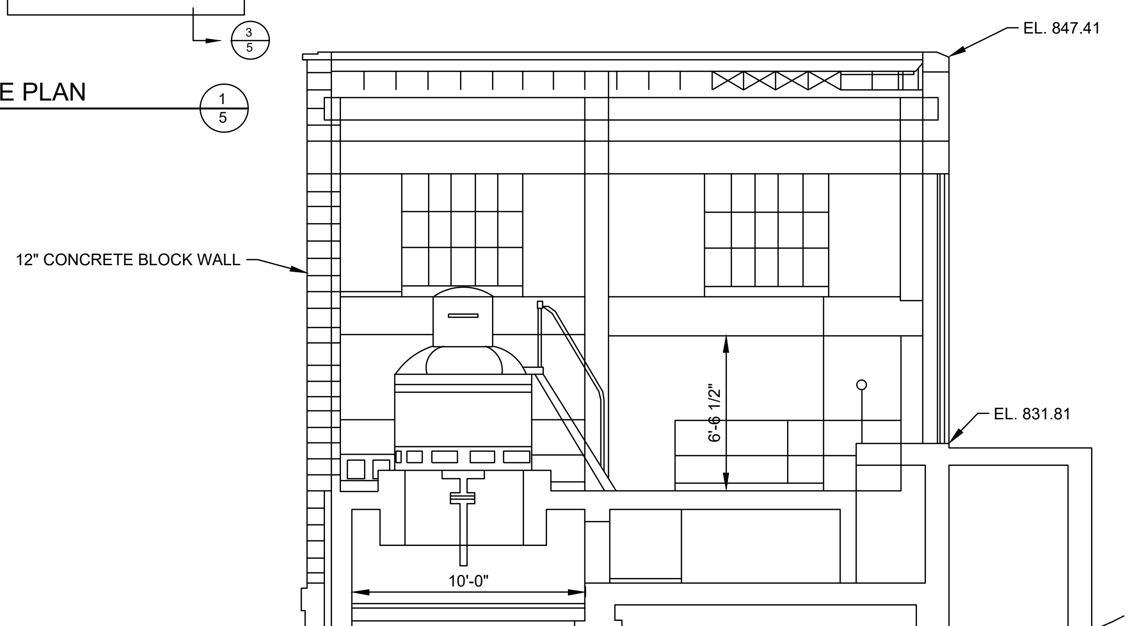
DOWNSTREAM ELEVATION
1"=20'-0"

DES BY	PEH		NOT FOR CONSTRUCTION	POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	EXISTING CONDITIONS	SHEET NO. 4
DR BY	ARR	PROJ NO 26-1155.00	NO / DATE / REVISION				
CHK BY	EF	DATE JAN 11, 2021					



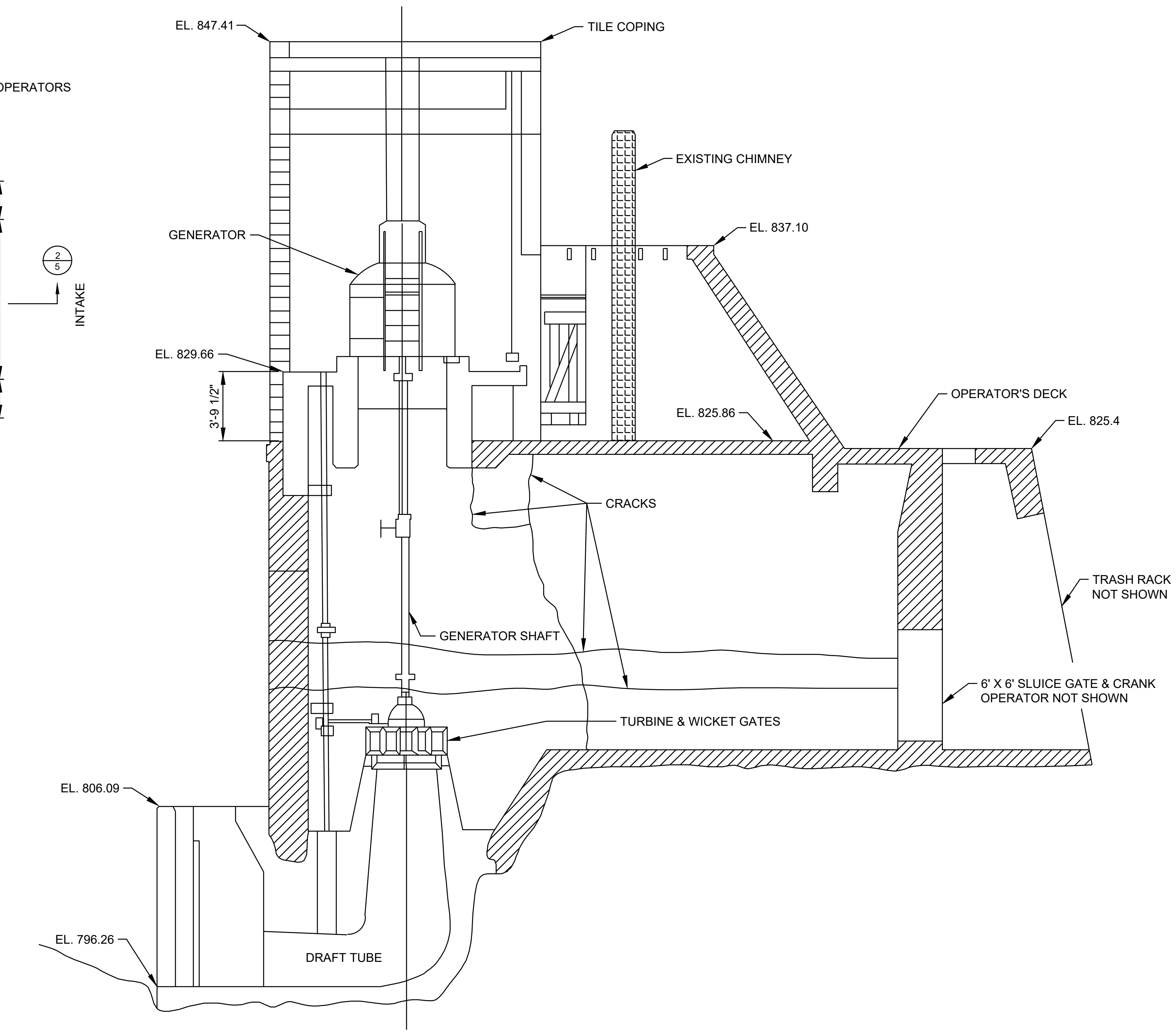
POWERHOUSE PLAN (1/5)

1/8"=1'-0"



SECTION ON EAST & WEST GENERATOR ℄ (3/5)

1/8"=1'-0"



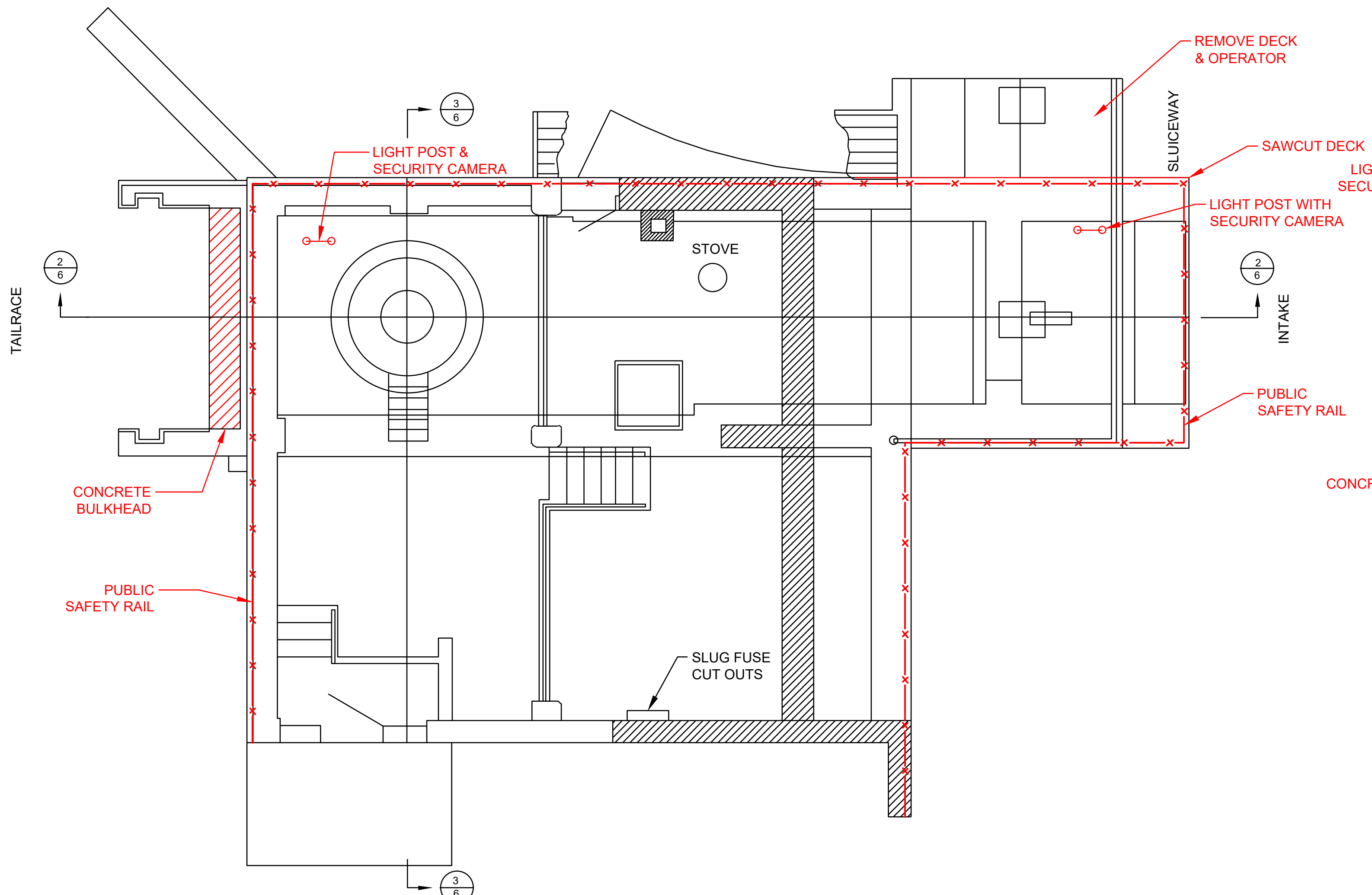
SECTION THROUGH INTAKE & GENERATOR (2/5)

1/8"=1'-0"

0 4 8

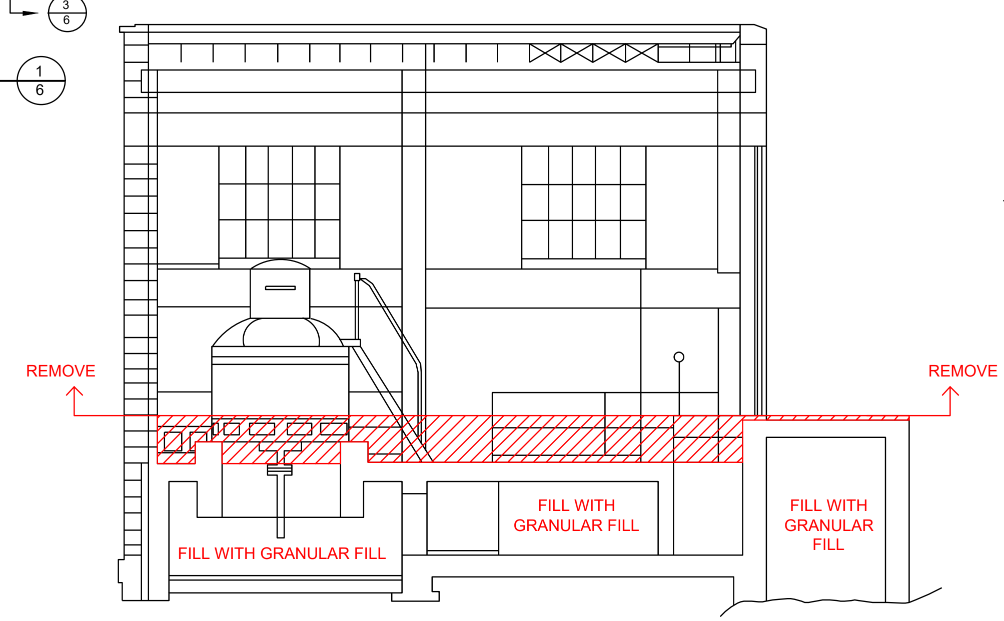
DES BY	PEH		NOT FOR CONSTRUCTION		POWELL FALLS DECOMMISSIONING PLAN	AYRES	EXISTING POWERHOUSE CONDITIONS	SHEET NO.
DR BY	ARR	PROJ NO 26-1155.00			FERC PROJECT NO. 10489-016-WI	Eau Claire, WI 54701 715.834.3161		5
CHK BY	EF	DATE JAN 11, 2021	NO / DATE / REVISION	NO / DATE / REVISION				

AA-Standard.stb 1/26/2021 I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\3 EXISTING SITE.dwg, Layout: 5 EXISTING POWERHOUSE CONDITIONS



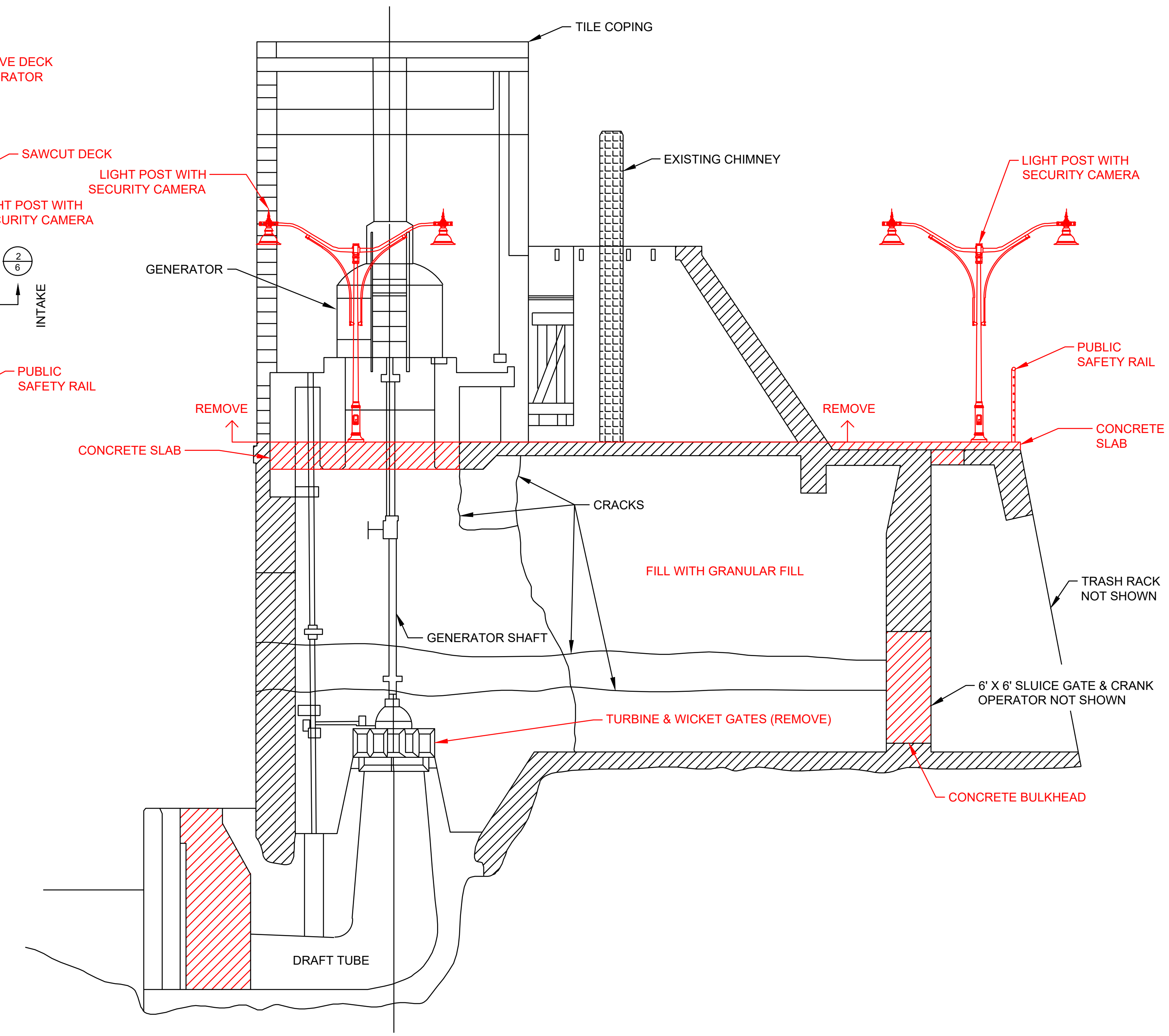
POWERHOUSE PLAN (1/6)

1/8"=1'-0"



SECTION ON EAST & WEST GENERATOR ℄ (3/6)

1/8"=1'-0"



SECTION THROUGH INTAKE & GENERATOR (2/6)

1/8"=1'-0"

*NOTE:
PROPOSED ADDITIONS SHOWN IN RED

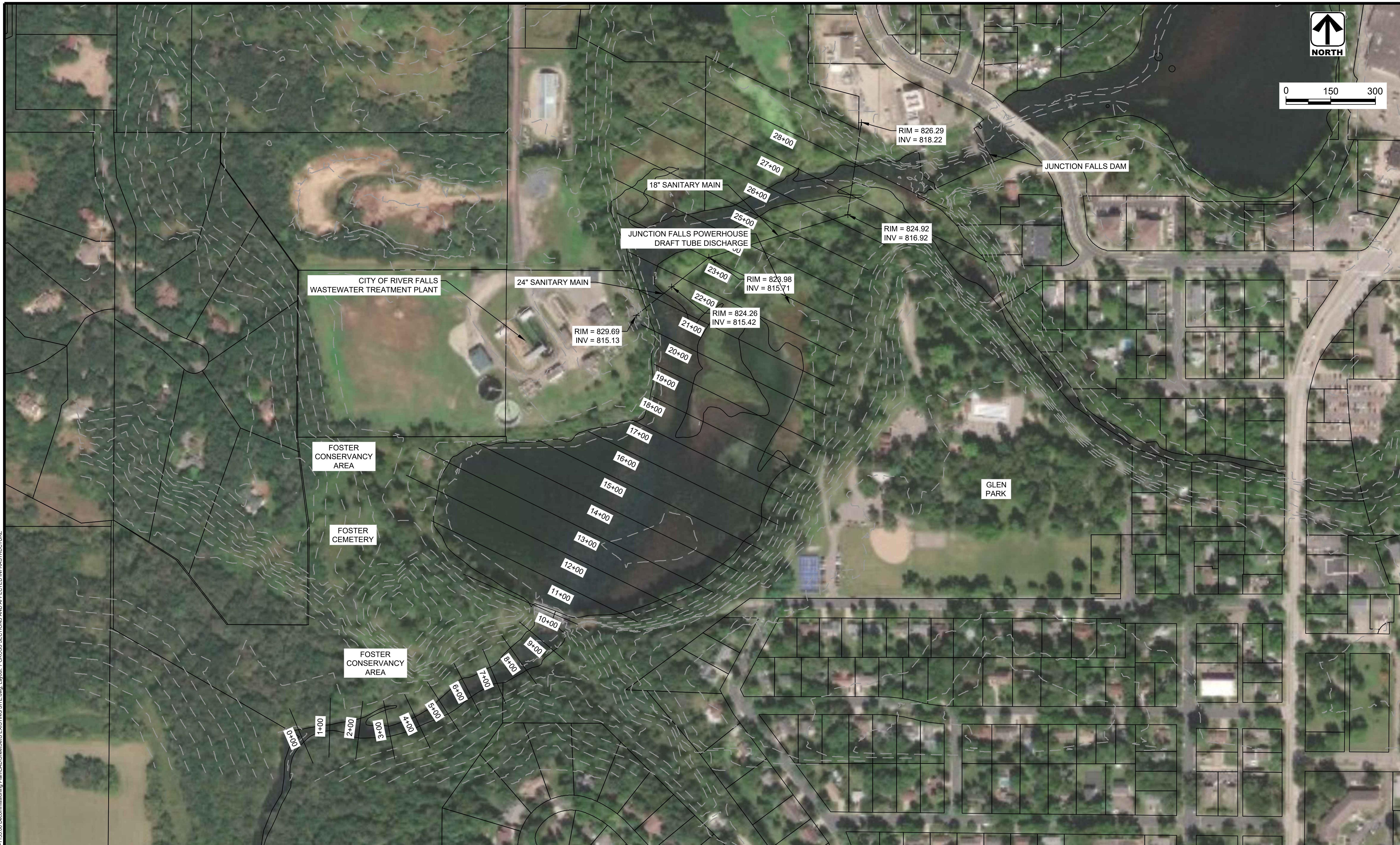
DES BY: PEH			
DR BY: ARR	PROJ NO: 26-1155.00	NOT FOR CONSTRUCTION	
CHK BY: EF	DATE: JAN 11, 2021	NO / DATE / REVISION	NO / DATE / REVISION

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

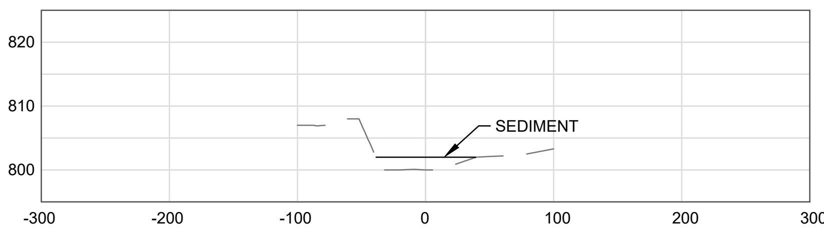
PROPOSED POWERHOUSE CONDITIONS

SHEET NO. 6



DES BY	PEH			NOT FOR CONSTRUCTION			POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	CROSS SECTIONS AND AFFECTED INFRASTRUCTURE	SHEET NO. 7
DR BY	ARR	PROJ NO	26-1155.00							
CHK BY	EF	DATE	JAN 11, 2021	NO / DATE / REVISION		NO / DATE / REVISION				

