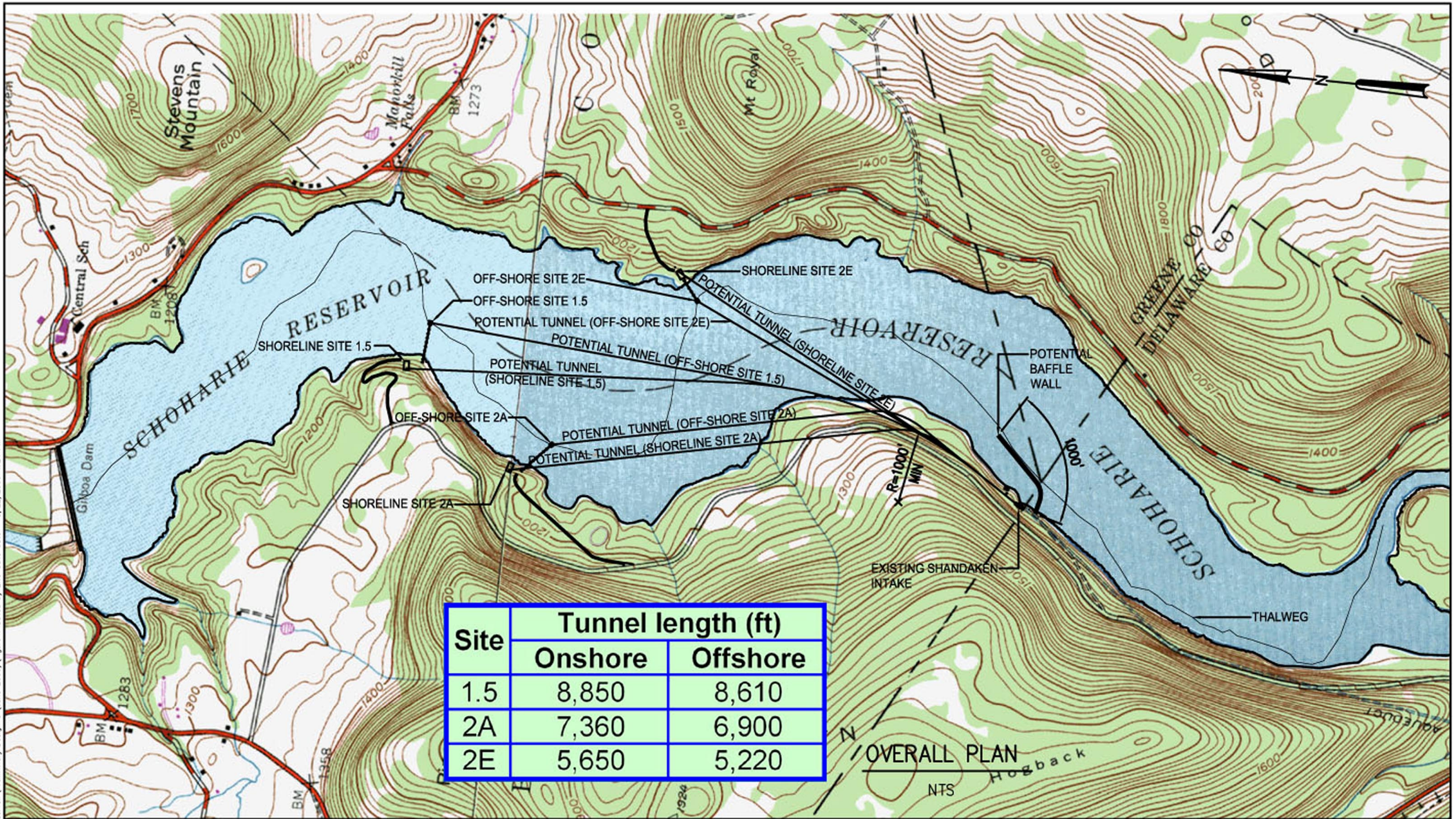


## **APPENDIX D: MULTI-LEVEL INTAKE AND BAFFLE DRAWINGS**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 1 Saved by ENG Save date = 8/22/2006 4:24 PM



CAT  
211

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



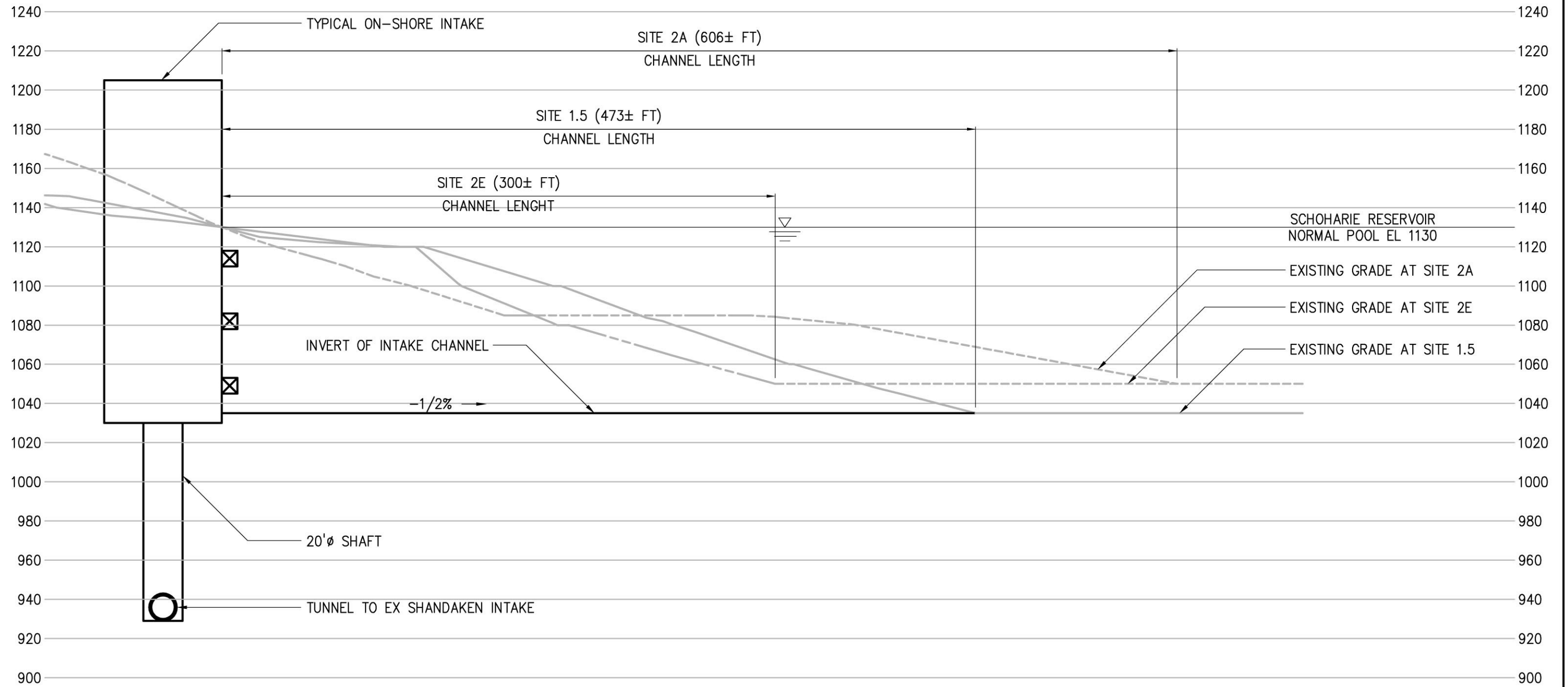
**Gannett Fleming**

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

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**MULTI-LEVEL INTAKE  
GENERAL SITE PLAN**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 2 Saved by ENG Save date = 8/18/2006 10:20 AM



### TYPICAL SECTION FOR ALL SITE (SHORELINE)

1"=50'

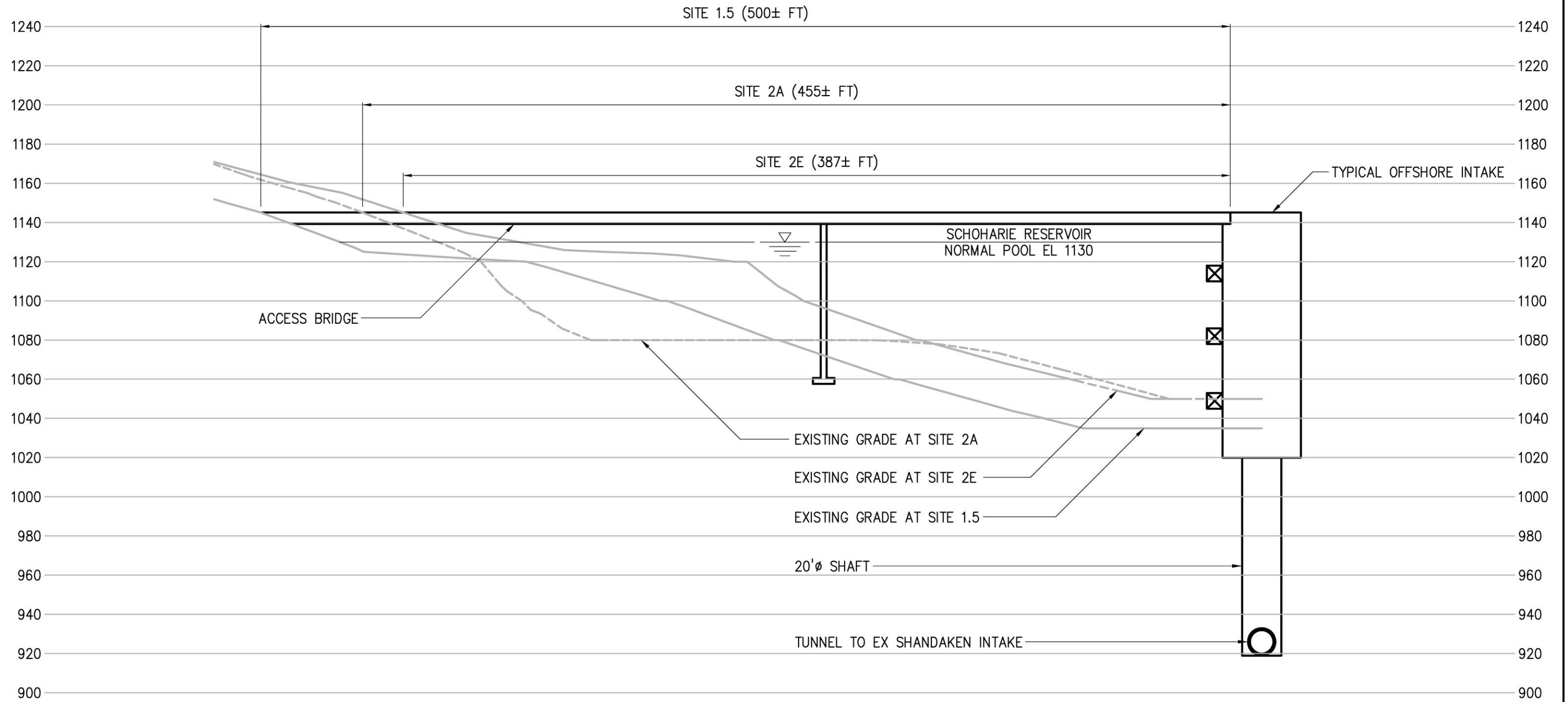


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



## MULTI-LEVEL INTAKE TYPICAL SECTION ONSHORE ALTS.

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 3 Saved by ENG Save date = 8/18/2006 10:27 AM



### TYPICAL SECTION FOR ALL SITE (OFFSHORE)

1"=50'



CAT  
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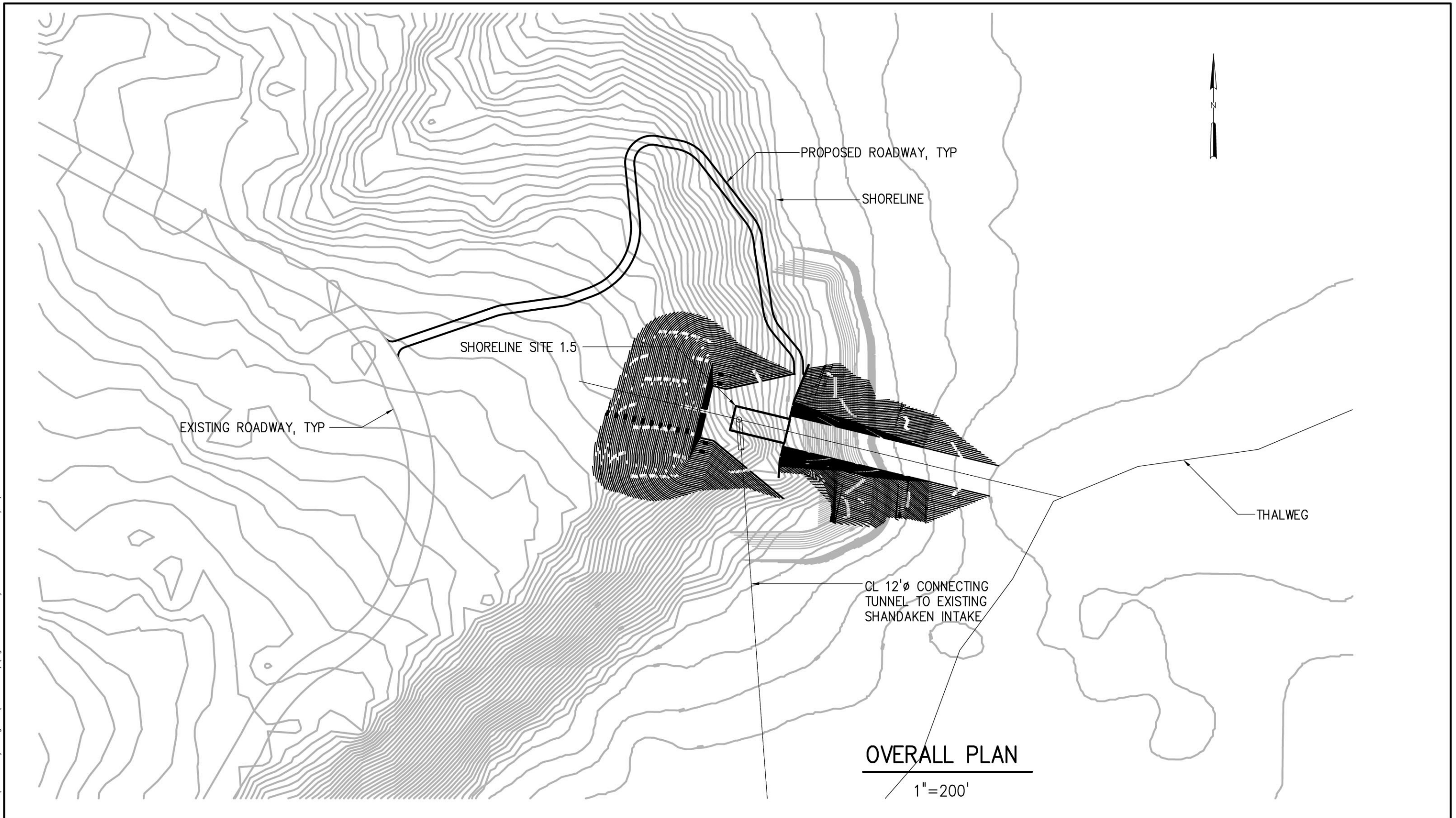
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MULTI-LEVEL INTAKE  
TYPICAL SECTION OFFSHORE ALTS.

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 4 Saved by ENG Save date = 8/22/2006 2:59 PM

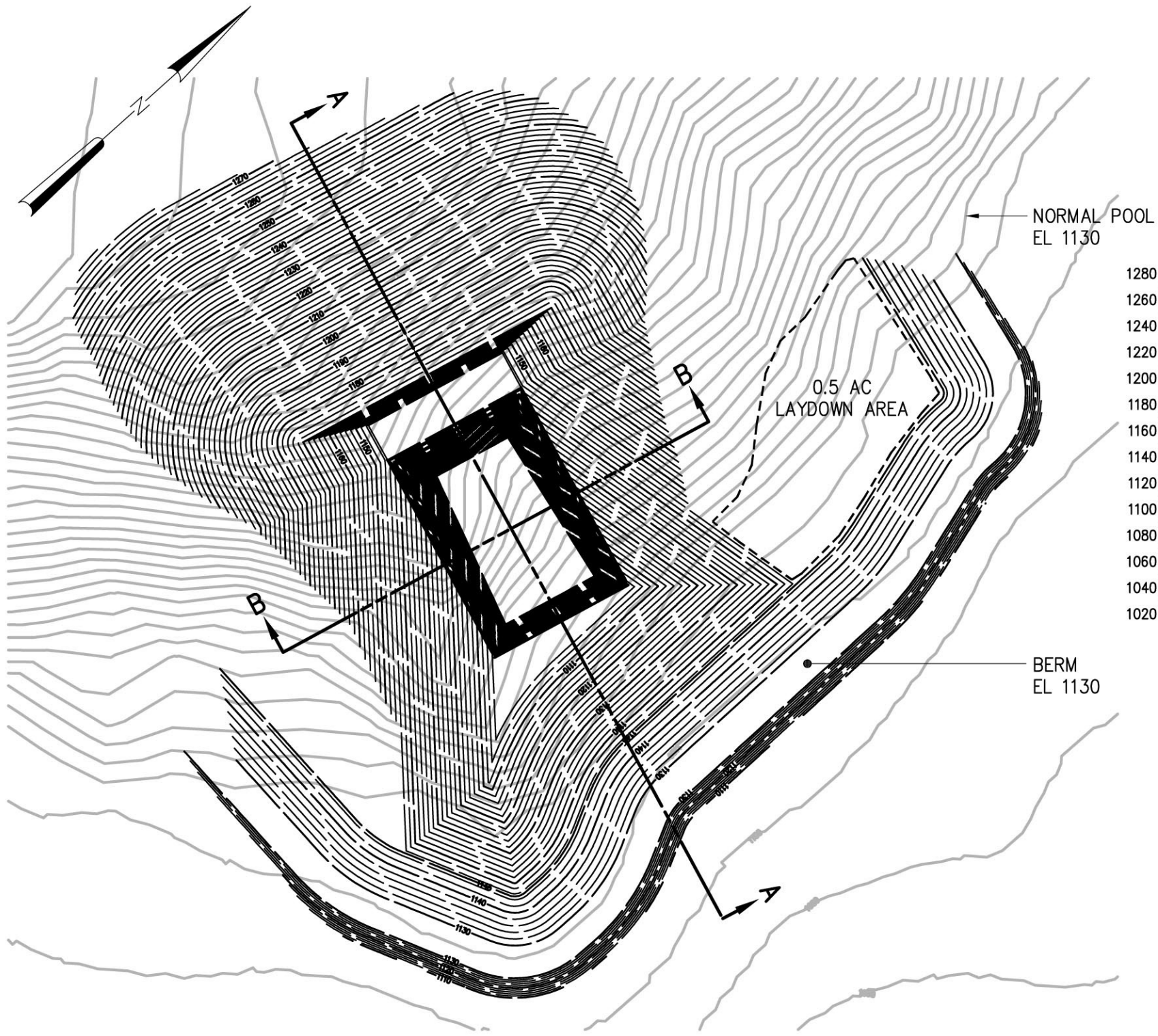


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**MULTI-LEVEL INTAKE  
SITE 1.5 SHORELINE INTAKE  
SITE PLAN**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 5 Saved by ENG Save date = 8/22/2006 3:02 PM

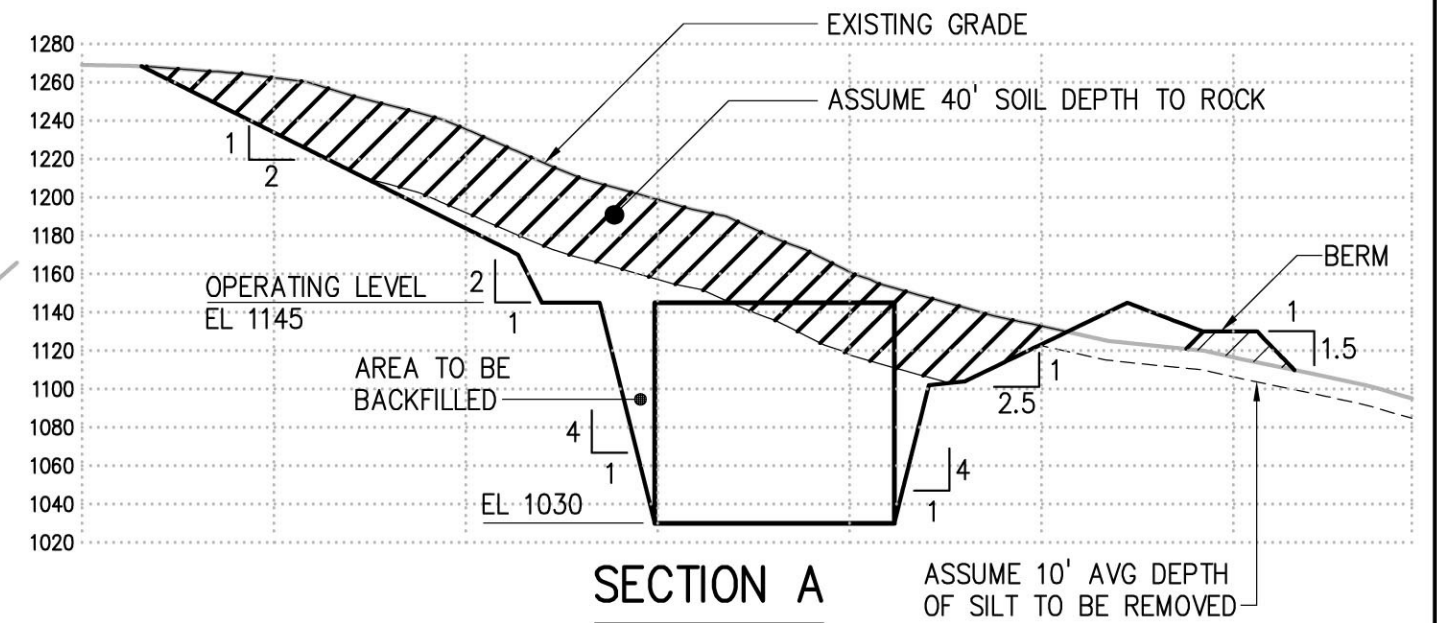


**SITE PLAN**

1"=100'

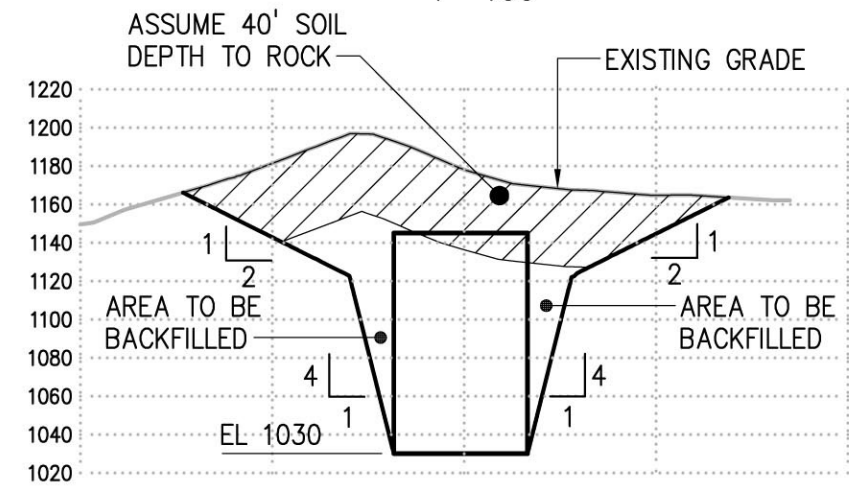
**MAIN ACTIVITIES:**

- 1 CONSTRUCT ACCESS ROAD, AND CLEAR AND PREPARE SITE.
- 2 CONSTRUCT COFFERDAM TO EL 1130.
- 3 COMPLETE EXCAVATIONS TO BUILDING FOUNDATION.
- 4 CONSTRUCT TUNNEL CONNECTING SHAFT.



**SECTION A**

1"=100'



**SECTION B**

1"=100'



**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



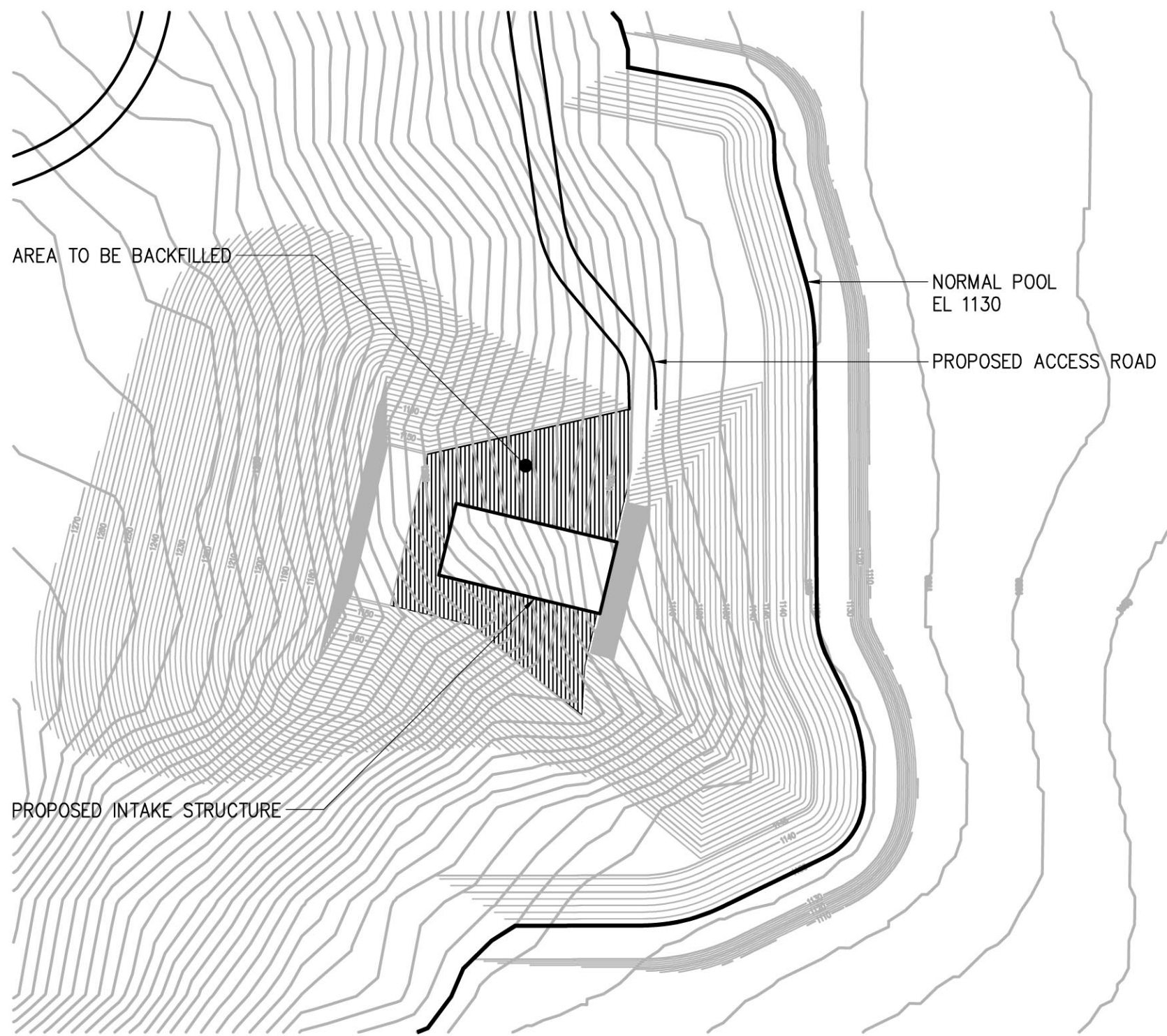
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**MULTI-LEVEL INTAKE  
SITE 1.5 SHORELINE INTAKE  
CONSTRUCTION SEQUENCE 1/3**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 6 Saved by ENG Save date = 6/27/2006 3:30 PM



### MAIN ACTIVITIES

- 1 CONSTRUCT INTAKE STRUCTURE.
- 2 BACKFILL TO OPERATING EL 1145, EXCEPT AT FRONT OF STRUCTURE.

### SITE PLAN

1"=100'



**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



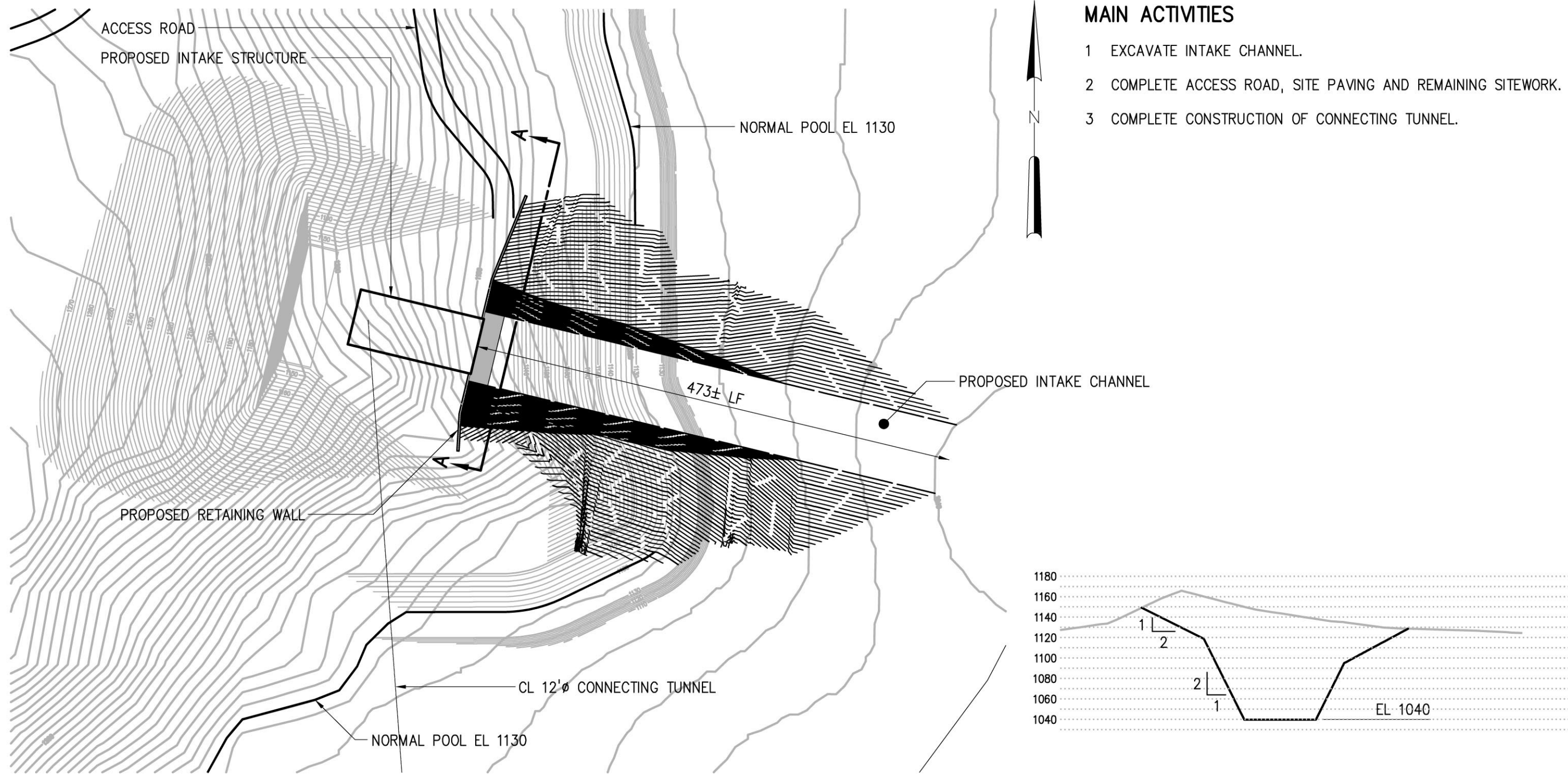
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MULTI-LEVEL INTAKE  
SITE 1.5 SHORELINE INTAKE  
CONSTRUCTION SEQUENCE 2/3

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 7 Saved by ENG Save date = 8/22/2006 3:22 PM



### MAIN ACTIVITIES

- 1 EXCAVATE INTAKE CHANNEL.
- 2 COMPLETE ACCESS ROAD, SITE PAVING AND REMAINING SITEWORK.
- 3 COMPLETE CONSTRUCTION OF CONNECTING TUNNEL.

