0094575

DD-48121
Revision 0

30%/60% Combined Engineering Design Package for Grouting 221-U Plant Canyon

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

RECEIVED
FEB 28 2011
EDMC

Approved for Public Release;
Further Dissemination Unlimited

Attached to: 0094575

DD-48121
Revision 0

30%/60% Combined Engineering Design Package for Grouting 221-U Plant Canyon

Date Published
January 2011

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington

Release Approval 02/03/2011
Date

Approved for Public Release;
Further Dissemination Unlimited

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

Executive Summary

This Engineering Design Package provides a 30%/60% combined package for the void space grouting[1] of the 221-U Canyon.

In October 2005, the U.S. Environmental Protection Agency (EPA), the U.S. Department of Energy (DOE), and the Washington State Department of Ecology (Ecology) agreed to disposition the 221-U Facility under a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*[2] Record of Decision (EPA et al., 2005).[3] The remedy selected to disposition the 221-U Facility comprises five major components and is expected to continue for approximately 15 years. For these reasons, it was determined that detailed remedial design packages would be produced for each major component of the remedy over the course of the remedial action.

DOE/RL-2006-21, *Remedial Design/Remedial Action Work Plan for the 221-U Facility* (Work Plan),[4] was approved in 2009. The Work Plan and a subsequent letter (Bond and Cameron, 2010)[5] addressed the preparation and submittal of intermediate 30% and 60% design information for selected components. The 30% and 60% design reports will be prepared and submitted for regulatory review as secondary documents under the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989).[6]

The five major components of the remedy include (1) equipment size reduction, (2) Cell 30 Tank 10 contents disposition, (3) canyon void space grouting, (4) canyon demolition, and (5) engineered barrier construction.

---

[1] Grout or grouting in this document refers to use of a self-consolidating concrete mixture to meet performance criteria for void space filling in the 221-U Canyon.

[2] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

[3] EPA, DOE, and Ecology, 2005, *Record of Decision 221-U Facility (Canyon Disposition Initiative) Hanford Site, Washington*, U.S. Environmental Protection Agency, U.S. Department of Energy, and Washington State Department of Ecology, Olympia, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA01060264.

[4] DOE/RL-2006-21, 2008, *Remedial Design/Remedial Action Work Plan for the 221-U Facility*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0902180737.

[5] Bond, Rick and Craig Cameron, 2010, "Joint Regulatory Agency Approval of 90% Design for Equipment Size Reduction and Placement in Cells within the 221-U Facility" (letter to Al Farabee, U.S. Department of Energy, Richland, Washington), U.S. Environmental Protection Agency and Washington State Department of Ecology, June 30. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=1007020362.

[6] Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=81.

The primary purpose of the void space grouting of the 221-U Canyon is to provide structural stability, prevent subsidence, and provide effective chemical and physical stabilization. This will help ensure effective chemical reaction with the waste, production of a monolithic block with high structural integrity, and significant reduction of waste constituent mobility/solubility.

The scope of this 30%/60% Combined Engineering Design package for void space grouting of the 221-U Canyon includes grout production (Section 2.1), grout formulation including grout performance criteria (Section 2.2), grout delivery (Section 2.3), and grouting sequence (Section 3). In some cases, the information provided in this document goes beyond that required for a 30% or 60% design and is consistent with the 90% design requirements.

The primary performance criteria are based on the production of a minimum compressive strength with high flow properties, and a relatively low heat of hydration. The design also provides for an onsite batch plant with a capacity to produce and deliver 160 yd^3 of grout per hour through specific delivery locations to the canyon. A preliminary grout formulation has been developed that is expected to meet the performance criteria, but the final grout formulation will be submitted as part of the 90% design.

Grouting of the 221-U Canyon has been designed with the following specific objectives:

- Grouting the most contaminated areas of the canyon first
- Grouting the lowest points in the canyon liquid waste disposal system to prevent potential releases
- Grouting the process cells and internally contained equipment to prevent vessels from becoming buoyant
- Grouting in a manner and sequence that promotes the continued operation of the canyon ventilation system until nearly all of the void space grouting is complete

The 30%/60% Combined Engineering Design Package provides a sound basis for the execution and completion of the void space grouting of the 221-U Canyon and enables the remedy to proceed to the canyon demolition phase of the remedial action.

Contents

1 Introduction 1

1.1 Purpose 2

1.2 Scope 2

1.3 Document Organization 2

2 Grout Production, Formulation, and Delivery Remedial Design 3

2.1 Grout Production 3

2.2 Grout Formulation 3

2.3 Grout Delivery Design 7

3 Grouting Methodology and Sequencing Design 9

3.1 Grouting Methodology 9

3.2 Grouting Sequence 9

3.2.1 Drain Header 9

3.2.2 Process Sewer 11

3.2.3 Buoyant Vessels 11

3.2.4 Process Cells 11

3.2.5 Hot Pipe Trench 15

3.2.6 Electrical Gallery 15

3.2.7 Piping Gallery 15

3.2.8 Ventilation Tunnel 15

3.2.9 Vent Ducts to Stack 15

4 References 21

Appendices

A 90% Summary Design Presentation ..... A-i

B Scope and Technical Specification of the Request for Proposal ..... B-i

C Supporting Engineering Design Drawings ..... C-i

Figures

Figure 1. 221-U Canyon Facility Photograph 1
Figure 2. Location of Grout Production Batch Plant 4
Figure 3. Locations for Grout Pumping Skids 8
Figure 4. Location of Drain Header 10
Figure 5. Location of Process Sewer 12
Figure 6. Location of Buoyant Vessels 13
Figure 7. Location of Process Cells 14
Figure 8. Location of Hot Pipe Trench 16
Figure 9. Location of Electrical Gallery 17
Figure 10. Location of Pipe Gallery 18
Figure 11. Location of Ventilation Tunnel 19
Figure 12. Location of Vent Ducts to Stack and Sand Filter 20

Tables

Table 1. Grout Quantities by Location 3
Table 2. Preliminary Grout Mix Design 6

Terms

ASTM	American Standard Test Method
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
HRWRA	High Range Water Reducing Admixture
N/A	not applicable
RD/RA	remedial design/remedial action
RDR	remedial design report
ROD	Record of Decision
Work Plan	*Remedial Design/Remedial Action Work Plan for the 221-U Facility*

1 Introduction

In October 2005, the U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE), and Washington State Department of Ecology (Ecology) agreed to disposition the 221-U Facility under a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* Record of Decision ([ROD]; EPA et al., 2005, *Record of Decision 221-U Facility [Canyon Disposition Initiative] Hanford Site, Washington*). The remedy selected to disposition the 221-U Facility involves a number of different activities over a period of approximately 15 years. For this reason, it was determined that detailed remedial design report (RDR) packages would be produced for each major component of the remedy over the course of the remedial action. Figure 1 provides an aerial photograph of the 221-U Facility. The five major components of the remedy include: (1) equipment size reduction, (2) Cell 30 Tank D-10 disposition, (3) canyon void space grouting,[1] (4) canyon demolition, and (5) engineered barrier construction.