0+00



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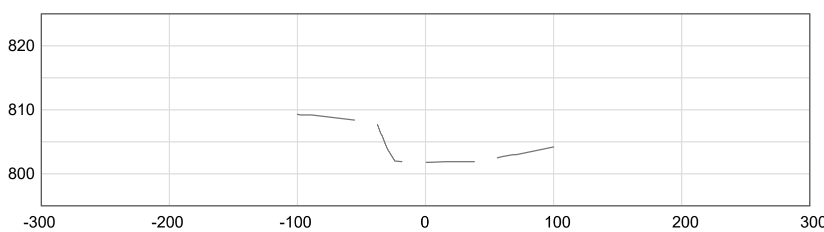

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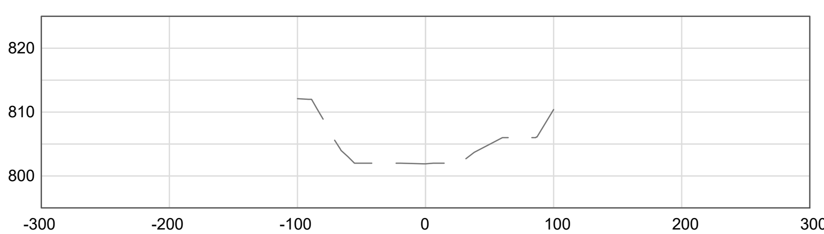

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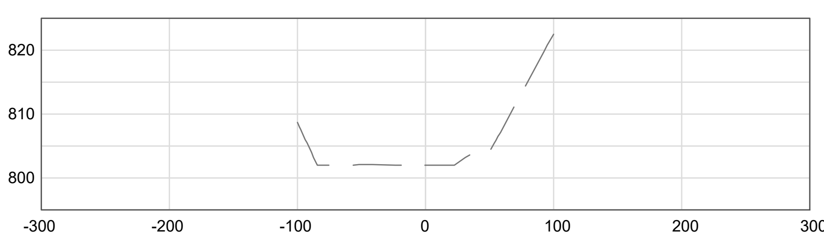

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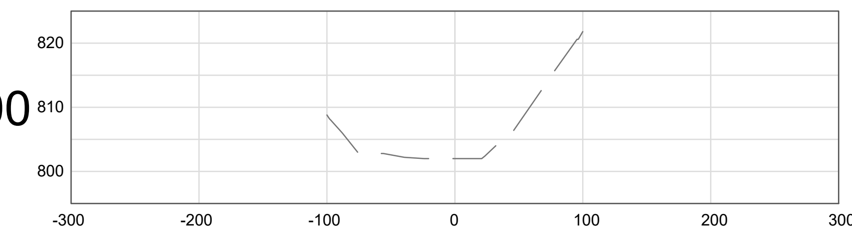

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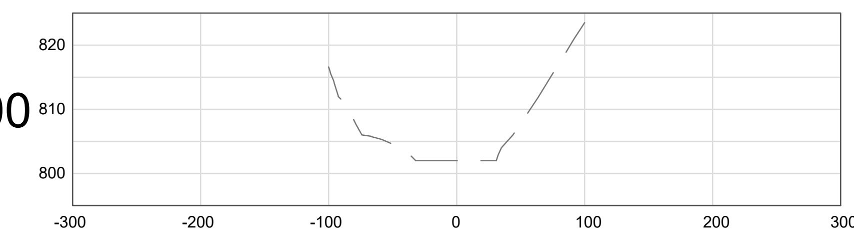

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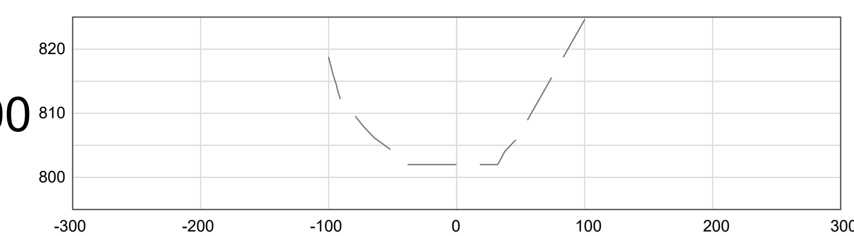

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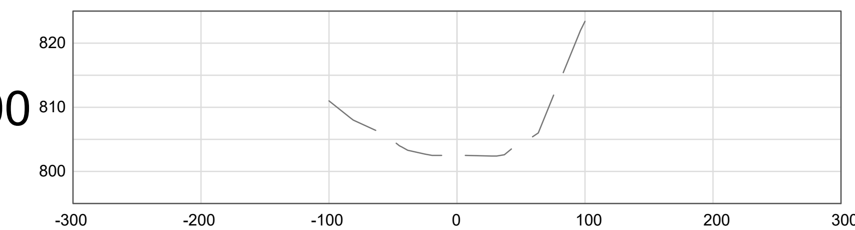

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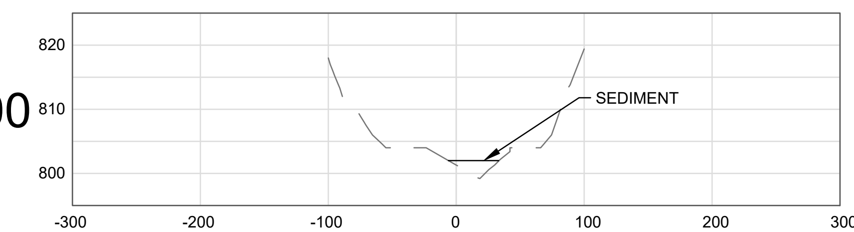

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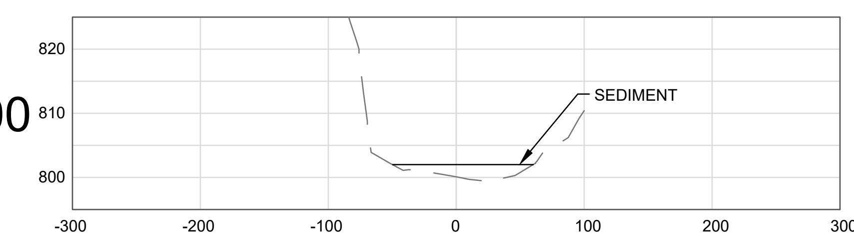
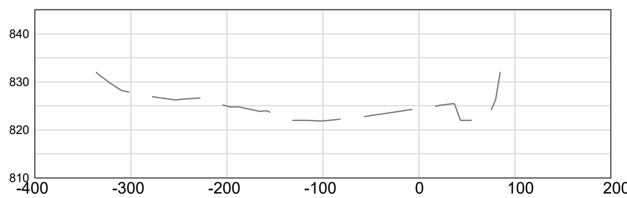


DES BY	PEH		NOT FOR CONSTRUCTION							POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	EXISTING SECTIONS STA. 0+00 TO 9+00	SHEET NO. 8
DR BY	ARR	PROJ NO 26-1155.00											
CHK BY	EF	DATE JAN 11, 2021	NO	DATE	REVISION	NO	DATE	REVISION					

AA-Standard.stb
1/26/2021
I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\3 EXISTING SITE.dwg, Layout: 8 EXISTING SECTIONS STA. 0+00 to 9+00

10+00



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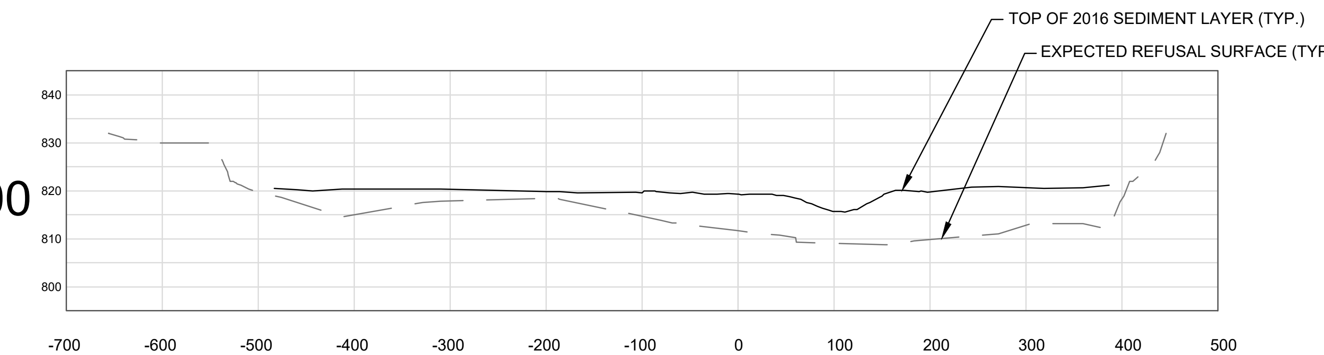
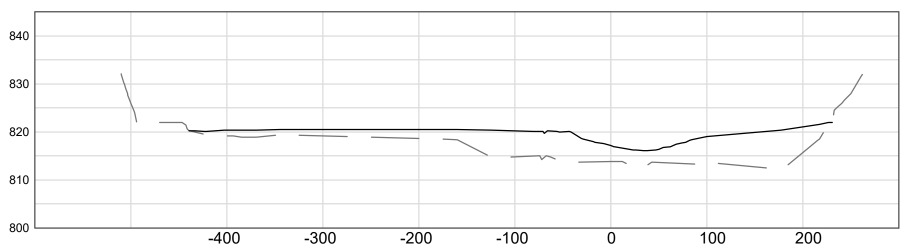


11+00



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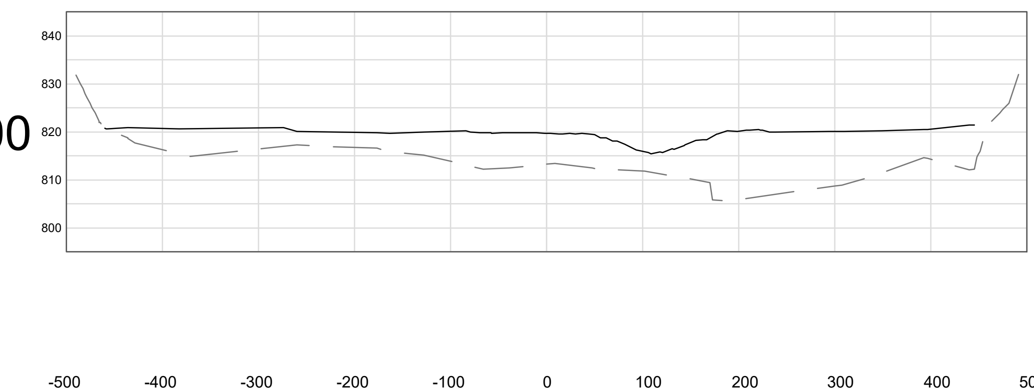
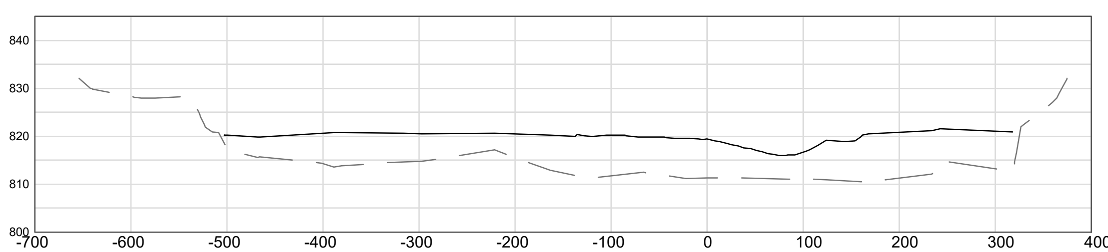


12+00



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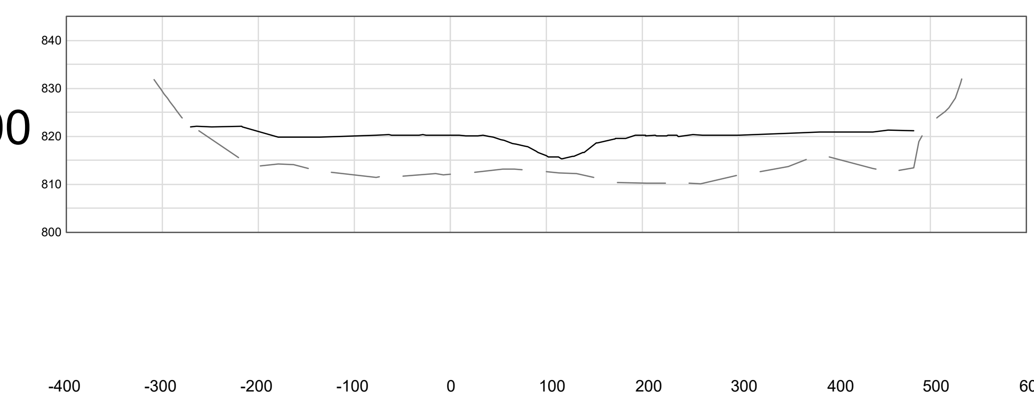
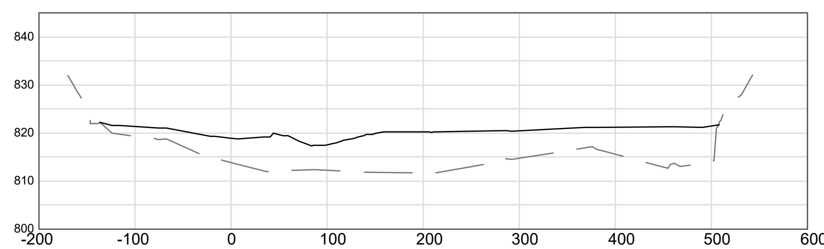


AA-Standard.stb
1/26/2021
I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\3 EXISTING SITE.dwg, Layout: 9 EXISTING SECTIONS STA. 10+00 to 15+00

DES BY	PEH		NOT FOR CONSTRUCTION	POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	EXISTING SECTIONS STA. 10+00 TO 15+00	SHEET NO. 9
DR BY	ARR	PROJ NO 26-1155.00					
CHK BY	EF	DATE JAN 11, 2021	NO / DATE / REVISION				

16+00



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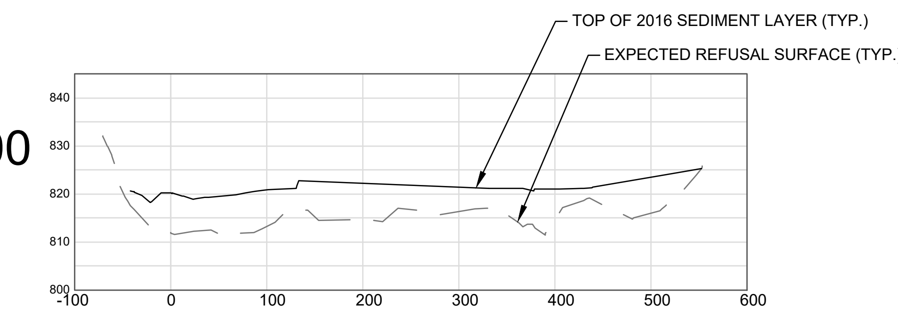
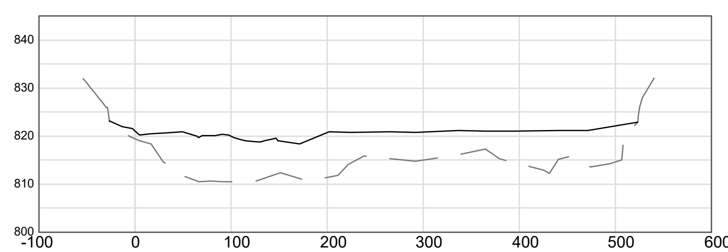
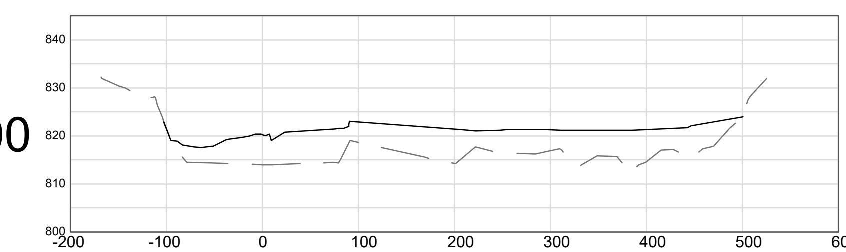


17+00



20+00



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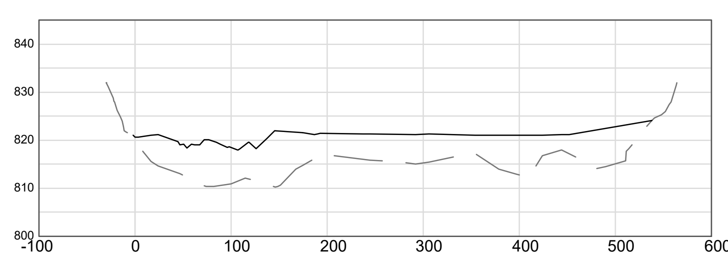
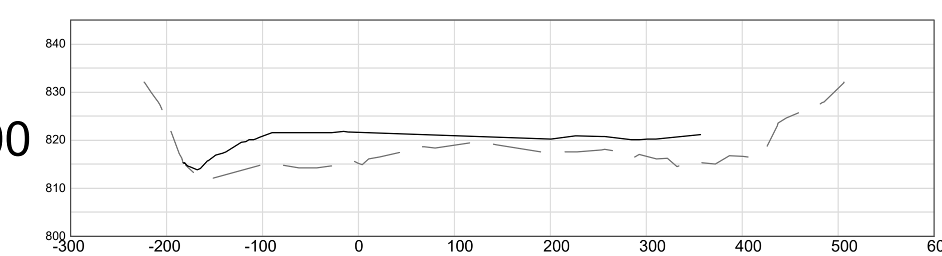


21+00



DES BY	PEH		
DR BY	ARR	PROJ NO	26-1155.00
CHK BY	EF	DATE	JAN 11, 2021

~~NOT FOR CONSTRUCTION~~

NO	DATE	REVISION

NO	DATE	REVISION

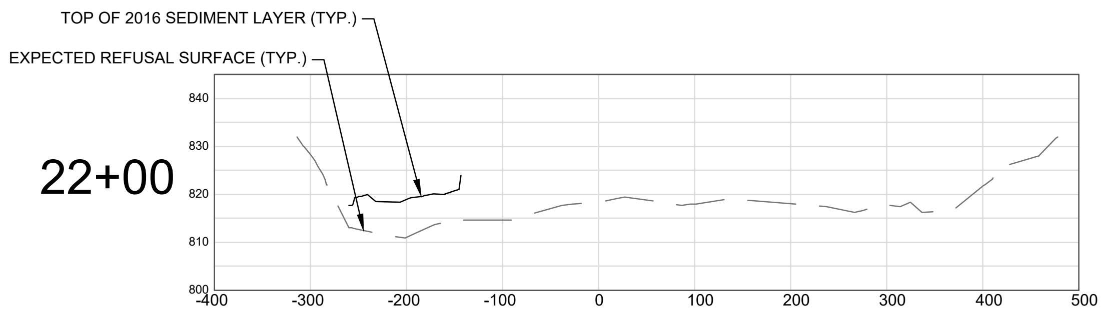
POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