### SITE PLAN

1"=100'

### SECTION A-A

1"=100'



**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**Gannett Fleming**

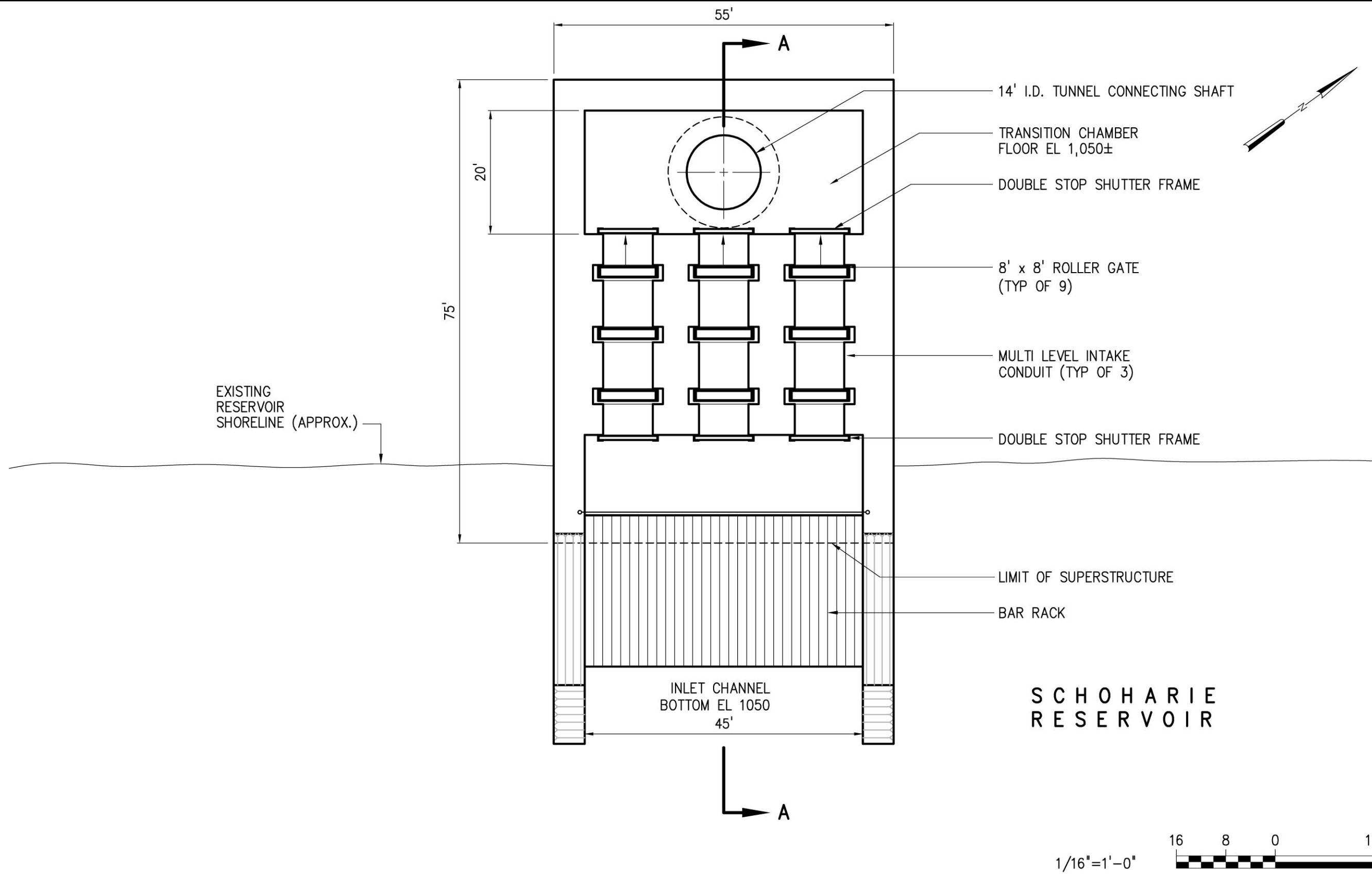
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**MULTI-LEVEL INTAKE  
SITE 1.5 SHORELINE INTAKE  
CONSTRUCTION SEQUENCE 3/3**



File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 8 Saved by HMICHEL Save date = 8/22/2006 3:25 PM

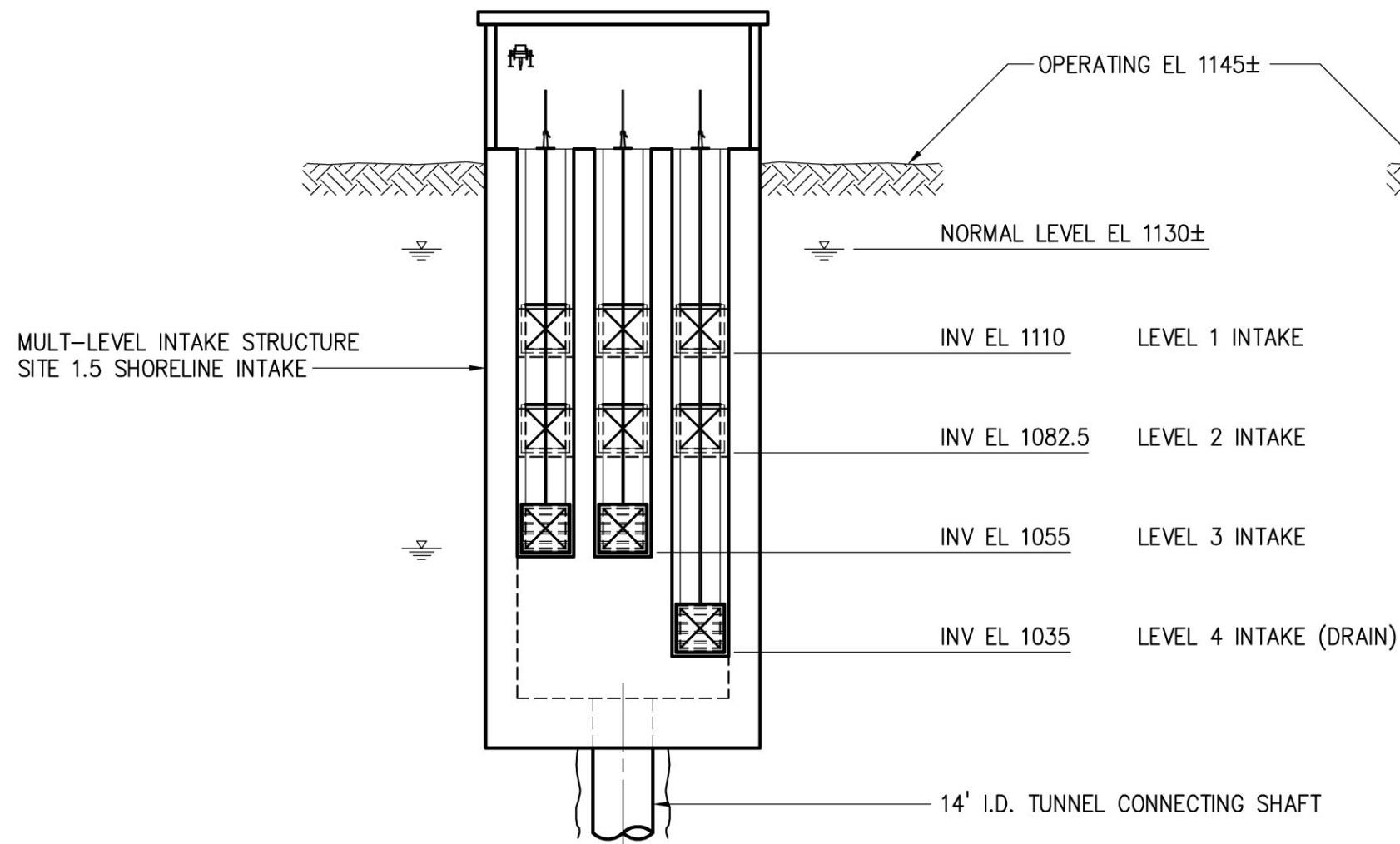


CAT 211 ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES

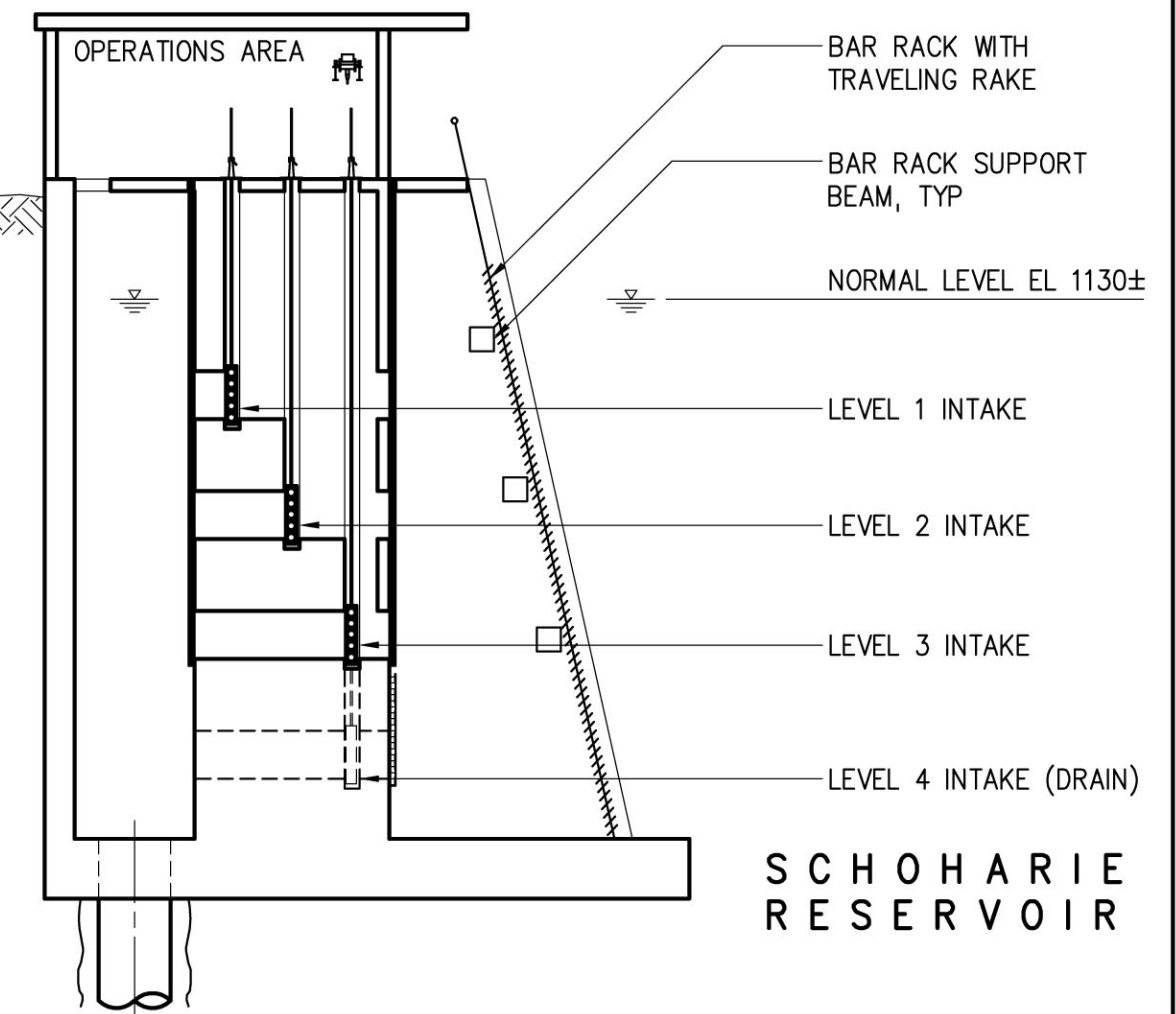


# MULTI-LEVEL INTAKE SITE 1.5 SHORELINE INTAKE PLAN

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 9 Saved by ENG Save date = 8/22/2006 3:34 PM



**FRONT ELEVATION**



**SECTION A-A**

**SCHOHARIE  
RESERVOIR**

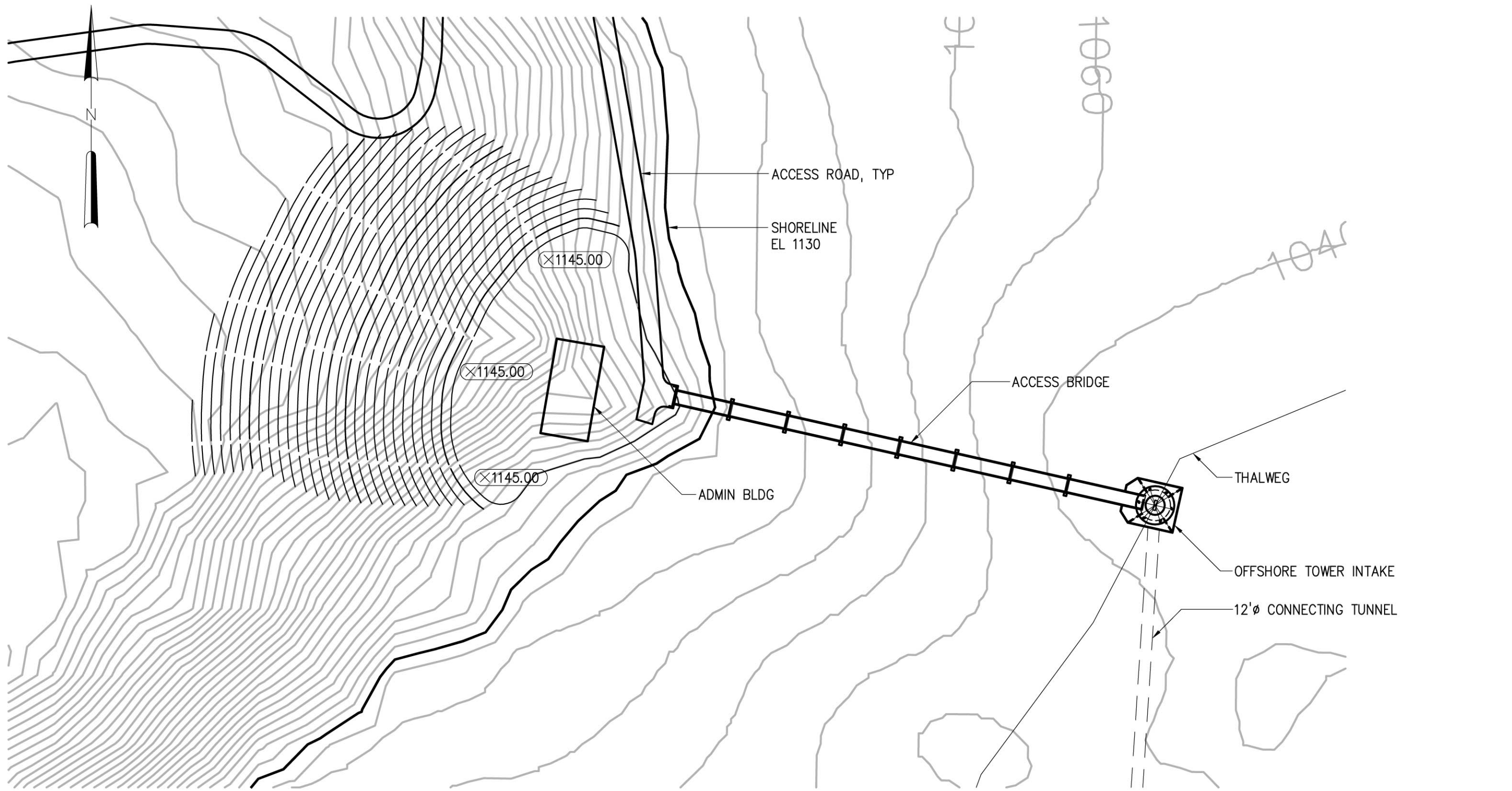


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**MULTI-LEVEL INTAKE  
SITE 1.5 SHORELINE INTAKE  
SECTIONS**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 10 Saved by ENG Save date = 8/22/2006 3:36 PM



### SITE PLAN

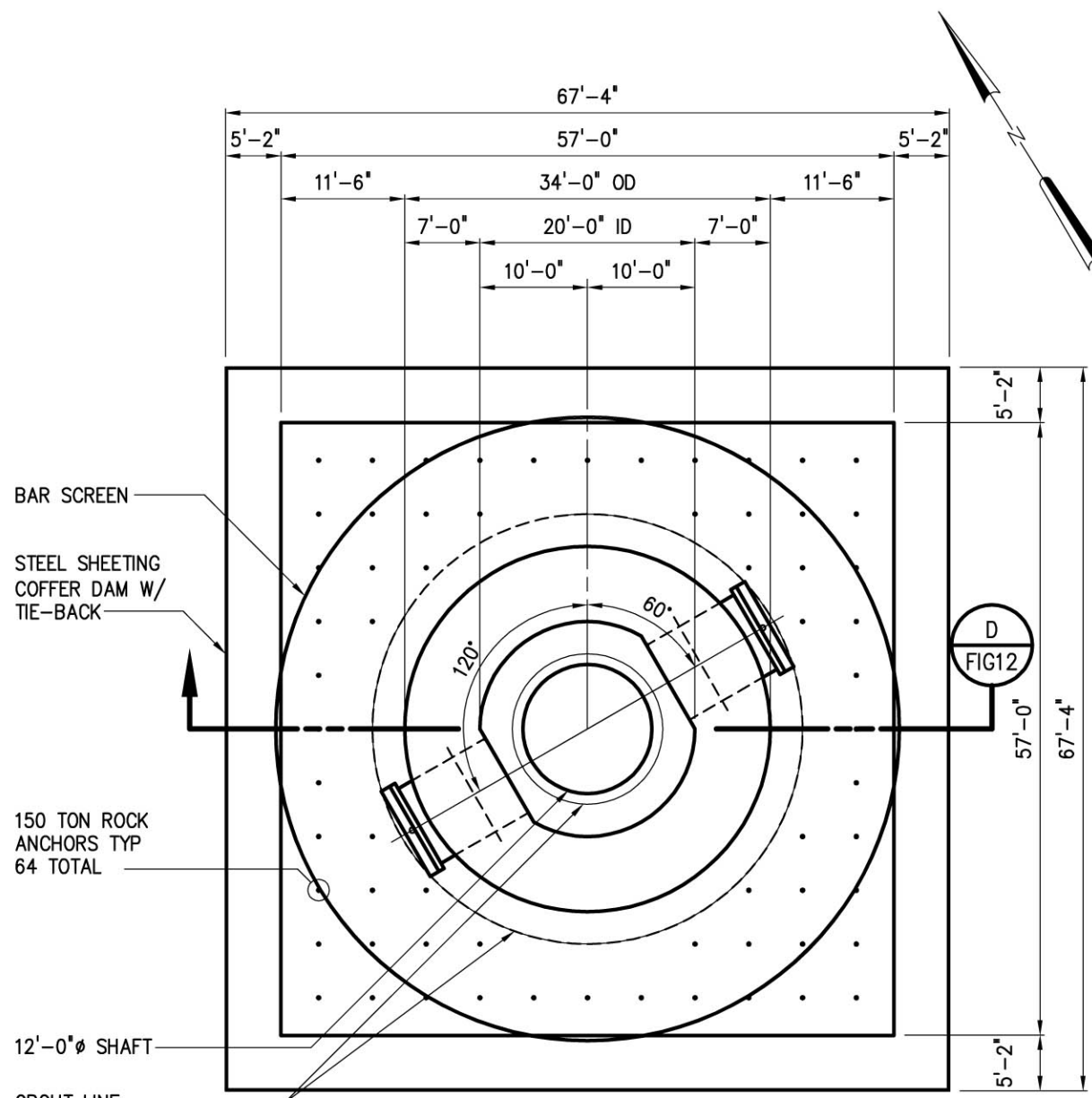


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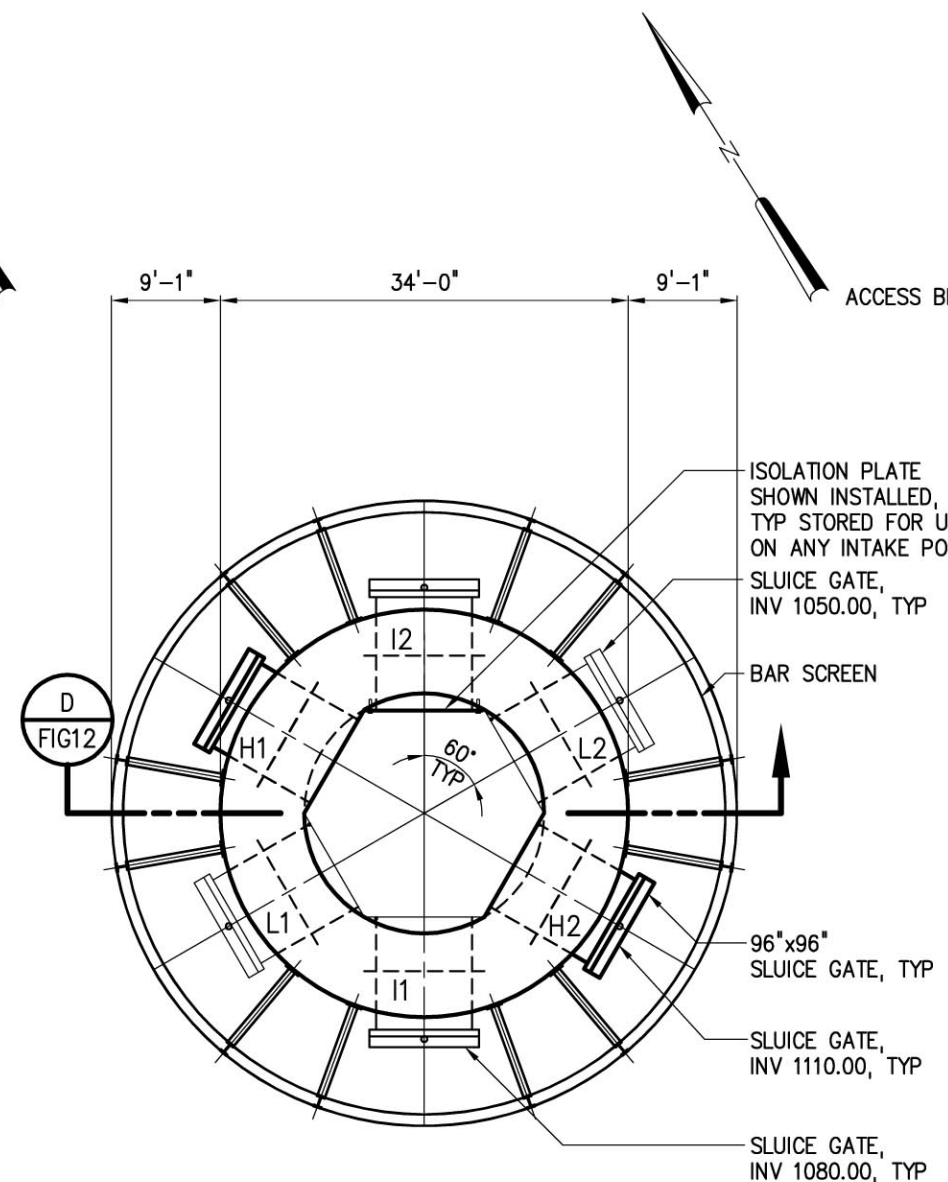
**MULTI-LEVEL INTAKE  
 SITE 1.5 OFFSHORE INTAKE  
 SITE PLAN**

File = H:\9480\Scholarie Reservoir\Preliminary Design 3 (June 2006)\Figure 11 Multi-Level Intake Plan - Site 1.5 Off-Shore Tower-HM Saved by gresser Save date = 5/17/2006 2:03 PM



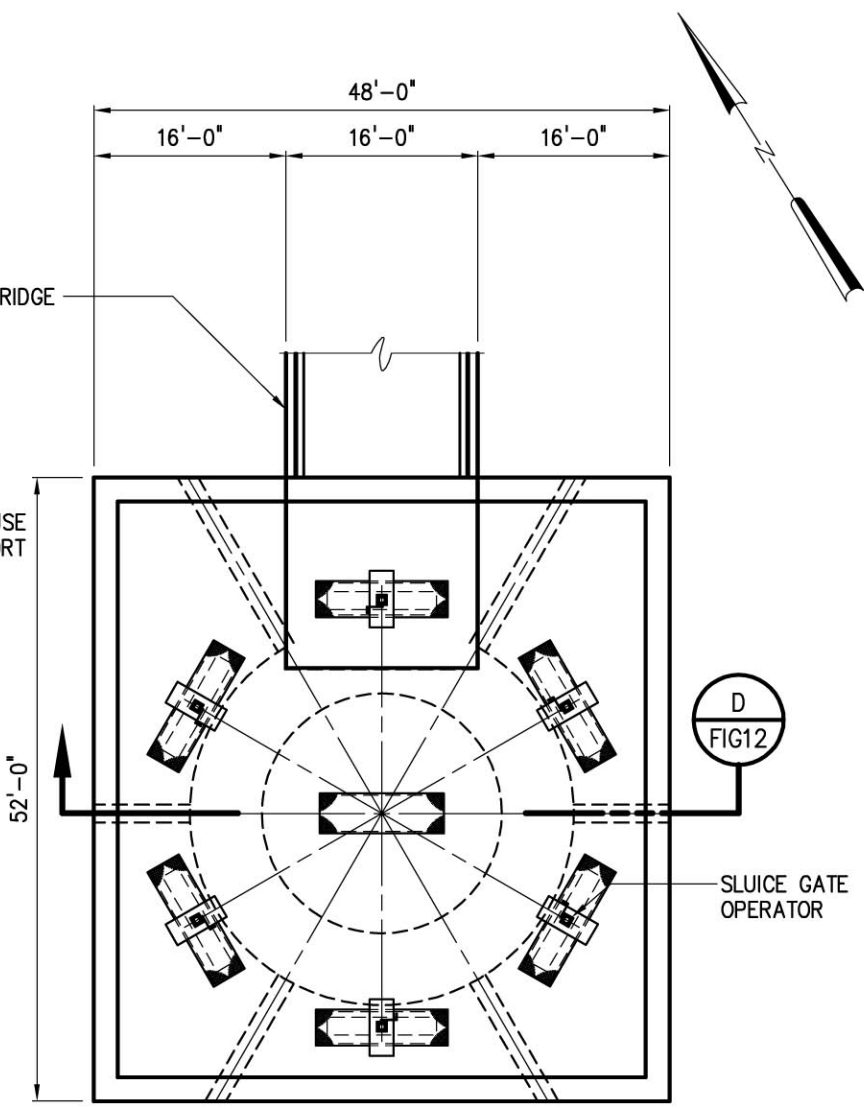
**BOTTOM PLAN**

1"=20'



**INTERMEDIATE PLAN**

1"=20'



**TOP PLAN**

1"=20'