Figure 1. 221-U Canyon Facility Photograph

DOE/RL-2006-21, Remedial Design/Remedial Action (RD/RA) Work Plan for the 221-U Facility (Work Plan) was approved in February 2009. The Work Plan documents, "As stated in Topic 3 of the Hanford Federal Facility Agreement and Consent Order (HFFACO) Resolution of Dispute Agreement at the Inter-Agency Management Integration Team Level for the 221-U Facility RD/RA Work Plan, dated June 26, 2008, design documents that are 30% and 60% completion will be HFFACO secondary documents and follow the HFFACO 9.2.3 Secondary Documents review process. A copy of this resolution agreement is attached in Appendix A of this document."

[1] Grout or grouting in this document refers to use of a self-consolidating concrete mixture to meet performance criteria for void space filling in the 221-U Canyon.

In a June 30, 2010, letter to the U.S. Department of Energy, Richland Operations Office, EPA and Ecology documented "Joint Regulatory Agency Approval of 90% Design for Equipment Size Reduction and Placement in Cells within the 221-U Facility," and clarified expectations for other design deliverables (Bond and Cameron, 2010). The expectations are listed as follows:

- Specific regulator involvement
- Actual 90% designs in the form of officially transmitted draft RDR addenda
- Establishment of screening criteria for the use of low-risk rubble to offset resource needs for building the engineered surface barrier
- Process to involve public, stakeholder, and Tribal Nations feedback

1.1 Purpose

The purpose of this 30%/60% Combined Engineering Design Package is to provide Remedial Design information for the canyon void space grouting component of the selected remedy for the 221-U Facility. The requirements for canyon void space grouting in the 221-U Facility ROD are as follows:

> *Cementitious grout will be pumped into the galleries, cell drain header, process cells, and tanks containing residual materials to the maximum extent practical, to minimize the potential for void spaces and to reduce the mobility, solubility, and/or toxicity of the grouted waste. Grout amendments, such as fly ash or zeolite clays, and the cost-benefit of using soil cement grout mixture will be considered during final design for grouting activities to reduce the potential for leaching of radioisotopes, while maintaining desirable properties of portland cement (e.g., flowable, structural grout with good compressive strength).*

This design package was prepared to provide the basis for meeting the requirements of the 221-U Facility ROD for canyon void space grouting and substantial detail describing the actions to complete the grouting component of the selected remedy.

1.2 Scope

The scope of this 30%/60% Combined Engineering Design Package for void space grouting of the 221-U Canyon includes grout production, grout formulation including grout performance criteria, grout delivery, and grouting sequence.

In some cases, the information provided in this document may exceed the 30% and 60% design level and may be consistent with the 90% design required for each component of the remedy.

1.3 Document Organization

This document is organized as follows: Section 2 provides remedial design information supporting grout production, formulation, and delivery. Section 3 provides the description of the methodology and sequencing for void space grouting of the 221-U Canyon. Appendix A contains the 90% Summary Design Presentation for Void Space Grouting of the 221-U Canyon. Note that design changes have been made since issuance of that presentation and are reflected in this document. Appendix B contains the scope and technical specification from the Request for Proposal for the grout production, formulation, and delivery services. Appendix C contains engineering design drawings supporting the 221-U Canyon void space grouting.

2 Grout Production, Formulation, and Delivery Remedial Design

The sections that follow provide available remedial design information for the onsite production of grout, the performance requirements and formulation of the grout, and the methods for delivery of grout to the 221-U Canyon.

2.1 Grout Production

An onsite batch plant will be used to produce grout to fill void spaces within the 221-U Canyon. Figure 2 identifies the location of the batch plant to be used for grout production. The batch plant location is directly north of the 221-U Canyon and provides easy access to the canyon and necessary onsite resources needed to support grout production.

The batch plant will be designed to provide a minimum of (160 yd^3) of grout per hour. The batch plant location shall also provide storage space to stockpile sufficient grout materials to support efficient production operations. This location is also expected to be used to manage wastewater generated by the batch plant and equipment cleaning operations. Table 1 identifies the grout volume estimates required to fill the 221-U Canyon void spaces. Volume estimates for each location are considered to be +25 or –25 percent, resulting in a total grout volume estimate of between 15,239 and 25,398 yd^3.

Table 1. Grout Quantities by Location

Location	Quantity (cubic yards)
Drain Header	110
Process Sewer	93
Buoyant Vessels	670
Process Cells	6,084
Hot Pipe Trench	1,029
Electrical Gallery	4,497
Piping Gallery	4,314
Ventilation Tunnel	2,940
Vent Ducts to Stack	581
Total	**20,318**

Remaining elements of the grout production remedial design to be provided with the 90% design include the final grout formulation and testing program, final layout of the batch plant and stockpile, and the provisions for management of wastewater.

2.2 Grout Formulation

A preliminary grout mix has been developed to fill void spaces within the 221-U Canyon. The primary purpose of canyon void space grouting is to provide structural stability, prevent subsidence, and provide effective chemical and physical stabilization. This will help ensure effective chemical reaction with the waste, production of a monolithic block with high structural integrity, and significant reduction of waste constituent mobility/solubility.

The development of this grout formulation was based on meeting the following set of performance criteria:

- Minimum Compressive Strength—1,500 lbs/in.^{2} at 28 days
- Minimum Flow Distance—24 m (80 ft)
- Maximum Heat of Hydration—not greater than-10°C (13°F) for 45 kg (100 lb) of cement

These performance criteria were developed to create a flowable, structural grout with good compressive strength capable of filling void spaces within the canyon to the maximum extent practicable.