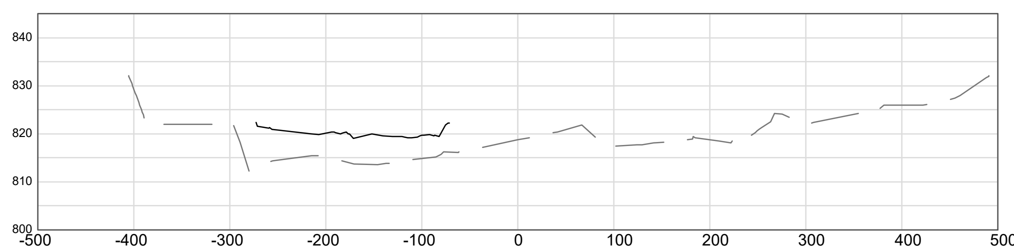
EXISTING SECTIONS STA. 16+00 TO 21+00

SHEET NO.
10

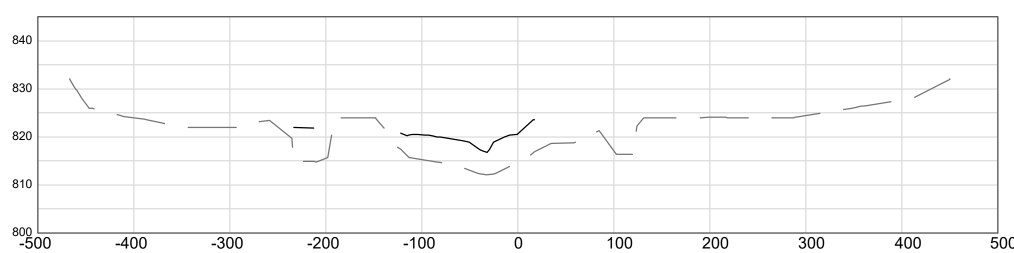
22+00



23+00



24+00



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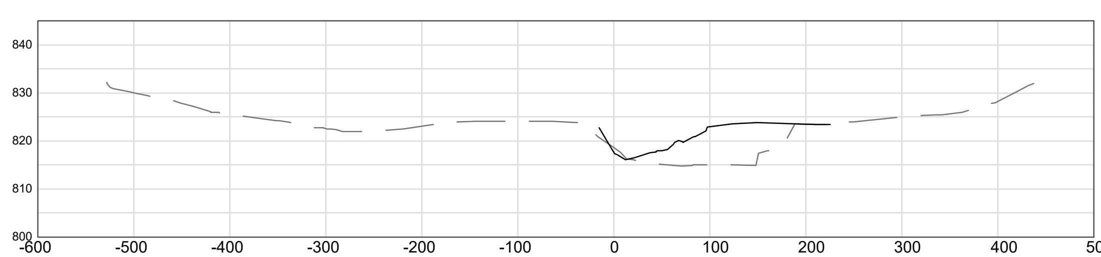
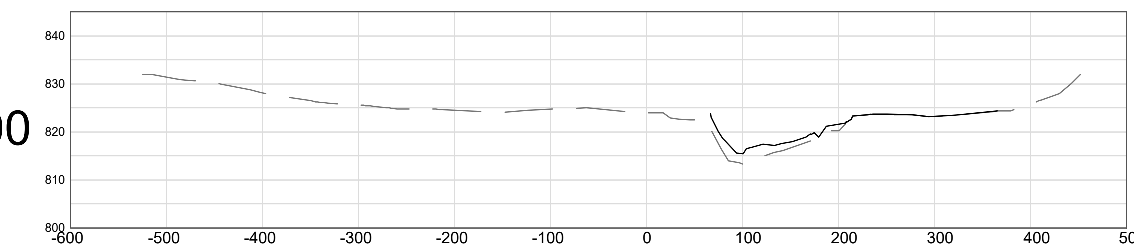
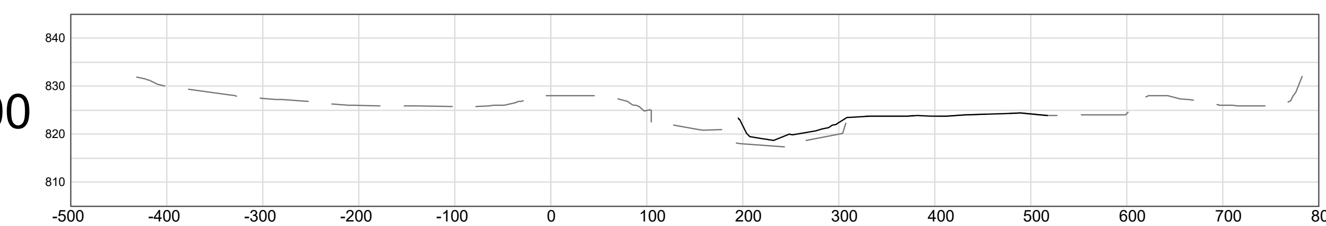


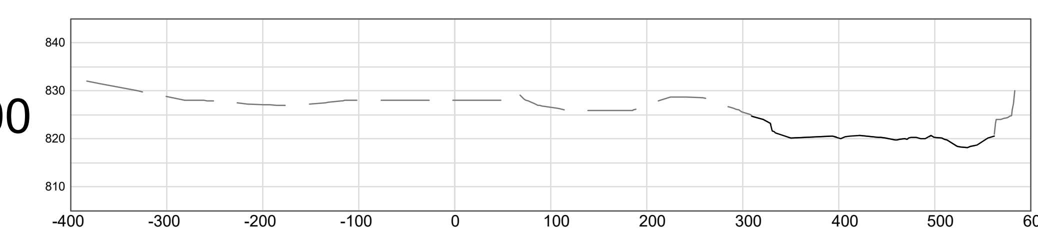
26+00



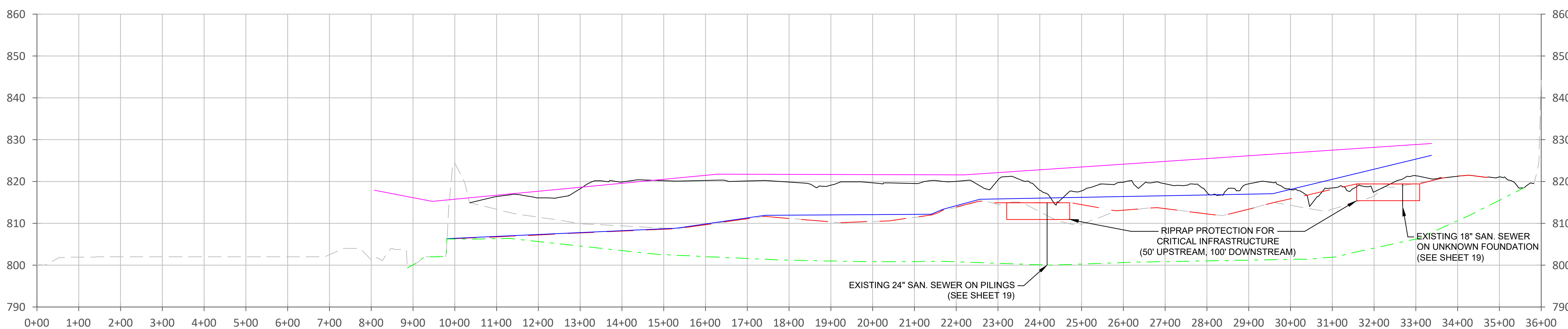
27+00



28+00



DES BY PEH		NOT FOR CONSTRUCTION	POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	EXISTING SECTIONS STA. 22+00 TO 28+00
DR BY ARR	PROJ NO 26-1155.00				SHEET NO. 11
CHK BY EF	DATE JAN 11, 2021	NO / DATE / REVISION	NO / DATE / REVISION		



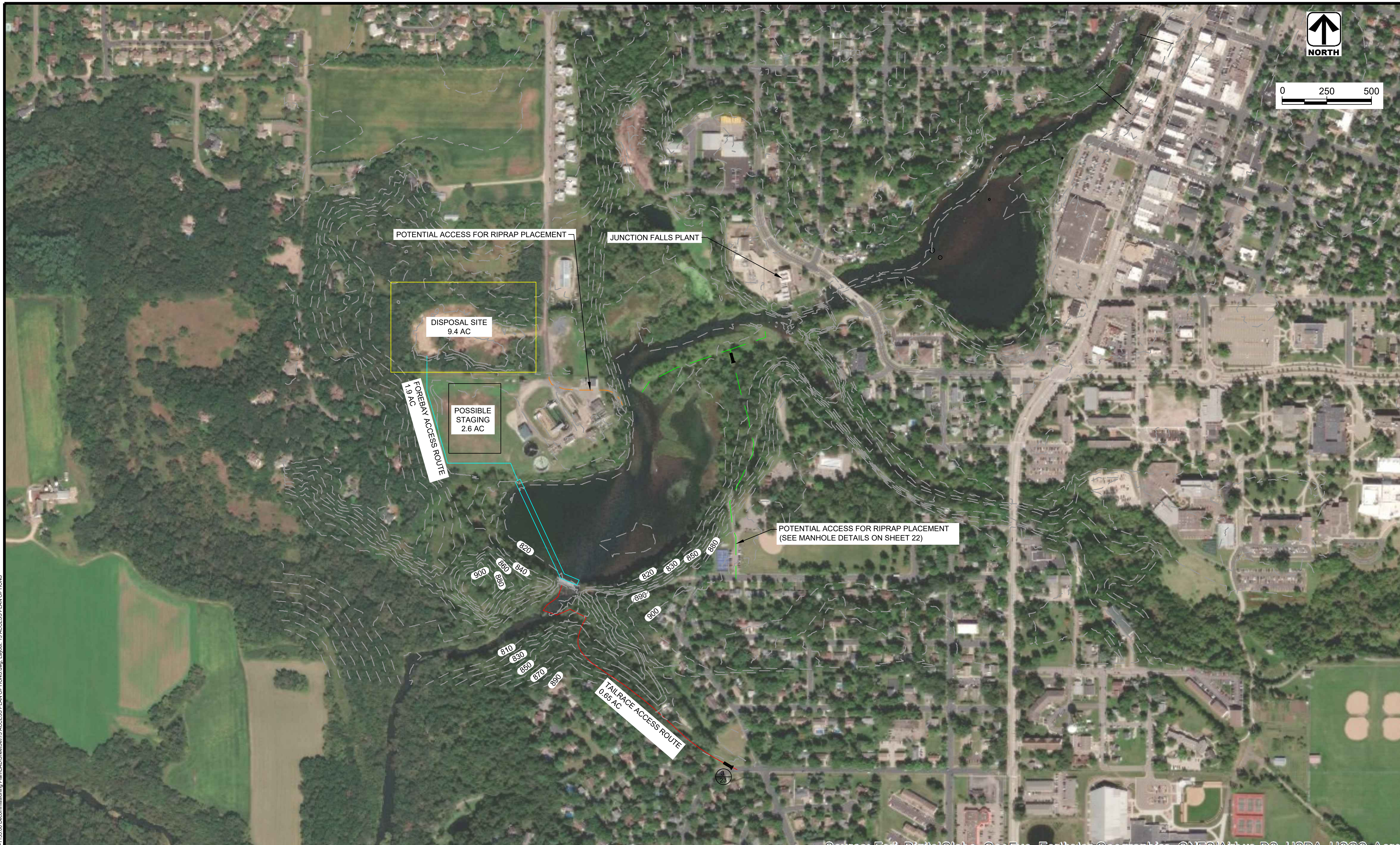
LEGEND:

- LIMIT OF SEDIMENT PROBES*
- EXISTING RIVER BED*
- RIVER BED AFTER REMOVAL**
- Q NORMAL AFTER REMOVAL**
- Q100 WATER SURFACE AFTER REMOVAL**
- ASSUMED BEDROCK**

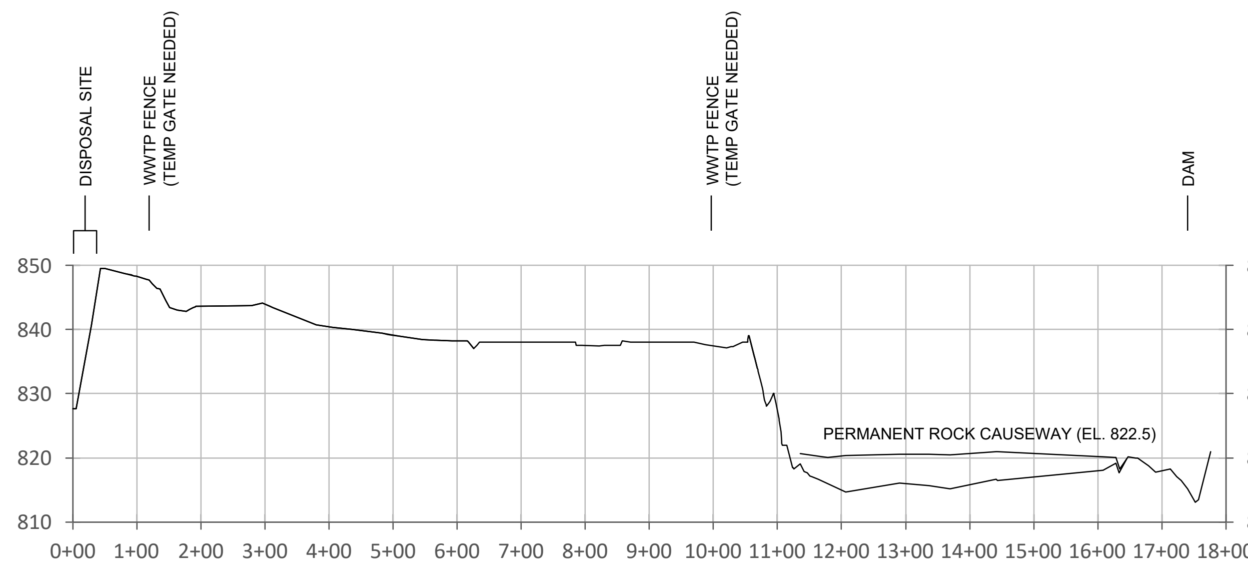
FUTURE RIVER CHANNEL CENTERLINE

DATA SOURCES:
* INTER-FLUVE. LAKE GEORGE AND LAKE LOUISE SEDIMENT ASSESSMENT REPORT, 2016.
** INTERPRETED BY AYRES.

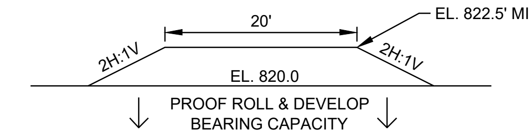
DES BY PEH		NOT FOR CONSTRUCTION		POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	PROFILE THROUGH THALWEG	SHEET NO. 12
DR BY ARR	PROJ NO 26-1155.00						
CHK BY EF	DATE JAN 11, 2021	NO / DATE / REVISION	NO / DATE / REVISION				



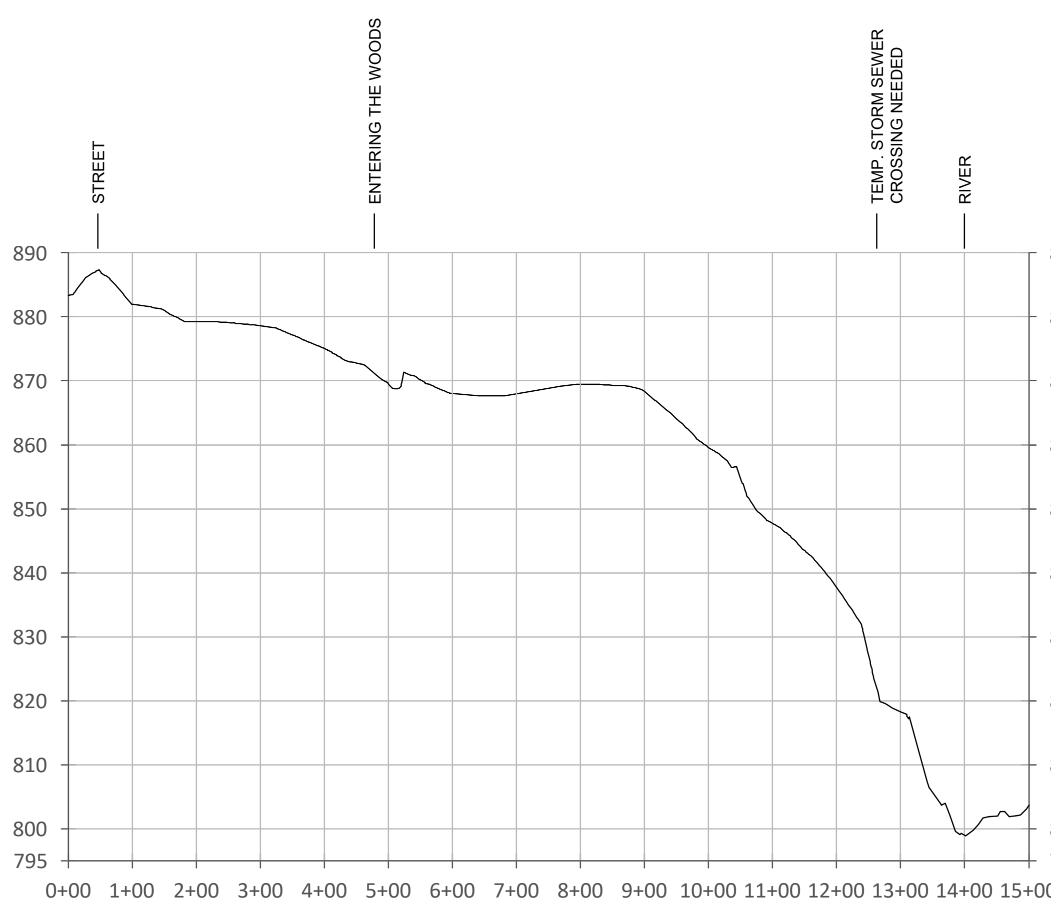
DES BY	PEH			NOT FOR CONSTRUCTION				POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	ACCESS PLAN OPTIONS	SHEET NO. 13
DR BY	ARR	PROJ NO	26-1155.00								
CHK BY	EF	DATE	JAN 11, 2021	NO	DATE	REVISION	NO / DATE / REVISION				



FOREBAY ACCESS ROUTE PROFILE



TYPICAL CAUSEWAY



TAILRACE ACCESS ROUTE PROFILE

DES BY PEH		NOT FOR CONSTRUCTION	POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	ACCESS ROUTE PROFILES
DR BY ARR	PROJ NO 26-1155.00		AYRES Eau Claire, WI 54701 715.834.3161	SHEET NO. 14
CHK BY EF	DATE JAN 11, 2021	NO / DATE / REVISION — NO / DATE / REVISION		

AA-Standard.stb 1/26/2021 I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\13 ACCESS PLAN OPTIONS.dwg, Layout: 14 ACCESS ROUTE PROFILES

DES BY	PEH		
DR BY	ARR	PROJ NO	26-1155.00
CHK BY	EF	DATE	JAN 11, 2021

NOT FOR CONSTRUCTION

NO	DATE	REVISION

NO	DATE	REVISION

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

PROPOSED EROSION CONTROL

SHEET NO. 15

AA-Standard.stb 1/26/2021 I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\15 PROPOSED EROSION CONTROL.dwg, Layout: 15 PROPOSED EROSION CONTROL

DES BY	PEH		
DR BY	ARR	PROJ NO	26-1155.00
CHK BY	EF	DATE	JAN 11, 2021

NOT FOR CONSTRUCTION

NO	DATE	REVISION

NO	DATE	REVISION

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

PROPOSED EROSION CONTROL & WETLANDS

SHEET NO. 16

AA-Standard.stb
1/26/2021
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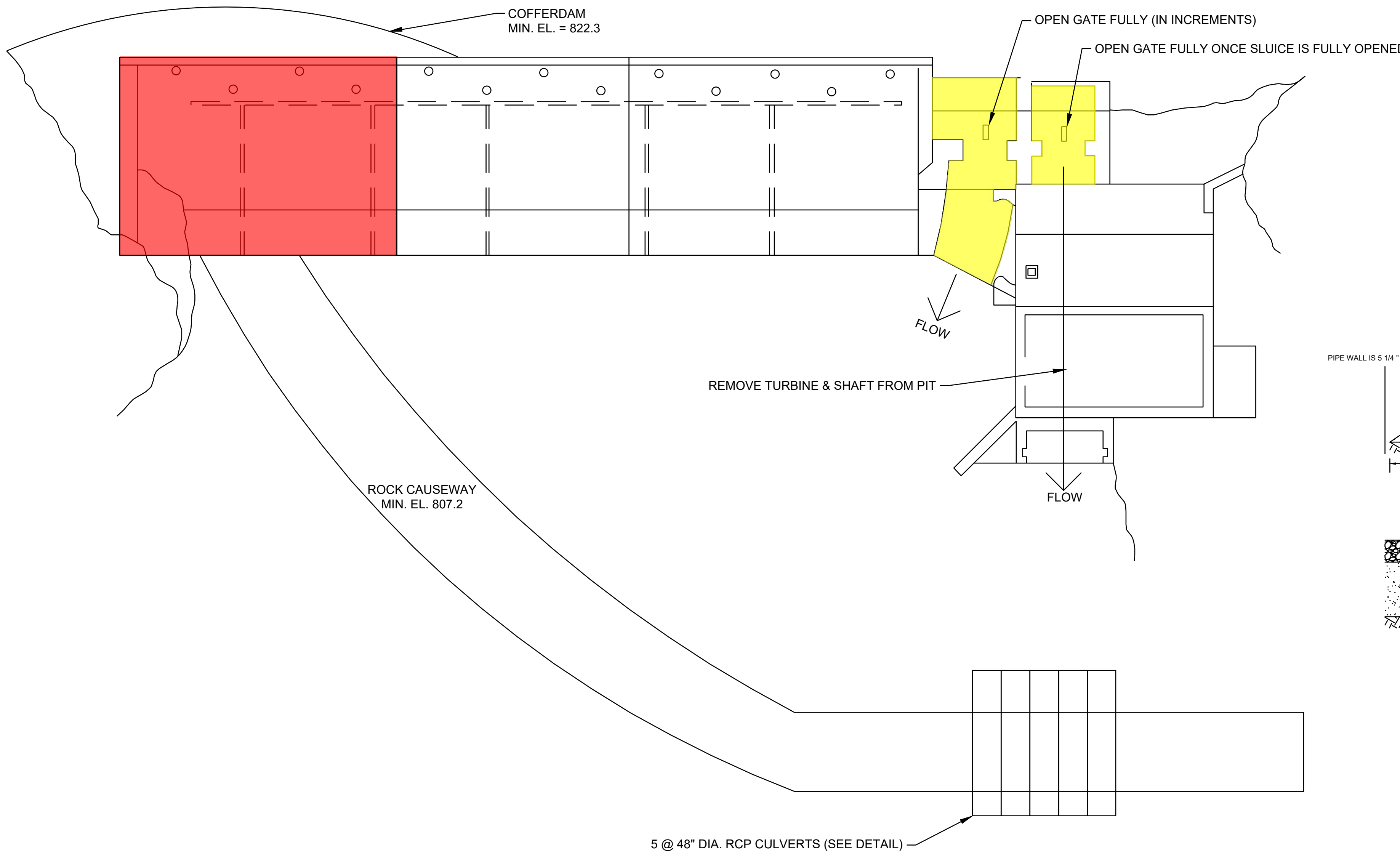
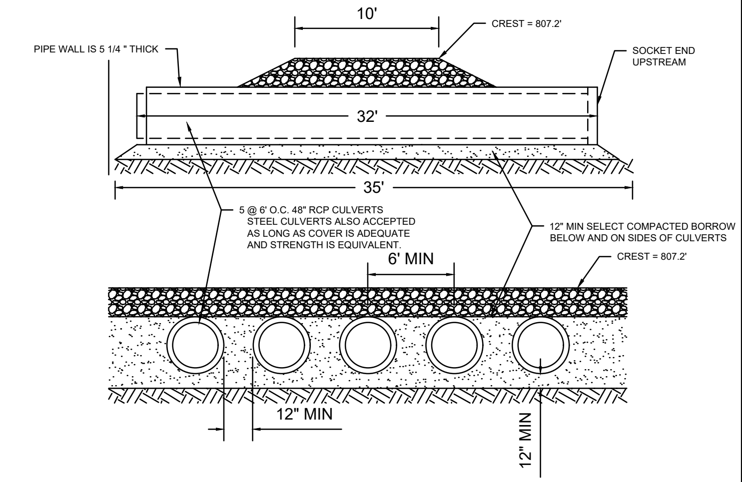
LEGEND:

- REMOVAL AREA
- FLOW AREA

STEADY STATE RATING CURVE:

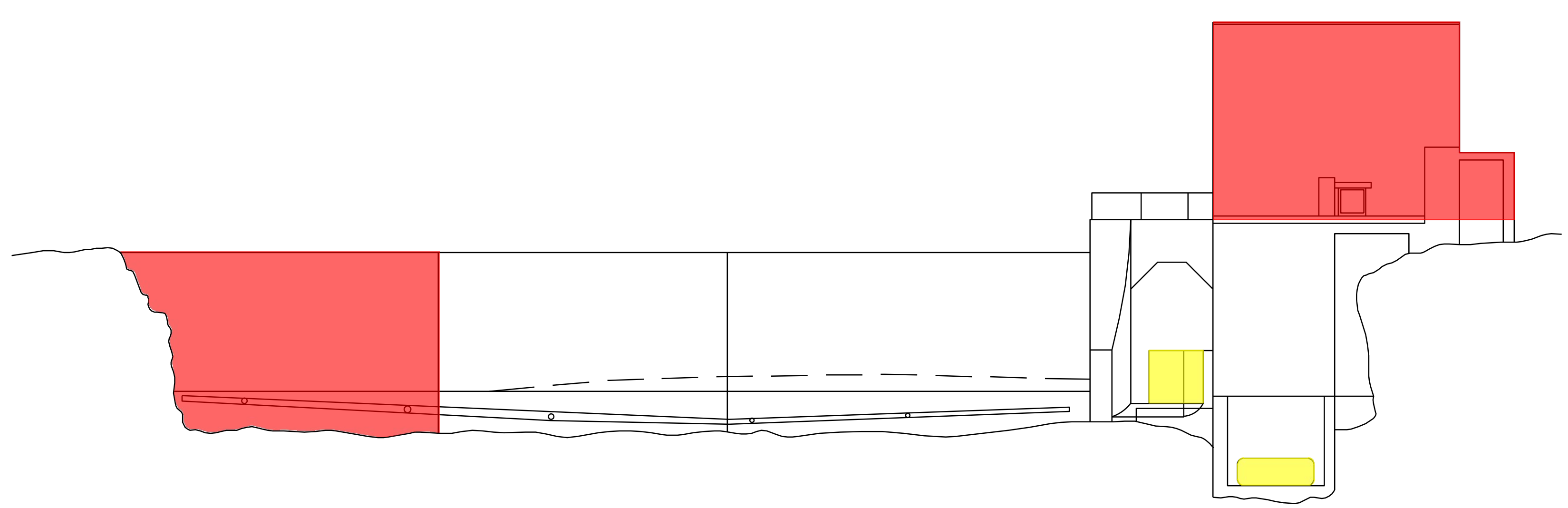
CHANCE	FLOW	HW	TW
1%	12800	830.7	814.0
2%	11000	829.9	813.1
10%	6800	827.9	810.5
50%	2500	824.9	806.7





ROCK CAUSEWAY DETAIL

N.T.S.



NOTE:
SEE DECOMMISSIONING PLAN FOR DETAILED DESCRIPTION OF STAGES

DES BY	PEH		
DR BY	ARR	PROJ NO	26-1155.00
CHK BY	EF	DATE	JAN 11, 2021

NOT FOR CONSTRUCTION

NO	DATE	REVISION

NO	DATE	REVISION

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

REMOVAL SEQUENCE 1&2

SHEET NO. 17

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1/26/2021
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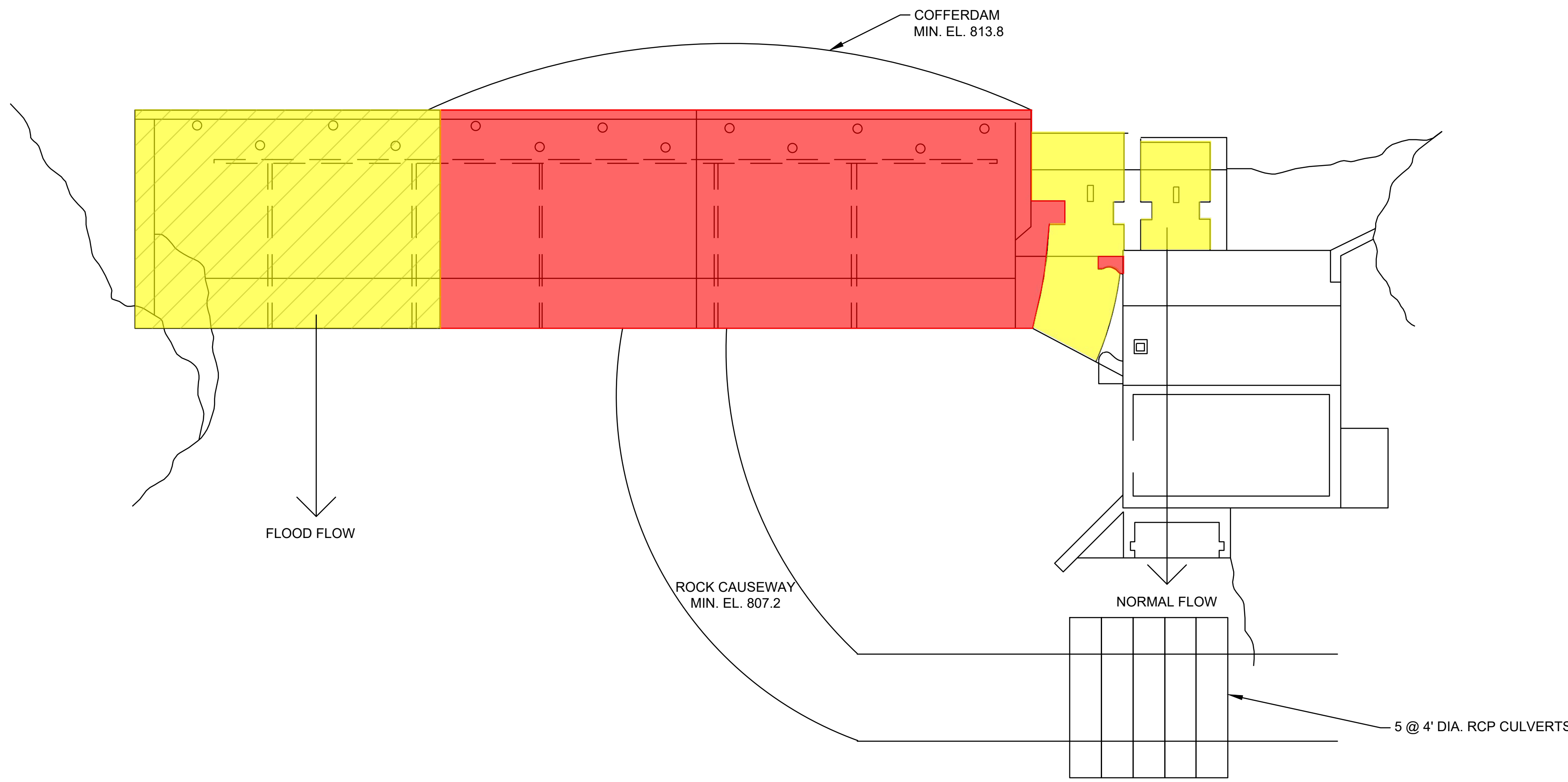
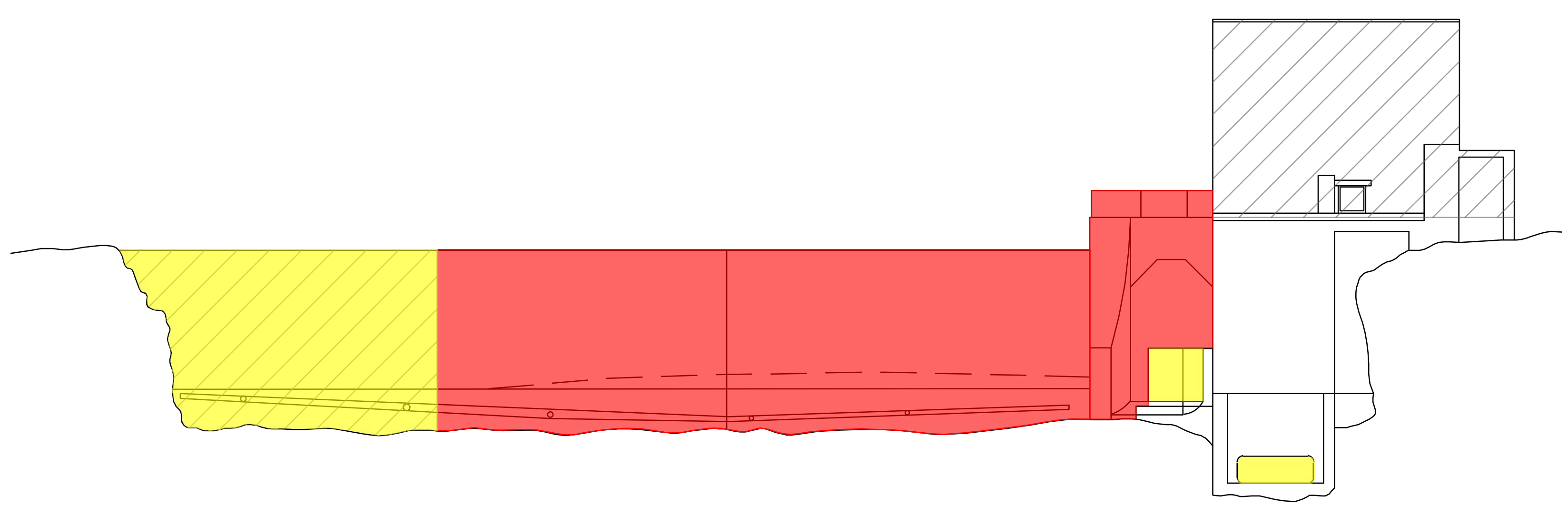
LEGEND:

- REMOVAL AREA
- FLOW AREA
- PREVIOUSLY REMOVED AREA

STEADY STATE RATING CURVE:

CHANCE	FLOW	HW	TW
1%	12800	824.1	814.0
2%	11000	822.9	813.1
10%	6800	818.8	810.5
50%	2500	813.3	806.7





DES BY	PEH			NO	DATE	REVISION	NO	DATE	REVISION
DR BY	ARR	PROJ NO	26-1155.00						
CHK BY	EF	DATE	JAN 11, 2021						

NOT FOR CONSTRUCTION

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

REMOVAL SEQUENCE 3

SHEET NO.
18

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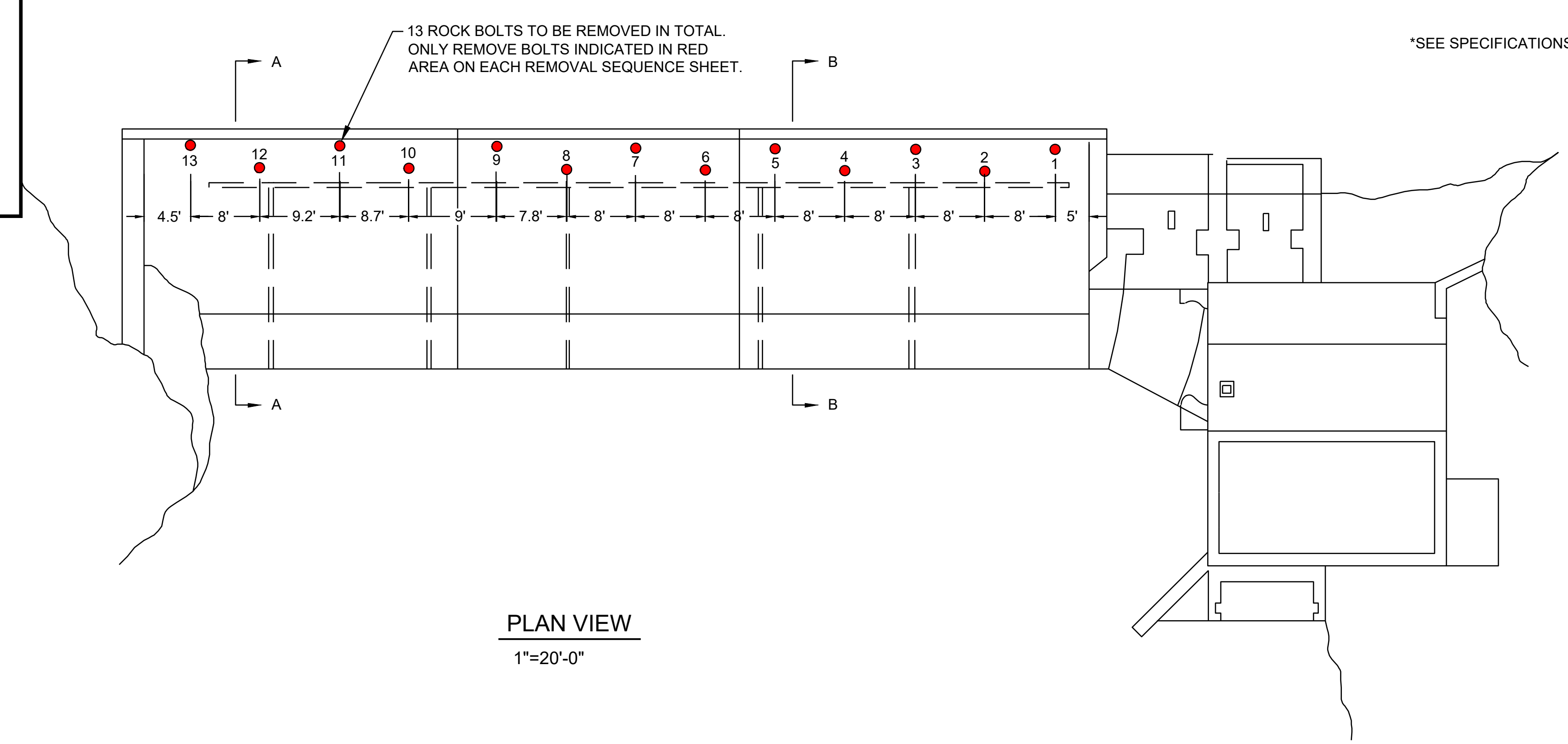
Rock Bolt	Crest EL	Bedock EL	Cored EL
1	821.80	807.97	806.22
3	821.81	808.56	806.81
5	821.83	808.16	805.16
7	821.81	807.64	805.64
9	821.82	805.97	804.32
11	821.81	806.35	805.31
13	821.80	807.40	805.59

*SEE SPECIFICATIONS FOR BOLT REMOVAL REQUIREMENTS.

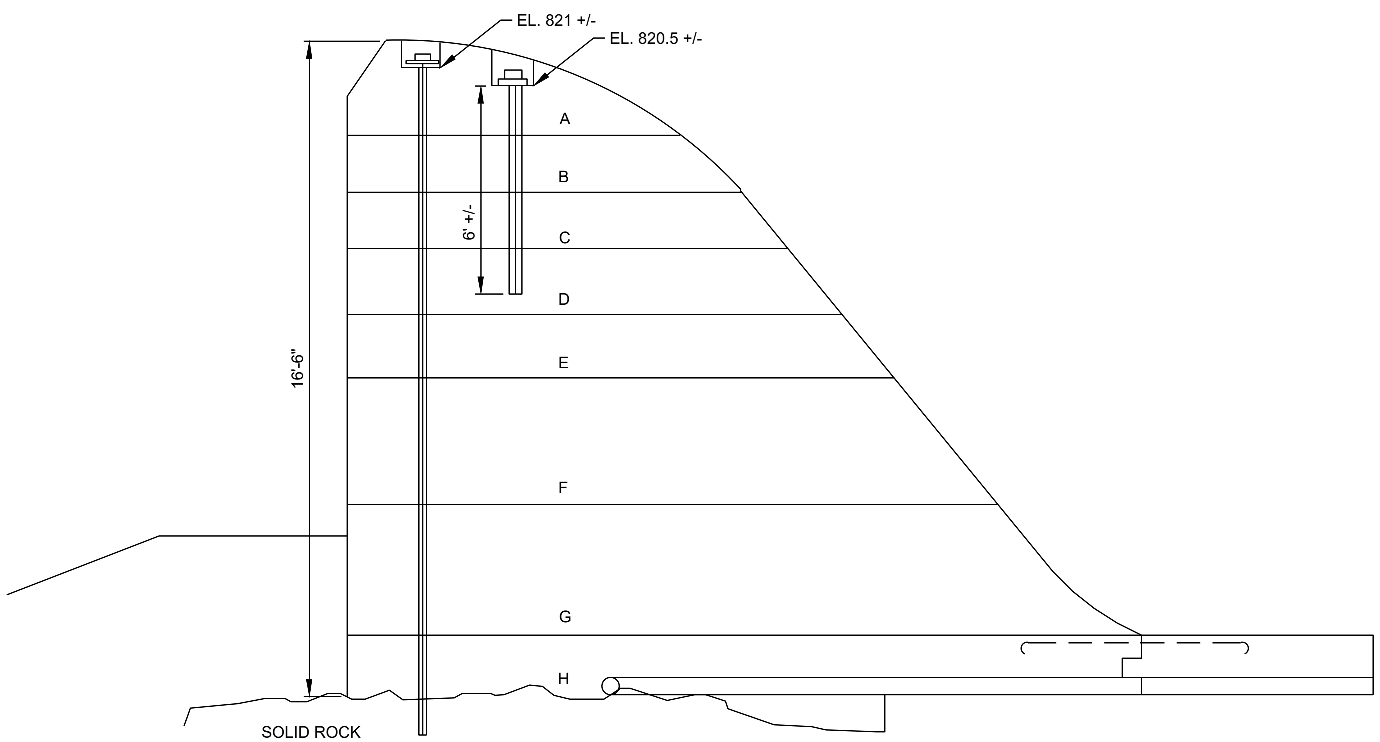
NORTH

0 150 300



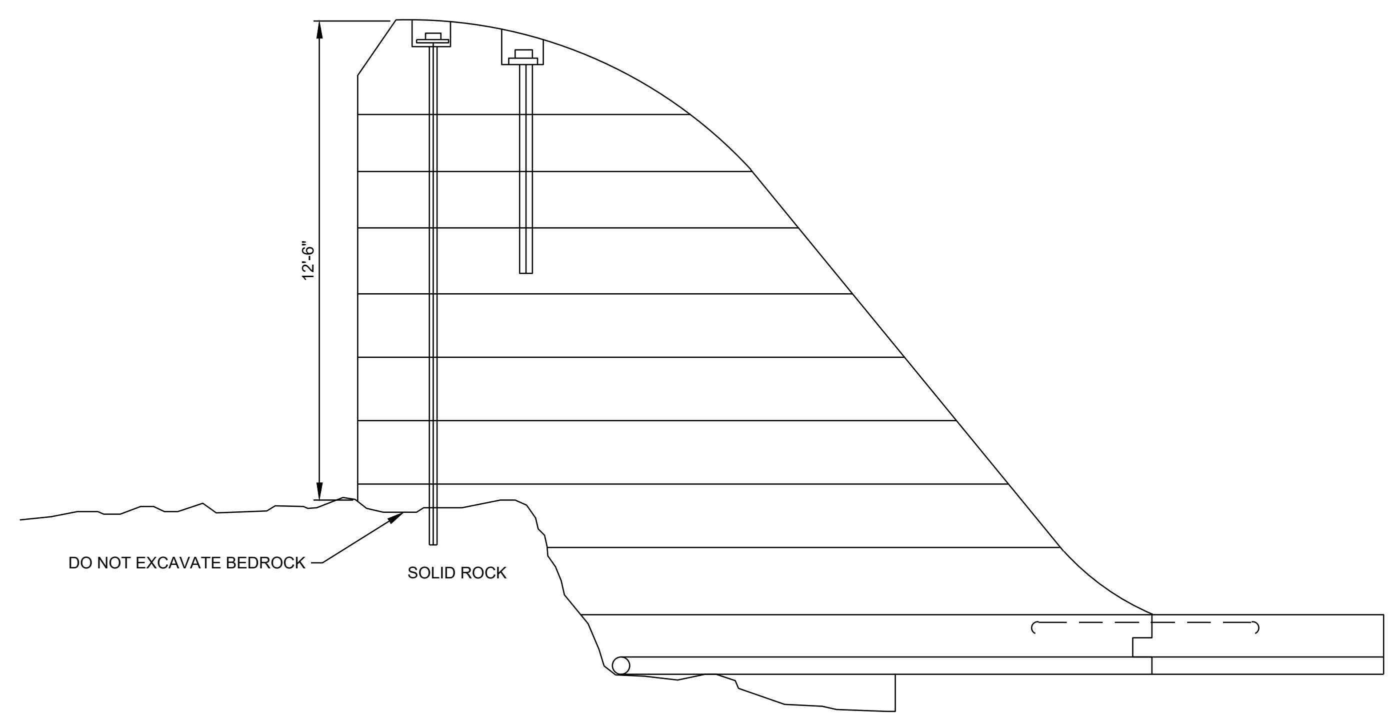
PLAN VIEW

1"=20'-0"



SECTION A

1"=5'-0"



SECTION B

1"=5'-0"

DES BY	PEH		NOT FOR CONSTRUCTION	POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	ROCK BOLT REMOVAL	SHEET NO. 19
DR BY	ARR	PROJ NO 26-1155.00	NO / DATE / REVISION				
CHK BY	EF	DATE JAN 11, 2021	NO / DATE / REVISION				

AA-Standard.stb 1/26/2021 I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\19 ROCK BOLT REMOVAL.dwg, Layout: 19 ROCK BOLT REMOVAL