**CAT 211**

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



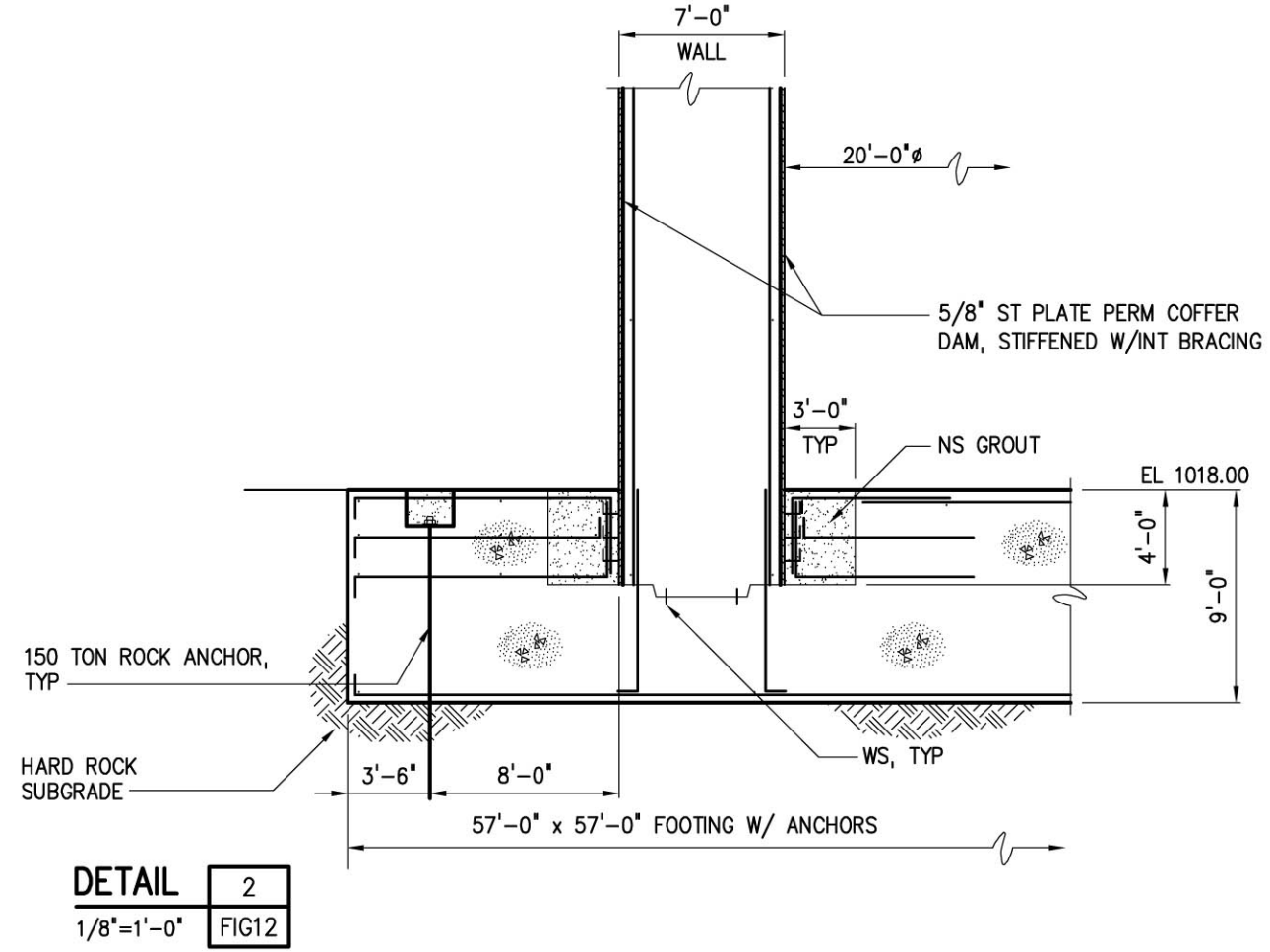
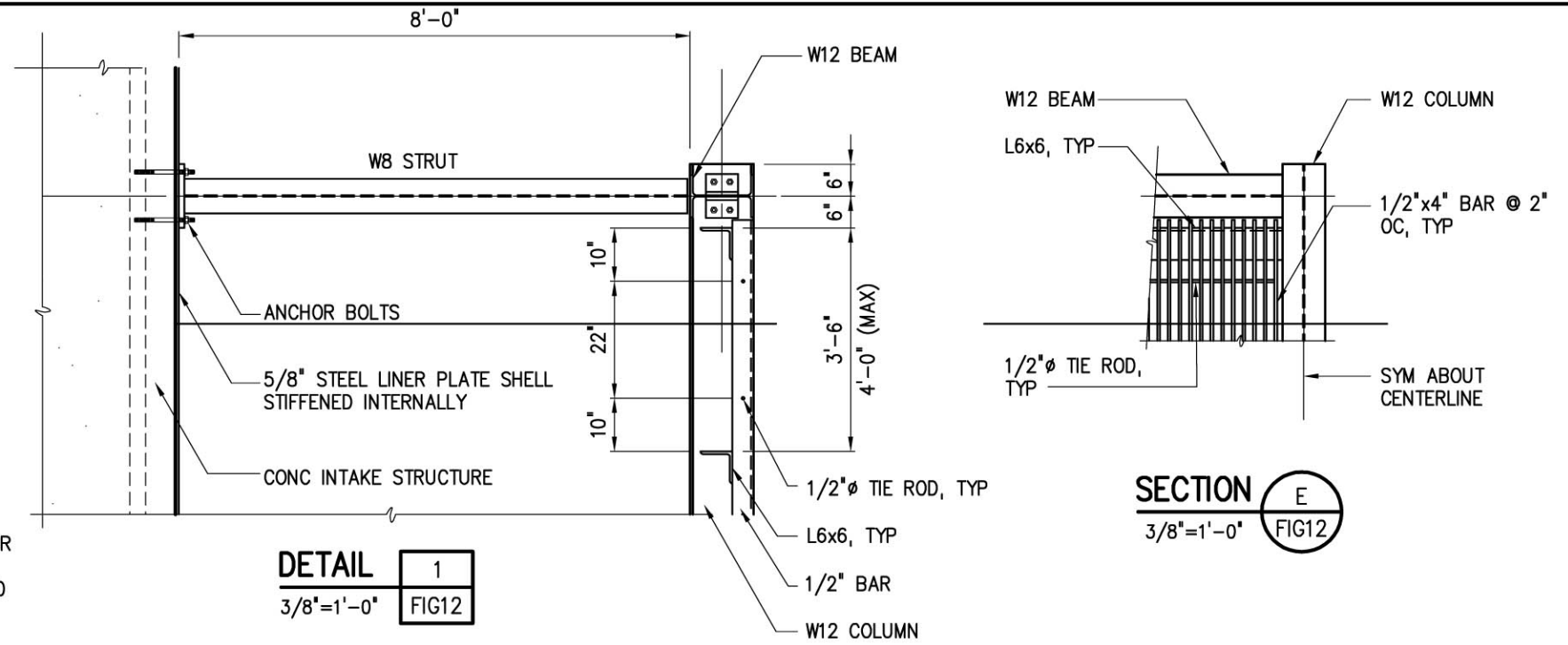
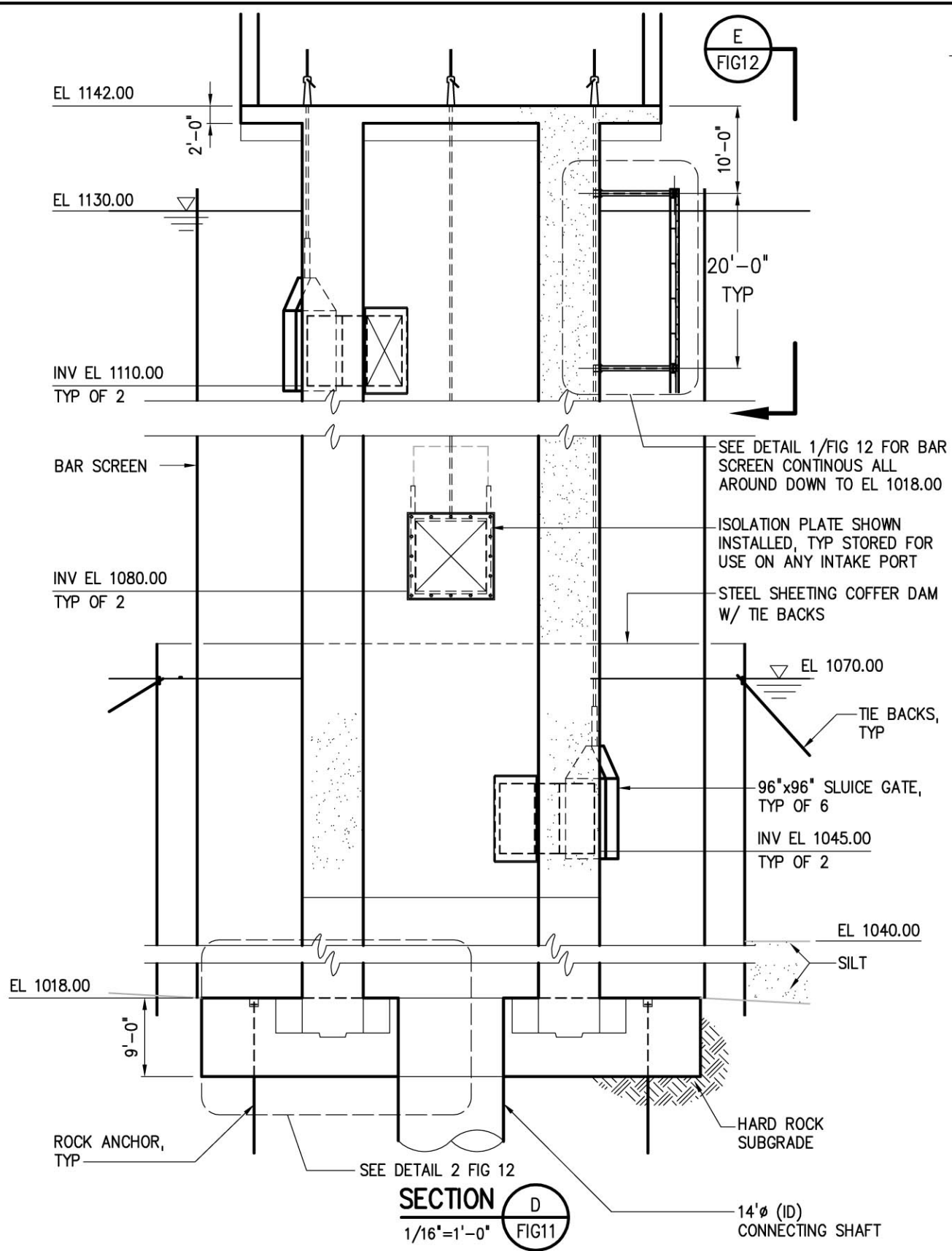
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**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

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**MULTI-LEVEL INTAKE  
SITE 1.5 OFFSHORE TOWER INTAKE  
PLAN (SLUICE GATE OPTION)**

File = H:\9480\Scholarie Reservoir\Preliminary Design 3 (June 2006)\Figure 12 Multi-Level Intake Section Site 1.5 Off-Shore Tower-HM Saved by ENG Save date = 8/22/2006 3:45 PM



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ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



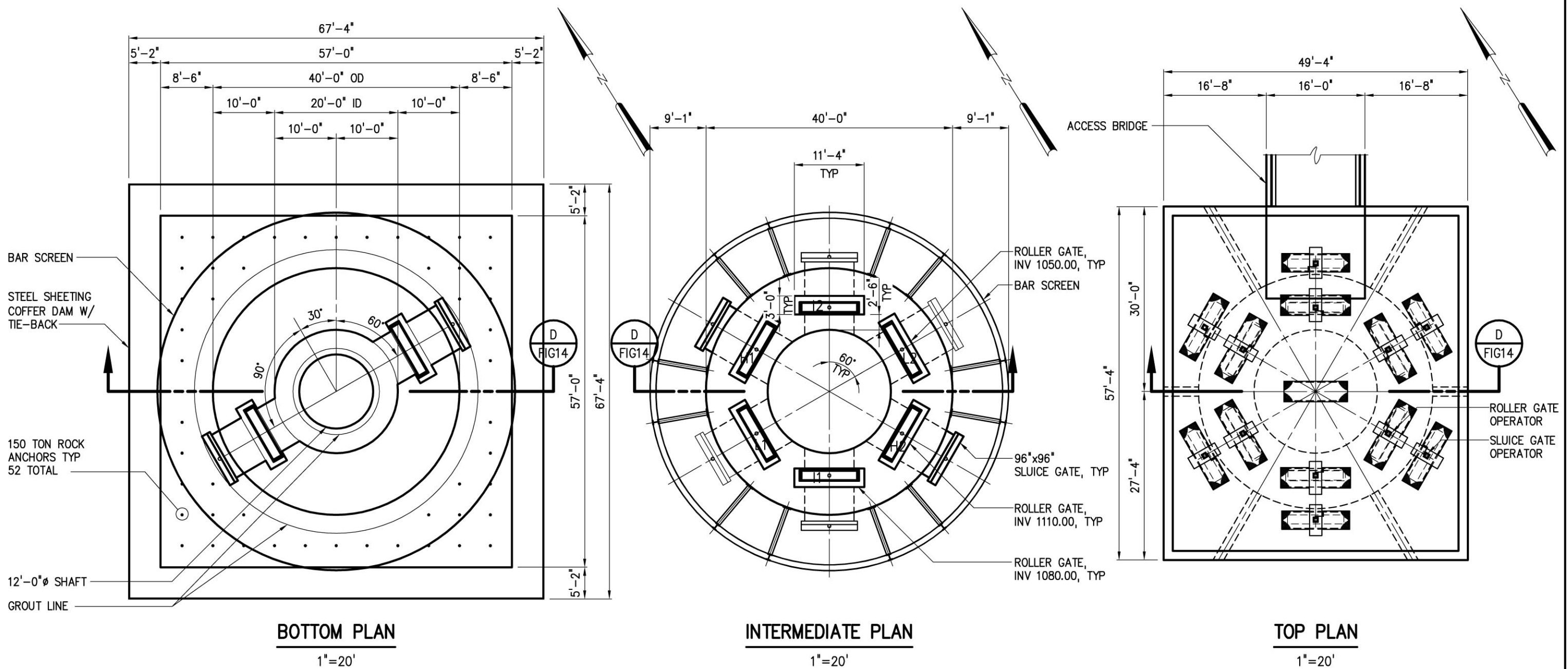
**Gannett Fleming**

**HAZEN AND SAWYER**  
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**MULTI-LEVEL INTAKE  
SITE 1.5 OFFSHORE TOWER INTAKE  
SECTIONS (SLUICE GATE OPTION)**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 1.3 Multi-Level Intake Plan - Site 1.5 Off-Shore Tower Saved by sroesser Save date = 5/17/2006 3:51 PM



**CAT 211**

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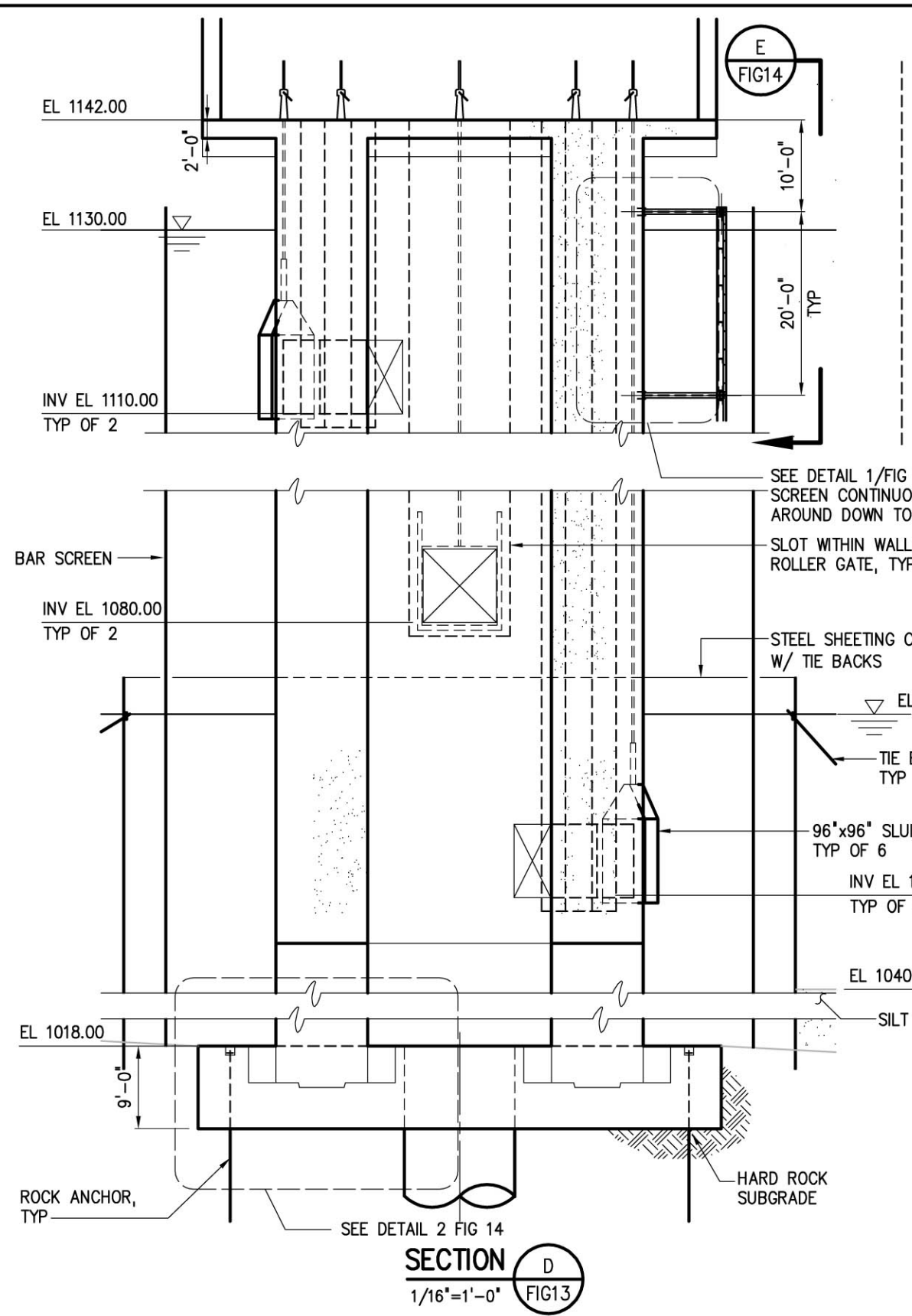
**Gannett Fleming**

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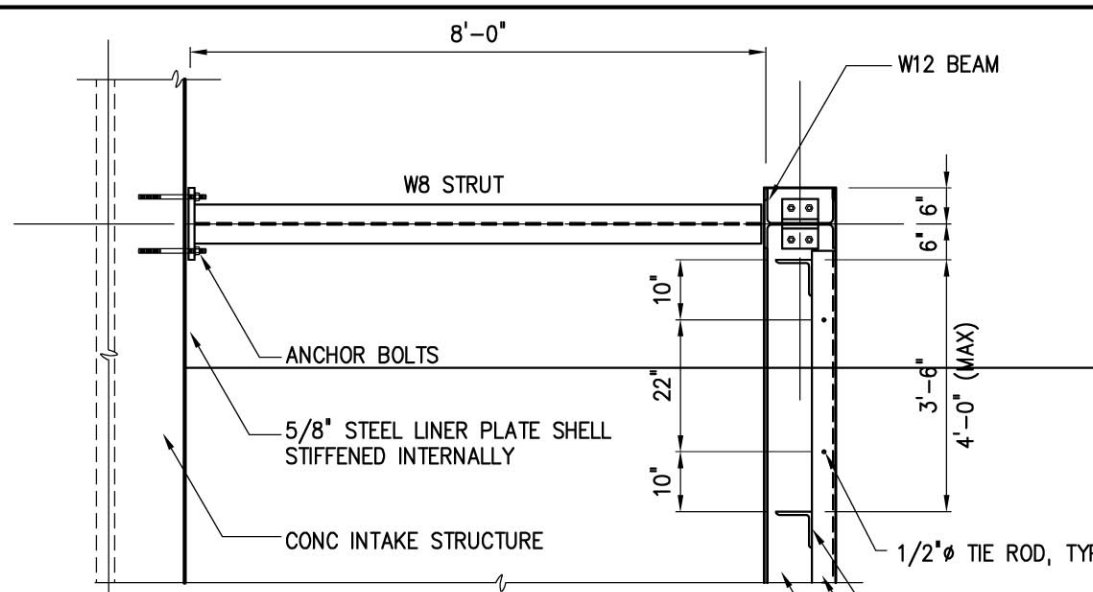
A JOINT VENTURE

**MULTI-LEVEL INTAKE  
SITE 1.5 - OFFSHORE TOWER INTAKE  
PLAN (ROLLER GATE OPTION)**

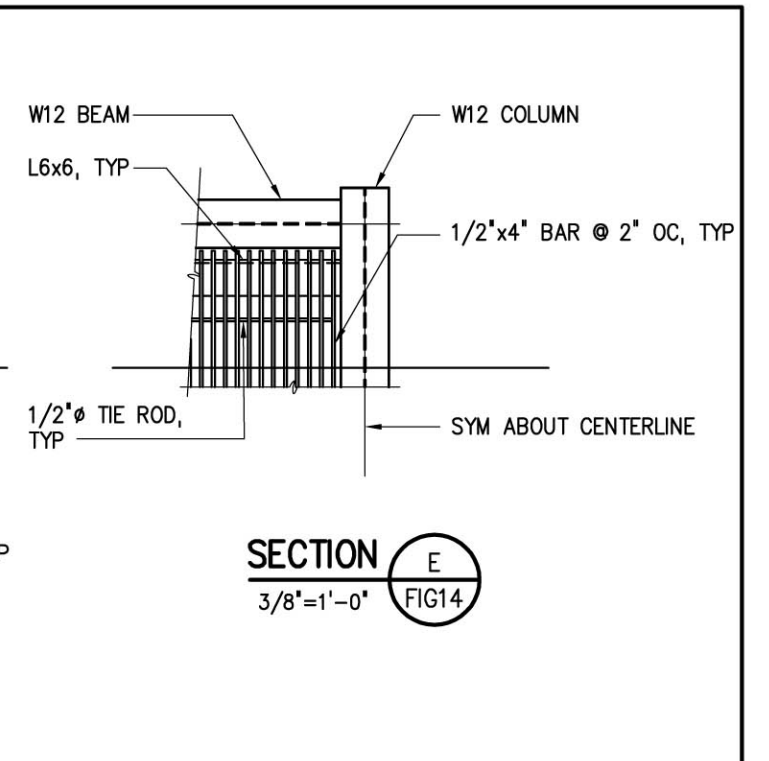
File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 14 Multi-Level Intake Section Site 1.5 Off-Shore Tower Saved by greaser Save date = 8/18/2006 10:30 AM



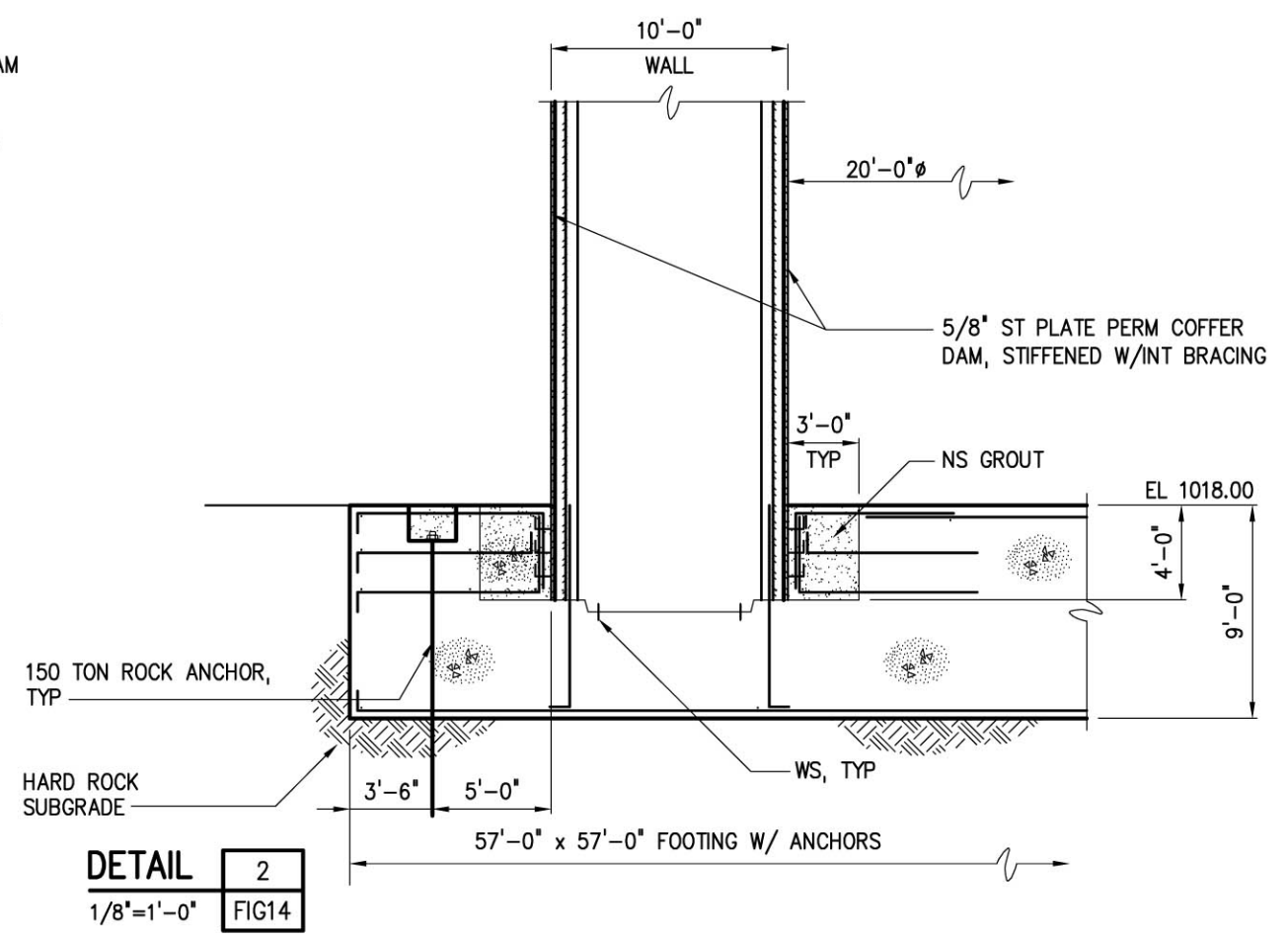
**SECTION D**  
1/16"=1'-0"  
FIG13



**DETAIL 1**  
3/8"=1'-0"  
FIG14



**SECTION E**  
3/8"=1'-0"  
FIG14



**DETAIL 2**  
1/8"=1'-0"  
FIG14

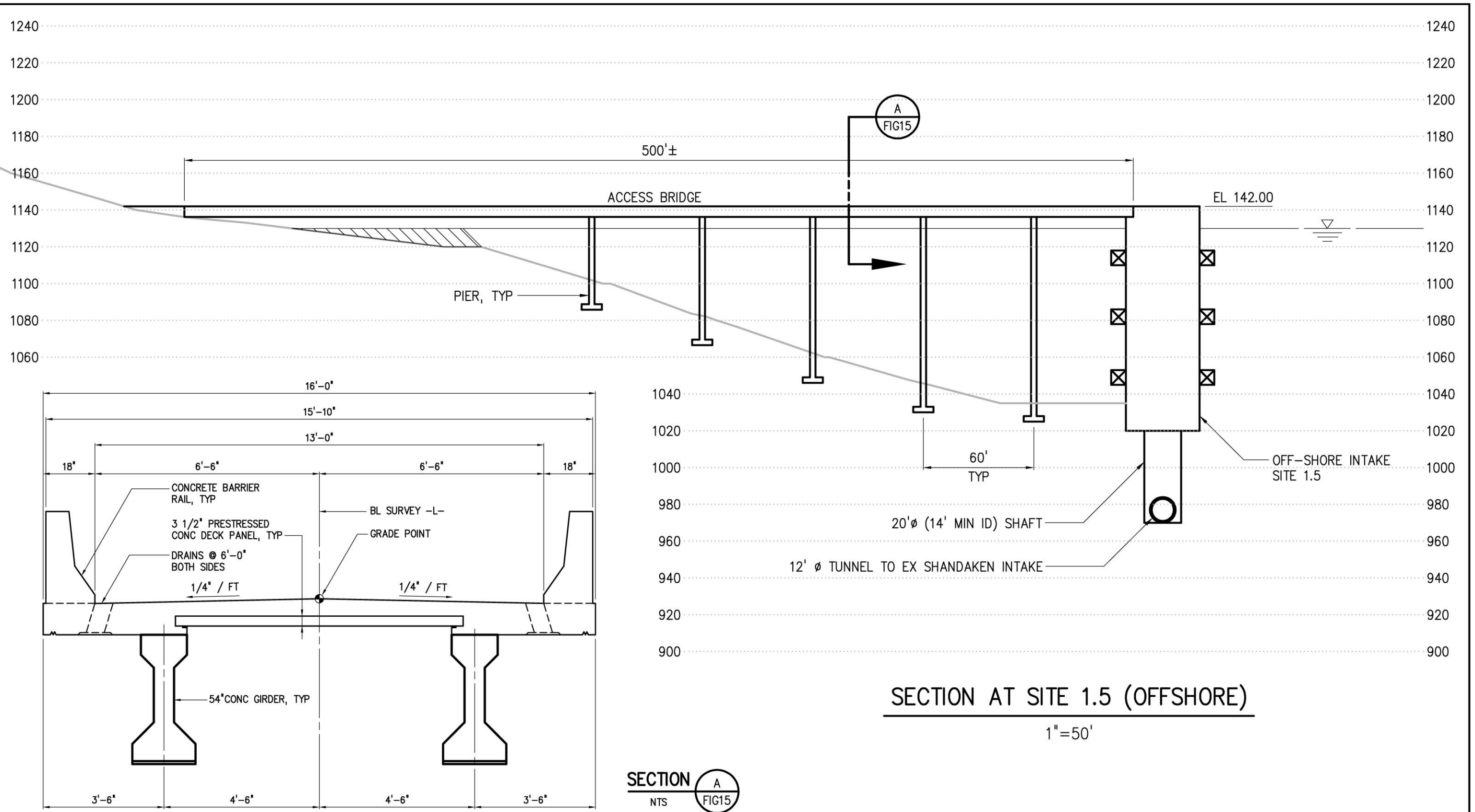


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**MULTI-LEVEL INTAKE  
SITE 1.5 OFFSHORE TOWER INTAKE  
SECTIONS (ROLLER GATE OPTION)**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 15 Saved by ENG Save date = 8/22/2006 3:47 PM



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**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

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**MULTI-LEVEL INTAKE  
SITE 1.5 OFFSHORE TOWER INTAKE  
ACCESS BRIDGE SECTION**



File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 16 Saved by ENG Save date = 6/27/2006 4:14 PM

**CONSTRUCTION SEQUENCE**

**STAGE 1 - CONSTRUCT FOUNDATION AND LOWER PORTION OF INTAKE IN THE DRY**

- 1 LOWER RESERVOIR AS MUCH AS POSSIBLE (TO EL. 1090 VIA EXISTING SHANDAKEN INTAKE, OR LOWER IF NEW GILBOA DAM BLOWOFF STRUCTURE IS COMPLETE)
- 2 MOBILIZE, SET BARGE AND RIG CRANE
- 3 DRIVE STEEL SHEETING FOR COFFERDAM SUFFICIENTLY OR PREDRILL AND GROUT IF NECESSARY TO KEY TIP INTO ROCK (COMPLETED COFFERDAM MUST EXTEND ABOVE WATER SURFACE AND BE DESIGNED TO BE DEWATERED INSIDE.)
- 4 LOWER WATER INSIDE AS NEEDED TO INSTALL FIRST ROW OF WALES AND TIE-BACKS OR BRACING
- 5 LOWER WATER ADDITIONALLY 10-FEET AND INSTALL SECOND ROW OF WALES AND TIE-BACKS OR BRACING
- 6 REPEAT STEP 5 UNTIL COFFERCELL DEWATERED TO SILT BOTTOM
- 7 CONTINUE TO PUMP AS NECESSARY TO PROVIDE ADEQUATE CONDITIONS FOR WORK IN THE DRY
- 8 EXCAVATE SILT, SOIL OVERBURDEN AND ROCK TO SUBGRADE EL. 1009, CONTINUING TO INSTALL WALES AND TIE-BACKS IN 10 FOOT DEPTH INCREMENTS
- 9 INSTALL FOUNDATION REINFORCING AND PLACE CONCRETE IN TWO LIFTS TO EL. 1018 WITH FORMED BLOCKOUTS FOR INTAKE WALL
- 10 AFTER INITIAL SET OF CONCRETE PLACE FIRST PORTION OF DOUBLE WALL STEEL LINER
- 11 GROUT STEEL LINER INTO FOOTING AT FORMED BLOCK-OUTS
- 12 CONSTRUCT DOUBLE WALL STEEL LINER UP TO ABOVE SILT LINE (APPROX EL 1045)
- 13 PLACE REINFORCING AND CONCRETE INSIDE DOUBLE WALL STEEL LINER TO EL. 1045
- 14 INSTALL AND TEST ALL ROCK ANCHORS
- 15 REMOVE COFFERDAM
- 16 ALLOW RESERVOIR TO BEGIN FILLING

**STAGE 2 - COMPLETE REMAINDER OF INTAKE WALLS IN THE WET**

- 1 FABRICATE AND DROP DOUBLE WALL STEEL LINER IN SECTIONS ON COMPLETED PORTION OF INTAKE USING DIVERS TO BOLT FLANGED CONNECTIONS
- 2 AFTER COMPLETION OF DOUBLE WALL STEEL LINER TO EL. 1140, DEWATER BETWEEN DOUBLE WALLS OF STEEL LINER AND CLEAN OUT MUD AND DEBRIS
- 3 PLACE REINFORCING AND CONCRETE IN SUFFICIENT LIFTS INSIDE DOUBLE WALL STEEL LINER TO EL. 1140
- 4 INSTALL GATES ON OUTSIDE OF INTAKE USING DIVERS
- 5 WITH ALL GATES CLOSED, DEWATER INSIDE OF INTAKE

**STAGE 3 - CONSTRUCT SHAFT AND TUNNEL TO EXISTING SHANDAKEN INTAKE**

- 1 DURING STAGES 1 AND 2, DRILL ACCESS SHAFT ON SHORE, AND TUNNEL FROM SHORE ACCESS SHAFT OUT TO LOCATION BELOW INTAKE
- 2 AFTER STAGE 2 IS COMPLETE, DRILL SHAFT FROM INSIDE DEWATERED INTAKE DOWN TO TUNNEL, AND TUNNEL FROM SHORE ACCESS SHAFT TO EXISTING SHANDAKEN INTAKE

**STAGE 4 - CONSTRUCT TOP SLAB AND SUPERSTRUCTURE OF INTAKE**

- 1 CONSTRUCT TOP SLAB OF INTAKE
- 2 CONSTRUCT SUPERSTRUCTURE OVER INTAKE

**NOTES REGARDING BRIDGE CONSTRUCTION:**

- 1 BRIDGE PIER CONSTRUCTION CAN BE PERFORMED CONCURRENTLY WITH STAGE 1.
- 2 BRIDGE DECK CONSTRUCTION (EXCEPT FOR LAST SPAN TO INTAKE) CAN BE PERFORMED CONCURRENTLY WITH STAGE 1 OR 2.
- 3 LAST SPAN OF BRIDGE DECK TO INTAKE CAN BE PERFORMED DURING STAGE 3 OR 4.