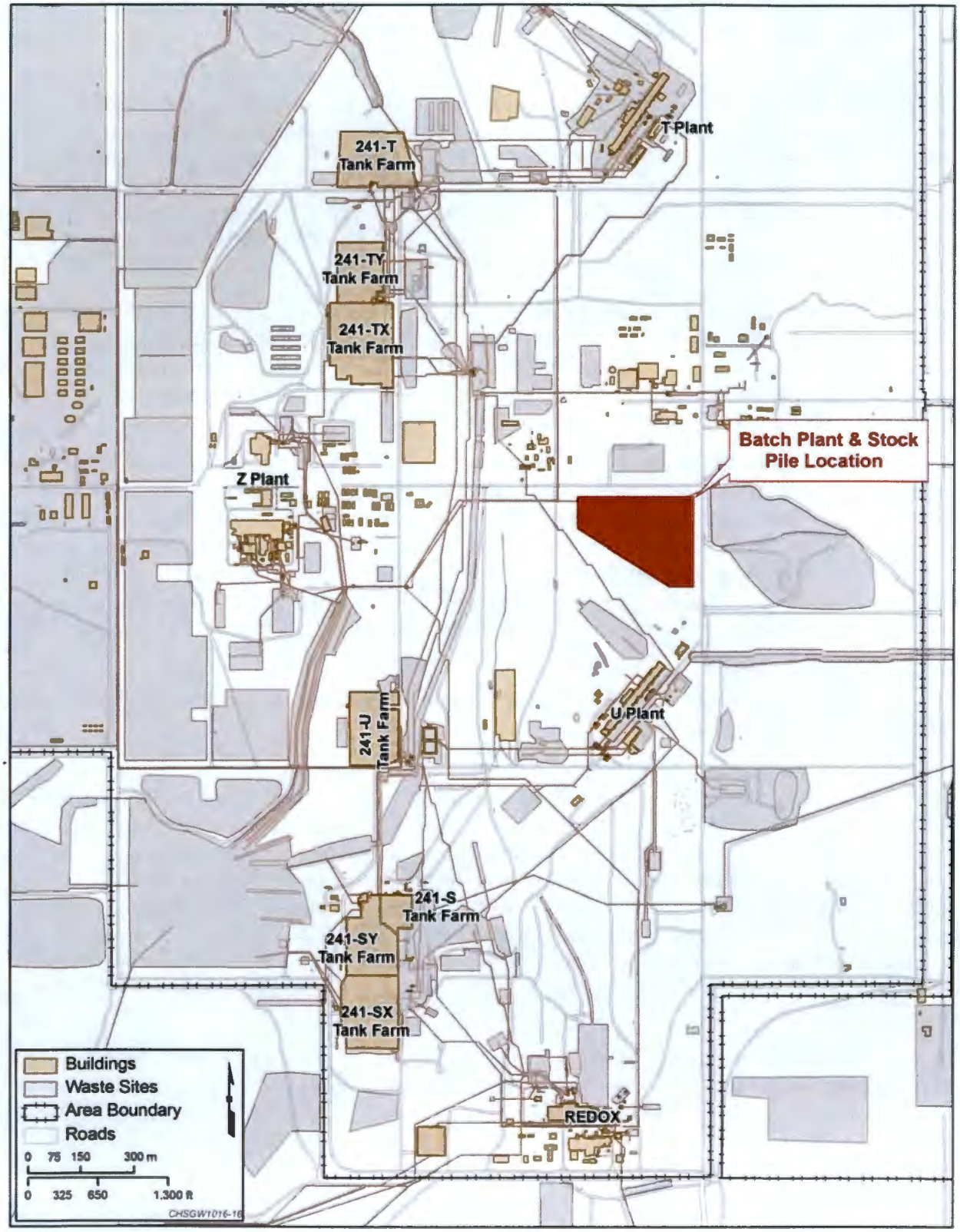


Figure 2. Location of Grout Production Batch Plant

The three performance criteria were determined based upon the conceptual design, assumptions for the proposed environmental barrier, and an engineering control for thermal stress in the existing structure and the new grout.

The 1,500 psi compressive strength at 28 days was determined by estimating the expected loads to which the canyon will be subjected during the construction and completion of the environmental barrier. The stress created when the rubblized walls are placed on top of the canyon's operating deck, the stress created by the initial construction equipment loads on top of the rubble, and the overburden itself were all factored into the estimate. The ROD stated that a flowable structural grout with good compressive strength will be used. Given this information, an estimate was developed for 1,500 psi at 28-day compressive strength to meet these requirements.

The minimum flow distance of 24 m (80 ft) was given to the contractor based on the number of core holes to be drilled into the vent tunnels to allow for all voids to be grouted from a minimum of two directions where physically possible. Nine core holes spaced in the 182 m (600 ft) of ventilation tunnel to allow for grout to be placed and still account for the angle of repose from a grout that is expected to flow 24 m (80 ft). This consideration was based on a balancing of efficiencies.

The heat of hydration performance criterion was derived to add an engineering control where an expected amount of heat can be assumed and managed by controlling the volume that flows into the canyon. The lift depth of each pour, and the amount of time allowed for the heat of hydration to dissipate both provide methods for controlling the heat rise in the canyon and the new grout. Other qualitative criteria have been identified for consideration in the development of grout for use in filling canyon void spaces. These criteria are focused on the chemical properties of the grout that reduce the mobility, solubility, and/or the toxicity of the contaminants within the grouted waste. The criteria will be defined further after the final grout formulation is developed.

Table 2 provides a preliminary grout mix designed to achieve the quantitative and qualitative performance criteria for filling canyon void space.

A review was performed during the 30%/60% Grout Design development to evaluate the potential use of fly ash from the two coal-fired steam plants located in the 200 Area at Hanford as one component in the grout formulation. It was determined that approximately 15 tons of fly ash remained as a result of past coal plant operations. No data are available to determine the quality of the onsite fly ash and whether it meets American Standard Test Method (ASTM) C618–08a, *Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete*, Class F requirements. Based on the preliminary grout formulation, 4,200 tons of fly ash will be needed to produce the 20,000 yd^3 of grout required to grout the 221-U Canyon Facility. The onsite fly ash represents less than one-half of 1 percent of that needed to grout the canyon and would require extensive testing to ensure the fly ash meets the required specifications.

The onsite fly ash piles were collected and hydraulically deposited to pits. As such, the fly ash component has been hydrated and will not function as a pozzolonic material as does commercial fly ash collected from bag houses at coal-fired plants. Hence, the fly ash fraction of this material has little value for 221-U Facility grout formulations.

Table 2. Preliminary Grout Mix Design

Material	Specification	Amount
Cement	ASTM C150/C150M–09, Type II only, low heat of hydration	(175 lb/yd^3)
Fly Ash	ASTM C618–08a, Class F only (< 5% CaO)	(150 lb/yd^3)
Water/Cement Ratio	N/A	0.4 cement content (cement + fly ash wt.)
Coarse Aggregate[a]	ASTM C33/C33M–08, natural gravels only. Crushed gravels are not allowed.	
Fine Aggregate[a]	ASTM C33/C33M–08 manufactured sand is not allowed.	Materials passing 200 sieve: 4 percent maximum
Water Reducing Admixture[b]	ASTM C494/C494M–10, Type A or Type D	
HRWRA[c]	ASTM C494/C494M–10, Type F or Type G	

Source:

ASTM C150/C150M–09, 2009, *Standard Specification for Portland Cement.*

ASTM C618–08a, 2008, *Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.*

ASTM C33/C33M–08, 2008, *Standard Specification for Concrete Aggregates.*

ASTM C494/C494M–10, 2010, *Standard Specification for Chemical Admixtures for Concrete.*

a. The contractor shall not use the bottom 6 in. of the coarse or fine aggregate stockpiles.

b. Acceptable water-reducing admixture manufacturers are BASF Admixtures Inc., Shakopee, MN; Pozzolith or Polyheed; W.R. Grace & Co., Cambridge, MA, WRDA with HYCOL; or Euclid Chemical Co., Cleveland, OH, Eucon WR-91.

c. Acceptable HRWRA manufacturers are BASF Admixtures Inc., Shakopee, MN, Rheobuild or Polyheed; W.R. Grace & Co., Cambridge, MA, Daracem 100; or Euclid Chemical Co., Cleveland, OH, Eucon 537. Use anti-washout admixture in accordance with manufacturer's recommendations.