AA-Standard.stb
1/26/2021
I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\20 DRAFT RESTORATION PLAN.dwg, Layout: 20 DRAFT RESTORATION PLAN

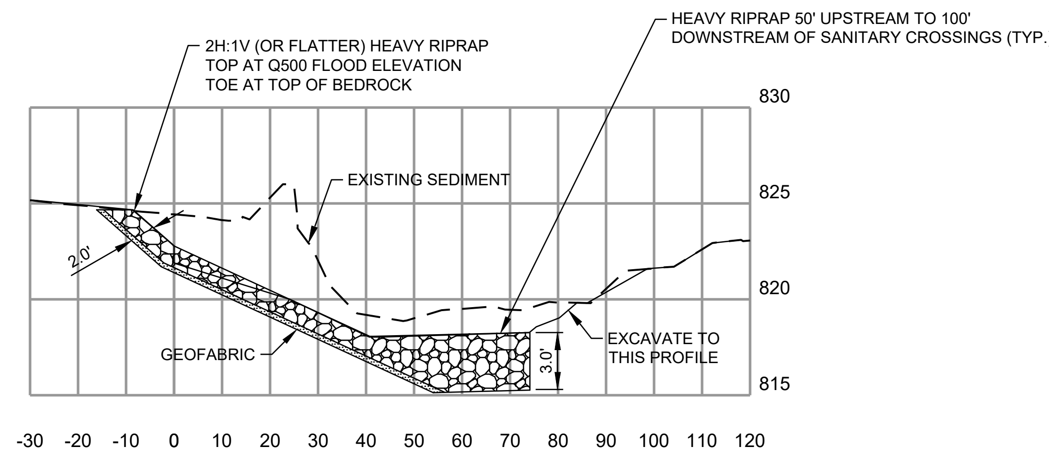
DES BY	PEH								
DR BY	ARR	PROJ NO 26-1155.00	NOT FOR CONSTRUCTION						
CHK BY	EF	DATE JAN 11, 2021	NO	DATE	REVISION	NO	DATE	REVISION	

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

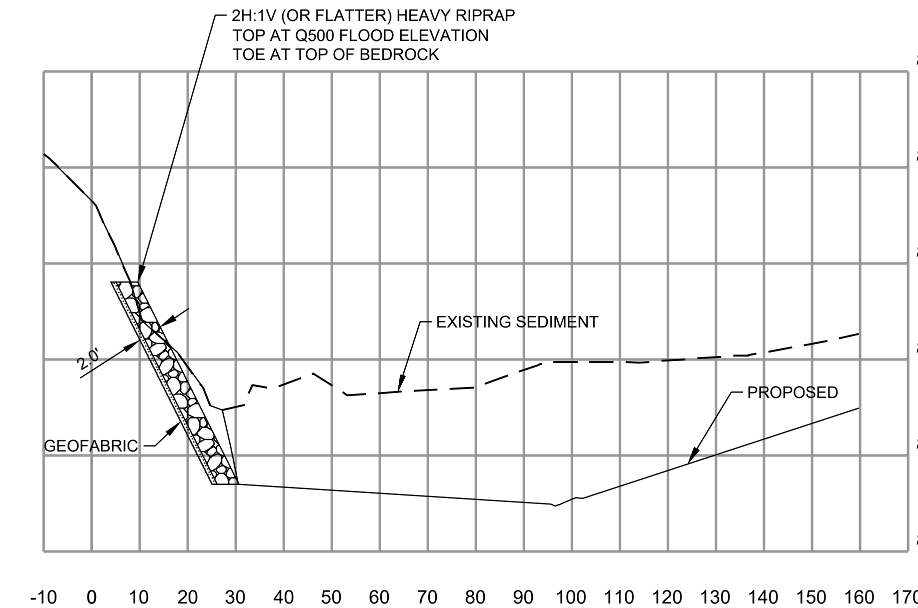
AYRES
Eau Claire, WI 54701
715.834.3161

DRAFT RESTORATION PLAN

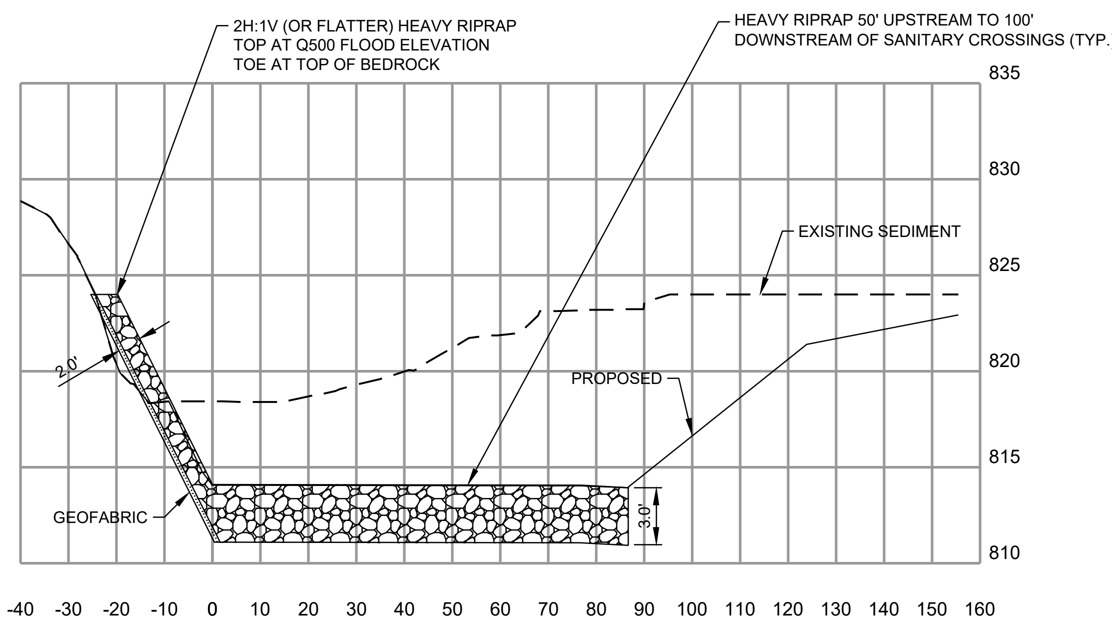
SHEET NO. 20



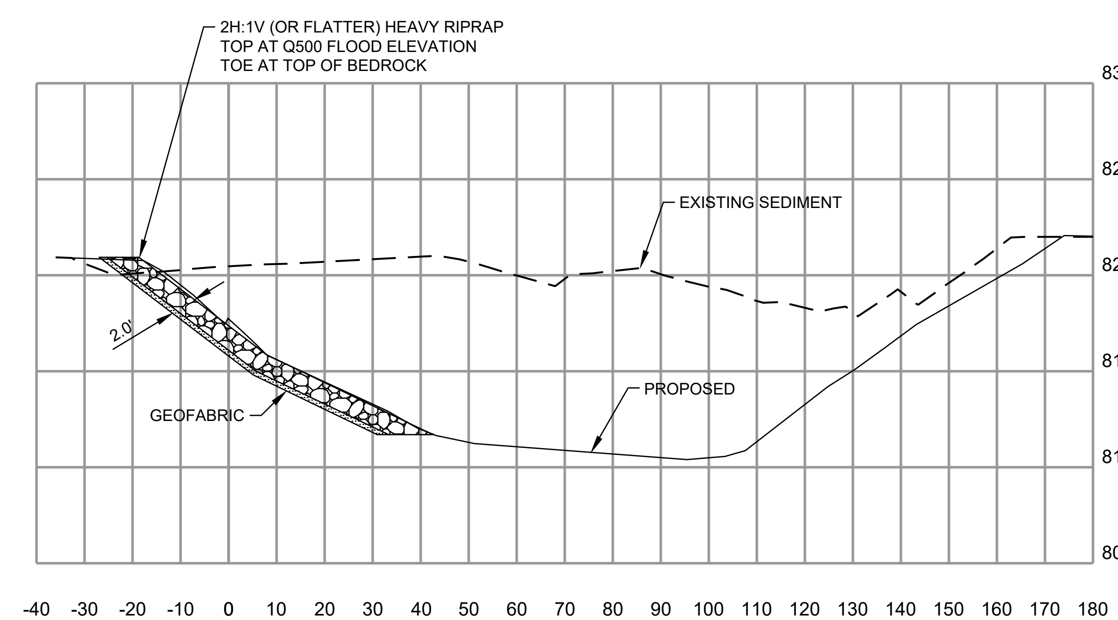
CROSS SECTION 1



CROSS SECTION 2



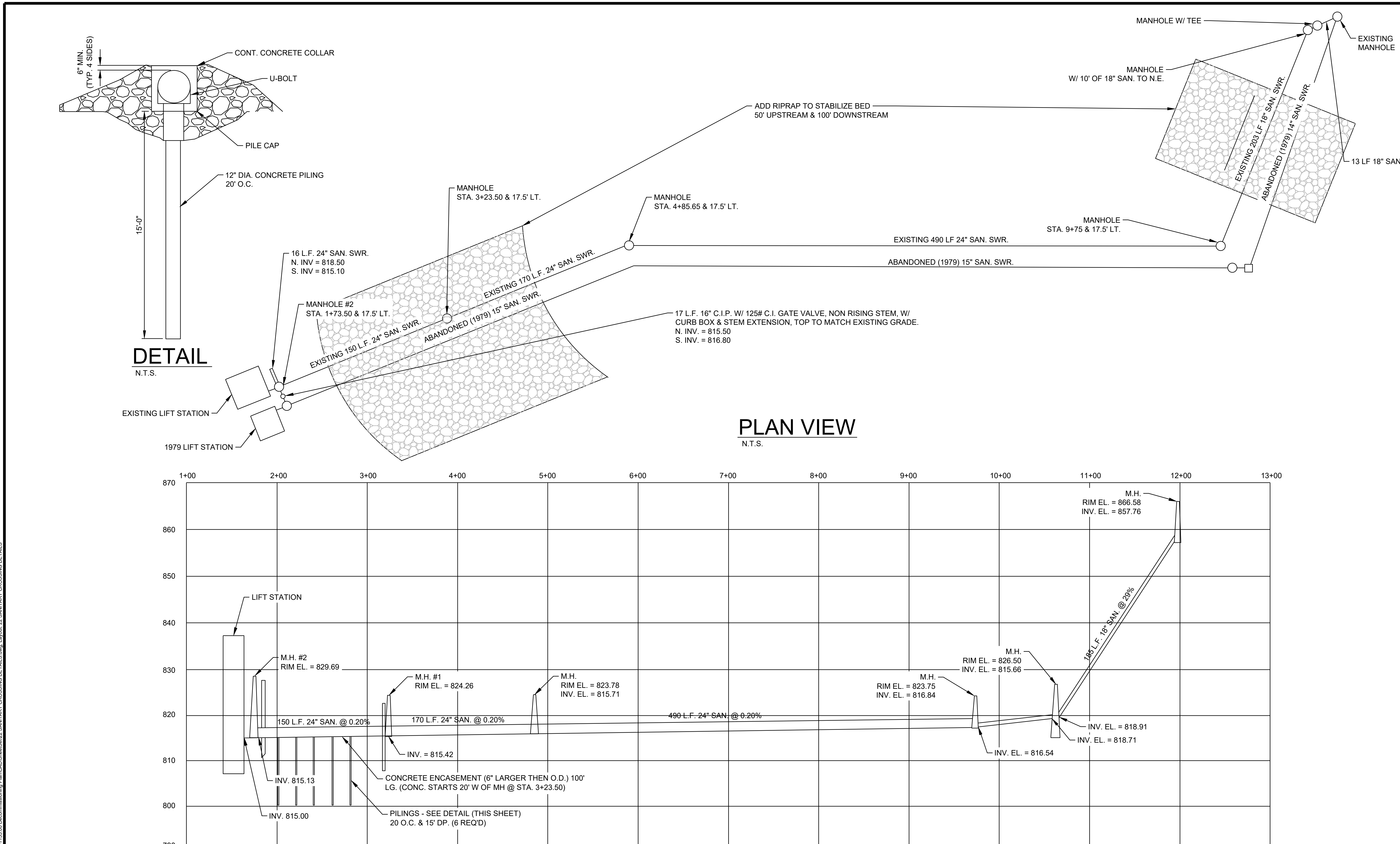
CROSS SECTION 3



CROSS SECTION 4

NOTE:
SEE SHEET 20 FOR CROSS SECTION LOCATIONS

DES BY	PEH		NOT FOR CONSTRUCTION	POWELL FALLS DECOMMISSIONING PLAN FERC PROJECT NO. 10489-016-WI	AYRES Eau Claire, WI 54701 715.834.3161	PERMANENT RIPRAP DETAILS	SHEET NO. 21
DR BY	ARR	PROJ NO 26-1155.00	NO / DATE / REVISION				
CHK BY	EF	DATE JAN 11, 2021	NO / DATE / REVISION				



DES BY	PEH		
DR BY	ARR	PROJ NO	26-1155.00
CHK BY	EF	DATE	JAN 11, 2021

NOT FOR CONSTRUCTION

NO	DATE	REVISION	NO	DATE	REVISION

POWELL FALLS DECOMMISSIONING PLAN
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Eau Claire, WI 54701
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SANITARY CROSSING DETAILS

SHEET NO. 22

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1/26/2021
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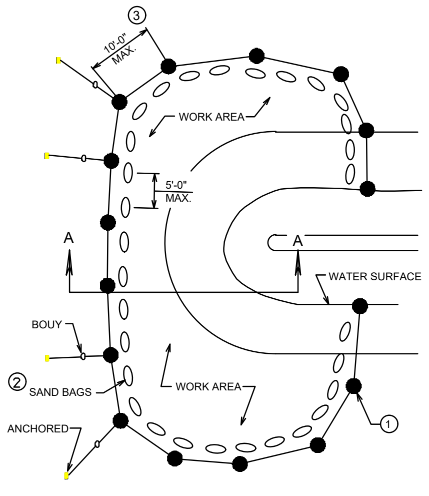
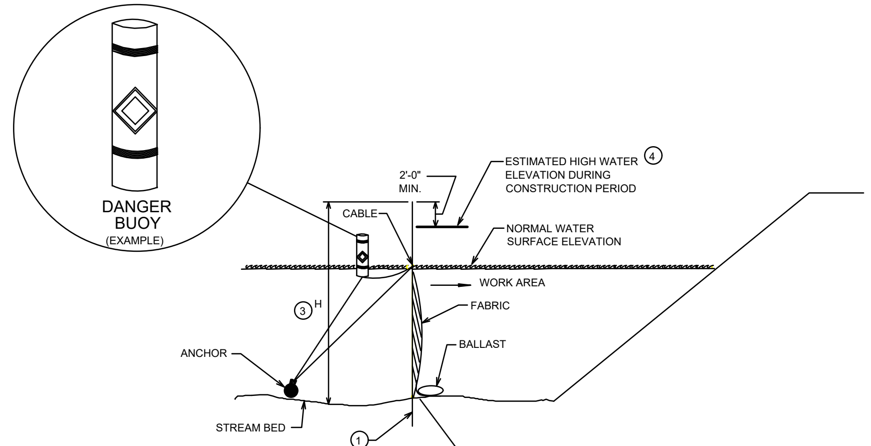
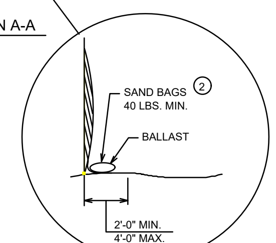


PLAN VIEW (TYPICAL)



SECTION A-A



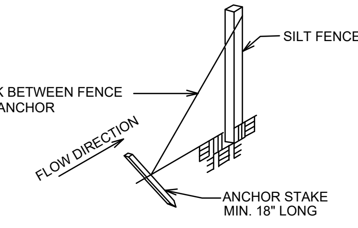
NOTES:

1. DRIVEN STEEL POSTS, PIPES, OR CHANNELS. LENGTH SHALL BE SUFFICIENT TO SECURELY SUPPORT BARRIER AT HIGH WATER ELEVATIONS.
2. SAND BAGS TO BE USED AS ADDITIONAL BALLAST WHEN ORDERED BY THE ENGINEER TO MEET ADVERSE FIELD CONDITIONS.
3. WHEN BARRIER HEIGHT, H. EXCEEDS 8'-0" POST SPACING MAY NEED TO BE DECREASED.
4. ELEVATION VALUE TO BE ESTABLISHED BY THE CONTRACTOR BASED ON THE TIME OF YEAR AND DURATION OF THE ACTIVITY.
5. TURBIDITY BARRIER SHALL COMPLETELY ENCLOSE ACTIVE DREDGING AREA AND BREAKWATER CONSTRUCTION AREA. CONTRACTOR SHALL DETERMINE LENGTH OF TURBIDITY BARRIER REQUIRED FOR CONTRACTORS OPERATION.

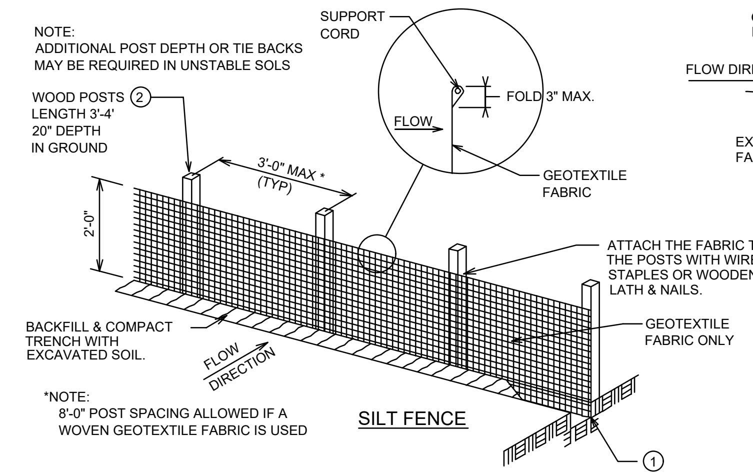
1 TURBIDITY BARRIER DETAIL
N.T.S 0156203

GENERAL NOTES:

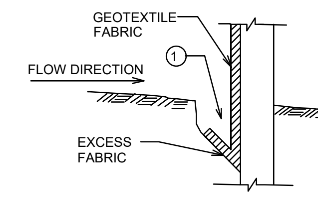
1. TRENCH SHALL BE A MIN OF 4" WIDE & 6" DEEP TO BURY AND ANCHOR THE GEOTEXTILE FABRIC, FOLD THE MATERIAL TO FIT TRENCH AND BACKFILL & COMPACT TRENCH WITH EXCAVATED SOIL.
2. WOOD POSTS SHALL BE A MIN SIZE OF 1 ½" x 1 ½" OAK OR HICKORY.
3. CONSTRUCT SILT FENCE FROM A CONTINUOUS ROLL IF POSSIBLE BY CUTTING LENGTHS TO AVOID JOINTS. IF A JOINT IS NECESSARY, USE ONE OF THE FOLLOWING TWO METHODS;
   A. TWIST METHOD -- OVERLAP THE END POSTS AND TWIST, OR ROTATE, AT LEAST 180 DEGREES.
   B. HOOK METHOD -- HOOK THE END OF EACH SILT FENCE LENGTH.