**ALTERNATE CONSTRUCTION SEQUENCE**

**STAGE 1 - CONSTRUCT FOUNDATION AND LOWER PORTION OF INTAKE IN THE WET**

- 1 LOWER RESERVOIR AS MUCH AS POSSIBLE (TO EL. 1090 VIA EXISTING SHANDAKEN INTAKE, OR LOWER IF NEW GILBOA DAM BLOWOFF STRUCTURE IS COMPLETE)
- 2 MOBILIZE, SET BARGE AND RIG CRANE
- 3 DRIVE STEEL SHEETING FOR COFFERDAM SUFFICIENTLY OR PREDRILL AND GROUT IF NECESSARY TO KEY TIP INTO ROCK. (COMPLETED COFFERDAM NEED ONLY EXTEND UP TO SILT LINE AND BE DESIGNED TO RETAIN SILT OUTSIDE WHEN INSIDE IS EXCAVATED IN THE WET. IT DOES NOT NEED TO RESIST WATER PRESSURE.)
- 4 EXCAVATE SILT, SOIL OVERBURDEN AND ROCK TO SUBGRADE EL. 1009 IN THE WET, INSTALLING WALES AND TIE-BACKS OR BRACING UNDERWATER AS REQUIRED TO SUPPORT SHEETING
- 5 INSTALL FOUNDATION REINFORCING AND PLACE CONCRETE UNDERWATER IN TWO LIFTS TO EL. 1018, WITH FORMED BLOCKOUTS FOR INTAKE WALL
- 6 INSTALL AND TEST ROCK ANCHORS
- 7 CONSTRUCT WATERTIGHT BOTTOM PORTION OF DOUBLE WALL STEEL LINER, INSTALL REINFORCING STEEL, AND FLOAT IT INTO POSITION OVER FOUNDATION
- 8 PUMP WATER INTO STEEL LINER, PARTIALLY SINKING STEEL LINER BUT LEAVING IT FLOATING
- 9 CONSTRUCT NEXT RISER SECTION OF STEEL LINER, WELDED ON TOP OF FIRST SECTION SO WATERTIGHT, WITH REINFORCING STEEL INSTALLED INSIDE
- 10 REPEAT STEPS 8 AND 9. INSTALL GATES ON LINER SECTIONS ABOVE THE WATER SURFACE WHERE REQUIRED AS LINER IS CONSTRUCTED
- 11 CONTINUE REPEATING STEPS 8, 9, AND 10, CONSTRUCTING STEEL LINER ABOVE THE WATER SURFACE FROM BARGE AND PUMPING WATER WITHIN TO PARTIALLY SINK IT, UNTIL BOTTOM OF LINER RESTS WITHIN FORMED BLOCKOUT IN FOUNDATION
- 12 GROUT STEEL LINER INTO FOUNDATION AT FORMED BLOCK-OUTS
- 13 TREMIE CONCRETE INSIDE DOUBLE WALL STEEL LINER TO TOP, DISPLACING THE WATER WITHIN THE LINER
- 14 REMOVE COFFERDAM DOWN TO SILT LINE. COFFERDAM BELOW SILT LINE MAY BE REMOVED OR STAY IN PLACE AT CONTRACTOR'S OPTION

**STAGE 2 - COMPLETE REMAINDER OF INTAKE WALLS IN THE DRY**

- 1 CONSTRUCT REST OF WALLS ABOVE WATER UP TO EL 1140
- 2 ALLOW RESERVOIR TO BEGIN FILLING
- 3 WITH ALL GATES CLOSED, DEWATER INSIDE OF INTAKE

**STAGE 3 - CONSTRUCT SHAFT AND TUNNEL TO EXISTING SHANDAKEN INTAKE**

- 1 DURING STAGES 1 AND 2, DRILL ACCESS SHAFT ON SHORE, AND TUNNEL FROM SHORE ACCESS SHAFT OUT TO LOCATION BELOW INTAKE
- 2 AFTER STAGE 2 IS COMPLETE, DRILL SHAFT FROM INSIDE DEWATERED INTAKE DOWN TO TUNNEL, AND TUNNEL FROM SHORE ACCESS SHAFT TO EXISTING SHANDAKEN INTAKE

**STAGE 4 - CONSTRUCT TOP SLAB AND SUPERSTRUCTURE OF INTAKE**

- 1 CONSTRUCT TOP SLAB OF INTAKE
- 2 CONSTRUCT SUPERSTRUCTURE OVER INTAKE



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ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



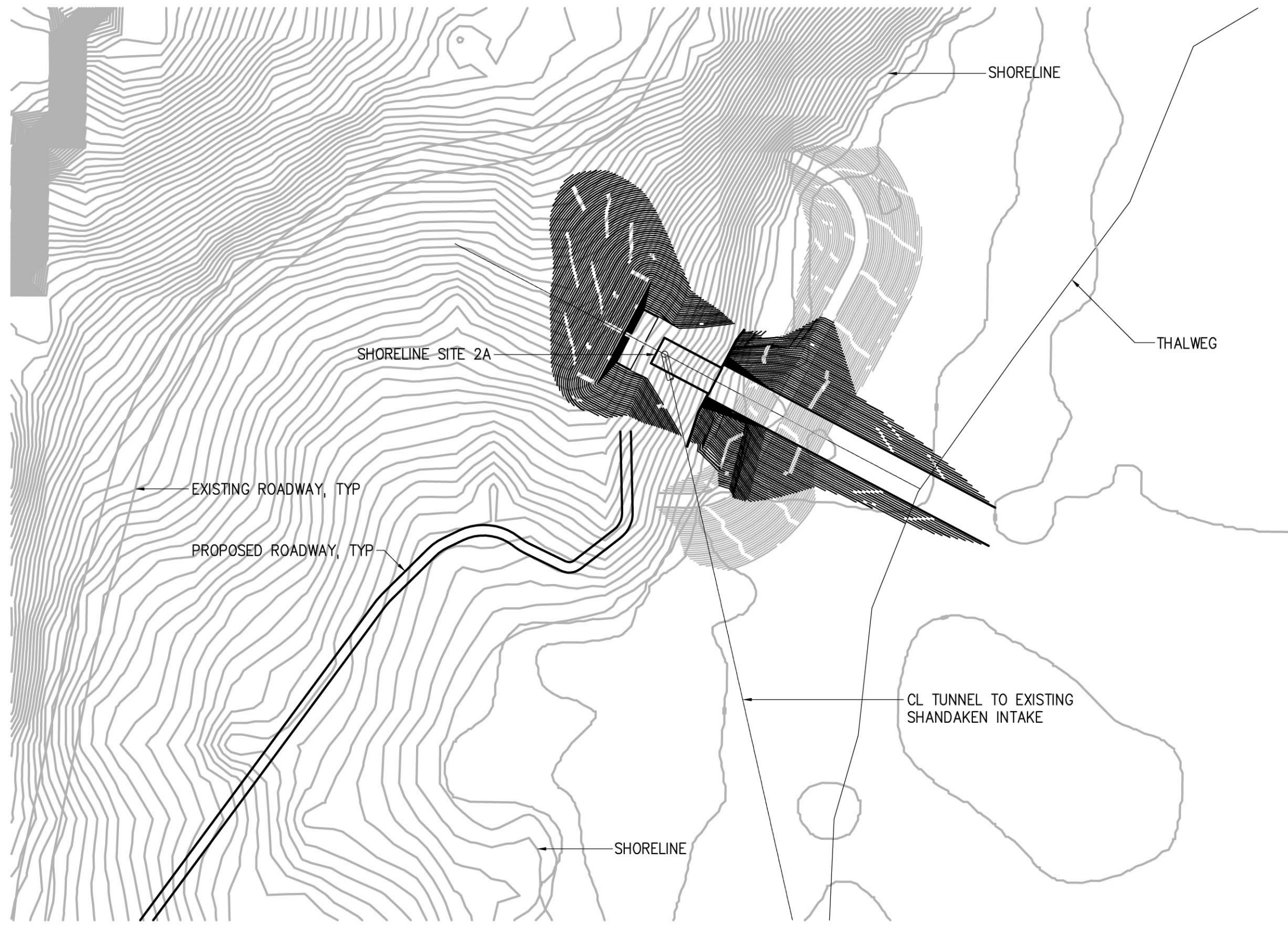
**Gannett Fleming**

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

A JOINT VENTURE

**MULTI-LEVEL INTAKE  
SITE 1.5 OFFSHORE INTAKE  
CONSTRUCTION SEQUENCE**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 17 Saved by ENG Save date = 6/27/2006 3:55 PM



**OVERALL PLAN**  
1"=200'

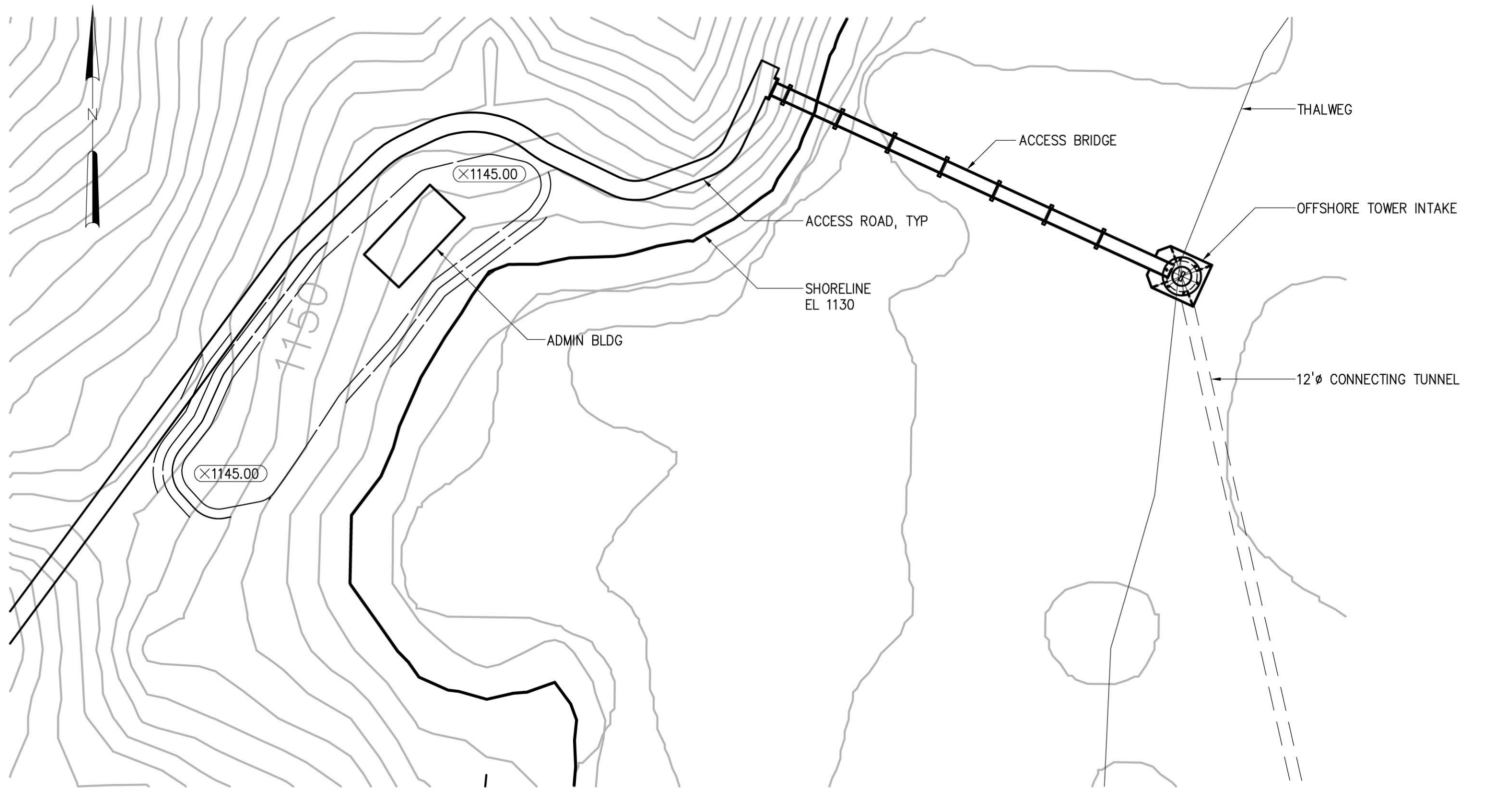


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES

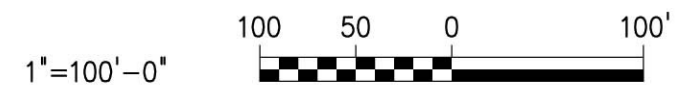
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**MULTI-LEVEL INTAKE  
SITE 2A SHORELINE INTAKE  
SITE PLAN**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 18 Saved by ENG Save date = 8/22/2006 3:48 PM



### SITE PLAN

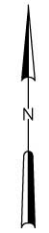
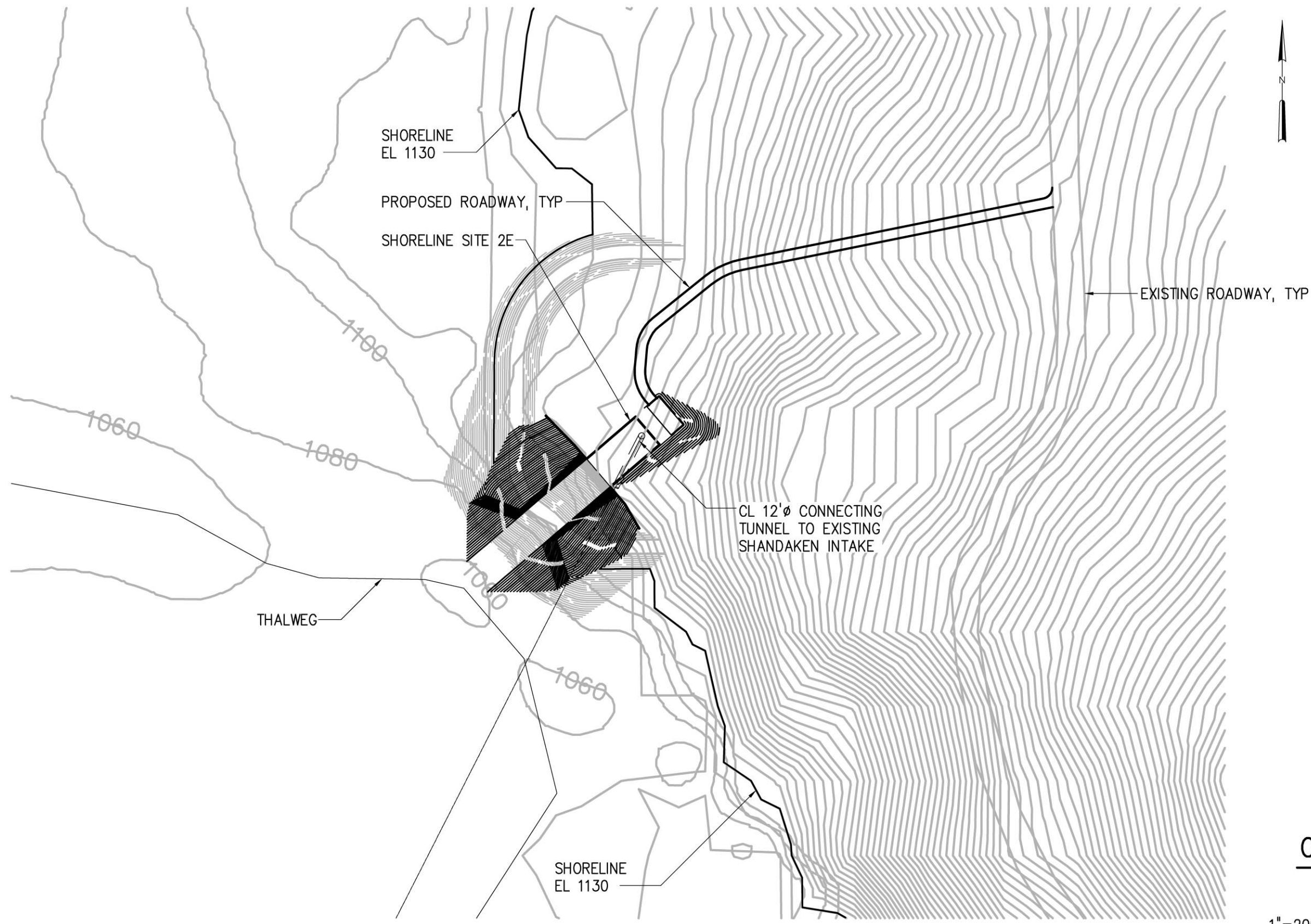


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES

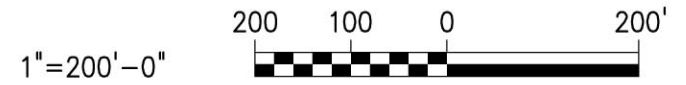
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### MULTI-LEVEL INTAKE SITE 2A OFFSHORE INTAKE SITE PLAN

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 19 Saved by ENG Save date = 8/22/2006 3:50 PM



**OVERALL PLAN**

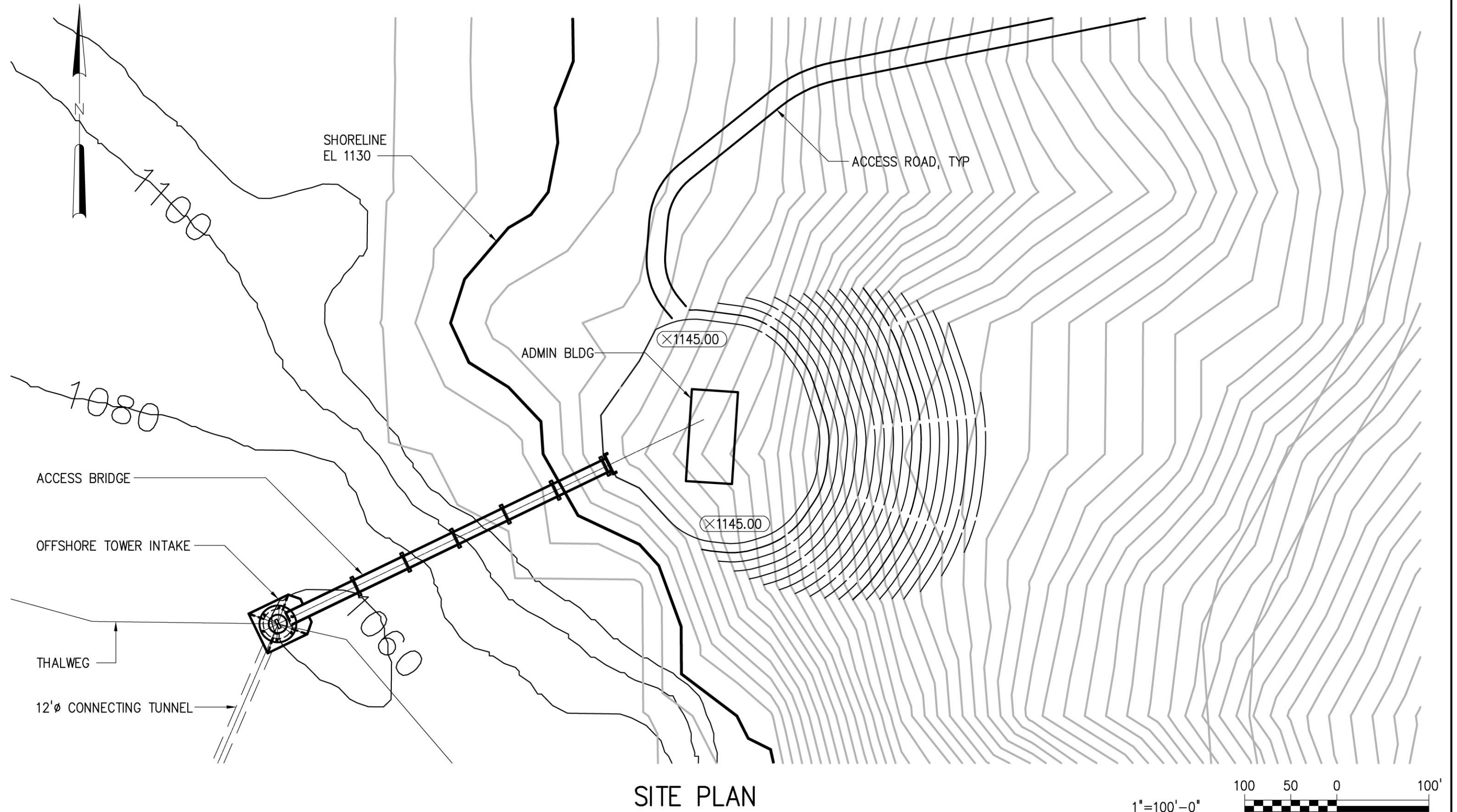


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES

**Gannett Fleming** **HAZEN AND SAWYER**  
Environmental Engineers & Scientists  
A JOINT VENTURE

**MULTI-LEVEL INTAKE  
SITE 2E SHORELINE INTAKE  
SITE PLAN**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 20 Saved by ENG Save date = 8/22/2006 3:52 PM

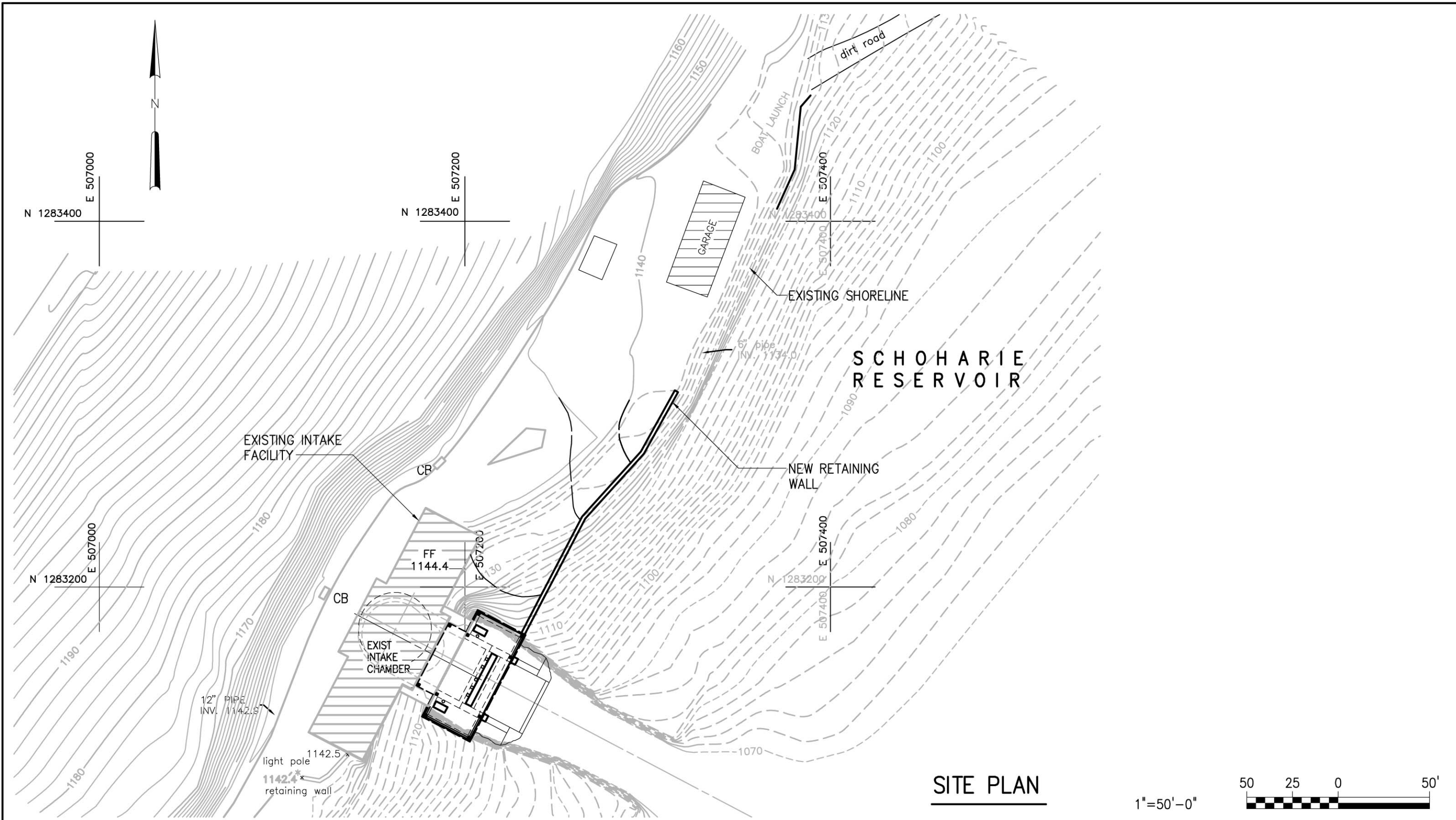


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**MULTI-LEVEL INTAKE  
SITE 2E OFFSHORE INTAKE  
SITE PLAN**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 21 Saved by ENG Save date = 8/17/2006 3:31 PM



**SITE PLAN**

1"=50'-0"



**CAT 211**

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



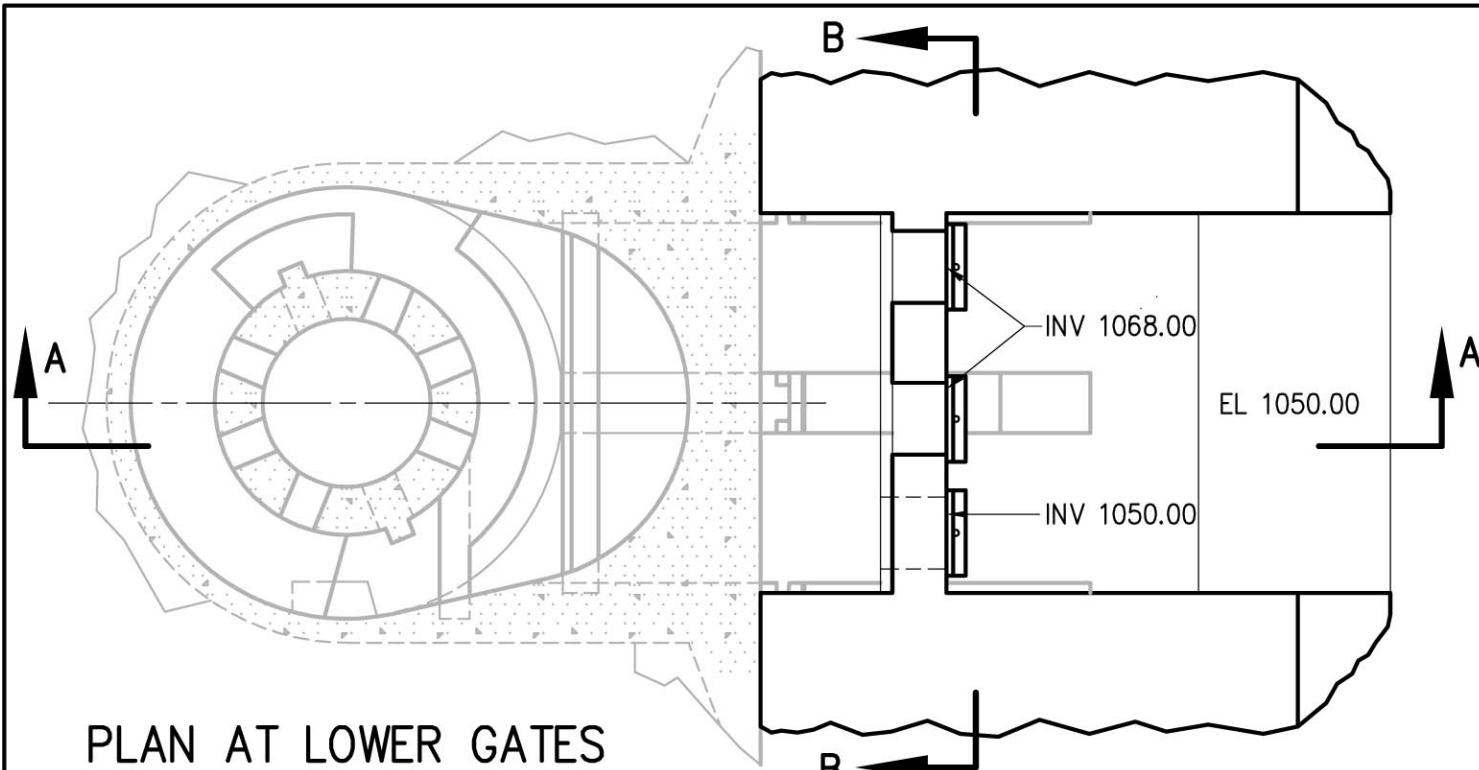
**Gannett Fleming**

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

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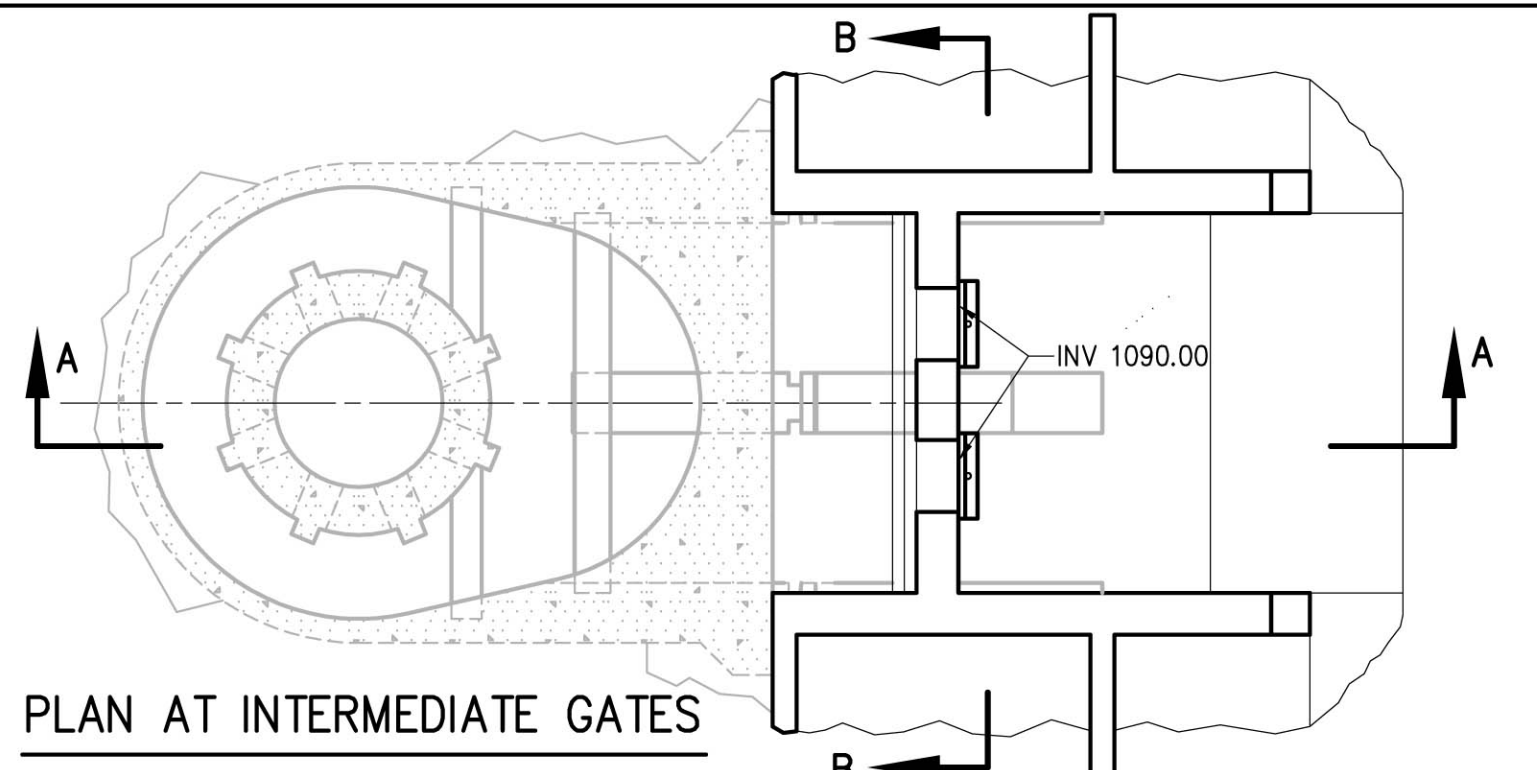
**MULTI-LEVEL INTAKE  
MODIFICATION OF EXISTING INTAKE  
SITE PLAN**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 22 Saved by SROESER Save date = 8/17/2006 3:42 PM