Although the bag houses in Hanford Site power houses may have once contained fly ash suitable for use as grout, they were apparently emptied during deactivation. The few collection bags that have been opened were confirmed to have been emptied. Furthermore, the amount of fly ash that could have possibly been retained in the bag houses is insufficient and not cost effective to sample, test, and retrieve. The maximum quantity of fly ash that the 284E and 284W bag houses could possibly contain would have only amounted to approximately 1.5 percent of the total quantity required, assuming that the fly ash meets specifications and all bags were completely full of suitable material. Furthermore, sampling and testing would be required to determine whether the material meets ASTM C618–08a Class F fly ash requirements. The costs to sample, test, and retrieve any fly ash remaining in the bag houses grossly exceed any savings offset from not having to purchase this minor amount of fly ash.

For these reasons, onsite fly ash was not considered further for use in the void space grouting of the 221-U Canyon.

This preliminary grout formulation provides the basic mixture of grout materials capable of meeting the performance criteria identified for grouting the 221-U Canyon Facility void spaces. The final grout formulation and the testing program to ensure the grout meets the performance criteria will be provided with the 90% Remedial Design. Applicable ASTM grout specifications consist of the following:

- ASTM C31/C31M–09, *Standard Practice for Making and Curing Concrete Test Specimens in the Field*
- ASTM C33/C33M–08, *Standard Specification for Concrete Aggregates*
- ASTM C39/C39M–09a, *Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens*
- ASTM C94/C94M–10, *Standard Specification for Ready-Mixed Concrete*
- ASTM C150/C150M–09, *Standard Specification for Portland Cement*
- ASTM C192/C192M–07, *Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory*
- ASTM C311–07, *Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete*
- ASTM C403/C403M–08, *Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance*
- ASTM C1077–10c, *Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation*

2.3 Grout Delivery Design

The design for delivery of grout to the 221-U Canyon is based on establishing 12 specific pumping locations along the canyon and near the exterior ventilation system. Figure 3 identifies the 12 locations selected for delivering grout to the canyon void spaces.

The design capacity for pumping and delivery of grout to the canyon is based on the operation of two pumps with a minimum 80 yd^3 per hour capacity and the piping necessary to deliver that quantity along the canyon exterior, through the canyon area, to the cells, galleries, and all other grout placement locations.

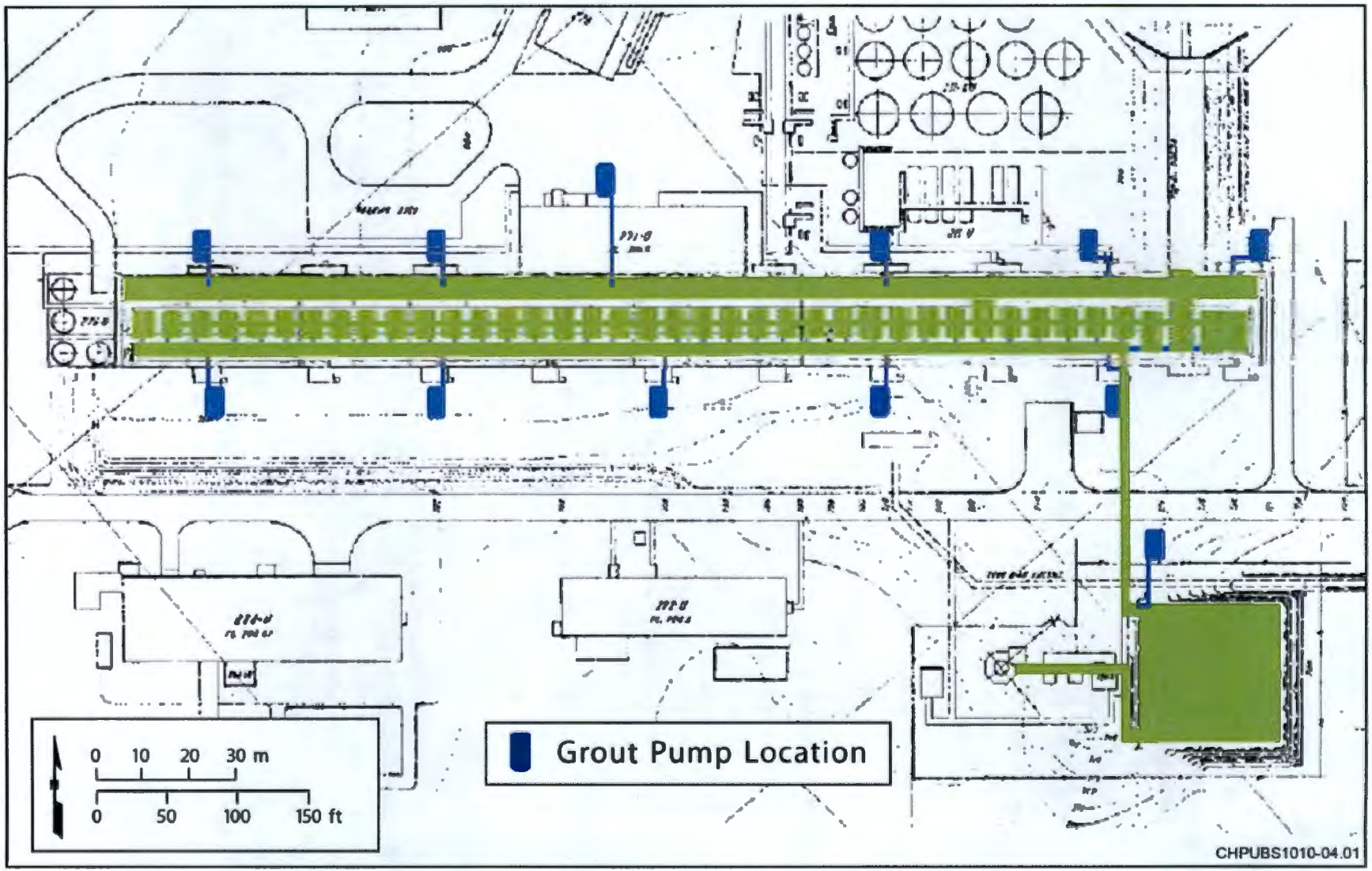


Figure 3. Locations for Grout Pumping Skids

3 Grouting Methodology and Sequencing Design

Void space grouting of the 221-U Canyon will begin with grouting a test cell (Cell 10). Grouting will then proceed with the most contaminated areas. Grouting the remaining void spaces will proceed in the following sequence:

- Cell drain header and process sewer
- Process cells, including the buoyant vessels
- Hot pipe trench
- Electrical and piping galleries
- Ventilation tunnel, vent duct, sand filter cap, and the vent ducts to the stack

The primary goals of sequencing the void space grouting in this manner are to grout the most contaminated areas first and grout the process waste system to prevent any future releases from the canyon. In addition, this sequence allows the canyon ventilation system to remain operational through most of the grouting process, thus reducing the potential for airborne contamination and enhancing worker protection during the grouting operations.

The sections that follow describe the methodology and sequencing of the void space grouting operation.

3.1 Grouting Methodology

The most contaminated areas of the canyon structure will be grouted first to encapsulate radiological and hazardous substances remaining in the canyon. Prior to the initiation of grouting operations, equipment on the canyon deck will be size reduced, as needed, and placed into the process cells. The cell drain header, process cells, and the bottom of the hot pipe trench will then be grouted first to isolate these contaminated areas. As the process cells are grouted, vessels with large cavities will be filled with grout to prevent them from becoming buoyant and moving within the cell. In addition to the large cells and void spaces, other small openings and connecting pipes will also be filled to isolate contaminants within these areas. The sequence for filling these smaller void spaces is dependent on delivering grout to these spaces, while promoting ventilation of trapped air to ensure that these voids are filled to the maximum extent practicable.

3.2 Grouting Sequence

The grouting sequence was designed to ensure that the voids within the canyon would be filled to the maximum extent practicable. Although this grouting sequence provides the basic order for completing canyon void space grouting, some of the activities and grouting operations will likely be performed concurrently. A description of the important actions and considerations for grouting each of the areas of the canyon follows.

3.2.1 Drain Header

The cell drain header runs the length of the canyon below the process cells and drains into a tank in Cell 10. The drain header will be grouted first to prevent the flow of contaminated materials from the cells into the cell drains in each cell. Figure 4 shows the relative location of the drain header and access line to the process cells. Grout will be directed through the cell drain in Cell 10 then fill the drain header from every second or third process cell until the drain header is completely full.

Drain Header

Remote Access Only
Low Point of the Canyon

▪ **Drain Header**	**110 CY**
▪ Process Sewer	93 CY
▪ Buoyant Vessels	670 CY
▪ Process Cells	6,084 CY
▪ Hot Pipe Trench	1,029 CY
▪ Electrical Gallery	4,497 CY
▪ Piping Gallery	4,314 CY
▪ Ventilation Tunnel	2,940 CY
▪ Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

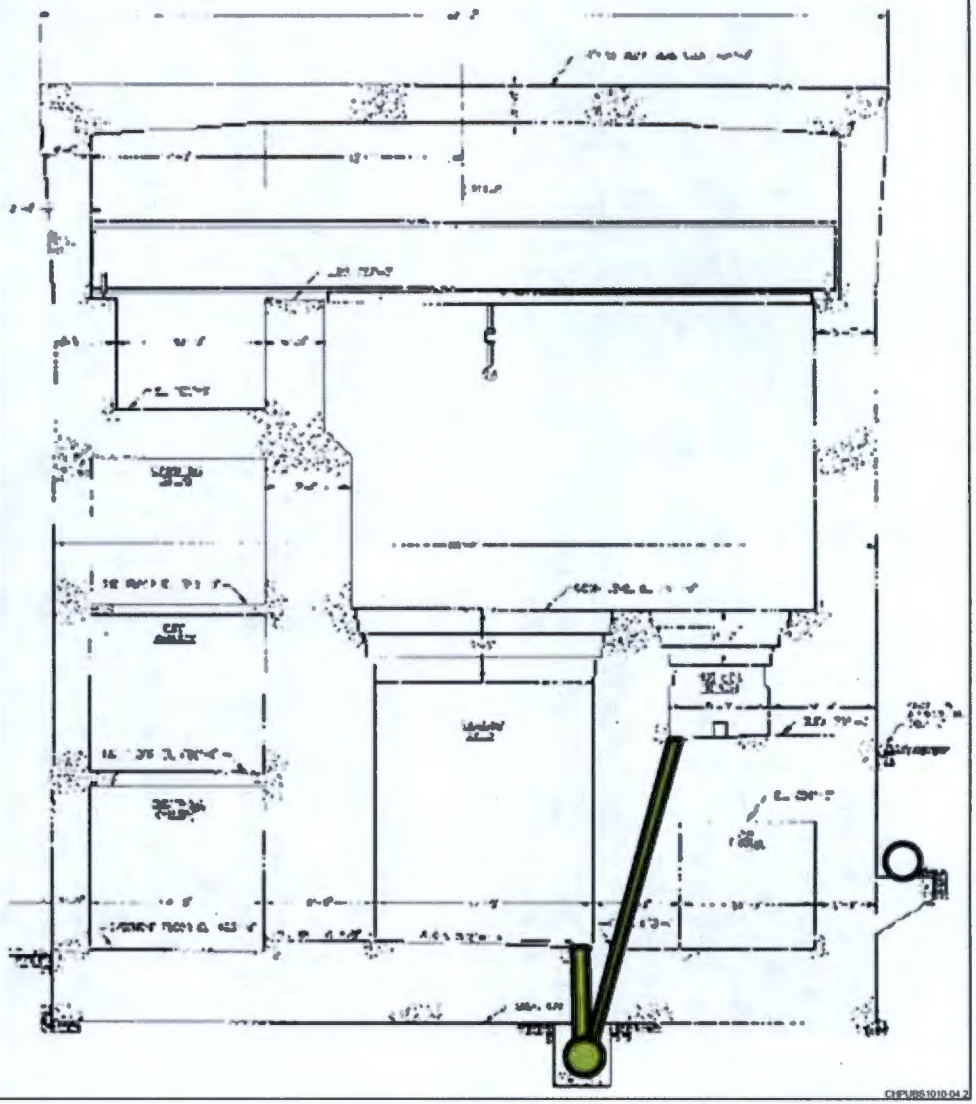


Figure 4. Location of Drain Header

3.2.2 Process Sewer

The exterior 60 cm (24 in.) diameter process sewer pipe that runs the entire length of the canyon will be excavated and exposed at the low end of the sewer at the southwest end of the 221-U Canyon. Figure 5 provides a schematic of the process sewer and the areas to be grouted. The approach to grouting the process sewer is to pressure pump the grout into tremie pipes in the exposed pipe end. A plug in the process sewer outlet fitted with a series of tremie pipes will be used to force grout through the header upward until it surfaces in the individual pipes in the process cells. Once grout appears in the monitored process cells, the process sewer will be considered filled.