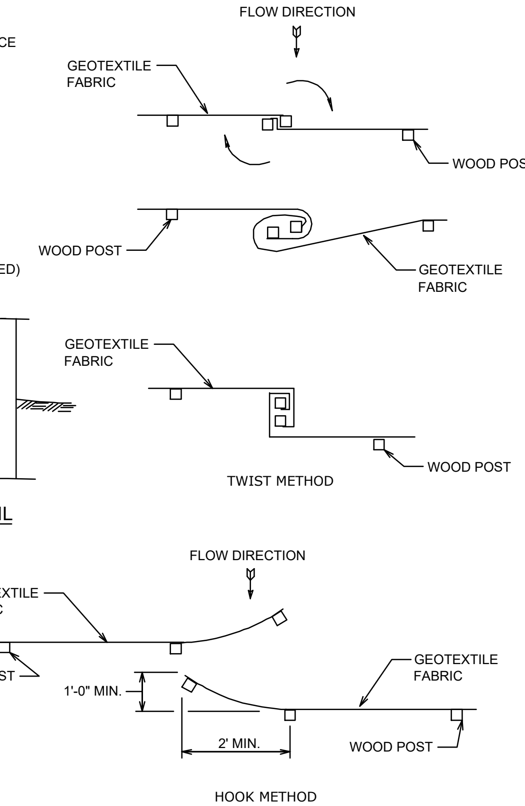
SILT FENCE TIE BACK
(WHEN ADDITIONAL SUPPORT REQUIRED)



SILT FENCE

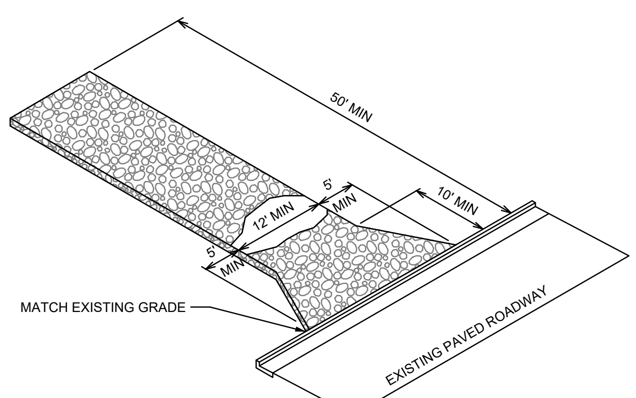


TRENCH DETAIL

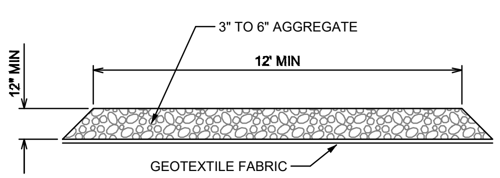


JOINING 2 LENGTHS OF SILT FENCE 3

2 SILT FENCE DETAIL
0156201

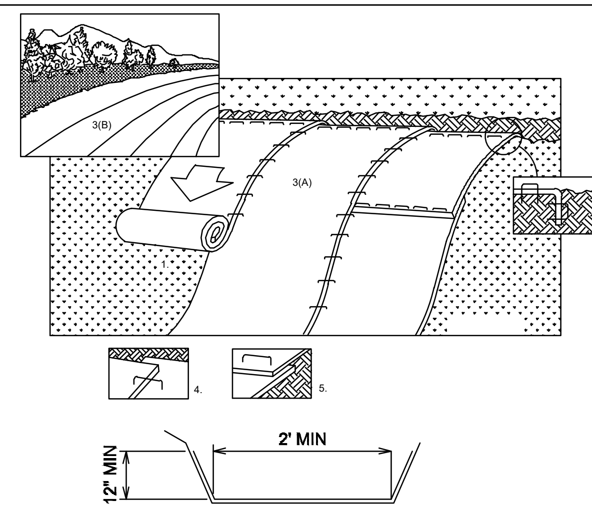


PLAN



SECTION

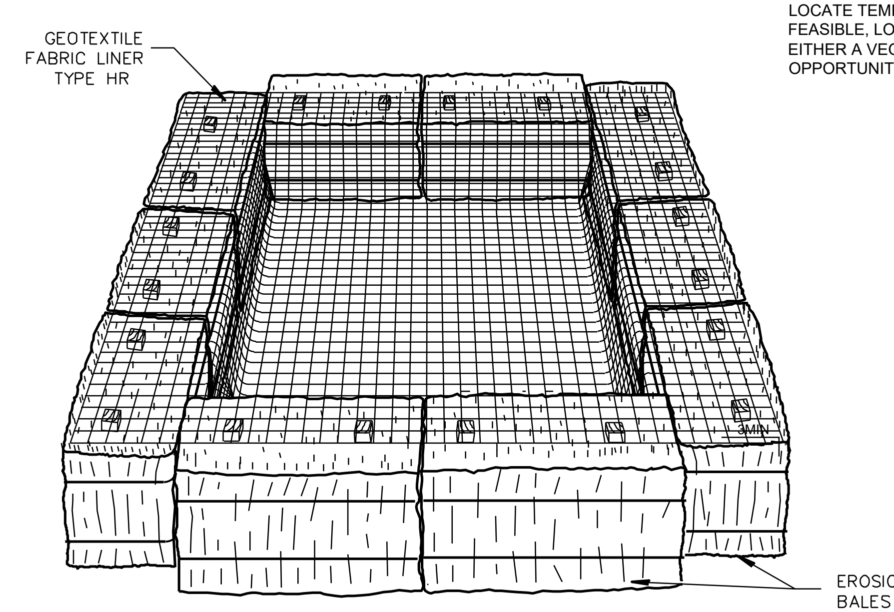
3 STONE TRACKING PAD
0156201



CHANNEL INSTALLATION

1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING SEED.
2. BEGIN AT THE TOP OF THE SLOPE OR CHANNEL BY ANCHORING THE BLANKET IN 6" DEEP X 6" WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
3. ROLL THE BLANKETS (3A.) DOWN OR (3B.) HORIZONTALLY ACROSS THE SLOPE.
4. THE EDGES OF PARALLEL BLANKETS SHALL BE STAPLED WITH 4" OVERLAP.
5. WHEN BLANKETS MUST BE SPLICED DOWN THE SLOPE OR CHANNEL, PLACE BLANKETS END OVER END (SHINGLE STYLE) WITH 6" OVERLAP. STAPLE APPROXIMATELY 12" APART.
6. ALL BLANKETS MUST BE SECURELY FASTENED TO THE SLOPE OR CHANNEL BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS RECOMMENDED BY THE MANUFACTURER.
7. USE EROSION CONTROL REVEGETATIVE MAT (ECRM) CLASS-1, TYPE-B.

4 EROSION MAT INSTALLATION DETAIL



LOCATE TEMPORARY SETTLING BASIN ON LEVEL OR GENTLY SLOPED TERRAIN. WHERE FEASIBLE, LOCATE BASIN OUTFALL SO THAT DISCHARGED WATER DIRECTLY ENTERS EITHER A VEGETATED AREA OR THE WATERWAY SO THAT EFFLUENT HAS MINIMAL OPPORTUNITY TO ENTRAIN SUSPENDED SOLIDS AFTER THE SETTLING POND.

(SIZE TO BE DETERMINED IN FIELD AS INDICATED BELOW:)

STORAGE VOLUME (SV in C.F.) = 16 X GPM (PUMP RATE)

EXAMPLE:
CONTRACTOR INDICATES PUMP CAPABLE OF 50 GPM
HEIGHT OF BALES = 1.5 FT.

SOLUTION:
SV in C.F. = 16 X 50
SV = 800 C.F.

$\frac{800\ C.F.}{1.5\ FT.}$ = 533 S.F.

USE A 20 FT. X 27 FT. BASIN

5 TEMPORARY SETTLING BASIN

DES BY	PEH							
DR BY	ARR	PROJ NO 26-1155.00	NOT FOR CONSTRUCTION					
CHK BY	EF	DATE JAN 11, 2021	NO	DATE	REVISION	NO	DATE	REVISION

POWELL FALLS DECOMMISSIONING PLAN
FERC PROJECT NO. 10489-016-WI

AYRES
Eau Claire, WI 54701
715.834.3161

DETAILS

SHEET NO. 23

AA-Standard.stb
1/26/2021
I:\26\TRC\River Falls\26-1155.00 Decommissioning Plan\CAD\SheetSet\23 DETAILS.dwg, Layout: 23 DETAILS

US Army Corps of Engineers ®
St. Paul District

Attachment I-8: Excerpt from 2017 Inter-Fluve Dam Removal Feasibility Report

Section 206 Continuing Authorities Program (CAP) Detailed Project Report
Kinnickinnic River
Aquatic Ecosystem Restoration and Protection Project

4. Dam Removal

Removing Junction and Powell Falls Dams requires planning how the structures will be removed, including access to the dams, demolition and disposal, and how to manage the water during the project. The following methods and approaches recommended for tearing down the dams are based on preliminary information and have not been engineered to final design or approved by any municipal or other government entity. Final design recommendations may differ, and construction contractors often have novel approaches to improve efficiencies and reduce costs.

This report assumes a project involving removal of both dams concurrently or in immediate succession. It is assumed that the same sediment management approach will be used for both dams, or that the sediment management approach will be fully coordinated between the two dam removals.

4.1 STAGING AND ACCESS PLAN

Junction Falls Access - Junction Falls Dam is accessible at the top of the right abutment via City property and the area below the dam can be accessed along the gated access road from Glen Park (Figure 21). Materials and equipment can be moved along the latter access path, and it can be locked during off hours. Utilizing this proposed access route will require the following steps:

1. Improvements to the existing paved trail to allow vehicle clearance.
2. Addition of gravel construction access pad at the end of the pavement. The gravel pad would likely be built to a height that avoids impacts from moderately high flows. Exact elevation would be determined during final design.
3. Construction of a river crossing at the South Fork Kinnickinnic River. This crossing will need to include culverts to convey South Fork Kinnickinnic River flow and would likely be constructed of a cobble base and a gravel road base. Culvert sizing would be accomplished during final design.
4. Improved construction access up Junction Falls to a work pad to be used for demolition work. The South Fork road can transition to a ramp that brings equipment to the flat area below the spillway. A gravel pad can be installed to protect the bedrock from damage.
5. Staging for both Junction Falls Dam demolition and the upper Lake Louise restoration activity can be located both at the top of the incline road within Park entrance (e.g. parking lot, construction trailer), and at the bottom of the incline in the floodplain on river left (e.g., active equipment storage, parking). Weather can be monitored and equipment moved to higher ground as needed.
6. Upon finishing construction, the temporary construction ramp and road would be removed.
7. Signs and fencing should be posted at entrances to warn residents to keep out of the construction area.

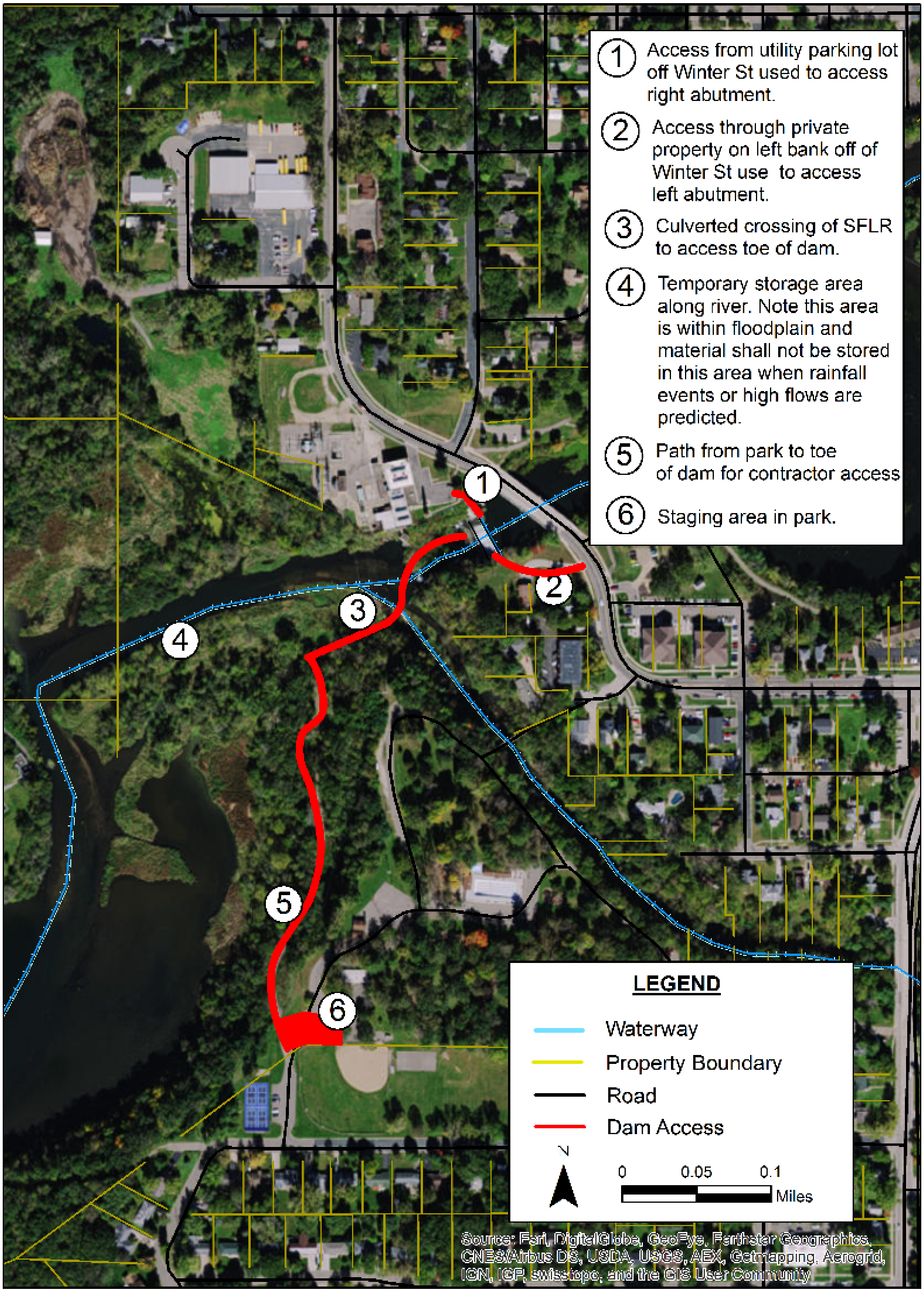


Figure 21: Junction Falls – Proposed Access Plan

Additional access may be accomplished from the top of the gorge wall on either the right or left bank. Right bank access would be on public property and left bank access would be through private property (including residence) at 407 South Winter Street.

The following access routes were considered, but deemed infeasible:

- Access from upstream of the dam via barge. This action was considered to be problematic due to clearance and size issues at the Winter Street Bridge. A barge may be able to navigate the river above Junction Falls Dam, but it may not fit between the bridge piers or under the bridge beams (with or without an excavator).
- Access via haul road from left bank of the gorge upstream of the dam.

Access to the Lake George impoundment area can be gained through either side of Winter Street Bridge. The East side of the bridge has an old mill access road on river left, while the existing walk path and parking area on right bank could be used as the main right floodplain entrance location. Temporary haul roads may need to be constructed as the sediment dries out upon drawdown.

Powell Falls Access - Access at Powell Falls is also targeted at the downstream side of the spillway. Haul trucks typically need an incline of less than 10% for effective and safe hauling, but the steep valley walls near the dam exceed 10% slope. Therefore, the most practical route to the base of the dam is the South Kinnickinnic River Trail, which connects Powell Dam to the intersection of Bartosh Lane and Foster Street on river right. The upper part of the left abutment can be accessed via a constructed paved or gravel path through Glen Park and the toe of the dam can be accessed via the South Kinnickinnic River Trail. Figure 22 shows the proposed access route for Powell Dam.

Steps for accessing the toe of the dam for demolition will follow these steps:

1. Improvements to the South Kinnickinnic River Trail to allow for vehicle clearance.
2. Add a gravel construction access to local road connections to limit turf and concrete damage and control erosion.
3. Construct a gravel access path along the left side of the river, possibly as far as 10 feet out into the channel margin. Elevations will need to be determined during final design to meet permit requirements and protect equipment.
4. Construct a crossing at the Bartosh Lane wastewater outlet, avoid damaging the newly installed stormwater outlet.
5. Improve construction access to the toe of Powell Falls Dam through construction of a work pad at the base of the dam.
6. Staging areas could be at the top of the path or in Glen Park. The southwest end of Glen Park offers a central staging area for both projects, thereby minimizing costs for mobilization and staging.

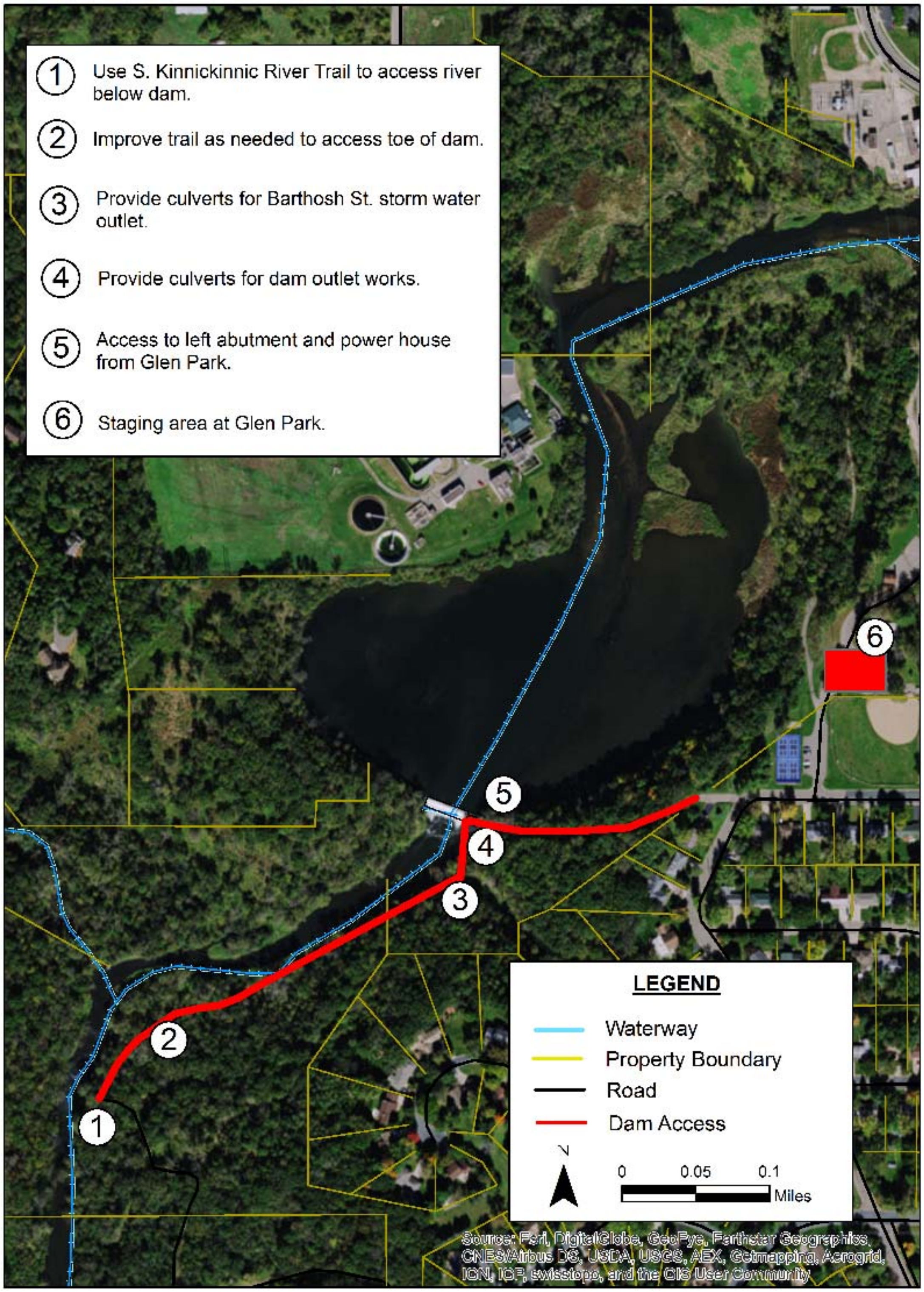


Figure 22: Powell Falls – Proposed Access Plan

4.2 PRELIMINARY DEMOLITION AND DEBRIS DISPOSAL PLAN

Demolition of the dams should begin once the impoundment water levels have been reduced using the wasteway bypass gates. The sequencing of removal should be determined during final design and with contractor input as staging area and equipment may play a role into the precise approach. However, in general, the demolition should proceed with the following concepts:

- Water flow through the wasteway gate and other temporary means of conveyance used during construction must be uninterrupted. Initial drawdown should minimize sediment transport in the impoundment areas. This can include managed output rates.
- Dam spillway notching from below the dam, starting at the top of the spillway and working down using either sawcut equipment or a hydraulic hammer mounted to a track excavator.
- Removed material will be transported away from the site via the construction access.
- The dam structures will need to be removed in a controlled fashion so that water flow is not interrupted and fine concrete debris washing into the river is minimized.
- Waste material will need to be removed on a continuous basis and should not be stored in the floodplain.

Traditionally, the "means and methods" for demolition are left to the contractor, however, for these cost estimates, it is assumed that the contractor will use a hydraulic hammer attached to an excavator to demolish the dam (Figure 23). Demolition rates can be relatively slow using this technique, depending on the density of steel reinforcement or the type of equipment used. Inter-Fluve recommends notching the spillway in 4 to 5 foot increments before hammering deeper on the dam face. This method allows for closing the gates if needed, but at a lower upstream pool volume to manage sediment excavation in the impoundment. Sediment immediately upstream of the spillway will likely need to be excavated to facilitate work. Once sections are demolished, hydraulic excavators and/or front end loaders will be required at the downstream base of the dam to load the debris onto trucks. The contractor may be required to salvage the reinforcing steel for recycling or disposal. Disposal can involve simple bulk loading of concrete and rebar, or secondary staging piles, divided into concrete and stripped rebar, can be generated prior to loading. Rebar can be partially stripped of concrete by having the jackhammer comb through the rebar and remove concrete. Additionally, vibration monitoring should be conducted to protect nearby buildings and other infrastructure such as Winter Street Bridge and the historic smoke stack on city property.

It may be feasible to leave the abutments intact if removing them causes the project to exceed available funds or if their removal would have a potential impact on nearby infrastructure. If this is a desired endpoint, a structural analysis of the portions of the dam that may be left would be required to verify that they are not under threat of collapse.

In lieu of a hydraulic hammer, saw cutting using a diamond wire saw is well-suited to demolishing sections of the reinforced concrete spillway and abutments. The saw consists of a hydraulic/electric drive unit and a series of pulleys designed to apply tension to and guide the diamond wire. The wires are then threaded through drilled holes and pulled in the direction of the cut as they circulate. The pulleys, guides, and wire are relatively light and can be set up by hand or lifted into place by a small machine. This method is more expensive, but limits the harmful vibrations, noise, debris, and dust associated with hammering. Holes would be drilled at the corners of the cut area in order to insert the saw bands. The diamond wire saw band is then threaded through the holes and attached to the saw. The cuts create well-defined sections, or blocks, of concrete. A crane would be required to remove and load the cut sections onto trucks.

Multiple demolition methods can be combined to complete the project. Hammering is the most efficient way to breach the spillway. However, the clean cuts of the diamond wire saw are likely preferred to demolish sections surrounding essential infrastructure. Finally, the inability to control debris, and the impact of the noise and possible shaking to the adjacent urban area, prohibits blasting as a removal method.

Demolition of Junction Falls and Powell Falls Dams will require extensive concrete removal, and may require removing the penstock and adjacent concrete and brick structures to fully expose the bedrock. Salvage and protection of any of these adjacent structures will be coordinated during the final design process. The location, dimension, and orientation of demolished spillway and abutment sections should be planned out so that the remaining portions of the dam are stable for anticipated loads. Concrete adhering directly to bedrock wall areas will require fine excavation, handwork or sandblasting.

Figure 23. Jackhammers comb through a rebar reinforced concrete spillway during dam demolition (photo Inter-Fluve).

Measurements taken from the 1990 dam reinforcement design plans suggest demolition of Junction Falls Dam will generate 1800 cubic yards of reinforced concrete including the removal of the penstock. At Powell Falls Dam, photograph and design plans suggest removal will generate an estimated 942 cubic yards of reinforced concrete. Reinforced concrete removal quantities assume both spillways are comprised of solid concrete. The removal of the two powerhouses may also be demolished and removed pending City input and the outcome of a recommended Phase 1 investigation. Due to the likelihood that asbestos and PCB material is present at the two powerhouses, required handling and disposal requirements for these and other materials, governed by state statues, may be defined in a Phase 1 investigation.