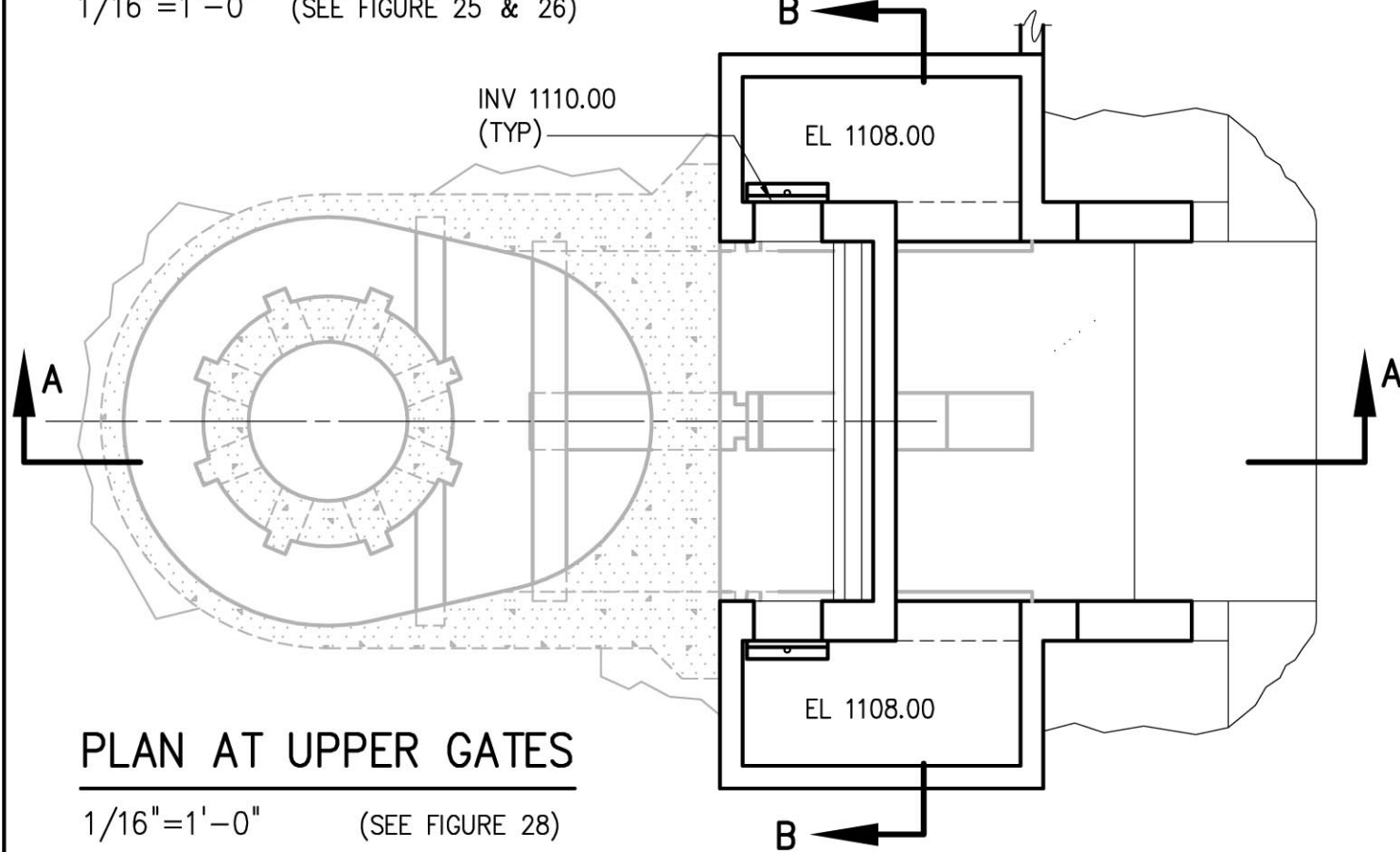
PLAN AT LOWER GATES

1/16"=1'-0" (SEE FIGURE 25 & 26)



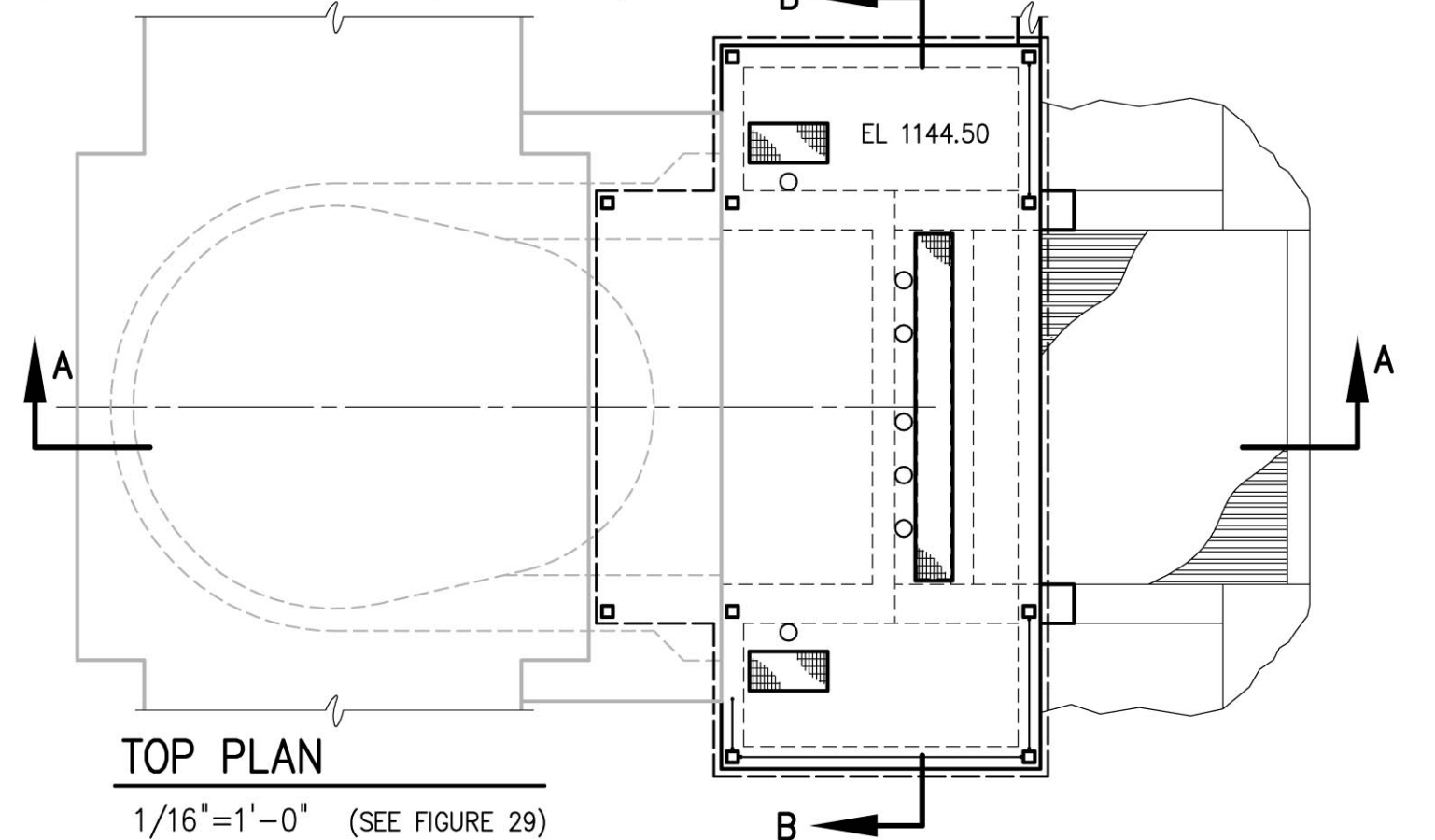
PLAN AT INTERMEDIATE GATES

1/16"=1'-0" (SEE FIGURE 27)



PLAN AT UPPER GATES

1/16"=1'-0" (SEE FIGURE 28)



TOP PLAN

1/16"=1'-0" (SEE FIGURE 29)



CAT 211

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



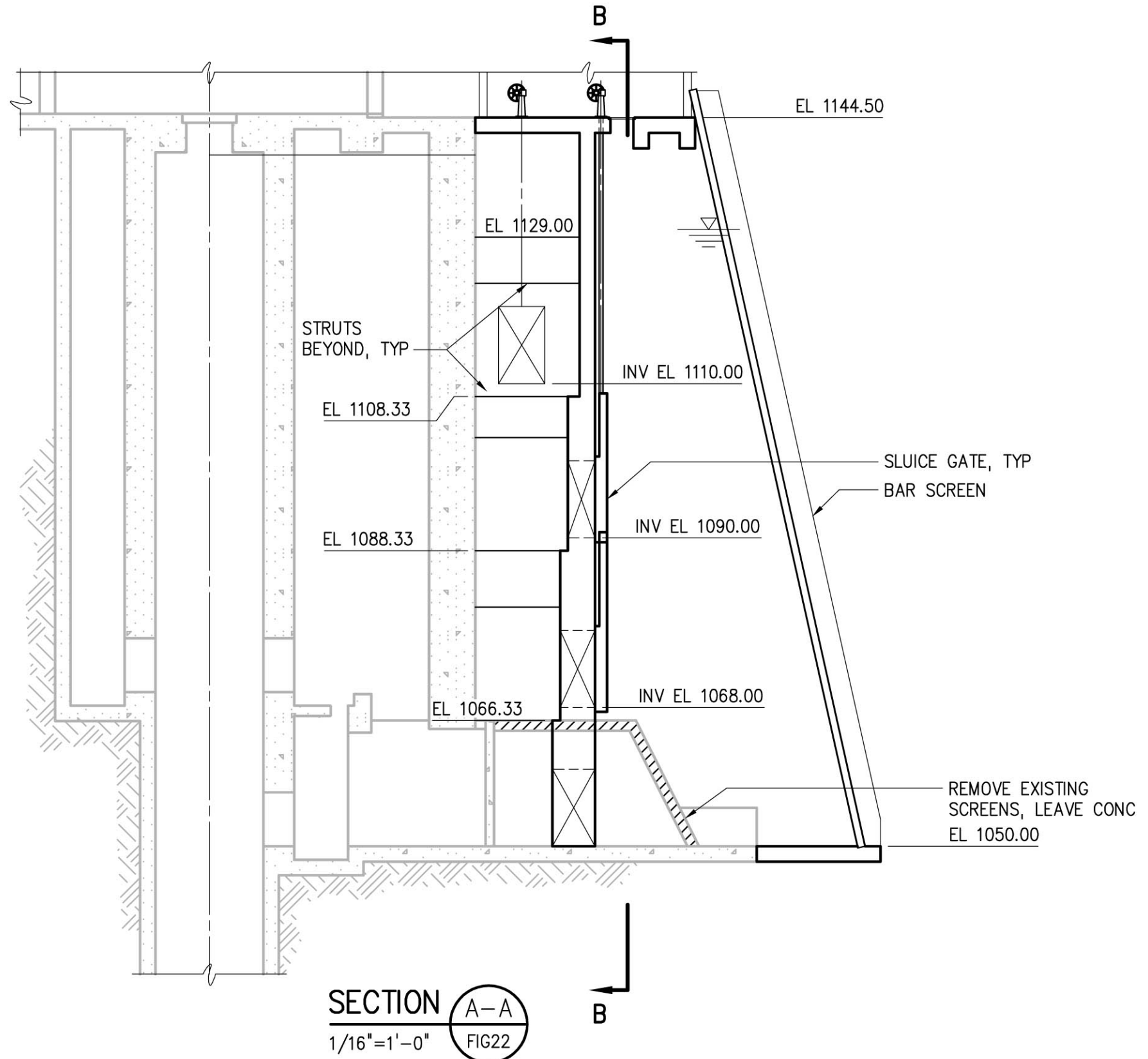
Gannett Fleming

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Environmental Engineers & Scientists

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MULTI-LEVEL INTAKE  
MODIFICATION OF EXISTING INTAKE  
OVERALL PLAN VIEWS

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 23 Saved by SROESER Save date = 8/17/2006 3:33 PM



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ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE  
RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



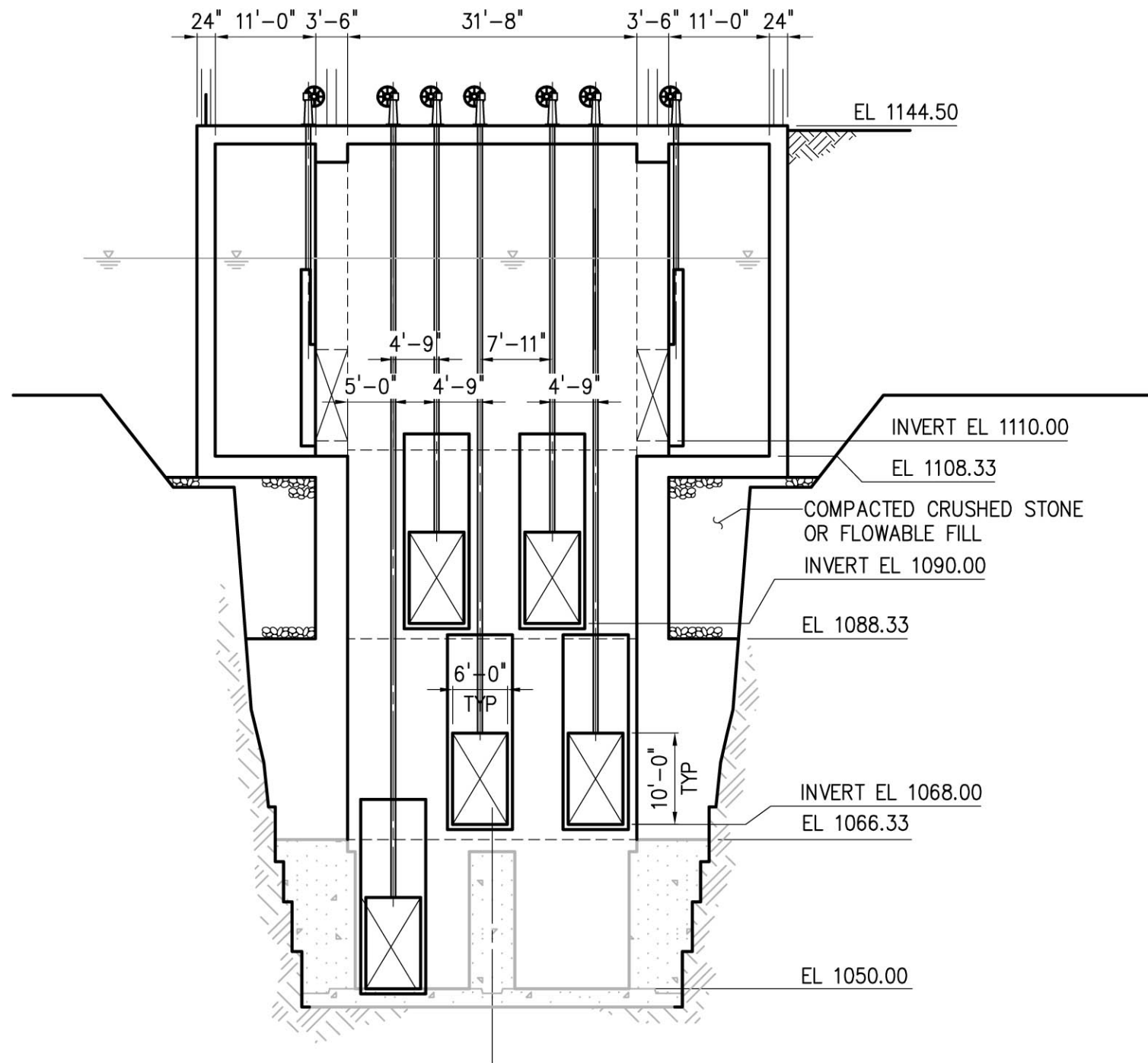
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**MULTI-LEVEL INTAKE  
MODIFICATION OF EXISTING INTAKE  
SECTION**





**ELEVATION B-B**

1/16" = 1'-0"

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 24 Saved by SROESER Save date = 8/17/2006 3:33 PM



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211**

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



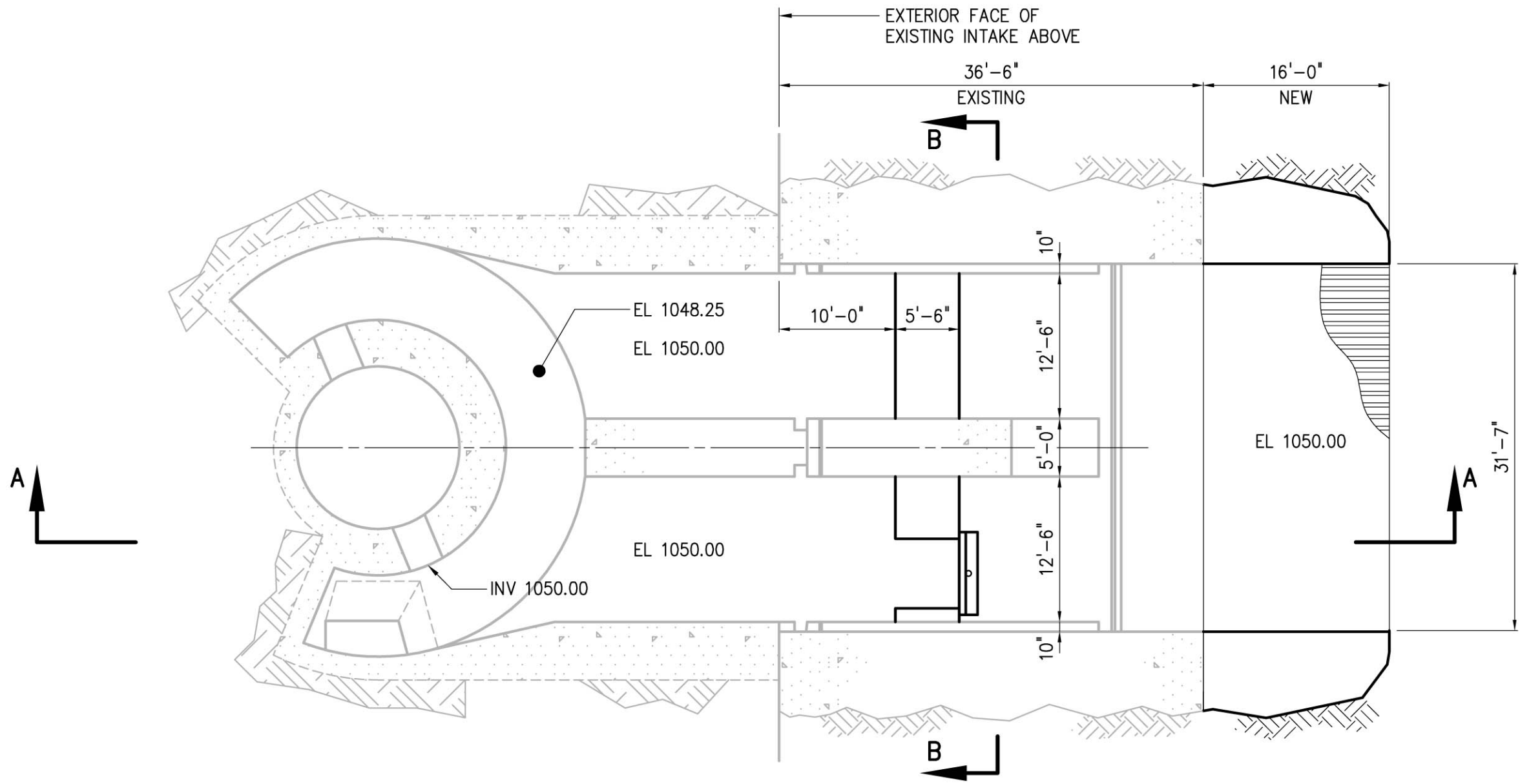
**Gannett Fleming**

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**MULTI-LEVEL INTAKE  
MODIFICATION OF EXISTING INTAKE  
FRONT ELEVATION**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 25 Saved by SROESER Save date = 8/17/2006 3:34 PM



### BOTTOM PLAN

3/32" = 1'-0"



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ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



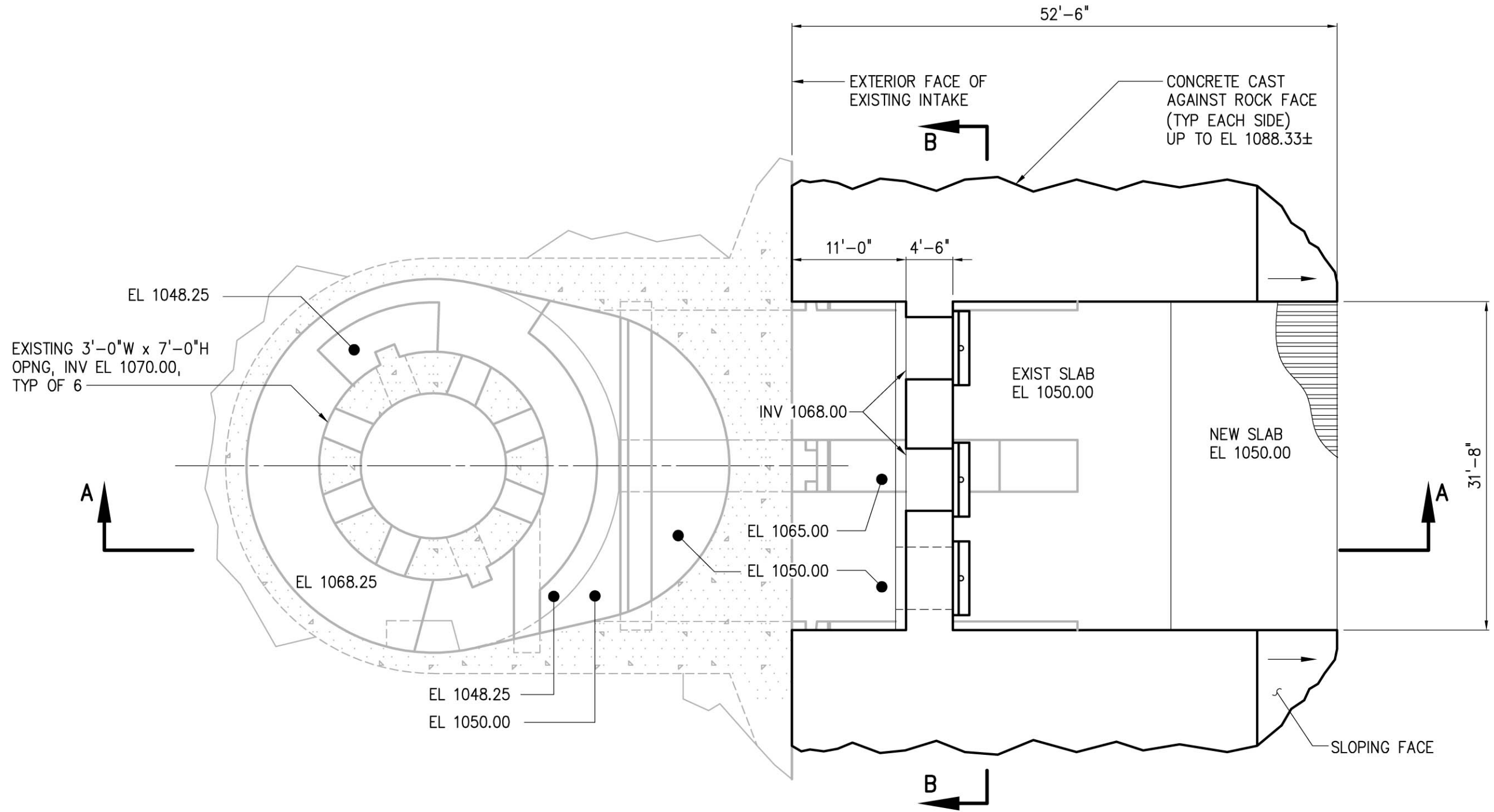
**Gannett Fleming**

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MULTI-LEVEL INTAKE  
MODIFICATION OF EXISTING INTAKE  
BOTTOM PLAN

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 26 Saved by SROESER Save date = 8/17/2006 3:35 PM



**PLAN AT LOWER GATES**

3/32" = 1'-0"

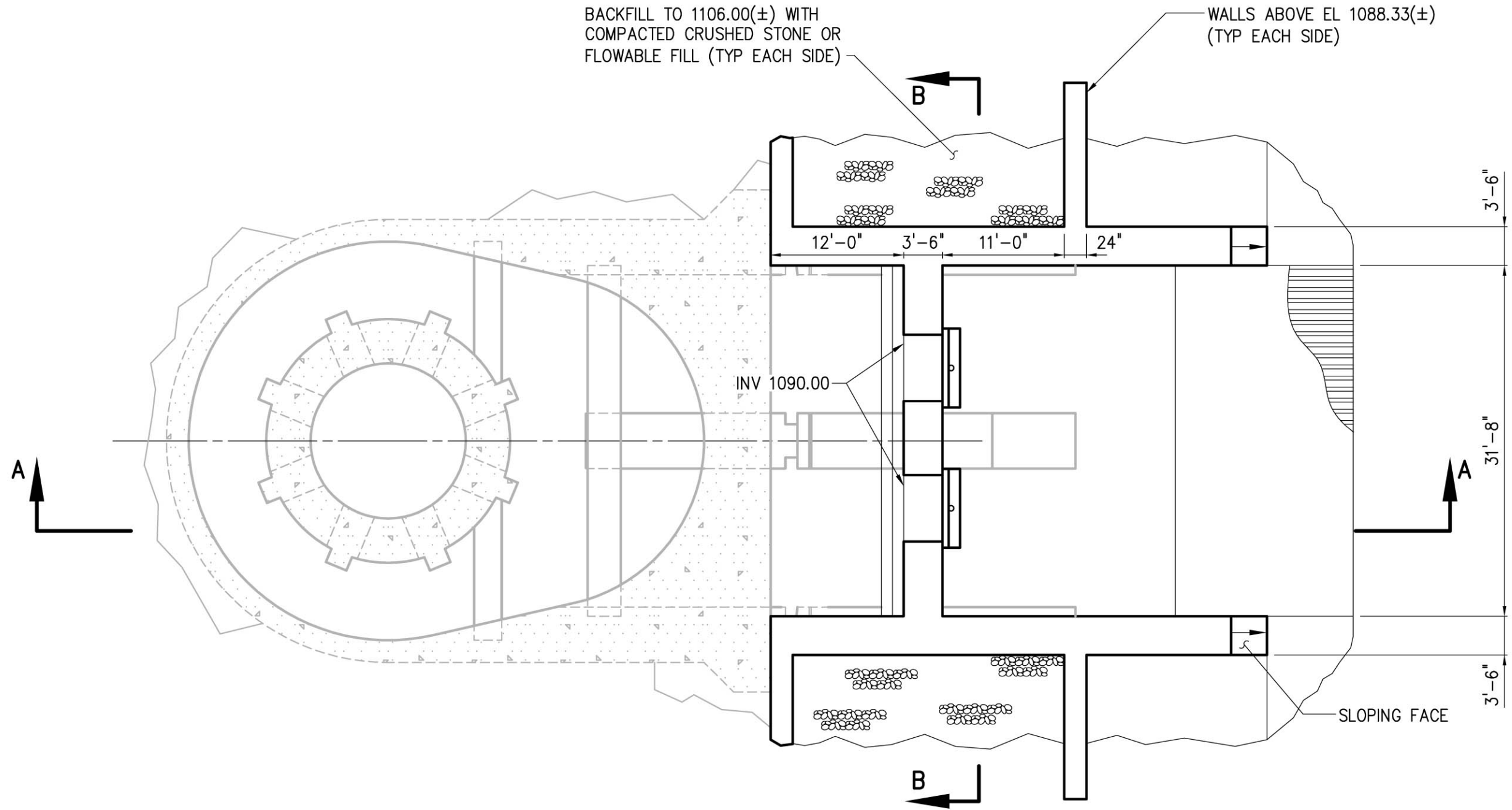


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**MULTI-LEVEL INTAKE  
MODIFICATION OF EXISTING INTAKE  
PLAN AT LOWER GATES**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 27 Saved by ENG Save date = 8/17/2006 3:37 PM



### PLAN AT INTERMEDIATE GATES

3/32" = 1'-0"



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ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