3.2.3 Buoyant Vessels

The first step in grouting the process cells will be to place free-flowing grout into the open tops of vessels contained within the process cells to prevent them from floating during flood grouting of the cells. Figure 6 provides a schematic of the type of vessels that will require grouting prior to placing grout in the process cell.

3.2.4 Process Cells

The process cells will be grouted after the cell drain header, the process sewer, and buoyant vessels are completed. The canyon crane will be operational to support grouting operations. The overhead crane will be used to deliver grout to the process cells from the grout pump locations adjacent to the canyon. The delivery system will be a combination of fixed steel pipe and flexible hose affixed to the steel pipe. The grout transfer lines will then be positioned using the crane to allow grout to be pumped into the cells. Figure 7 provides a graphic depiction of a process cell filled with grout.

After equipment within the cells is filled to prevent buoyant conditions, a 0.9 to 1.8 m (3 to 6 ft) thick layer of grout will be placed in the bottom of the cell and allowed to set. A second lift will then be placed in the cell to a level just above the level of the vent pipes leading to the ventilation tunnel and allowed to set. Grout will not be allowed to flow into the ventilation pipes. Where necessary, ventilation pipes will be plugged or extended above the expected grout level. A third lift will then be placed to fill the cell to the 90 percent level just below the cover block. A final lift of non-aggregate grout can then be placed in the cell to a level just slightly above the bottom of the cover. The cover blocks can then be replaced to fill the remaining air space and seal each cell into a concrete monolith.

Some process cells will require specific actions to facilitate void space filling. Cell 2 and Cells 4 through 39 can be grouted through the open top after cover blocks have been removed with the canyon crane. Cell 3 is open to the rail tunnel and cannot be grouted separately from the tunnel without placement of a barrier to hold grout in the cell. Since the rail tunnel is to be demolished, a bulkhead will be installed at the exterior wall of the canyon so as not to allow grout placement in Cell 3 to flow into the rail tunnel. The present configuration of the bridge crane will not permit lifting of the cover blocks on Cell 1 and Cell 40. Cell 1 will be grouted through an opening in Cell 2. The slave crane located over Cell 40 prevents access to that cell from the bridge crane. Holes will be drilled through the cover blocks to inject grout into the cell and allow air trapped in the cell to escape.

Process Sewer

External Access by Manholes
Low Point of the Canyon

Drain Header	110 CY
Process Sewer	**93 CY**
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

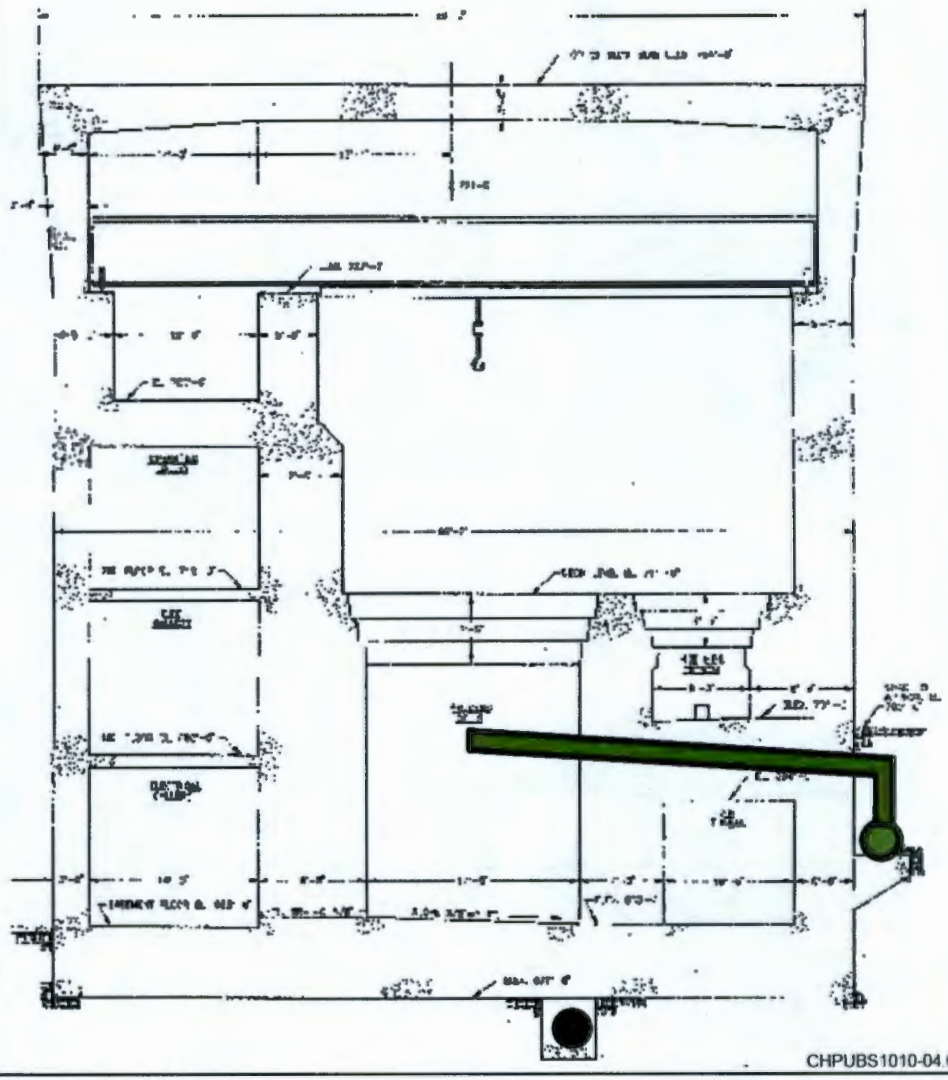


Figure 5. Location of Process Sewer

Buoyant Vessels

Remote Access Only
FNAVFS Required

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	**670 CY**
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