To minimize construction traffic through River Falls, it will be advantageous to locate off-site debris and sediment disposal sites south of the City. The preferred hauling route for sediment and demolition debris, such as concrete, rebar and other solid waste, will be via the inclined access road, Park Street, and southbound South Main Street. For northbound traffic, 830th Avenue can be used to access Hwy 65 north. Access for sediment removal and restoration of the Lake George impoundment can be via the old mill ramp on the east side of the river north of Winter Street, or from the park trail parking lot area on the west side of the river north of Winter Street. Truck traffic would be routed to South Main Street or 830th Avenue. Hauling of all removed concrete would require between 140 and 200 truckloads, depending on the haul volume per truck.

4.3 PRELIMINARY WATER ROUTING PLAN

4.3.1 Dewatering Methods

Dewatering of the impoundments (Lake Louise and Lake George) will benefit from the inclusion of a lake drain in the design of the structures. This component of the dams is referred to as the wasteway on the existing dam plans. At Junction Falls Dam, this outlet is controlled by a gate and the operator indicated that the gate is operable and has been used in the past for maintenance purposes. At the Powell Falls Dam, the wasteway gate is also operable by a controlling gate. However, the gate is aged and appears to not have been operated recently. The operator speculated that the gate could be opened but not closed.

Due to the presence of the wasteway openings, the dewatering approach can follow these general steps:

1. Lower the water to the minimum level possible using main opening to tailrace.
2. Clean any debris from screens and remove accumulated material from in front of the wasteway gate.
3. Open the wasteway gate in a controlled fashion to comply with drawdown permit requirements (typically 1’ or less per day or customized for notching and sediment management).
4. Install a debris boom in front of the wasteway opening to avoid clogging during dam demolition.
5. Remove the primary spillway in stages. Coordinate with sediment management upstream.
6. Install a cofferdam or other water control if needed (e.g. Supersacks or other means) to isolate the left abutment for removal in the dry or partial wet.
7. Remove the left abutment. Repeat for the right abutment.
8. Remove the cofferdam and construction access roads.

This approach will require heavy equipment to cross flowing water at the base of each dam to reach the right abutment. Alternatively, the contractor could remove the right abutment from the top of bank to avoid an additional cofferdam and river crossing.

Other considerations:

- Work should be scheduled for low flow periods, typically between July and February.
- Work must consider local haul road restrictions.
- The impoundment drawdown should be limited to a maximum of 1 foot per day or less. However, this assumption should be verified by a geotechnical investigation and through coordination with sediment management practices upstream.

- Sediment management activities need to be coordinated with drawdown activities to limit sediment mobilization beyond permitted levels. Sediment traps may need to be installed downstream of Powell Falls Dam and need to be designed with the haul/access road in mind.
- A Staged drawdown is typically the best way to lower impoundment levels for sediment removal and restoration. The drawdown can be done by opening gates incrementally.
- Fisheries restrictions may apply to the drawdown, and could limit work in the Fall and Winter due to the potential for trout spawning. However, since these reaches are not healthy trout waters, a variance may be appropriate. The WDNR ERR report (2016) recommends a spring/summer drawdown to protect overwintering herptiles.
- Work periods should be limited to daylight hours and possibly early evening hours to limit noise impacts. Such limits can be coordinated with stakeholders.

Alternative dewatering approaches that could be considered if the wasteway gates do not operate or the wasteway channel is otherwise inoperable include:

- It is possible for a contractor to remove sections of the dam using an excavator-mounted hydraulic hammer while water is flowing over the primary spillway (i.e., “in the wet”). Care would need to be taken to remove large pieces of concrete and to limit the downstream transport of fines. Controlling fines would be accomplished via rough notching of the dam and slowly lowering the water level in a controlled fashion. Because the dam is constructed of concrete this approach is the preferred alternative.
- Pumping / siphoning uses large diameter pipes and pumps to draw water out of the impoundment and discharge it downstream. Due to the relative small flows experienced at the sites during the preferred construction period, this method may be feasible and provide the contractor with flexibility on means and methods of removing the dam. Using a pump/ siphon system would make cofferdams unnecessary and make crossing the river less difficult (because it could be routed through a culvert under a construction access road. Negatives associated with pumps/ siphons are the cost of fuel and material.

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Appendix J: RECONS

Kinnickinnic River Continuing Authorities Program Section 206 Feasibility Report and Integrated Environmental Assessment

May 2025

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Appendix J RECONS

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1 General

The U.S. Army Corps of Engineers (USACE) Institute for Water Resources, Louis Berger, and Michigan State University have developed a regional economic impact modeling tool, RECONS (Regional ECONomic System), that provides estimates of jobs and other economic measures such as labor income, value added, and sales that are supported by USACE programs, projects, and activities. This modeling tool automates calculations and generates estimates of jobs, labor income, value added, and sales through the use of IMPLAN®'s multipliers and ratios, customized impact areas for USACE project locations, and customized spending profiles for USACE projects, business lines, and work activities. RECONS allows the USACE to evaluate the regional economic impact and contribution associated with USACE expenditures, activities, and infrastructure.

2 Description of Metrics

"Output" is the sum total of transactions that take place as a result of the construction project, including both value added and intermediate goods purchased in the economy. "Labor Income" includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income. "Value Added" or "Gross Regional Product" represents the value-added output of the study regions. This metric captures all final goods and services produced in the study areas because of the existence of the project. It is different from output in the sense that one dollar of a final good or service may have multiple transactions associated with it. "Jobs" is the estimated worker-years of labor required to build the project. The secondary impacts are a summary of the multiplier effects, which include both indirect and induced effects. Indirect impacts include industries that support the direct and indirect industries spend their salaries in the impact area, creating jobs, income, and value added. The jobs and output at each level (Local, State, US) are inclusive. For example, the state job impact value contains the local job impact value within it.

3 Assumptions

Input-output analysis rests on the following assumptions. The production functions of industries have constant returns to scale, so if output is to increase, inputs will increase in the same proportion. Industries face no supply constraints; they have access to all the materials they can use. Industries have a fixed commodity input structure; they will not substitute any commodities or services used in the production of output in response to price changes. Industries produce their commodities in fixed proportions, so an industry will not increase production of a commodity without increasing production in every other commodity it produces. Furthermore, it is assumed that industries use the same technology to produce all their commodities. The costs were calculated using FY 2024 price levels.

4 Results

4.1 Alternative 5 RECONS Results

The expenditures associated with All Work Activities, with Ability to Customize Impact Area and Work Activity at Pierce (WI) are estimated to be $10,770,000. Of this total expenditure, $8,042,046 will be captured within the local impact area. The remainder of the expenditures will be captured within the state impact area and the nation. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value added) as summarized in the following tables. The regional economic effects are shown for the local, state,

and national impact areas. In summary, the expenditures $10,770,000 support a total of 87.5 full-time equivalent jobs, $4,249,350 in labor income, $5,999,302 in the gross regional product, and $10,475,163 in economic output in the local impact area. More broadly, these expenditures support 192.5 full-time equivalent jobs, $12,396,935 in labor income, $16,981,595 in the gross regional product, and $28,140,008 in economic output in the nation.

Table 1. Alternative 5 Kinnickinnic River CAP 206 Regional Economic Development (RED) Summary

Area	Output	Jobs*	Labor Income	Value Added
Local				
Direct Impact	$8,042,046	69.8	$3,686,215	$4,835,421
Secondary Impact	$2,433,117	17.7	$563,134	$1,163,881
Total Impact	$10,475,163	87.5	$4,249,350	$5,999,302
State				
Direct Impact	$9,586,170	92.7	$5,631,330	$6,480,839
Secondary Impact	$8,235,799	45.6	$2,688,073	$4,597,616
Total Impact	$17,821,969	138.4	$8,319,403	$11,078,455
US				
Direct Impact	$10,695,014	114.0	$6,871,848	$7,455,914
Secondary Impact	$17,444,994	78.5	$5,525,087	$9,525,681
Total Impact	$28,140,008	192.5	$12,396,935	$16,981,595
* Jobs are presented in full-time equivalence (FTE). FY 2024 Price levels.				

4.2 Alternative 7 RECONS Results

The expenditures associated with All Work Activities, with Ability to Customize Impact Area and Work Activity at Pierce (WI) are estimated to be $19,767,000. Of this total expenditure, $14,760,179 will be captured within the local impact area. The remainder of the expenditures will be captured within the state impact area and the nation. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value added) as summarized in the following tables. The regional economic effects are shown for the local, state, and national impact areas. In summary, the expenditures $19,767,000 support a total of 160.6 full-time equivalent jobs, $7,799,155 in labor income, $11,010,976 in the gross regional product, and $19,225,864 in economic output in the local impact area. More broadly, these expenditures support 353.3 full-time equivalent jobs, $22,753,037 in labor income, $31,167,613 in the gross regional product, and $51,647,497 in economic output in the nation.

Table 2. Alternative 7 Kinnickinnic River CAP 206 Regional Economic Development (RED) Summary

Area	Output	Jobs*	Labor Income	Value Added
Local				
Direct Impact	$14,760,179	128.0	$6,765,592	$8,874,816
Secondary Impact	$4,465,685	32.5	$1,033,563	$2,136,160
Total Impact	$19,225,864	160.6	$7,799,155	$11,010,976
State				
Direct Impact	$17,594,226	170.2	$10,335,609	$11,894,776
Secondary Impact	$15,115,788	83.8	$4,933,625	$8,438,354
Total Impact	$32,710,014	254.0	$15,269,234	$20,333,131
US				
Direct Impact	$19,629,373	209.3	$12,612,426	$13,684,406
Secondary Impact	$32,018,125	144.1	$10,140,612	$17,483,206
Total Impact	$51,647,497	353.3	$22,753,037	$31,167,613
* Jobs are presented in full-time equivalence (FTE). FY 2024 Price levels.				

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St. Paul District

Appendix K Habitat Evaluation Procedures

Kinnickinnic River Continuing Authorities Program Section 206 Feasibility Report and Integrated Environmental Assessment

May 2025

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Appendix K Habitat Evaluation Procedures

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LIST OF FIGURES

1 Introduction

The U.S. Army Corps of Engineers (USACE) is committed to spending the nation's dollars wisely by investing in ecosystem restoration projects that provide the greatest benefits for the investment. As such, a national ecosystem benefits analysis is completed on restoration projects to help determine if projects are warranted and if so, which combination of proposed features provide the greatest benefit for the money.

This appendix describes the methods used to quantify the benefits for various alternatives considered for the Section 206 Continuing Authorities Project (CAP) Kinnickinnic River Aquatic Ecosystem Restoration Project.

Habitat Evaluation Procedures (HEP) were used to evaluate the potential benefits of habitat improvement features (trout stream, forest, and wetland marsh restoration) for the project. Four habitat suitability index (HSI) models were used to quantify the benefits of the project area; they included: Habitat Suitability Index Models and Instream Flow Suitability Curves: Brown Trout (Raleigh et al. 1986), Habitat Suitability Index Models: Veery (Sousa 1982), Habitat Suitability Index Models: Black-Capped Chickadee (Schroeder 1983), and Habitat Suitability Index Models: Marsh Wren (Gutzwiller and Anderson 1987). The brown trout model was used to assess the existing Lake George/Kinnickinnic River and any stream restoration, the veery and black-capped chickadee models were used to assess forest restoration, and the marsh wren model was used to evaluate wetland marsh restoration.

All models and spreadsheets used to assess benefits for the project have been certified or approved for use through the Corps – Environmental Planning Center of Expertise (ECO- PCX). The Annualization calculator in IWR Planning Suite II was used to annualize benefits over the project life.

2 Methods Data and General Assumptions

2.1 Habitat Evaluation Procedures

The U.S. Fish and Wildlife Service's 1980 version of Habitat Evaluation Procedures (HEP) was used to quantify and evaluate the potential project effects and benefits. The HEP methodology utilizes a Habitat Suitability Index (HSI) to rate habitat quality on a scale of 0 to 1 (1 being optimum). The HSI is multiplied by the number of acres of available habitat to obtain Habitat Units (HUs). One HU is defined as one acre of optimum habitat. Benefits of different alternatives can be quantified by comparing the projected HUs available without a proposed action to projected HUs with a proposed action or alternative. HSIs and HUs were calculated for the baseline (existing) conditions and for Future Without-Project (FWOP) and Future With-Project (FWP) conditions.

2.2 Habitat Objectives and Model Selection

Selection of evaluation species for a project is an important component of measuring the potential benefits of a project and comparing benefits among different alternatives. The selected evaluation species should reflect the project's objectives and the ecological values of the project area. Several objectives and opportunities were identified for the project as listed in Table 1.

Table 1. Restoration types designated to reach project objectives of the Kinnickinnic CAP 206 Project.

Habitat Areas	Project Objectives and Opportunities
Trout Stream Restoration **(objective)**	1. Restore natural hydrothermal dynamics to support native cold-water species prior to impoundment. 2. Increase riffle and pool geomorphic sequence to increase the use and availability of cold-water habitat species
Forest (Bottomland & Mesic Forest) (opportunity)	3. Increase riparian forest habitat.
Wetland Marsh (opportunity)	4. Increase emergent wetland habitat

The brown trout model was selected to evaluate objectives 1 and 2, as one of the primary goals of the project is to assure the continuation of the Kinnickinnic River as a Class 1 Trout Stream. A combination of the veery and black-capped chickadee models were selected to evaluate opportunity 3, as these species are often used to evaluate young and mature, respectively, forests. The marsh wren model was selected to evaluate opportunity 4, as this species is a surrogate for both shallow and deep-water marsh habitat.

2.3 Data Sources

Variables in the models required input from several available sources, as well as the collection, extrapolation and interpretation of additional data. Data inputs and their sources are discussed below.

2.3.1 Bathymetry, Topography & Ariel Imagery

Bathymetry and topography from the project area were used to categorize water depths and land elevations, respectively, within the project area. Topobathy utilizing LIDAR from 2021 of the entire area (a combination of both bathymetry and topography) from the Wisconsin DNR was used to analyze and delineate the entire project area. Additional, aerial imagery from multiple sources and years were used to inform some inputs for habitat modeling.

2.3.2 Water Quality

Water quality, specifically dissolved oxygen, and water temperature were used to assess lake and stream habitat quality throughout the project area.

2.3.3 Hydraulic Velocity

Hydraulic modelling, specifically for water velocity, peak flow and low-flow periods were used to assess the existing condition, FWP and FWOP throughout the project area. This information was modeled by the Corps through the Hydrologic Engineering Center's River Analysis System (HEC-RAS 6.2).

2.4 Software

ArcGIS Pro version 3.2.0 was used to examine, evaluate, and present the various layers of spatial information used to develop suitability indexes for a variety of habitat variables. Spreadsheets developed in Microsoft Excel were used in data storage and analysis. The IWR Planning Suite Annualization Calculator was used to annualize habitat units. The IWR Planning Suite software to conduct cost effectiveness and incremental cost analysis is discussed and presented in the main report.

2.5 Alternative Groups and Analysis Areas

The project area was divided into sub-areas that were used to evaluate the different project alternatives (Figure 1). Using sub-areas focused habitat evaluation to manageable areas that could be evaluated based on the different project alternatives. If certain elements were not evaluated, then habitat evaluation areas could be removed from the HEP analysis for a given project alternative. Also, using sub-areas ensured that benefits were only attributed to specific acreages once, preventing the double-counting of benefits. Depending on which dam would be removed under a project alternative, the number of acres could change throughout these complexes. The breakdown of the HSI acres that were analyzed between the different project alternatives during feasibility are shown in Tables 5 and 6 at the end of Section 3.4.

2.6 General Assumptions

Predicted FWOP and FWP conditions are used in the planning of all Corps restoration projects. These predictions are used to quantify the expected habitat benefits for use in alternatives evaluation and project justification. Predictions are based on factual information as much as possible; however, by their very nature, predictions require the considerable use of professional expertise and judgment. For this analysis, a number of general assumptions were made as follows:

1. A 50-year planning period is used. Because construction of this project would not begin until at least 2027, and likely not be complete until 2029, the planning period for this project is 2029-2079.
2. The projection of FWOP conditions assumes no habitat restoration measures would occur in the study area and natural forces would continue to change the area in a manner similar to what has occurred since Junction Falls Dam was constructed in the early 1900s and Lake Louise was drained in 2021.
3. Habitat benefits associated with changes in vegetation composition and extent would be realized within 3 years of construction for aquatic areas, specifically those geared toward emergent wetland/marsh (marsh wren).
4. River restoration features are designed to reach optimal variable values for brown trout (i.e., velocity, water depth, flow).

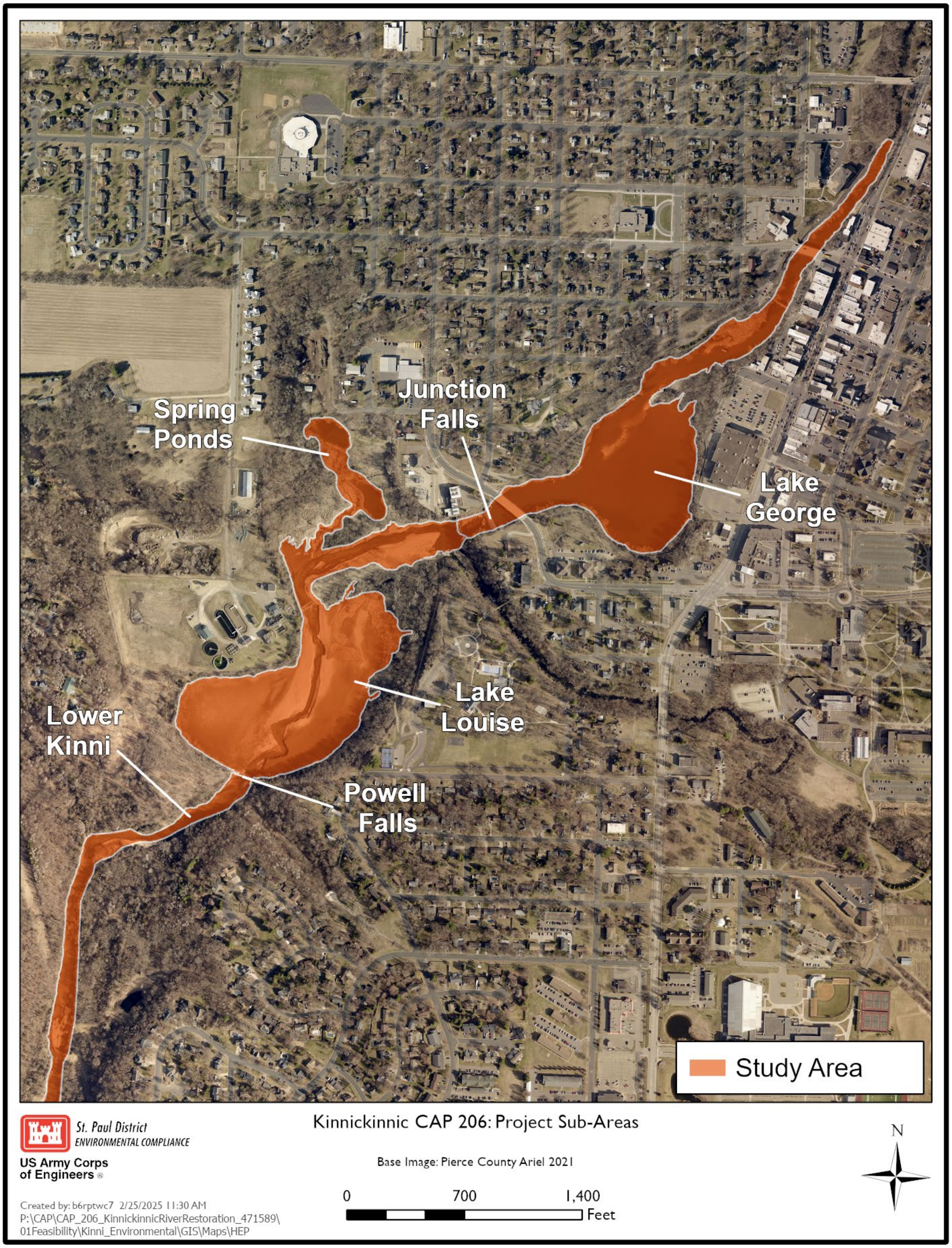

Figure 1. Kinnickinnic River sub-areas that were used to analyze the different alternatives of the project.