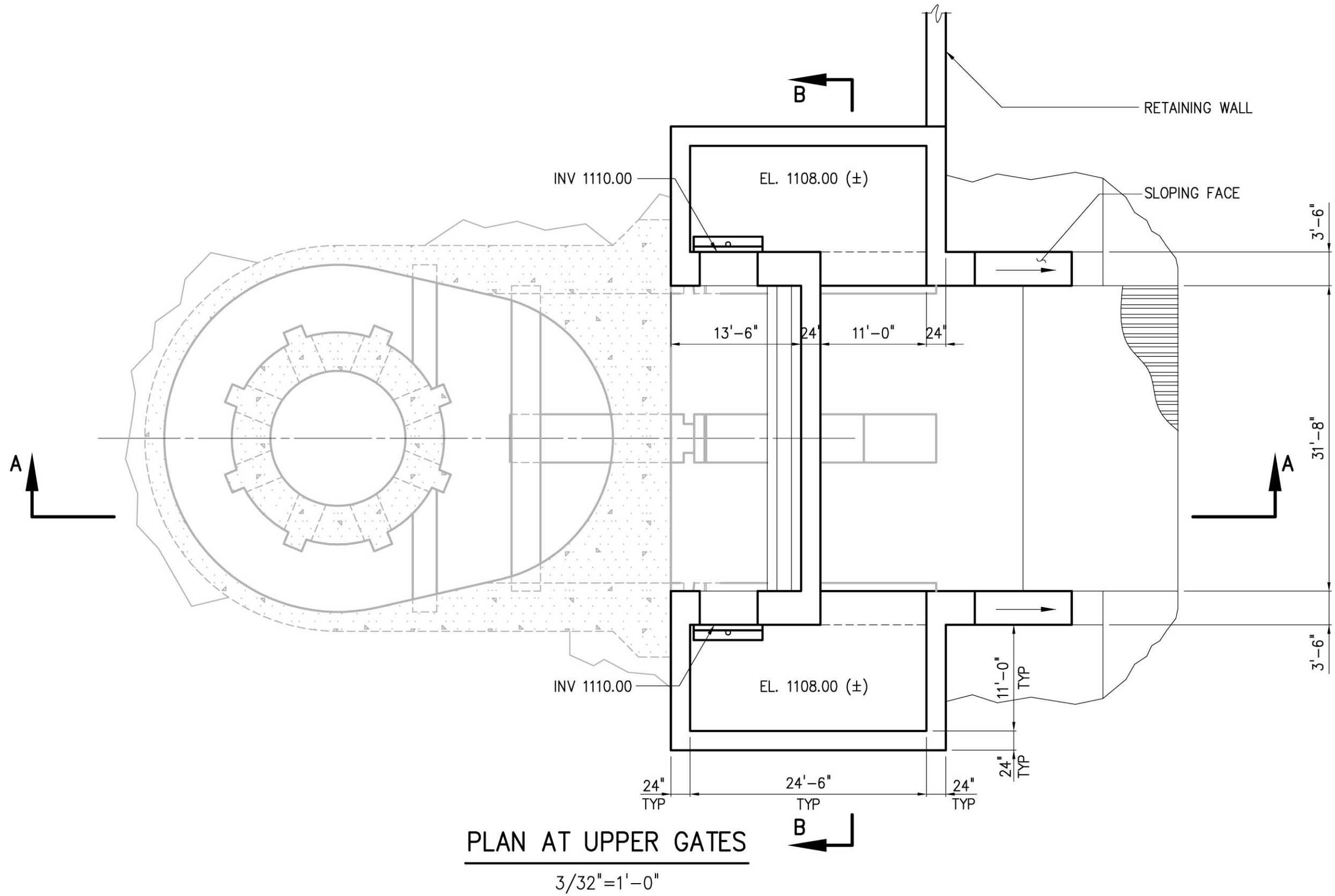
**Gannett Fleming**

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

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MULTI-LEVEL INTAKE  
MODIFICATION OF EXISTING INTAKE  
PLAN AT INTERMEDIATE GATES

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 28 Saved by ENG Save date = 8/17/2006 3:38 PM



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ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE  
RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



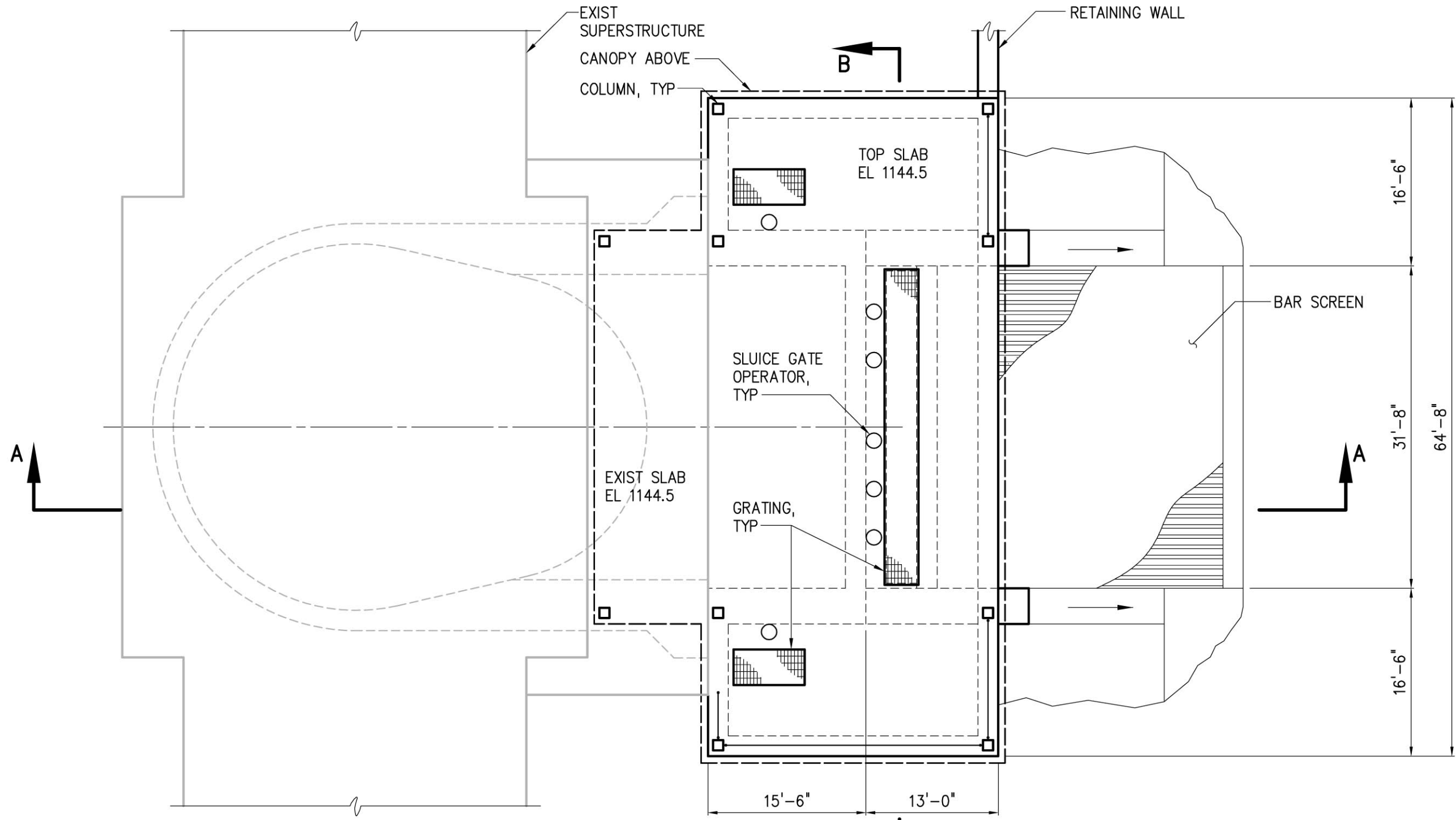
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**Hazen and Sawyer**  
Environmental Engineers & Scientists

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**MULTI-LEVEL INTAKE  
MODIFICATION OF EXISTING INTAKE  
PLAN AT UPPER GATES**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 29 Saved by SROESER Save date = 8/17/2006 3:39 PM



**TOP PLAN**  
 $3/32" = 1'-0"$



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ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



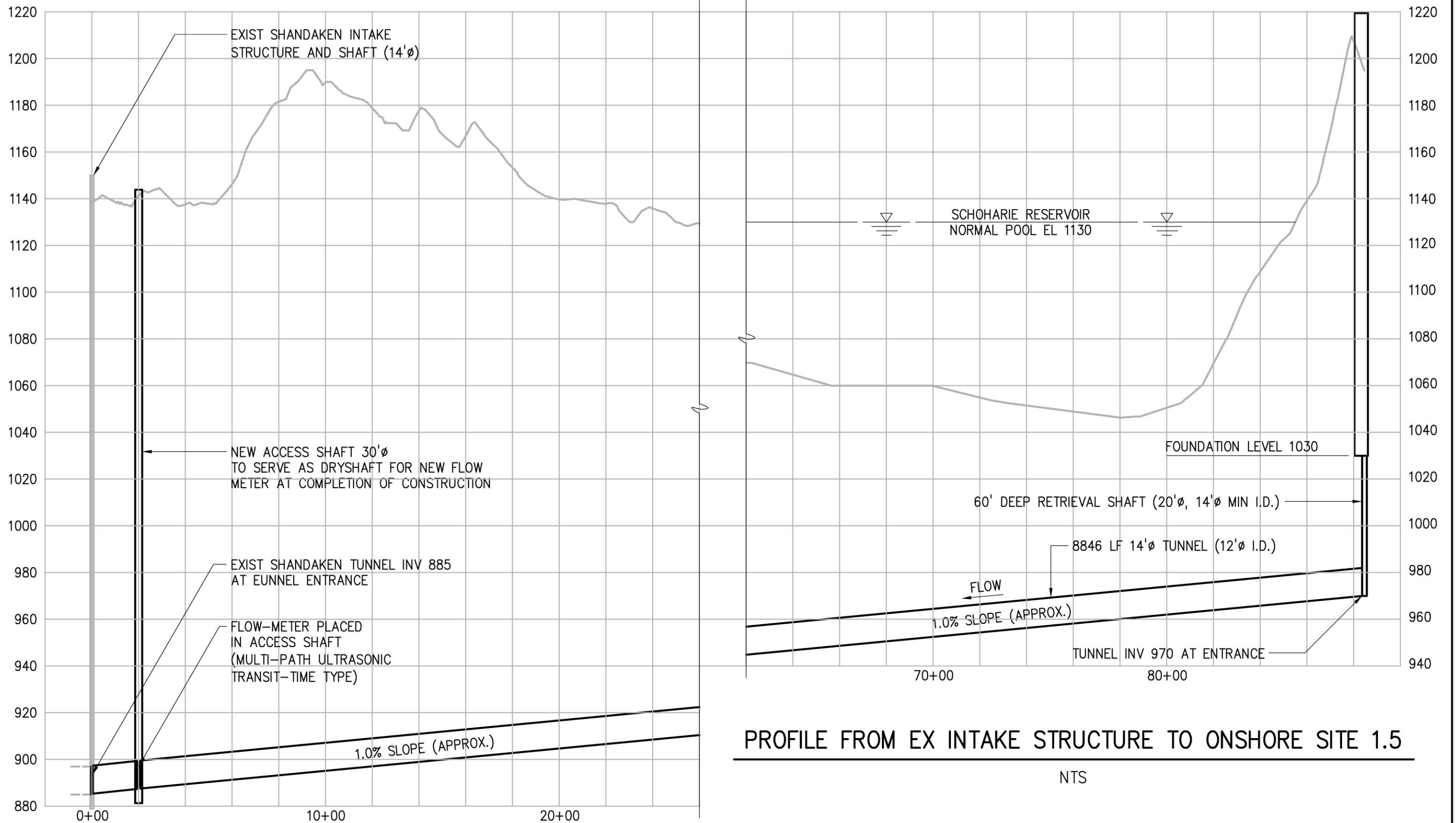
**Gannett Fleming**

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 Environmental Engineers & Scientists

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**MULTI-LEVEL INTAKE  
 MODIFICATION OF EXISTING INTAKE  
 TOP PLAN**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 30 Saved by ENG Save date = 8/22/2006 4:30 PM



CAT 211

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



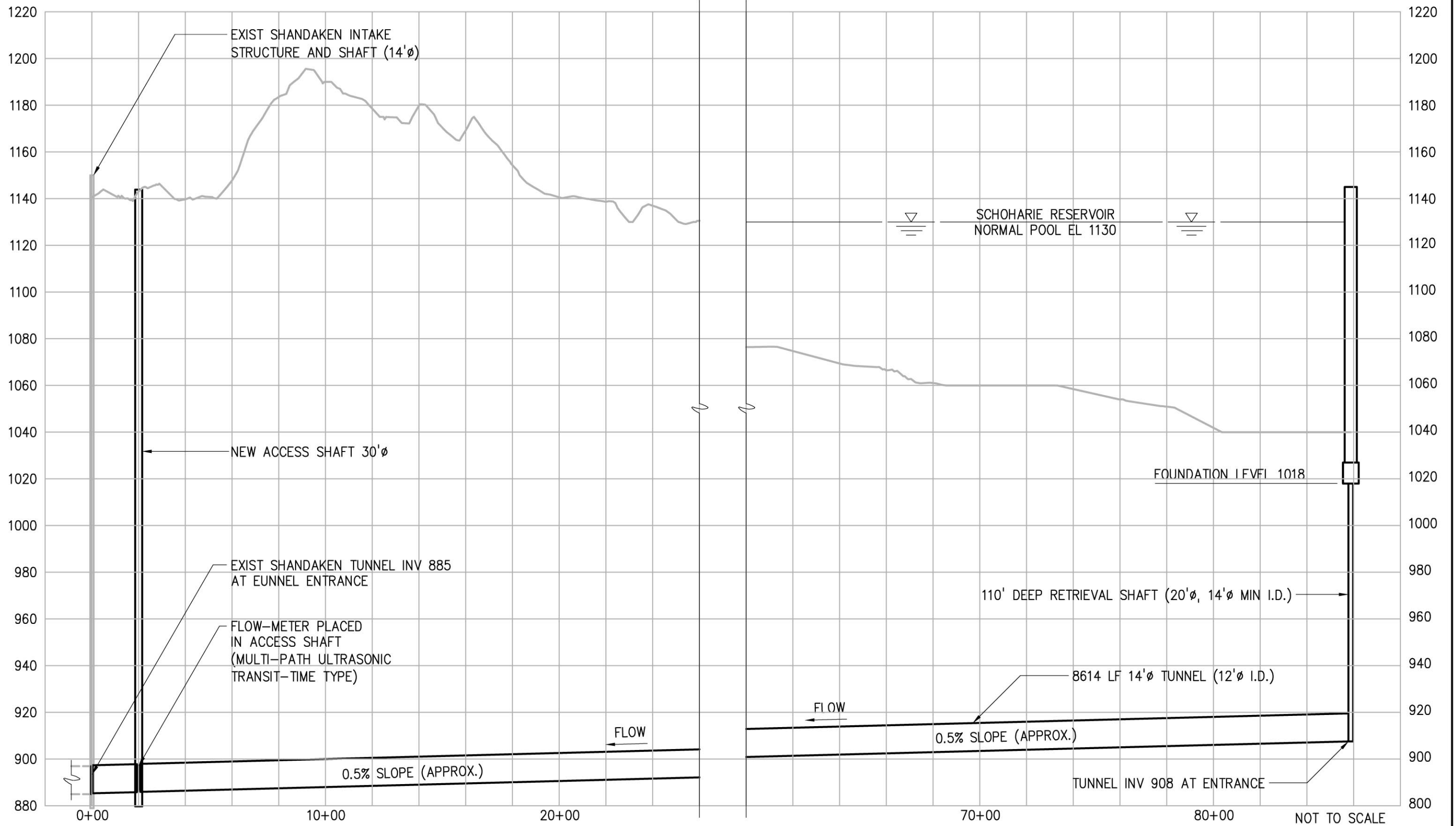
**Gannett Fleming**

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

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**MULTI-LEVEL INTAKE  
TUNNEL PROFILE  
SHANDAKEN - SITE 1.5 ONSHORE INTAKE**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 31 Saved by ENG Save date = 8/22/2006 4:32 PM



CAT 211

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



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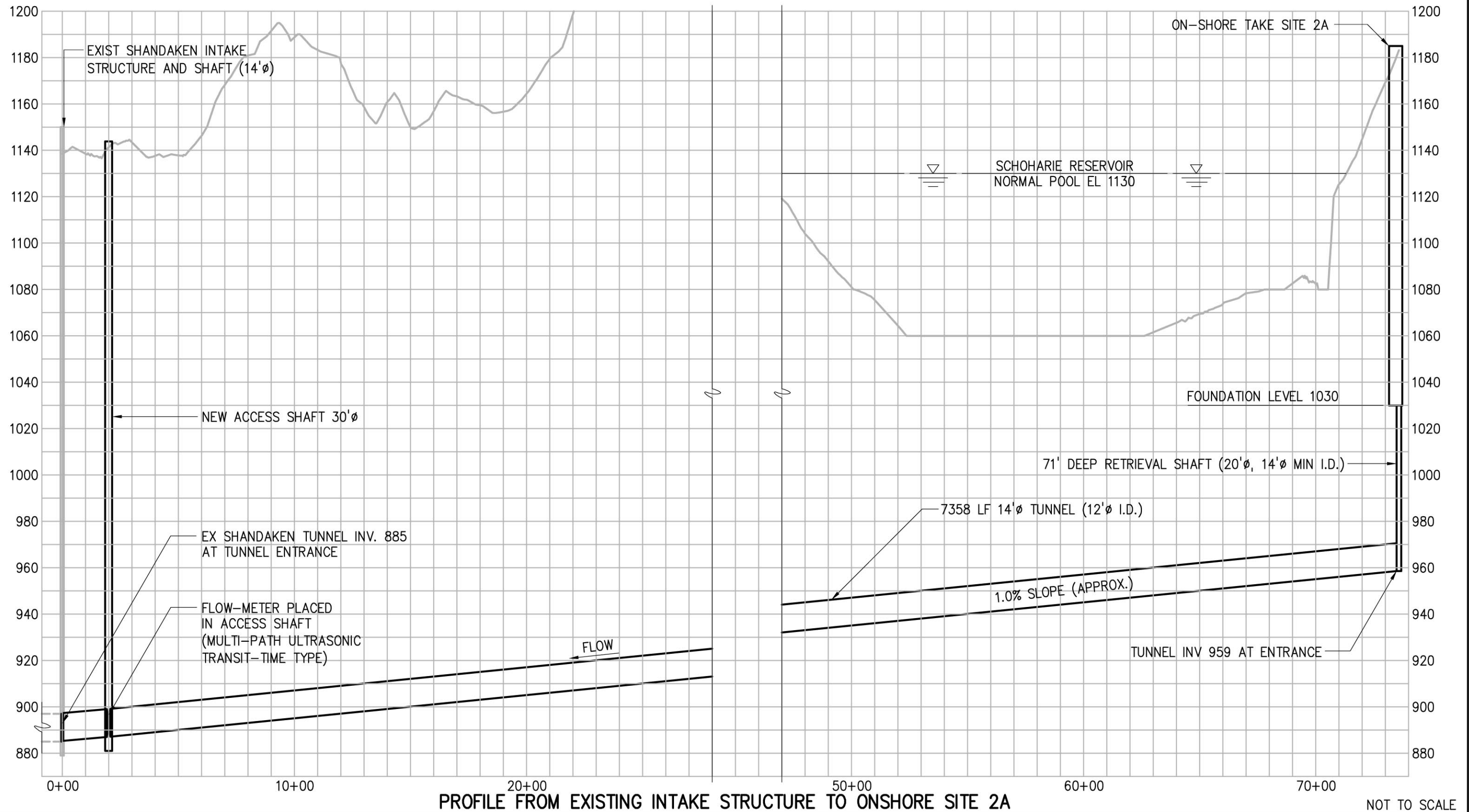
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# MULTI-LEVEL INTAKE TUNNEL PROFILE SHANDAKEN - SITE 1.5 OFFSHORE INTAKE



File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 32 Saved by ENG Save date = 8/22/2006 4:05 PM



PROFILE FROM EXISTING INTAKE STRUCTURE TO ONSHORE SITE 2A

NOT TO SCALE

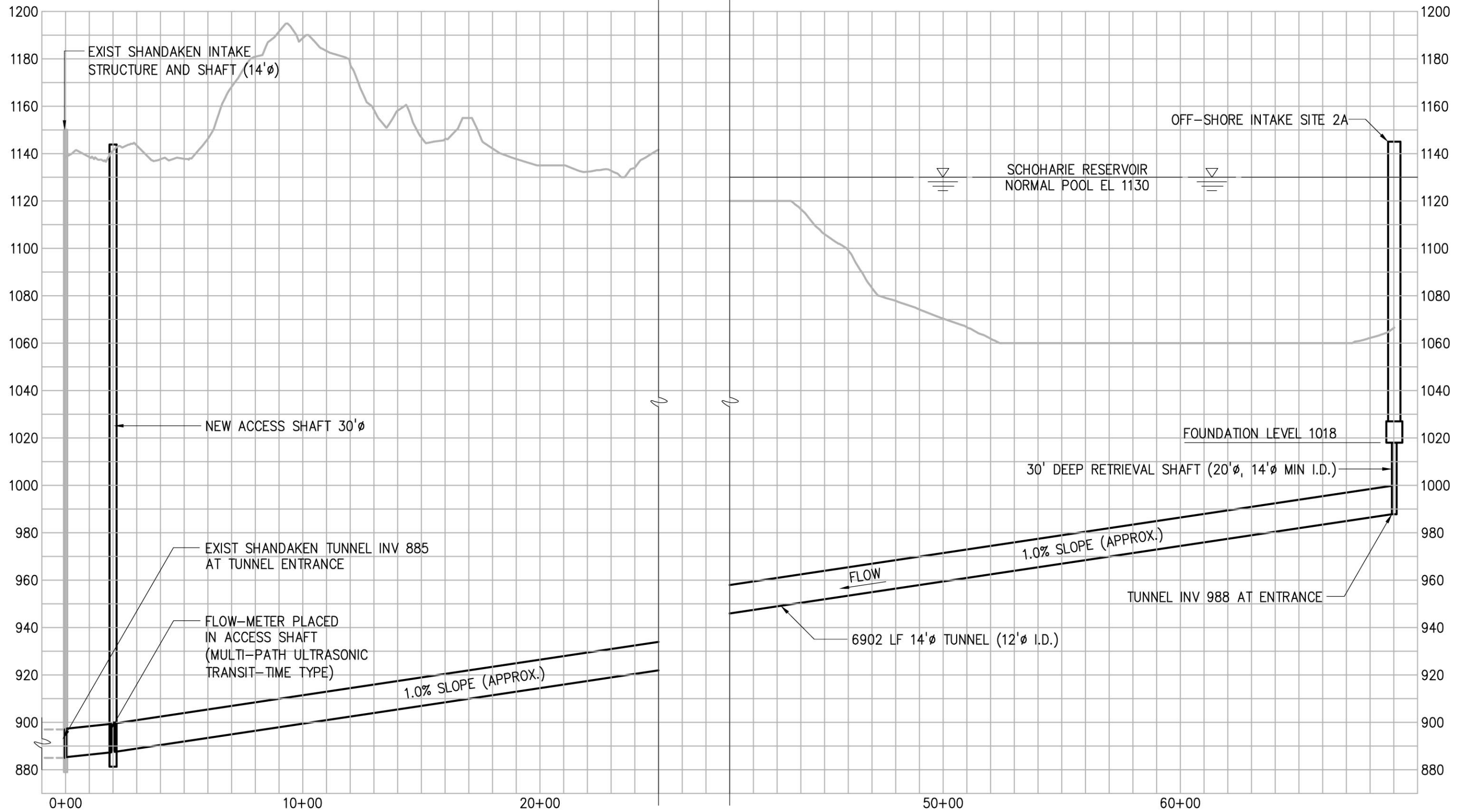


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**MULTI-LEVEL INTAKE TUNNEL PROFILE**  
**SHANDAKEN - SITE 2A ONSHORE INTAKE**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 33 Saved by ENG Save date = 8/22/2006 4:05 PM

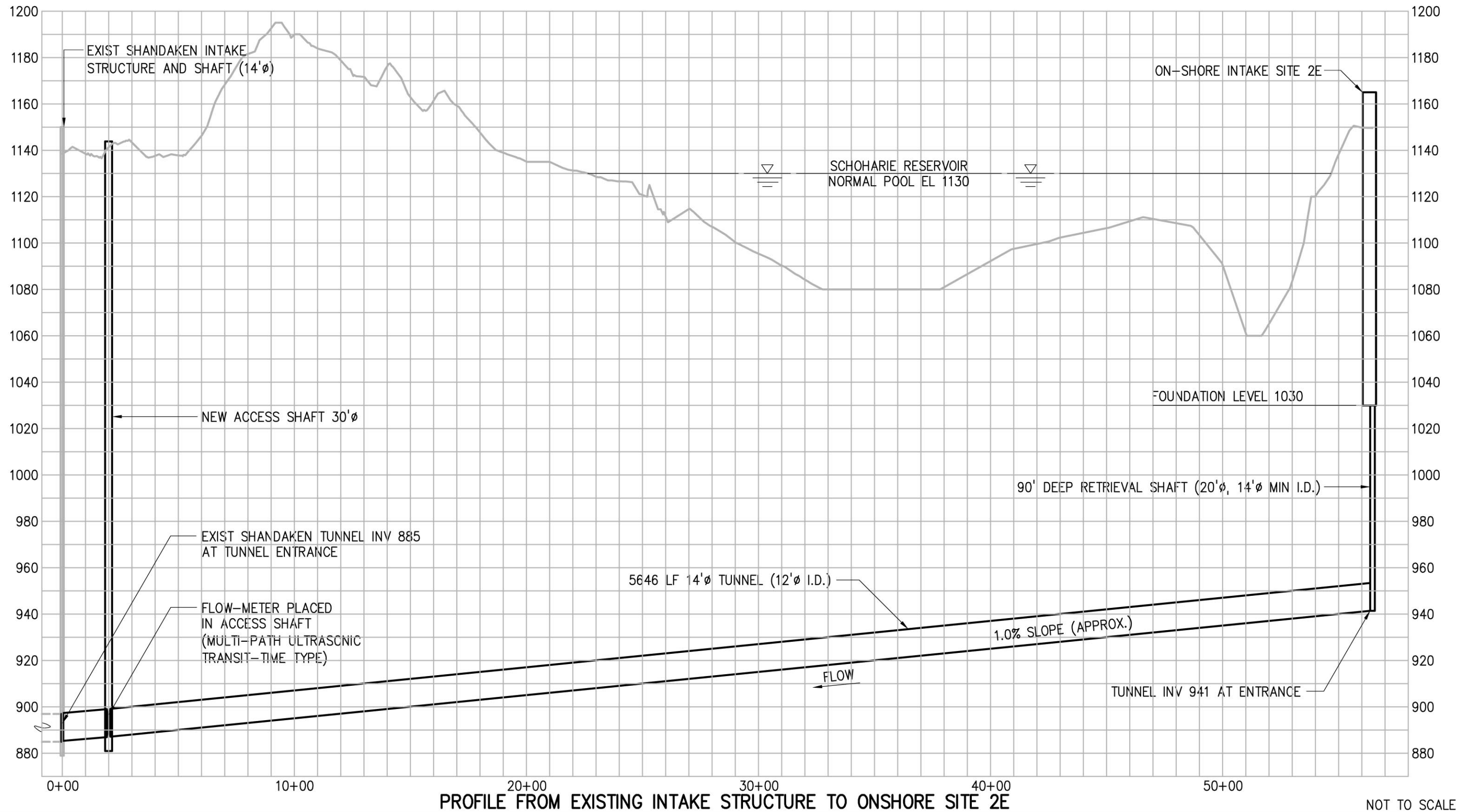


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**MULTI-LEVEL INTAKE  
TUNNEL PROFILE  
SHANDAKEN - SITE 2A OFFSHORE INTAKE**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 34 Saved by ENG Save date = 8/22/2006 4:04 PM



PROFILE FROM EXISTING INTAKE STRUCTURE TO ONSHORE SITE 2E

NOT TO SCALE



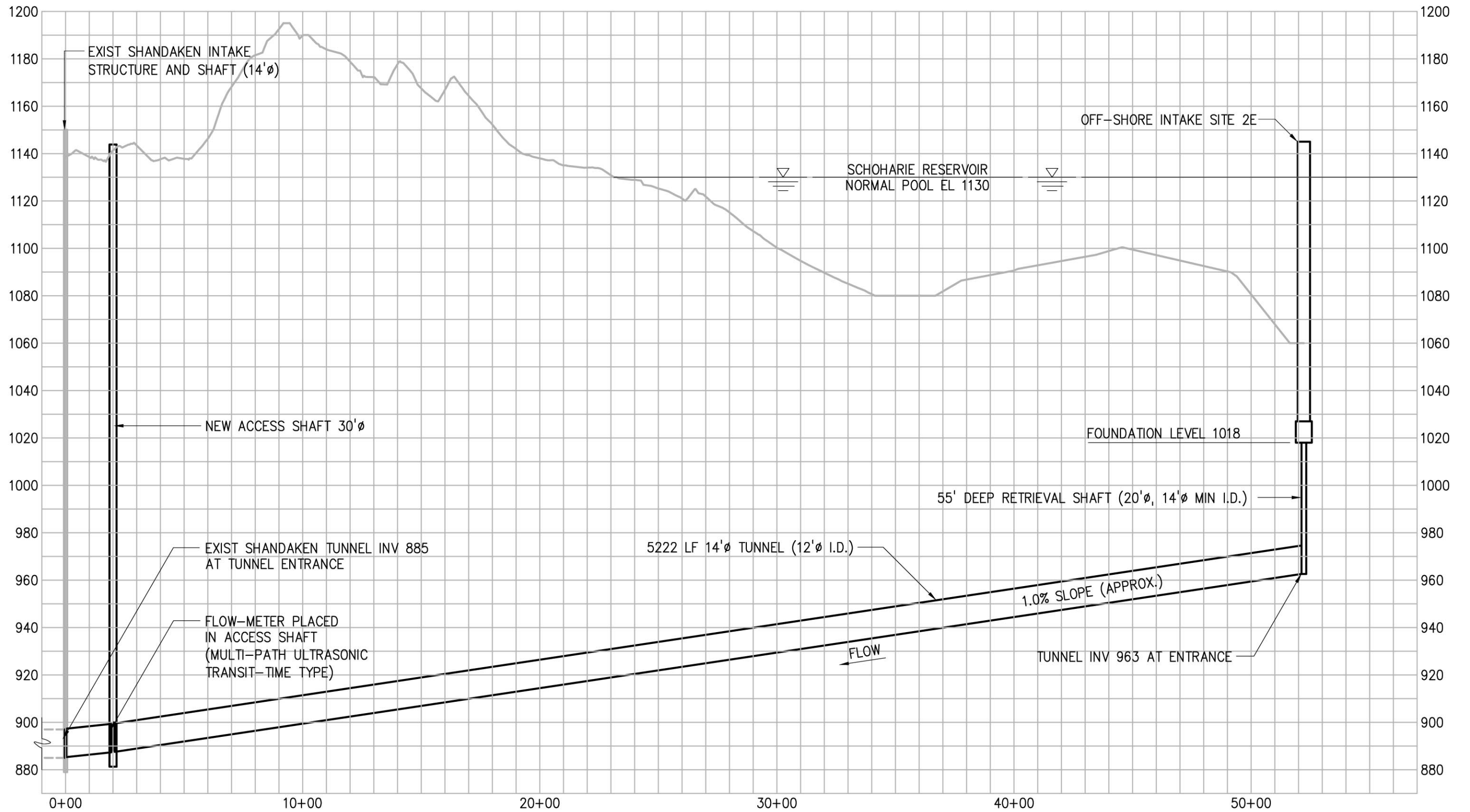
**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