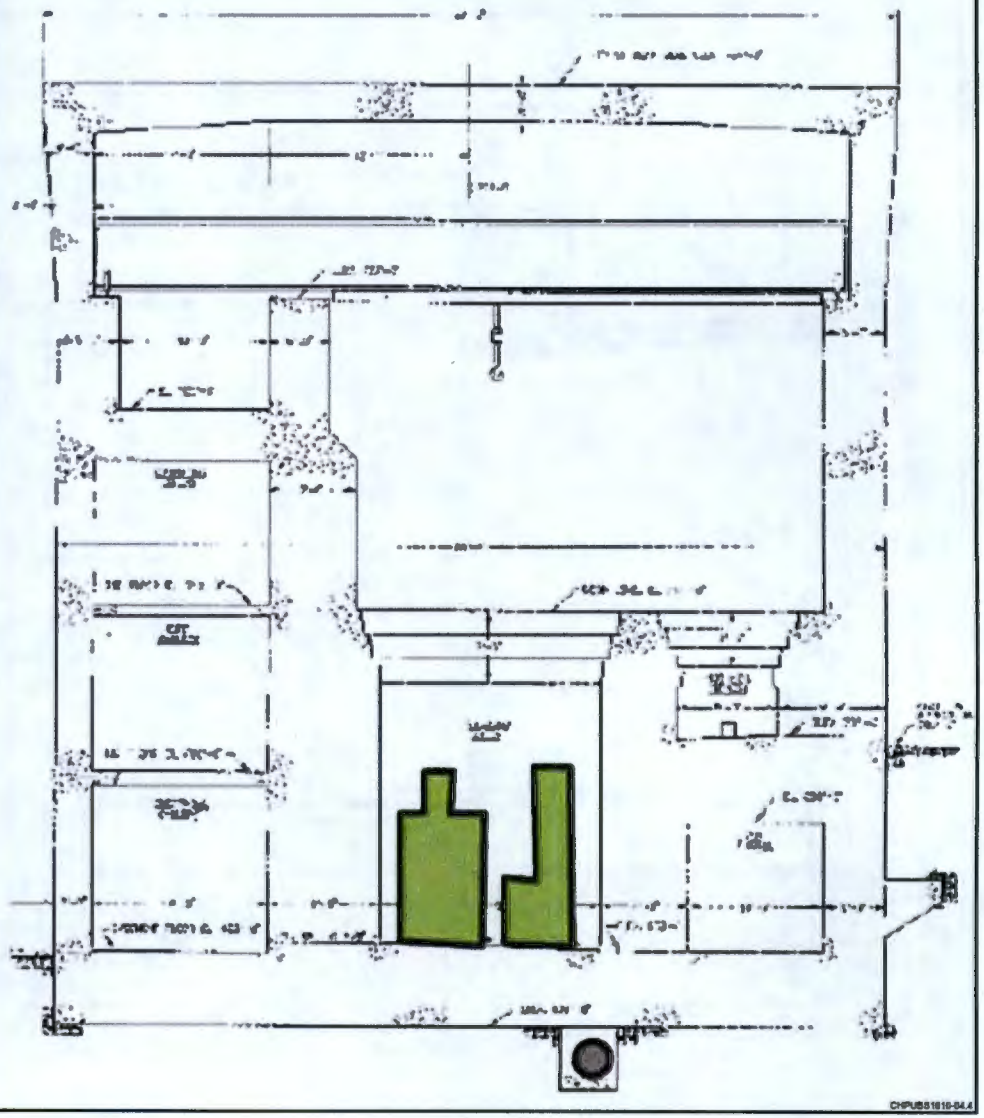


Figure 6. Location of Buoyant Vessels

Process Cells

Buoyant Vessels Filled First
Remote Access Only
Placed in Lifts

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	**6,084 CY**
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

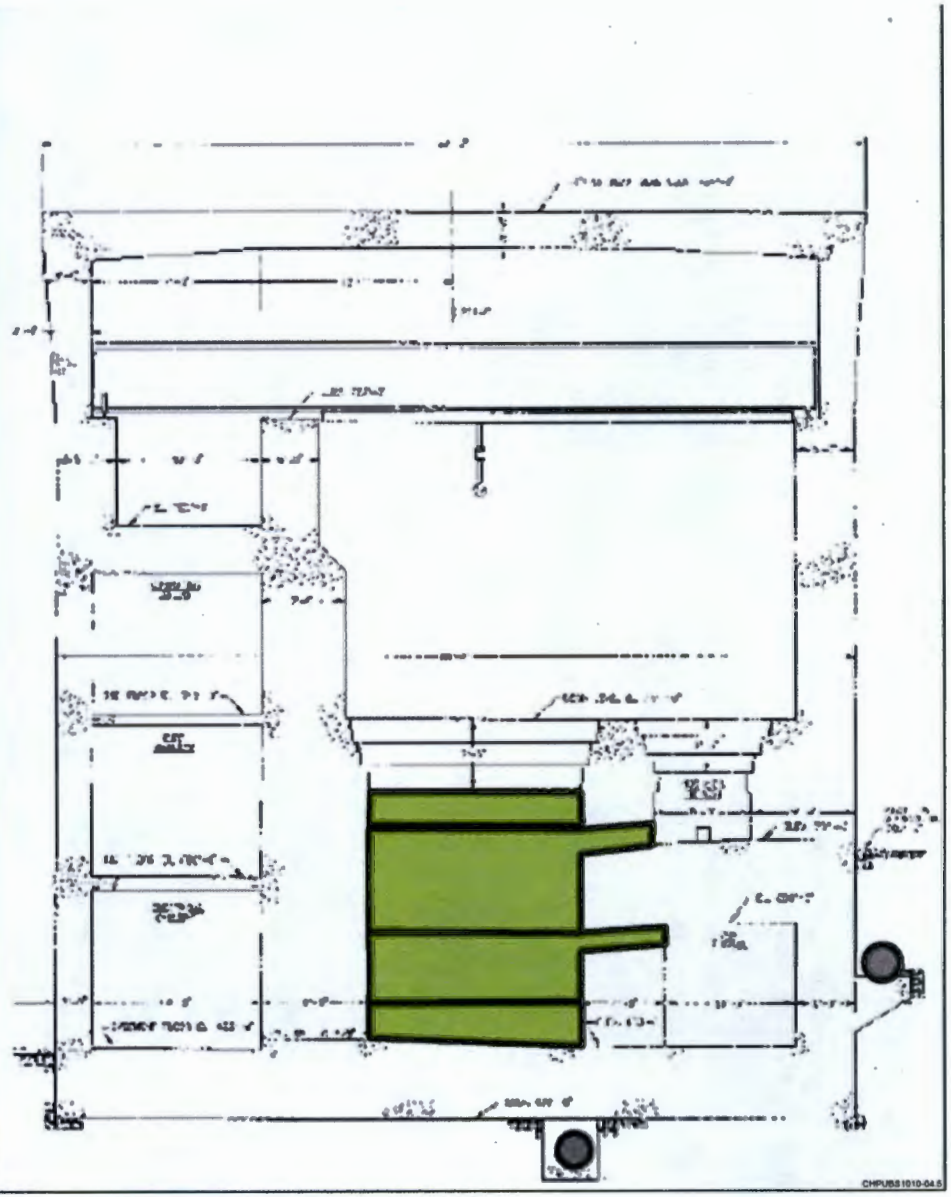


Figure 7. Location of Process Cells

3.2.5 Hot Pipe Trench

The hot pipe trench is a highly contaminated portion of the canyon requiring void space grouting. Figure 8 identifies the relative location of the hot pipe trench. As with the process cells, the pipe trench is connected to the ventilation tunnel through numerous vent pipes. Some vent pipes in the hot pipe trench will be plugged to prevent grout from flowing into the ventilation tunnel while others will be fitted with pipes to allow air from the canyon deck to exhaust through the ventilation tunnel. This will allow the ventilation system to remain operational after grouting of the hot pipe trench is complete. These vents may also be used later to grout the ventilation tunnel and are anticipated to be placed approximately every 15 m (50 ft) along the length of the tunnel.