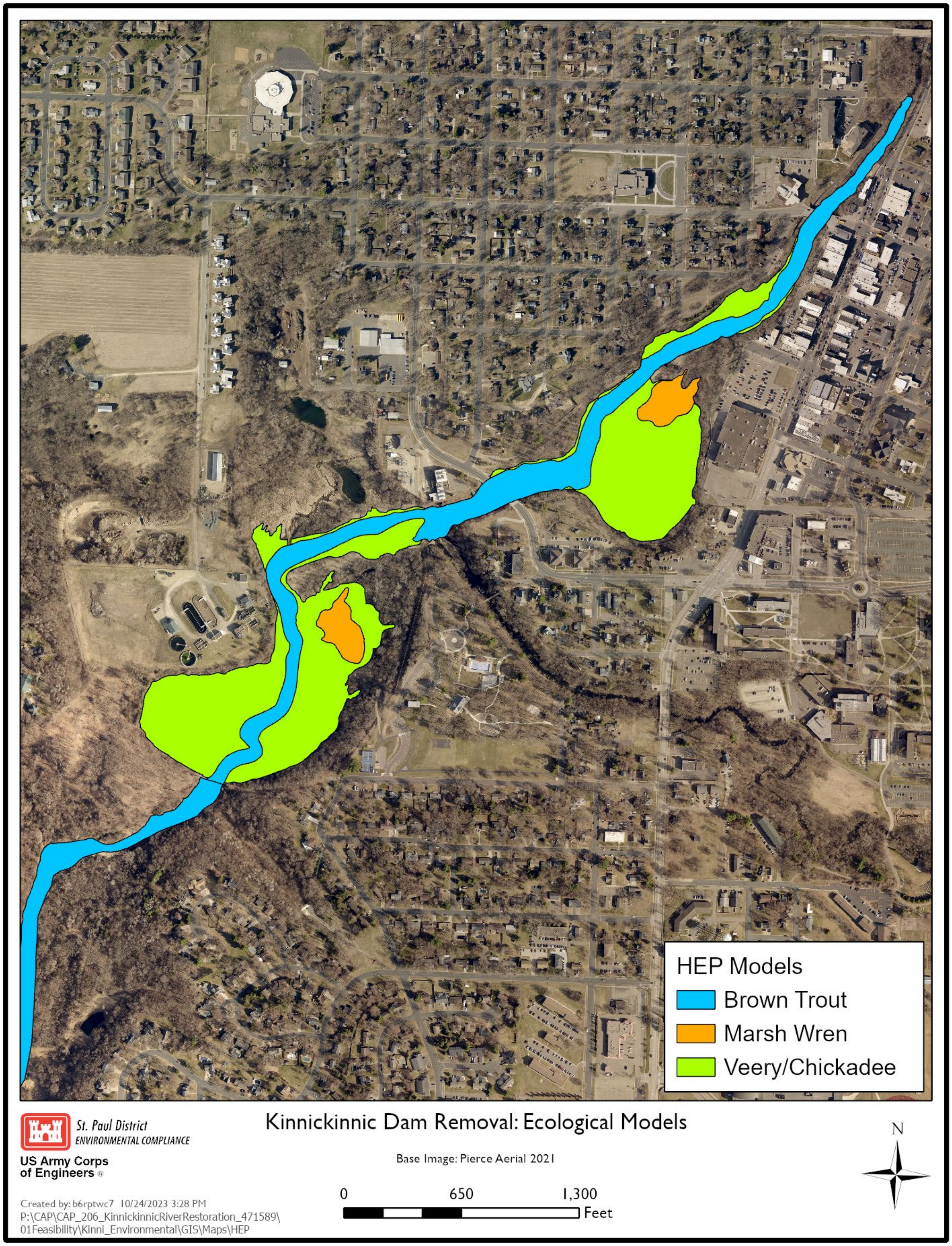

Figure 2. Kinnickinnic River HEP models used to analyze the different alternatives for the project.

3 Habitat Suitability Modeling

3.1 Trout Stream Habitat Suitability Index Modeling

3.1.1 Model Selection and Variables

The Kinnickinnic River is currently a Class 1 trout stream according to the Wisconsin Department of Natural Resources, which is the highest designation. Class 1 trout water signifies the highest quality possible trout waters that have sufficient natural reproduction to sustain wild trout populations that are at or near carrying capacity. As such, these streams do not require stocking of hatchery trout. The Kinnickinnic River contains an exceptionally high density and quality brown trout population, making it one of the best brown trout fisheries in the country. Native brook trout are found within certain stretches of the Kinnickinnic river, with brook trout representing the main trout species within the South Fork of the Kinnickinnic River. One of the larger concerns with habitat suitability on the Kinnickinnic River through River Falls is the increased water temperature due to water retention from Junction Falls Dam (Lake George). Even with the lowering of Lake Louise in 2021 and the associated lowering temperatures within the Kinnickinnic River below the dam, there are times when water temperatures are above the optimal temperature range for trout species (66.2°F, Kiap-TU-Wish 2023). If water temperature is elevated or increases through time, it could act as a limiting factor for trout suitability.

To quantify cold-water trout habitat within the Kinnickinnic River project area under the existing condition, the FWOP condition, and FWP condition, the Habitat Suitability Index Models and Instream Flow Suitability Curves: Brown Trout (Raleigh et al. 1986), or herein brown trout model, was used. This model looks at different life stages of trout, flow requirements, substrates, canopy cover and water quality variables to provide an HSI score. In total this model utilizes 18 variables, 13 of which are required for analysis, while 5 are optional. For this project the brown trout model was used as a surrogate to represent other native trout species (i.e., brook trout) and quantify cold-water stream habitat quality. Variables of the model include the following:

- **V1** - Maximum water temperature (°C) during the warmest period of the year (adults and juveniles)
- **V1** - Maximum water temperature (°C) during the warmest period of the year (fry)
- **V2** - Maximum water temperature (°C) during embryo development
- **V3** - Minimum dissolved oxygen (mg/L) during the late growing season, low-water period and during embryo development (<= 10°C)
- **V3** - Minimum dissolved oxygen (mg/L) during the late growing season, low-water period and during embryo development (> 10°C)
- **V4** - Average velocity (cm/s) over spawning areas during spawning and embryo development
- **V5** - Percent cover during the late growing season, low-water period at depths >= 15 cm and near bottom velocities <15 cm/s (juveniles)
- **V5** - Percent cover during the late growing season, low-water period at depths >= 15 cm and near bottom velocities <15 cm/s (adults)
- **V6** - Percent of total study area consisting of two spawning gravel size classes (1 to 7 cm)
- **V6** - Percent of total study area consisting of two spawning gravel size classes (0.3 to <1 cm and >7-10cm)
- **V7** - Percent of substrate as size class (10 to 40 cm) used for winter and escape cover by fry and small juveniles
- **V8** - Dominant (>=50%) substrate type in riffle-run areas for food production
- **V9** - Percent pools during the late growing season, low-water period

- **V10** - Average percent vegetation (trees, shrubs, and grasses-forbs) along the streambank during the summer for allochthonous input (2x % shrubs + 1.5x % grasses +% trees + 0x % bare ground)
- **V11** - Average percent rooted vegetation and stable rocky ground cover along the streambank during the summer (erosion control)
- **V12** - Annual maximal or minimal pH. Use measurement with lowest SI.
- **V13** - Average annual base flow regime during late summer or winter low-flow period as a percentage of the average annual daily flow (cfs)
- **V14** - Pool class rating during late growing season, low-flow period. Based on % of area that contains pools of the three described classes
- **V15** - Percent fines (<3mm) in spawning areas during average summer flows
- **V15** - Percent fines (<3mm) in riffle-run areas during average summer flows
- **V16** - Percent of stream area shaded between 1000 and 1400 hrs (for streams <=50m wide). Do not use for cold (<18 degrees C), unproductive streams
- **V17** - Levels of late summer nitrate-nitrogen in mg/L
- **V18** - Average annual peak flow as a multiple of average annual daily flow. For embryo and fry habitat suitability, use the average and highest flows that occur from time of egg deposition until two weeks after fry emergence.

3.1.2 Brown Trout HSI Model Results

3.1.2.1 Existing Conditions and Future without Project

Under the existing and Future without Project (FWOP) conditions Junction Falls Dam is and would remain in place, maintaining the Lake George impoundment. Any habitat evaluated for brown trout within the Lake George basin has an HSI value of zero due to the low velocity (cm/s) within this habitat area (V4). Low velocities throughout Lake George is acting as a limiting factor in the model for potential spawning areas, as this level of velocity would not allow brown trout embryos to properly develop. Habitat suitability in the Lake Louise sub-area would be marginal (0.3) for much of this timeframe due to the lack of adequate substate types. Other limiting variable through this river reach include percent cover ((V5 (adults)) and rooted vegetation and stable rocky ground cover (V11). The existing and FWOP condition for the Lower Kinnickinnic, which was evaluated to track water quality benefit only, is quite suitable (0.7 avg), with some loss of suitability due to increased temperature near the end of the project evaluation.

3.1.2.2 Future with Project

Under the FWP, Junction Falls Dam would be removed, along with the Lake George impoundment. Through this action, the habitat evaluated for brown trout would get immediate benefits from decreased water temperature, increased dissolved oxygen and optimal velocities. The proposed project would incorporate stream restoration features of riffles, pools, rock arch rapids, cross vanes, and Lunker structures throughout the entire river within the project area. Stream restoration features would be designed to provide optimal habitat for brown trout based on the HSI model. These features, along with the water quality benefits would provide higher suitability for all sub-areas evaluated under the model (Table 2). Finally, the FWP would provide water quality benefits (lower water temperature and increase dissolved oxygen) to the Lower Kinnickinnic River due to dam removal. To account for other cold-water inputs and dilution through the Lower Kinnickinnic, a decreasing percent benefit gradient was incorporated to account for a loss of benefits as the river gets closer to the confluence.

3.1.3 Brown Trout HSI Model Results Summary

Table 1 shows how the brown trout (trout stream) HSI changes over the project planning period of 50 years using the brown trout HSI model. These numbers were used in generating AAHUs for each alternative for the project (See Section 3.4, Tables 5 & 6).

3.2 Forestry Habitat Suitability Index Modeling

3.2.1 Model Selection and Variables

Forests take a long time to reach maturity. Trees planted or naturally seeded take at least fifty years to develop mature forest features. In the intervening time, the plant community undergoes several successional changes from an open herbaceous community with small seedlings to a dense stand of young saplings to a stand of young trees to a stand of mature trees beginning to differentiate in size, height, and structure. The successional pathways vary considerably by forest type. Mature forests develop unique characteristics such as large woody debris, standing snags, emergent trees, multi-layered canopy, and understory regeneration.

Because the forest undergoes such significant changes over the planning period, two models were used to evaluate the forest habitat. The veery model, which considers the value of shrubs and herbaceous plants, was used for young forests, using years 1, 10, and 20. The mature forest was evaluated at years 30, 40, and 50 using the chickadee model, which considers the value of canopy closure, tree height, and snags. Forestry benefits were analyzed among newly forested areas that would be built in riparian corridor of the project.

3.2.2 VEERY MODEL

The veery model was chosen to quantify the benefits provided by newly constructed floodplain forest for the first twenty years of the project. Veeries, a species of small woodland thrush, (*Catharus fuscescens*) prefer thick shrub and herbaceous cover in moist or wet woodlands and shrub wetlands. For a deciduous floodplain forest, optimal conditions in the model include:

a. A flooding regime that does not flood the habitat in spring and early summer.
b. At least 70% deciduous shrub crown cover.
c. Average deciduous shrub height between 1.5-3 m.
d. Herbaceous canopy cover over 90%.
e. Herbaceous canopy height over 30 cm.

3.2.3 CHICKADEE MODEL

The chickadee model was chosen to quantify the benefits provided by mature floodplain forest. The black-capped chickadee (*Parus atricapillus*) inhabits wooded areas throughout North America, and nests in dead or hollow trees. The chickadee is insectivorous and selects territories based on the potential abundance of food, determined primarily on canopy volume. Optimal conditions in the black-capped chickadee model include:

a. Tree canopy closure of 50 to 75 percent.
b. Average height of overstory trees is greater than 15 meters.
c. Two or more snags 10 to 25 cm diameter breast height (dbh) per acre.

3.2.4 Veery/Chickadee HSI Results

3.2.4.1 Existing and Future without Project Conditions

Within Lake George, the existing and FWOP conditions where riparian floodplain forest restoration would happen are currently aquatic (impoundment). This area would have HSI values of zero for each veery and chickadee variables, as it is inundated, and there are no shrubs or herbaceous canopy cover. Much of the other current terrestrial habitat evaluated for forest suitability is currently devoid of trees. The Lake Louise sub-area was once impounded, and proper restoration has not taken place since the lake was drained in 2021; this has resulted in the area being dominated by reed canary grass and other invasive species. Without intervention, suitability for veery and chickadee is anticipated to remain low, with some benefits around the 20-year evaluation period, with a dip in year 30 and on because of a lack of canopy cover and snags.

3.2.4.2 Future with Project

The early stages of forestry measures within the restored riparian corridor would provide early successional forest conditions, which is evident through shrubs and shrub-like trees. Tree seedlings and shrubs would be planted within restoration areas classified as bottomland and mesic forest. In Year 1, the habitat values would remain relatively low as the trees and shrubs become established. For the first twenty years the young trees would fill the same functional niche as shrubs. At year 20, the trees and shrubs form distinct layers. At this time, the young trees are no longer included in the shrub crown cover, but planted shrubs still provide optimal cover for veery HSI. At year 30, the herbaceous layer becomes less dense as the closing forest canopy shades it out. The transition from Veery to chickadee at year 30 causes the HSI scores to decline, as forests are still not mature. Trees reach maturity by year 50, indicating a high suitability of chickadee, representing highly productive forest habitat.

3.2.5 Veery/Chickadee HSI Model Results Summary

Table 3 shows how the forestry HSI changes over the project planning period of 50 years using the veery and chickadee HSI model. These numbers were used in generating AAHUs for each alternative for the project (See Section 3.4, Tables 5 & 6)

Table 2. Brown trout HSI model results summary.

Sub-Area	Alternative	Acres	TY0 HSI	TY10 HSI	TY20 HSI	TY30 HSI	TY40 HSI	TY50 HSI
Lake George	No Action	8.26	0.00	0.00	0.00	0.00	0.00	0.00
Lake George	Alt 2, 4, 5, 7	8.26	0.00	0.83	0.83	0.83	0.83	0.83
Lake Louise	No Action	4.99	0.30	0.30	0.30	0.30	0.42	0.42
Lake Louise	Alts 3, 6	4.99	0.30	0.60	0.60	0.60	0.60	0.60
Lake Louise	No Action	4.99	0.30	0.30	0.30	0.30	0.42	0.42
Lake Louise	Alts 4, 7	4.99	0.30	0.76	0.76	0.76	0.76	0.76
Lake Louise - No Restoration	No Action	3.52	0.30	0.30	0.30	0.30	0.42	0.42
Lake Louise - No Restoration	Alt 2, 5	3.52	0.30	0.30	0.30	0.30	0.42	0.42
Lower Kinni	No Action	74.20	0.74	0.74	0.71	0.69	0.66	0.63
Lower Kinni	Alt 2, 4, 5, 7	74.20	0.74	0.90	0.90	0.90	0.87	0.84
Spring Ponds	No Action	1.48	0.30	0.30	0.30	0.30	0.30	0.30
Spring Ponds	Alts 5, 6, 7	1.48	0.30	0.67	0.71	0.74	0.78	0.80

* The No Action Alternative is depicted as Alternative 1 for a planning purposes; however, alternatives 2-7 have No Action areas that corresponds with the footprint of each specific alternative to quantify benefits throughout the project life. This is true for all HEP results shown in this appendix.

Table 3. Veery and black-capped chickadee HSI model results summary.

Sub-Area	Forestry Type	Alternatives present	Acres	TY0 HSI veery	TY1 HSI veery	TY10 HSI veery	TY20 HSI veery	TY30 HSI chickadee	TY40 HSI chickadee	TY50 HSI chickadee
Lake George	Bottomland	No Action	7.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake George	Bottomland	Alts 2, 4, 5, 7	7.5	0.00	0.41	0.99	0.74	0.75	0.88	0.96
Lake George	Mesic	No Action	3.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake George	Mesic	Alts 2, 4, 5, 7	3.0	0.00	0.41	0.50	0.50	0.75	0.88	0.96
Lake Louise	Bottomland	No Action	9.5	0.25	0.25	0.25	0.46	0.05	0.10	0.15
Lake Louise	Bottomland	Alts 3, 5	9.5	0.25	0.41	0.99	0.74	0.75	0.88	0.96
Lake Louise	Mesic	No Action	7.9	0.25	0.25	0.25	0.46	0.05	0.10	0.15
Lake Louise	Mesic	Alts 3, 5	7.9	0.25	0.41	0.50	0.50	0.75	0.88	0.96
Spring Ponds	Mesic	No Action	1.6	0.14	0.14	0.14	0.14	0.50	0.56	0.63
Spring Ponds	Mesic	Alts 5, 6, 7	1.6	0.14	0.43	0.50	0.50	0.75	0.88	0.96

3.3 Wetland Marsh Habitat Suitability Index Modeling

3.3.1 Model Selection and Variables

The marsh habitat designed as part of the project would be Type 3 wetlands that consist of emergent aquatic plants that include grasses, bulrushes, cattails and arrowheads and provide habitat for waterfowl, herptiles small mammals, and fish. The bottom elevation of the marsh areas would be set to the elevation of the bottom of the Kinnickinnic River main channel, allowing the area to fall below the water table. The marsh wren model is ideal for evaluating increases in aquatic vegetation that would result from reduction of water velocities, and inundated areas that are ideal for emergent aquatic plants. This model was selected to measure the benefits associated with improving marsh or wetland habitat through restoration. The marsh wren HSI model consists of four simple variables that assess the habitat value of the type of vegetation and water depth of an area. Two specific areas covering a total of 2.67 acres, as seen in Figure 2, were evaluated using this HSI model.

Optimum conditions described in the model are as follows:

a. Growth form of emergent hydrophyte is bulrushes, cattails, and sedges.
b. Percent canopy cover of emergent herbaceous vegetation is 80% or greater.
c. Mean water depth is 15cm or greater.
d. Percent canopy cover of woody vegetation is zero.

3.3.2 Marsh Wren HSI Model results

3.3.2.1 Existing and Future without Project Conditions

The marsh wren model was applied to areas that would be constructed as wetland marsh habitat as part of the project. The current evaluation area of marsh wren within the Lake George sub-area within the impoundment area is void of emergent hydrophytes and herbaceous cover, resulting in an HSI of zero. By the end of the evaluation period, some emergent hydrophytes would be present in Lake George due to lake succession, resulting in some suitability for the marsh wren. The marsh habitat within the Lake Louise sub-area is not inundated and does not contain emergent hydrophytes, resulting in an HSI of zero. This area is anticipated to stay the same under the FWOP.

3.3.2.2 Future with Project

As part of the project, wetland marsh habitat would be designed as a type 3 wetland or shallow marsh through excavating to the water table. Marsh habitat vegetation would include grasses, bulrushes, cattails and arrowheads. Suitability at year 1 would be low due to the lack of emergent hydrophytes and herbaceous canopy cover. Emergent vegetation and canopy cover are expected to be greatly improved by year five years of the evaluation window. By year 50 herbaceous cover would be optimal, water depth would be slightly decreased due to sedimentation and woody canopy cover would be present due to the adjacent forest habitat.

3.3.3 Marsh Wren HSI Model Results Summary

Table 4 shows how the wetland marsh HSI changes over the project planning period of 50 years using the marsh wren HSI model. These numbers were used in generating AAHUs for each alternative for the project (See Section 3.4, Tables 5 & 6

Table 4. Marsh wren HSI model results summaries.

Sub-Area	Alternatives Present	Acres	TY0 HSI	TY1 HSI	TY5 HSI	TY50 HSI
Lake George	No Action	1.34	0.00	0.00	0.00	0.37
Lake George	Alts 2, 4, 5, 7	1.34	0.00	0.16	0.74	0.90
Lake Louise	No Action	1.33	0.00	0.00	0.00	0.00
Lake Louise	Alts 3, 4, 6, 7	1.33	0.00	0.16	0.74	0.90

3.4 Combined Habitat Units Results

Habitat units (HUs) are the product of the HSI value and acres of a given area, such that one habitat unit is one acre of habitat with a perfect HSI score of one. It is important to accurately quantify the acres of a given habitat type for each alternative being assessed. Table 5 summarizes the acres of habitat analyzed for each habitat model across the different alternatives. The maximum acres evaluated for the project was 121.2 acres. Evaluation acres per habitat model was multiplied by the HSI values for each target year and averaged over the 50-year project life. The resulting Average Annual Habitat Units (AAHUs) for each habitat model for each alternative is depicted in Table 6. The gain in AAHUs over the existing and FWOP condition for each project alternative are shown as incremental gains for each alternative. Incremental net gains of AAHUs were used in the Cost Effectiveness/Incremental Cost Analysis (CE/ICA) found in the main report and helped in determining the Tentatively Selected Plan for the project. The detailed HSI model inputs and calculations are available upon request.

Table 5. Acres of habitat evaluated for each HSI model per alternative.

Alternative	Analysis	Acres Per Habitat Type			
		Brown Trout	Veery/Chickadee	Marsh Wren	Total
Alt 2	No Action	86.0	10.5	1.3	97.8
	Alt 2	86.0	10.5	1.3	97.8
Alt 3	No Action	5.0	17.4	1.3	23.7
	Alt 3	5.0	17.4	1.3	23.7
Alt 4	No Action	87.5	27.9	2.7	118.1
	Alt 4	87.5	27.9	2.7	118.1
Alt 5	No Action	87.5	12.2	1.3	101.0
	Alt 5	87.5	12.2	1.3	101.0
Alt 6	No Action	6.5	19.1	1.3	26.9
	Alt 6	6.5	19.1	1.3	26.9
Alt 7	No Action	88.9	29.6	2.7	121.2
	Alt 7	88.9	29.6	2.7	121.2

Table 6. Average Annual Habitat Units (AAHU) calculated per Alternative Group and HSI model.

		AAHUs Per Habitat Type				
Alternative	Analysis	Brown Trout	Veery/Chickadee	Marsh Wren	Total	Inc. Gain
Alternative 2	No Action	53	0	0.2	53.2	
	Alt 2	65.6	7.9	1	74.6	21.3
Alternative 3	No Action	1.7	3.7	0	5.4	
	Alt 3	2.8	12.8	1	16.7	11.3
Alternative 4	No Action	53.3	3.7	0.2	57.3	
	Alt 4	68	20.8	2.1	90.8	33.5
Alternative 5	No Action	53.5	0.6	0.2	54.3	
	Alt 5	66.6	9.1	1	76.7	22.5
Alternative 6	No Action	2.1	4.3	0	6.4	
	Alt 6	3.9	13.9	1	18.8	12.4
Alternative 7	No Action	53.8	4.3	0.2	58.3	
	Alt 7	69	21.9	2.1	92.9	34.7

*Note – AAHU numbers are rounded to the tenth decimal place for display purposes, but are technically more exact, resulting in visible rounding errors in this table.

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