# MULTI-LEVEL INTAKE TUNNEL PROFILE

## SHANDAKEN - SITE 2E ONSHORE INTAKE

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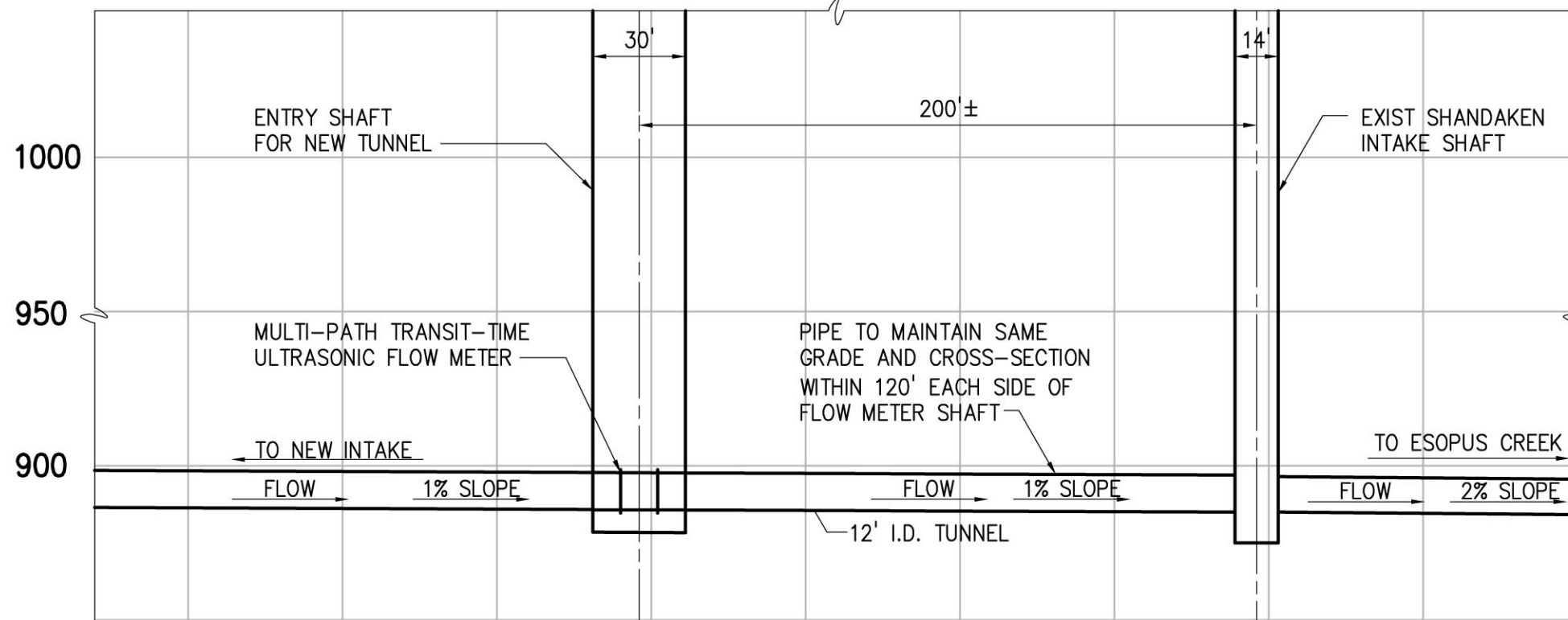
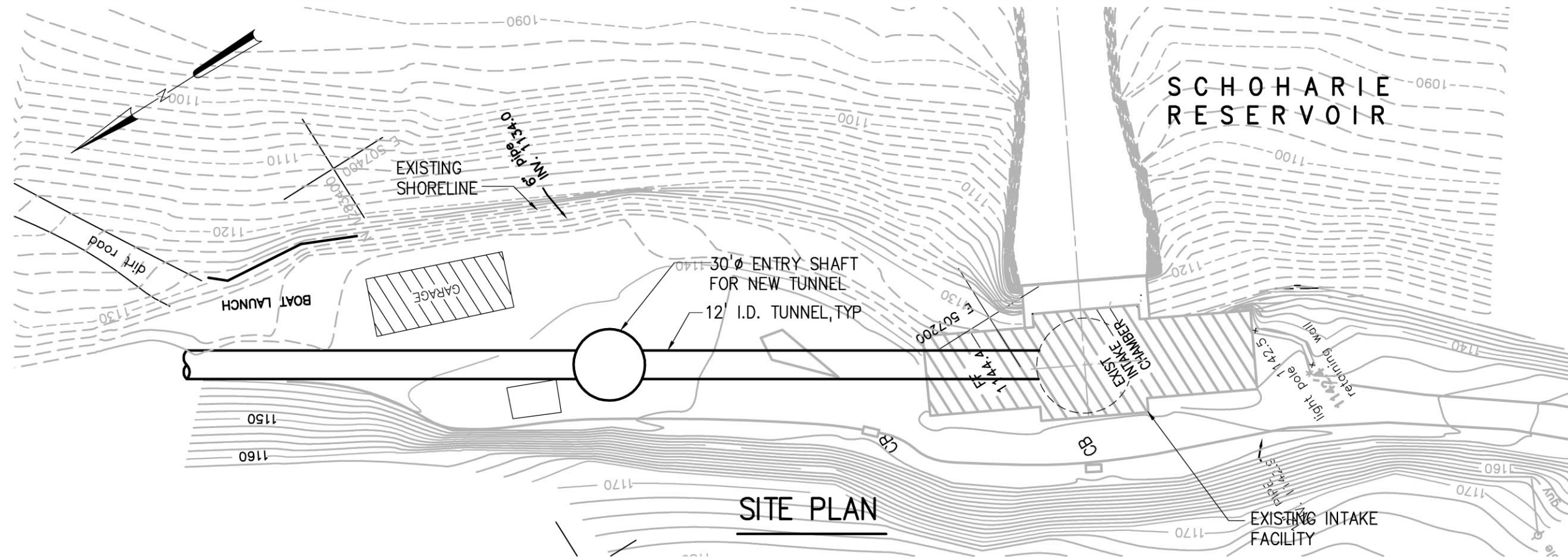


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**MULTI-LEVEL INTAKE  
TUNNEL PROFILE  
SHANDAKEN - SITE 2E OFFSHORE INTAKE**

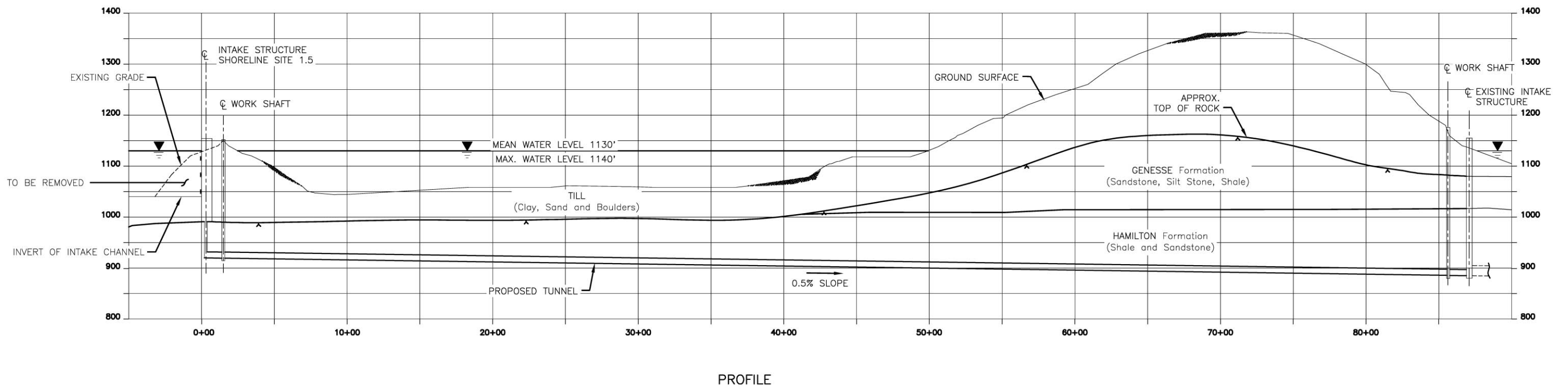
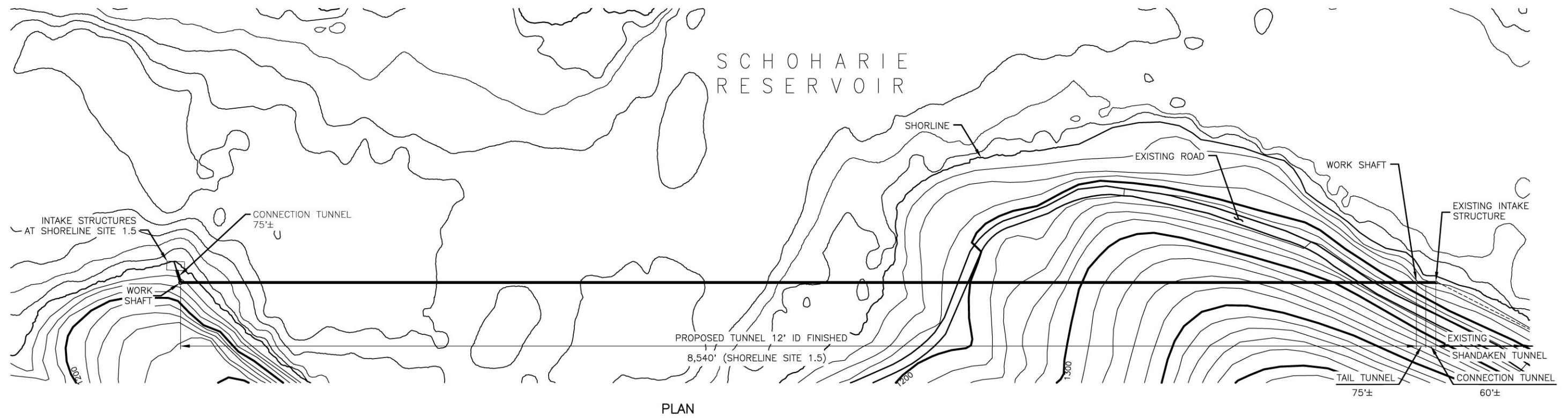
File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 36 Saved by ENG Save date = 8/17/2006 3:45 PM



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**MULTI-LEVEL INTAKE  
NEW SHANDAKEN FLOWMETER SHAFT  
SITE PLAN**



**TYPICAL PLAN AND GEOLOGICAL SECTION**

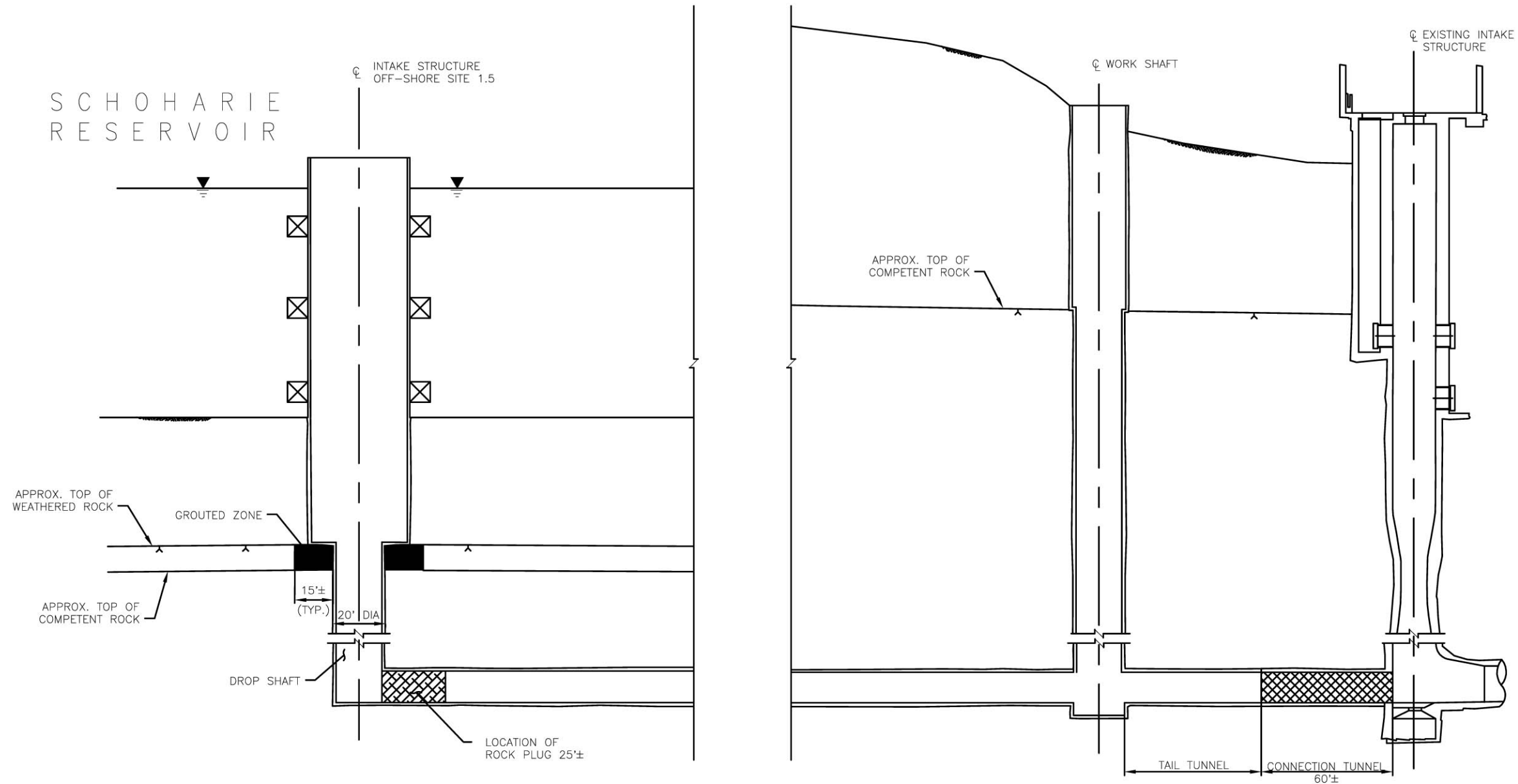


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



A JOINT VENTURE

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 38 Saved by Andrew Save date = 8/24/2006 10:55 AM



SEQUENCE OF CONSTRUCTION:

1. EXCAVATE WORK SHAFT AND TAIL TUNNEL NEAR EXISTING INTAKE.
2. ASSEMBLE TBM AND START MINING UPHILL TOWARD OFFSHORE INTAKE SITE 1.5.
3. TERMINATE MINING 25 FEET FROM SHAFT'S WALL CREATING A ROCK PLUG.
4. WALK TBM BACK TO WORK SHAFT.
5. CONSTRUCT OFF SHORE INTAKE STRUCTURE TO THE TOP OF THE BEDROCK.
6. INSTALL GROUTED ZONE.
7. EXCAVATE DROP SHAFT FROM BOTTOM OF INTAKE STRUCTURE TO TUNNEL LEVEL.
8. REMOVE ROCK PLUG .
9. INSTALL DROP SHAFT LINING.
10. INSTALL TUNNEL LINING AND GROUT THE ANNULUS.
11. CONSTRUCT CONNECTION TUNNEL AND CONNECT TO EXISTING INTAKE.
12. BACKFILL WORK SHAFT.



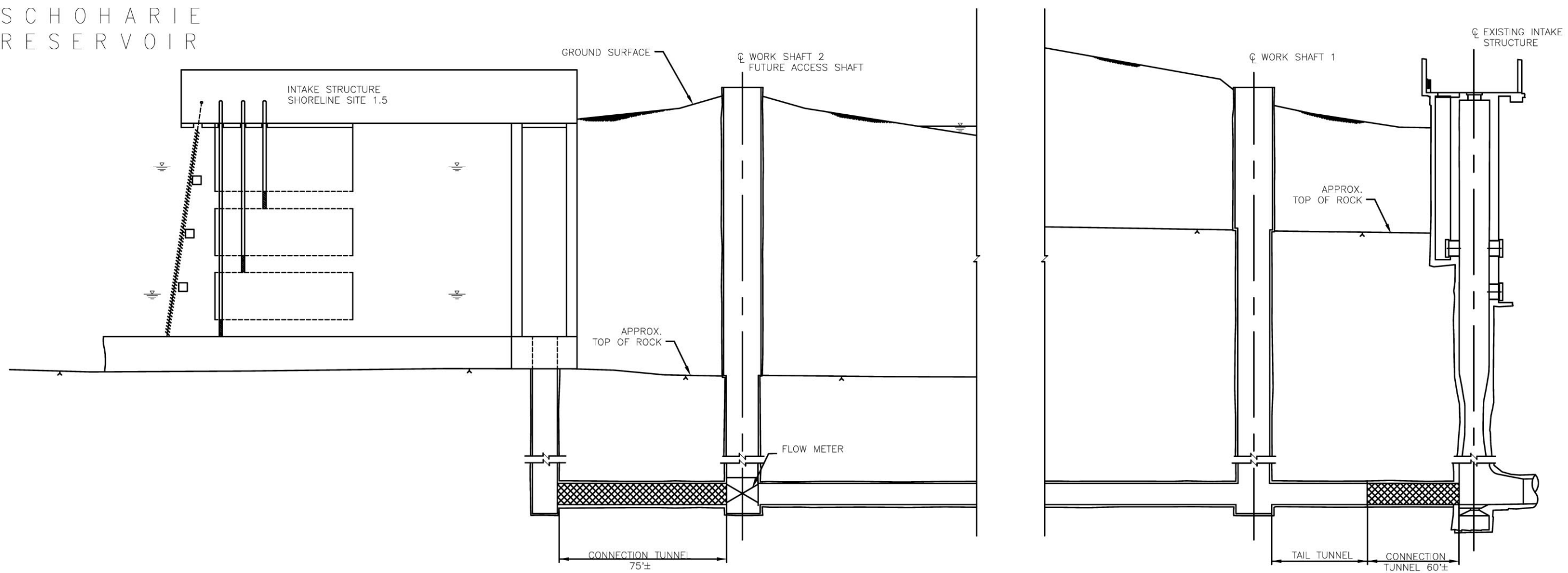
**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



A JOINT VENTURE

SEQUENCE OF CONSTRUCTION OFFSHORE ALTERNATIVES

SCHOHARIE  
RESERVOIR



SEQUENCE OF CONSTRUCTION:

1. EXCAVATE WORK SHAFT 1 AND TAIL TUNNEL NEAR EXISTING INTAKE.
2. ASSEMBLE TBM AND START MINING UPHILL TOWARD SHORELINE INTAKE SITE 1.5.
3. EXCAVATE WORK SHAFT 2 NEAR SHORELINE INTAKE 1.5.
4. AFTER COMPLETION OF TUNNELING RETRIEVE TBM THROUGH THE WORK SHAFT 2.
5. CONSTRUCT SHORELINE INTAKE STRUCTURE.
6. HAND MINE CONNECTION TUNNEL BETWEEN THE WORK SHAFT 2 AND SHORELINE INTAKE SITE 1.5 STRUCTURE.
7. INSTALL TUNNEL LINING AND GROUT ANNULUS.
8. INSTALL FLOW METER IN WORK SHAFT 2.
9. INSTALL FINAL LINING IN WORK SHAFT 2.
10. CONSTRUCT CONNECTION TUNNEL BETWEEN THE TAIL TUNNEL AND EXISTING INTAKE STRUCTURE.
11. BACKFILL WORK SHAFT 1.



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211

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**Gannett Fleming**

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists



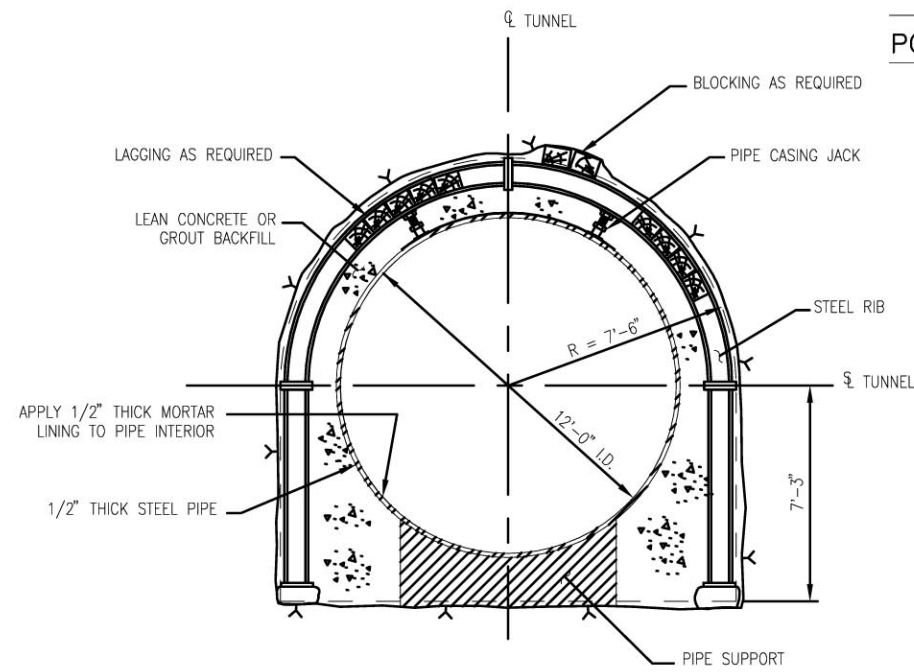
JENNY  
ENGINEERING  
CORPORATION  
CONSULTING ENGINEERS

A JOINT VENTURE

SEQUENCE OF CONSTRUCTION  
SHORELINE ALTERNATIVES

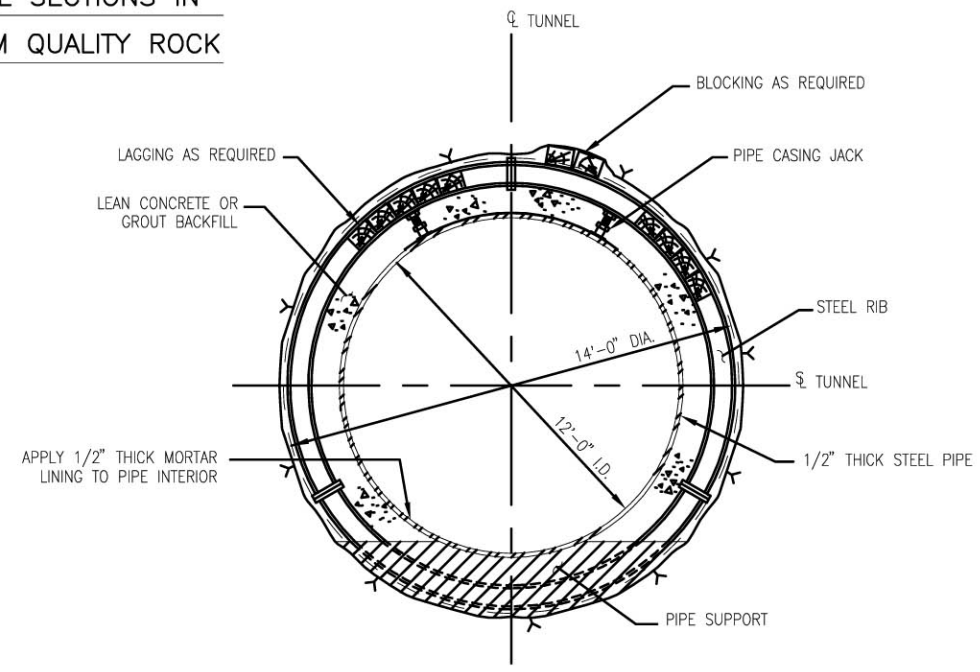


TYPICAL TUNNEL SECTIONS IN  
POOR TO MEDIUM QUALITY ROCK



DRILL AND BLAST EXCAVATION

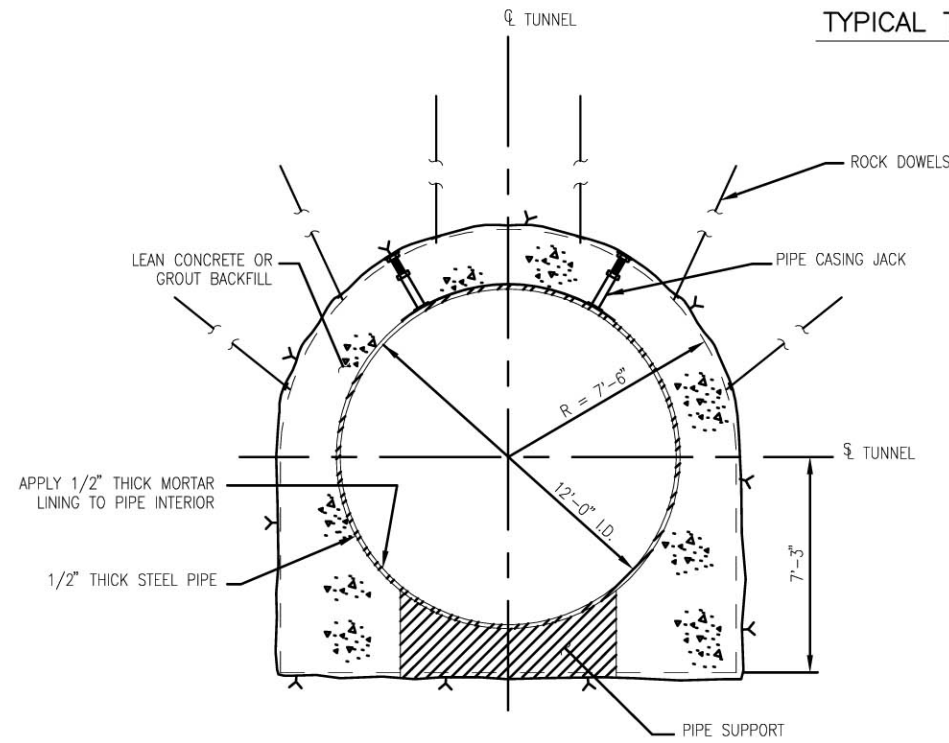
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TBM EXCAVATION

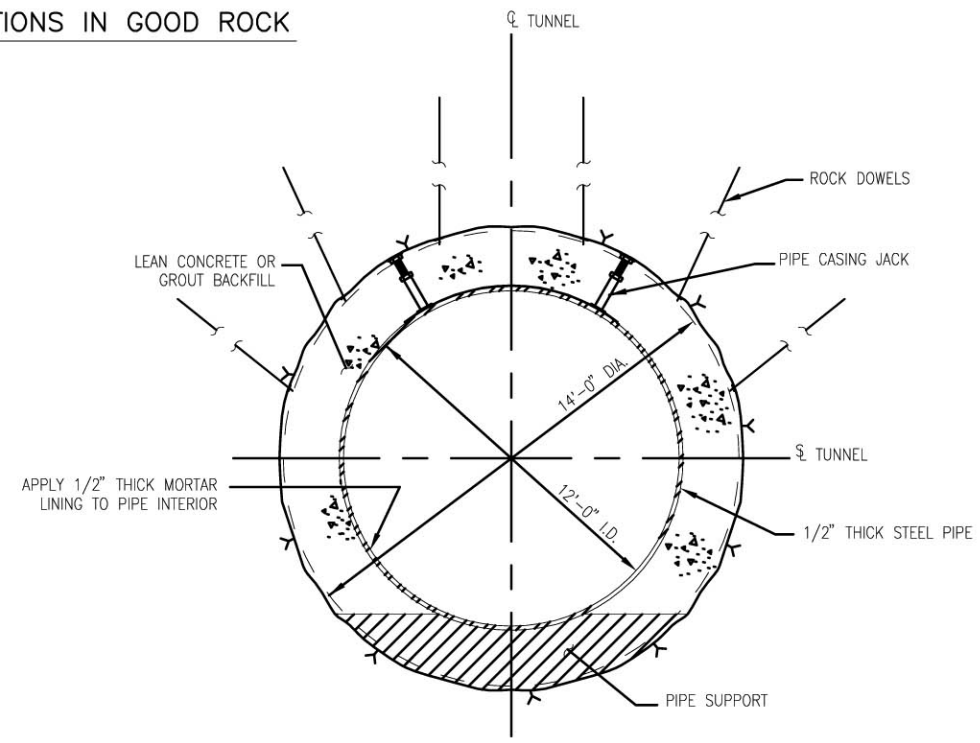
N.T.S.

TYPICAL TUNNEL SECTIONS IN GOOD ROCK



DRILL AND BLAST EXCAVATION

N.T.S.



TBM EXCAVATION

N.T.S.

TYPICAL TUNNEL SECTIONS



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ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE  
RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**Gannett Fleming**

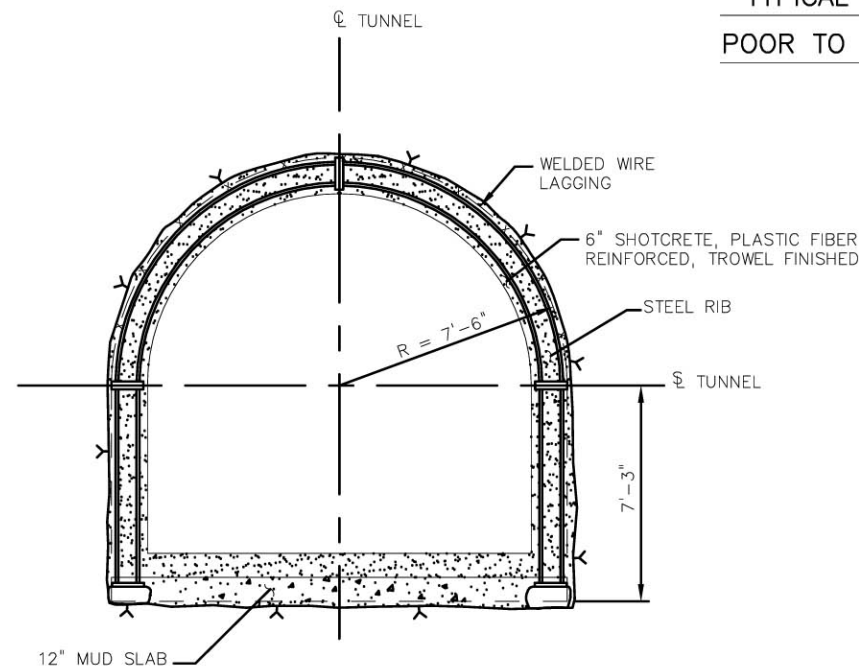
**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

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**JEC**  
JENNY  
ENGINEERING  
CORPORATION  
CONSULTING ENGINEERS

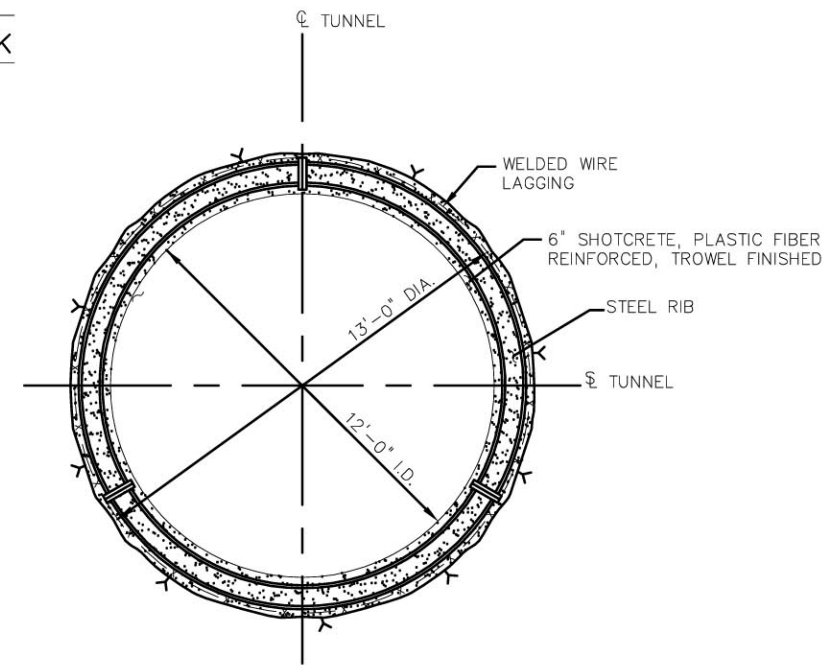
TYPICAL TUNNEL SECTIONS IN  
POOR TO MEDIUM QUALITY ROCK



DRILL AND BLAST EXCAVATION

ROCK DOWELS (TYP.)

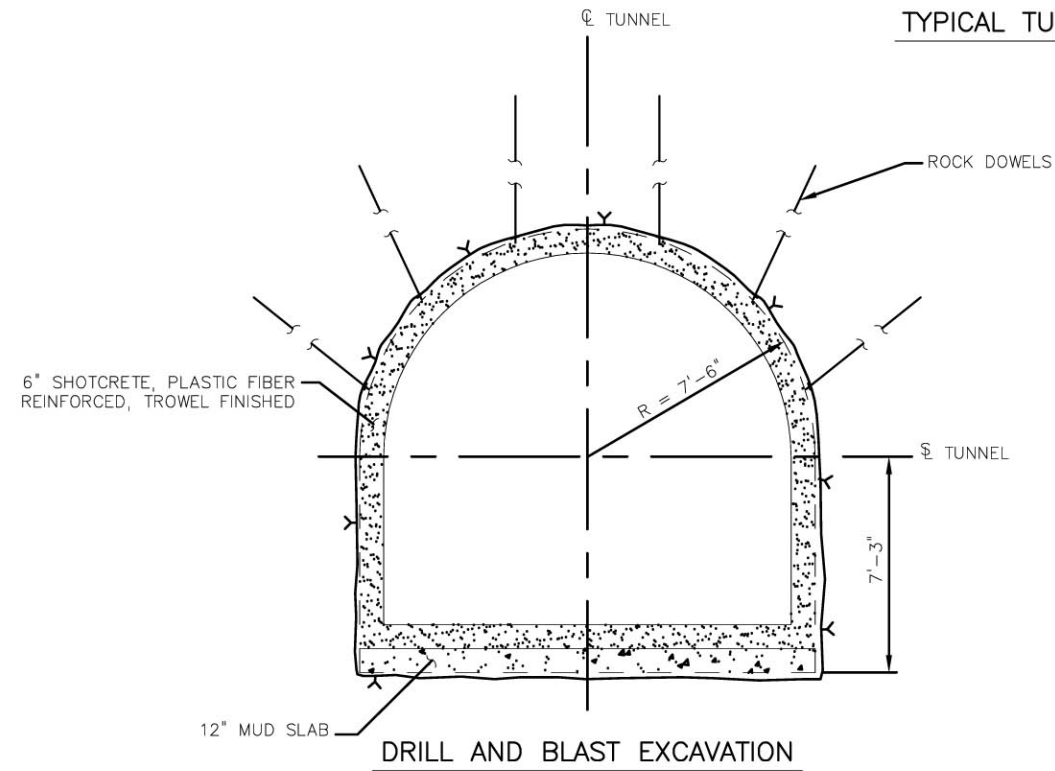
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TBM EXCAVATION

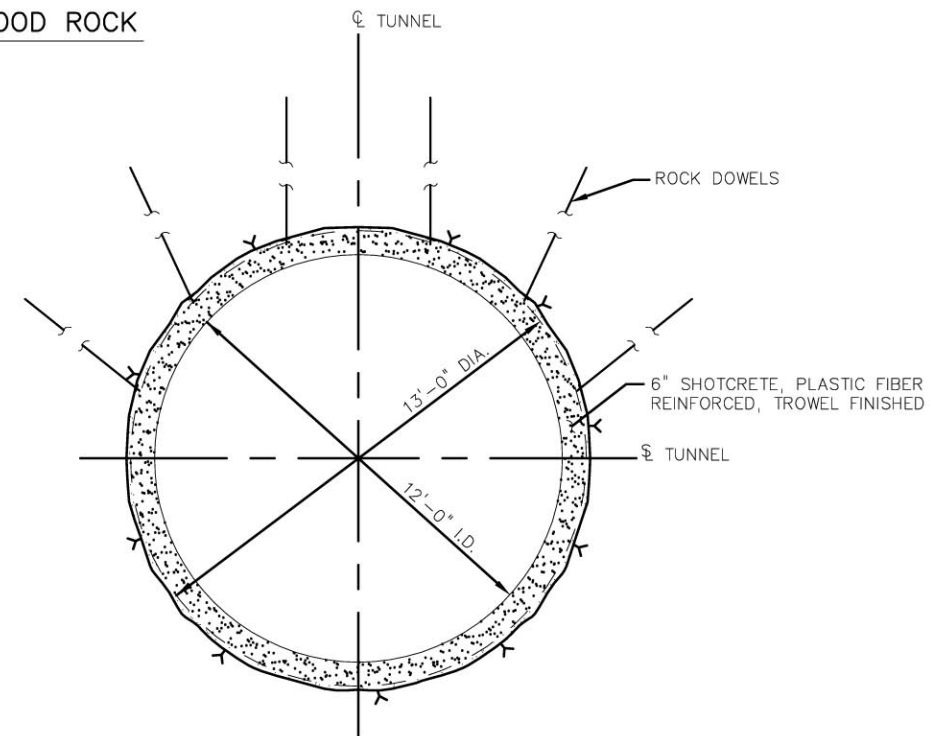
N.T.S.

TYPICAL TUNNEL SECTIONS IN GOOD ROCK



DRILL AND BLAST EXCAVATION

N.T.S.



TBM EXCAVATION

N.T.S.

TYPICAL TUNNEL SUPPORTS  
SECTIONS



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211

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE  
RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**Gannett Fleming**

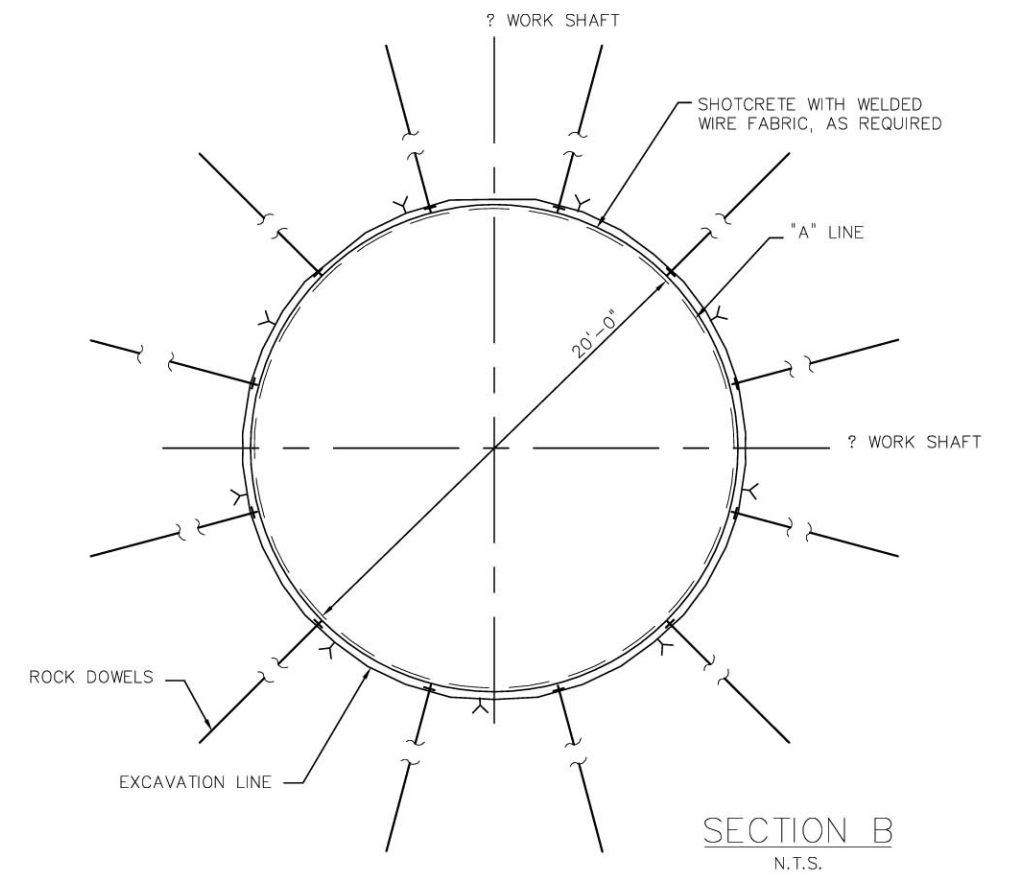
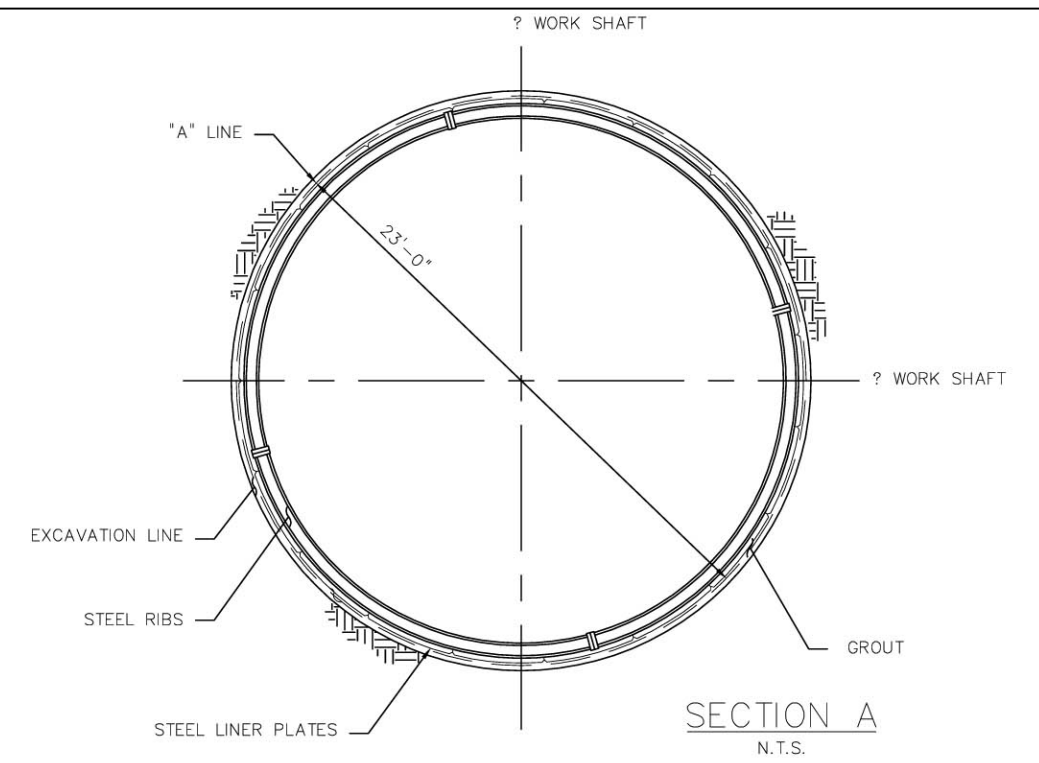
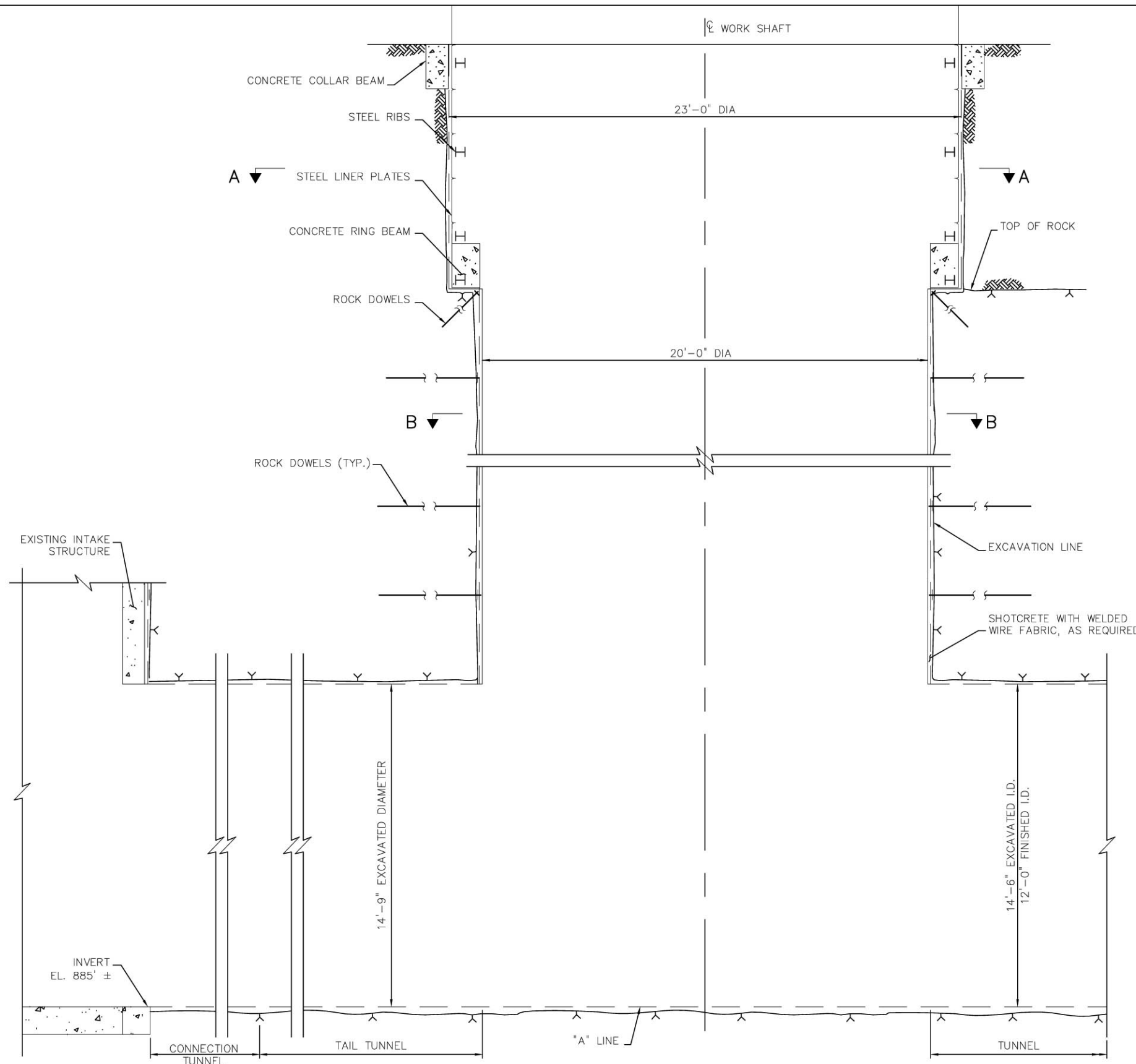
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File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 42 Saved by ---- Save date = 8/24/2006 11:14 AM



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ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**Gannett Fleming**

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

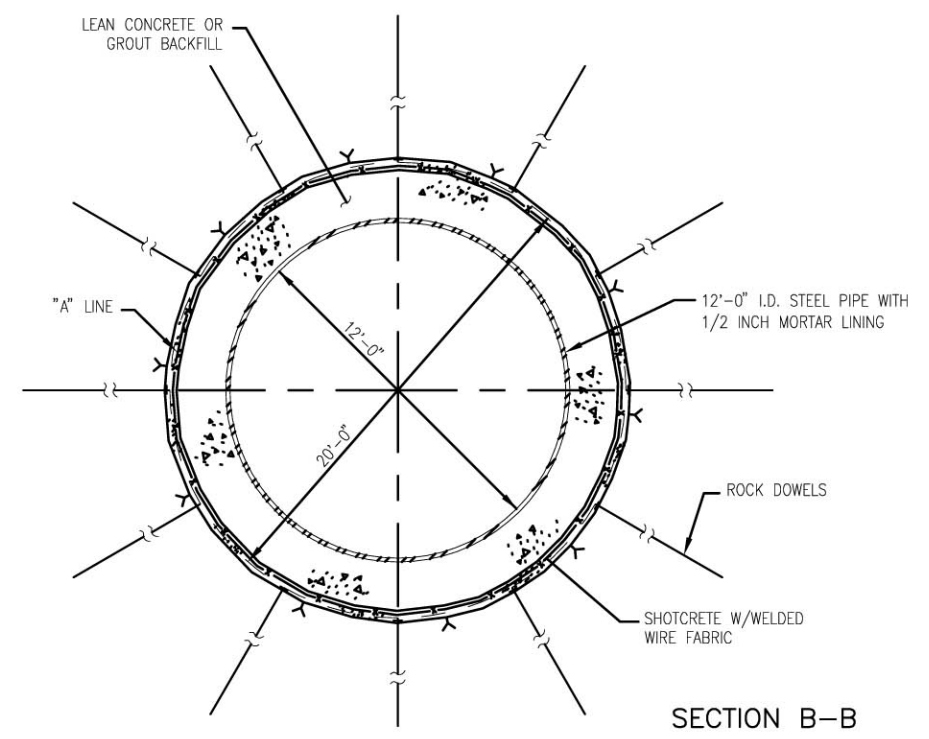
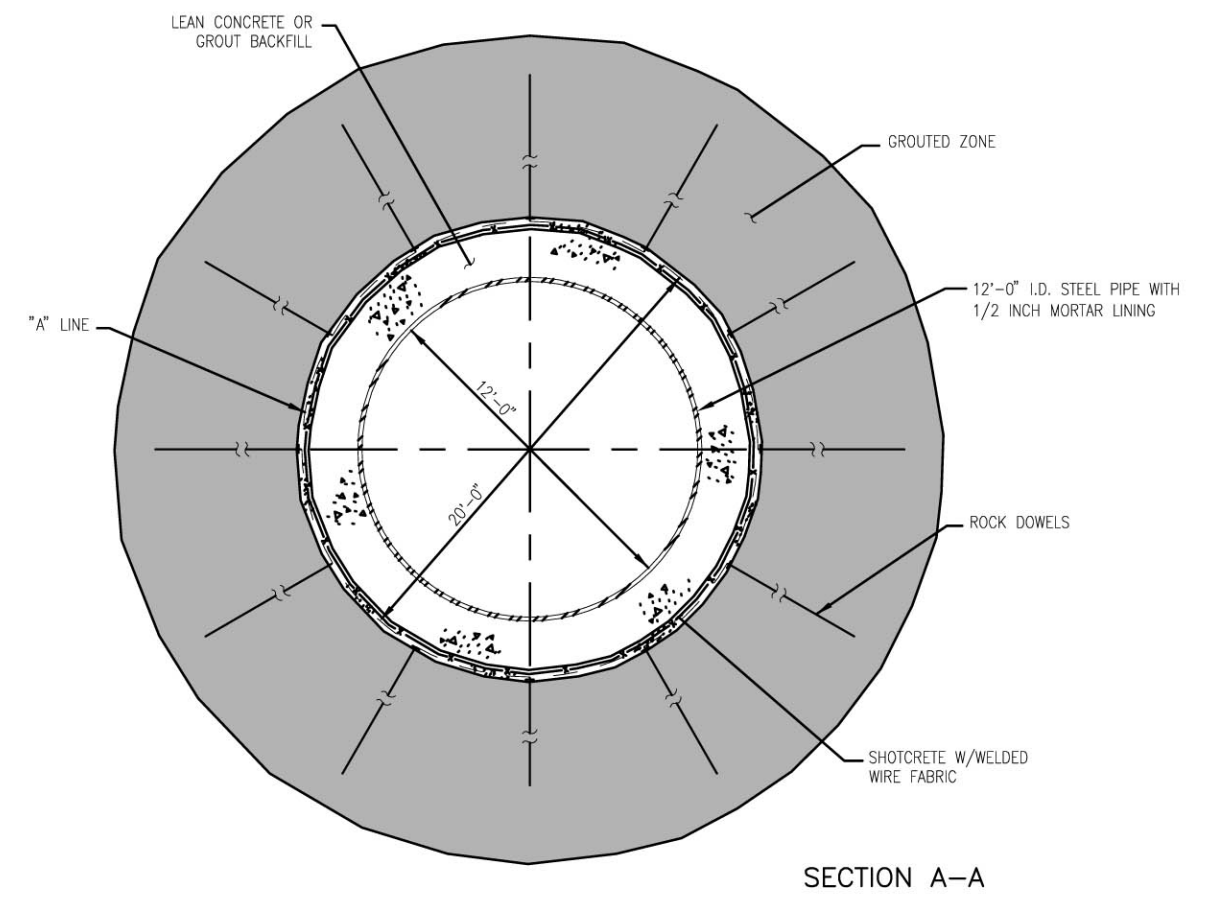
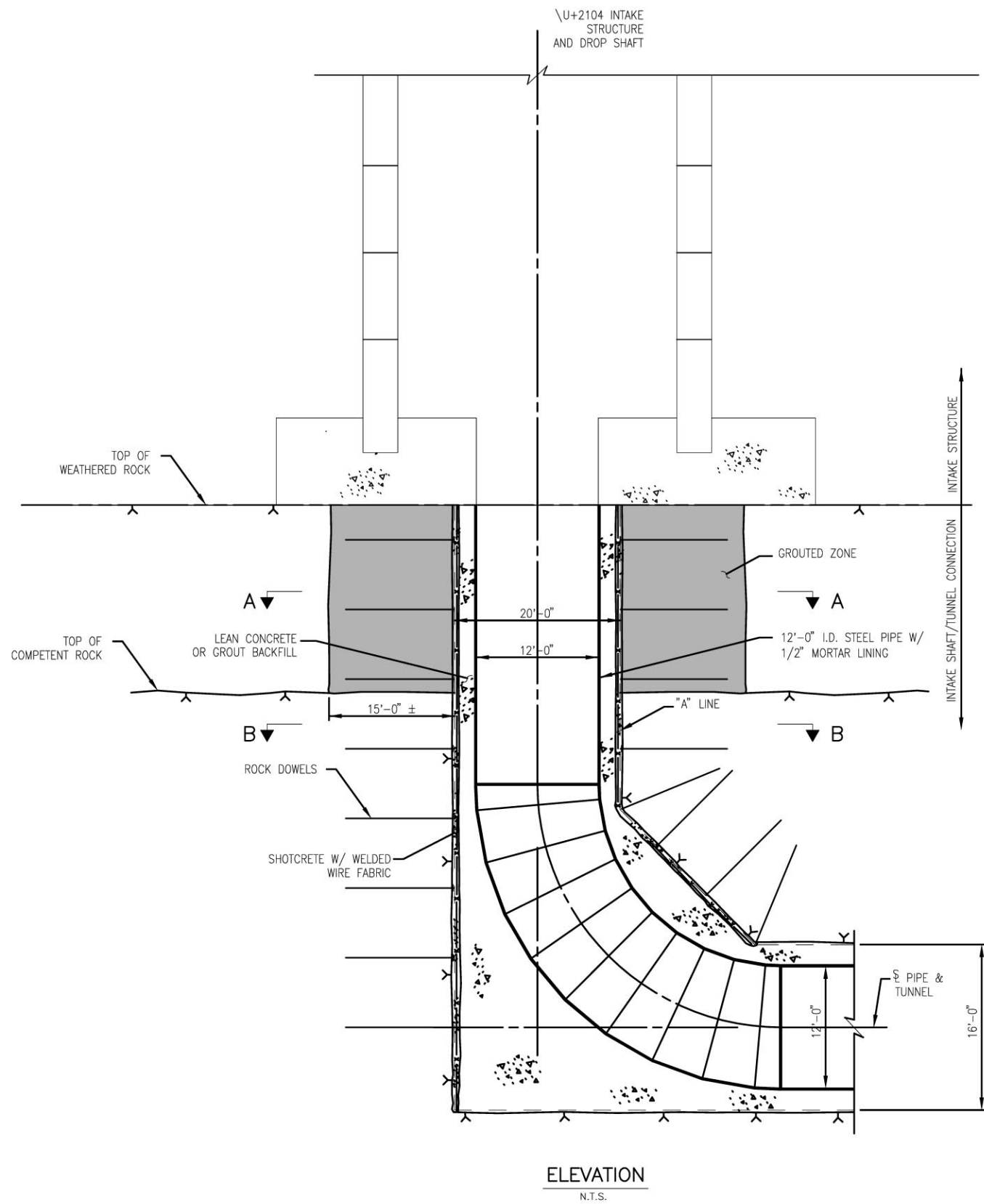


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JENNY ENGINEERING CORPORATION  
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**TYPICAL WORK SHAFT SECTIONS**

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 43 Saved by ----- Save date = 8/24/2006 11:19 AM



## TYPICAL CONNECTING SHAFT DETAILS

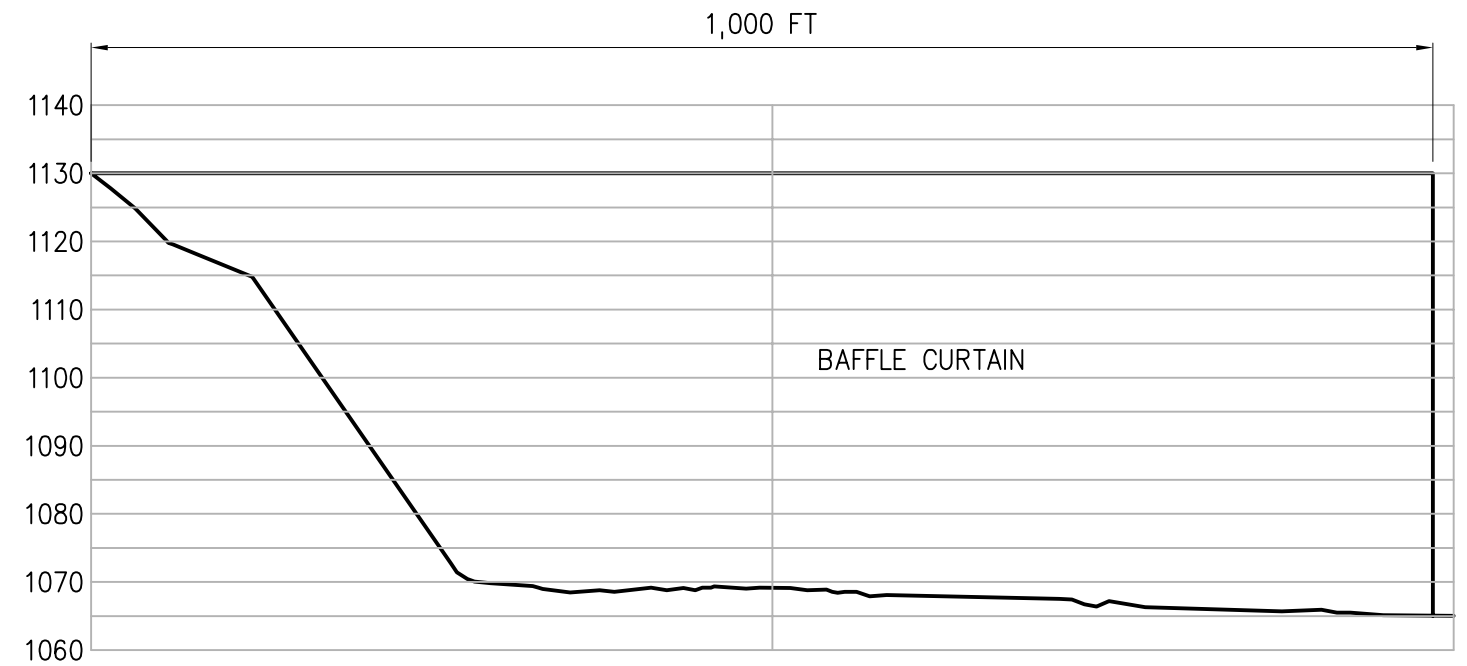
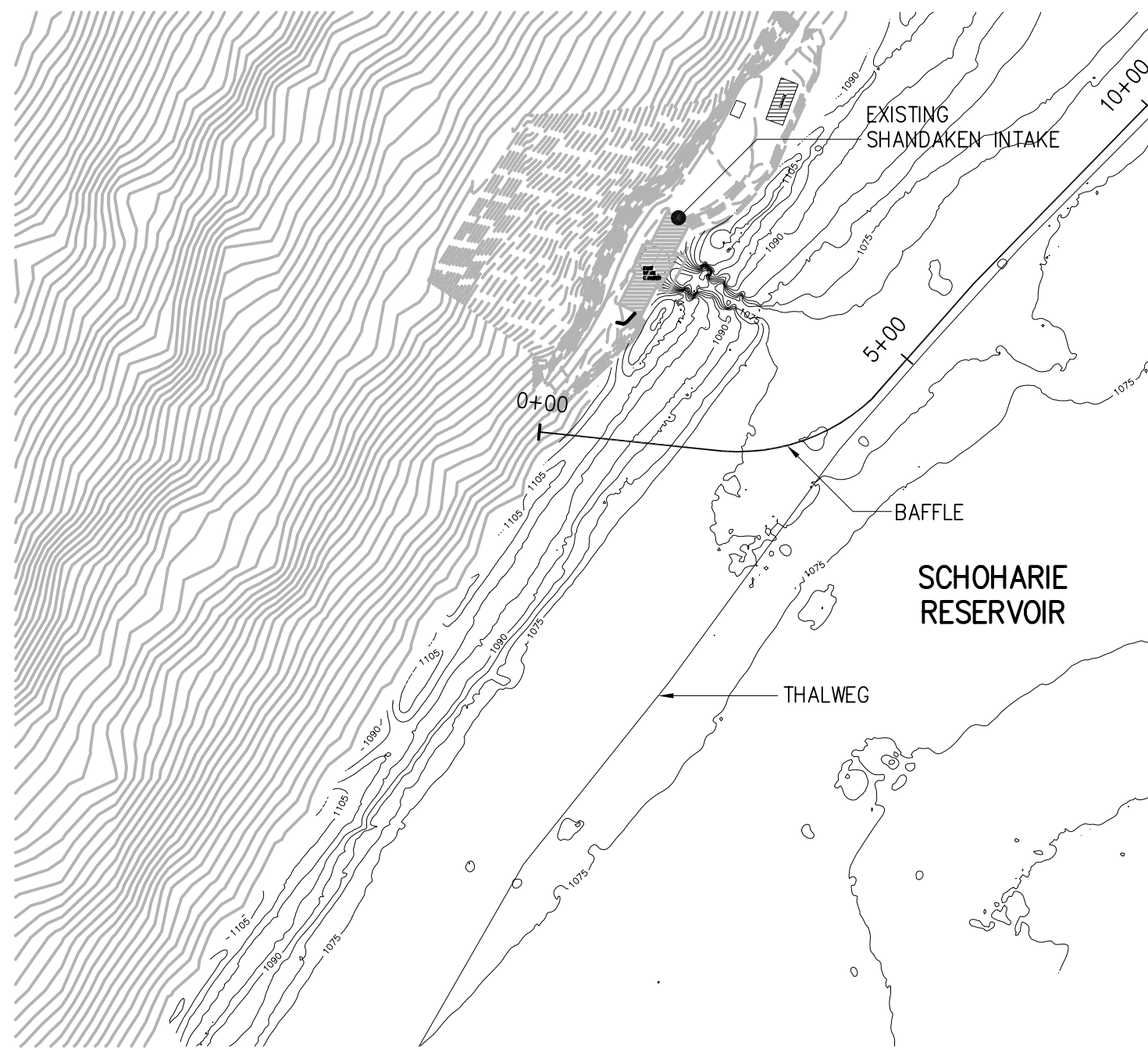


**CAT 211** ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



A JOINT VENTURE

File = H:\9480\Schoharie Reservoir\Preliminary Design 3 (June 2006)\Figure 44 Saved by ENG Save date = 9/26/2006 4:25 PM



**SITE PLAN**

NTS

**PROFILE**

NTS



**CAT 211**

ENGINEERING DESIGN SERVICES AND DESIGN DURING CONSTRUCTION FOR THE RECONSTRUCTION OF CATSKILL WATERSHED DAMS AND ASSOCIATED FACILITIES



**Gannett Fleming**

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

A JOINT VENTURE

# IN-RESERVOIR BAFFLE SITE PLAN AND PROFILE

FIGURE 44