3.2.6 Electrical Gallery

The electrical gallery is a low hazard area of the canyon with only limited amounts of existing contamination. Figure 9 shows the location of the electrical gallery beneath piping and operating galleries. Grout will be delivered to the electrical gallery through access points throughout the piping gallery. Grout will be pumped through these access points as well as through additional outlets installed in canyon walls and stairwells adjacent to the gallery. Grouting the electrical gallery could be executed concurrently with grouting the process cells. Grout in the electrical gallery will be placed in lifts and allowed to flow throughout the gallery by gravity feed. Each lift will be of limited thickness to prevent stresses on the walls and prevent the potential for outward collapse. There is no concern for collapse, because of the robust construction of the gallery and the method of introducing the grout fill in layers.

3.2.7 Piping Gallery

The piping gallery, like the electrical gallery, can be grouted through access points in the operating gallery and though other outlets in the canyon wall and other locations. After the electrical gallery is completely filled, grout will be placed into the piping gallery also using gravity feed. Figure 10 shows the location of the piping gallery directly above the electrical gallery and beneath the operating gallery.

3.2.8 Ventilation Tunnel

Grouting of the ventilation tunnel will represent the last major grouting operation within the canyon. The ventilation system will remain operational, as long as practical, to control contamination and maintain control of environmental conditions within the canyon. Figure 11 shows the location of the ventilation tunnel and the area to be grouted.

The ventilation tunnel will be grouted through ventilation pipe extensions installed in the southwest end of the hot pipe trench to prevent premature filling of the ventilation tunnel.

The ventilation pipes will also allow air trapped in the ventilation tunnel to exhaust during grouting the tunnel. After grouting the ventilation tunnel is complete, the final lift of grout will be placed in the hot pipe trench and grouting the internal canyon structure will be complete.

3.2.9 Vent Ducts to Stack

The external ventilation system for the 221-U Canyon is also planned for grouting as part of void space grouting. Figure 12 shows the three portions of the exterior ventilation system. First are the ventilation ducts leading from the ventilation tunnel in the canyon to the sand filter, 200-E-30. The sand filter is used to filter air exhausted from the ventilation tunnel. The remaining vent ducts lead from the sand filter to the stack.

Hot Pipe Trench

Access to Ventilation Tunnel by Core Drilling

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	**1,029 CY**
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

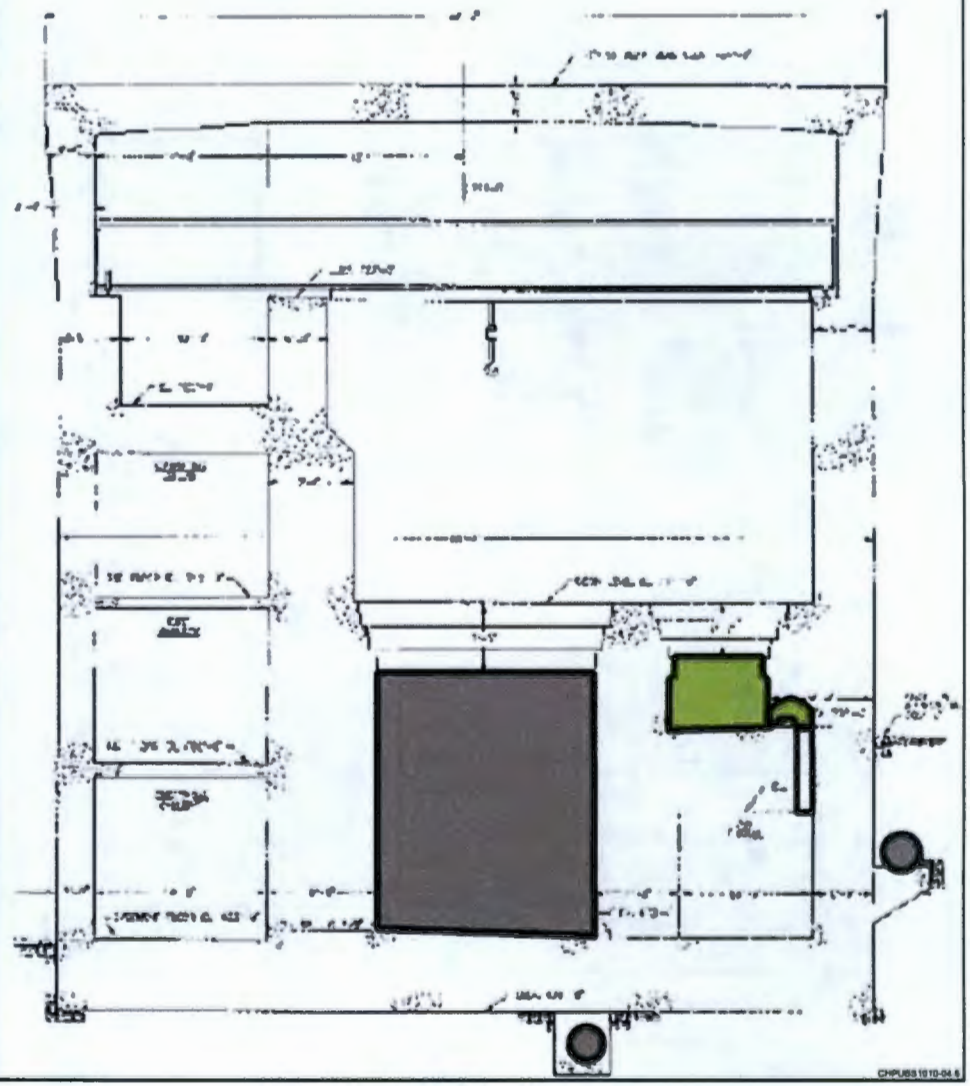


Figure 8. Location of Hot Pipe Trench

Electrical Gallery

Can be completed in parallel with the Process Cells

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	**4,497 CY**
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

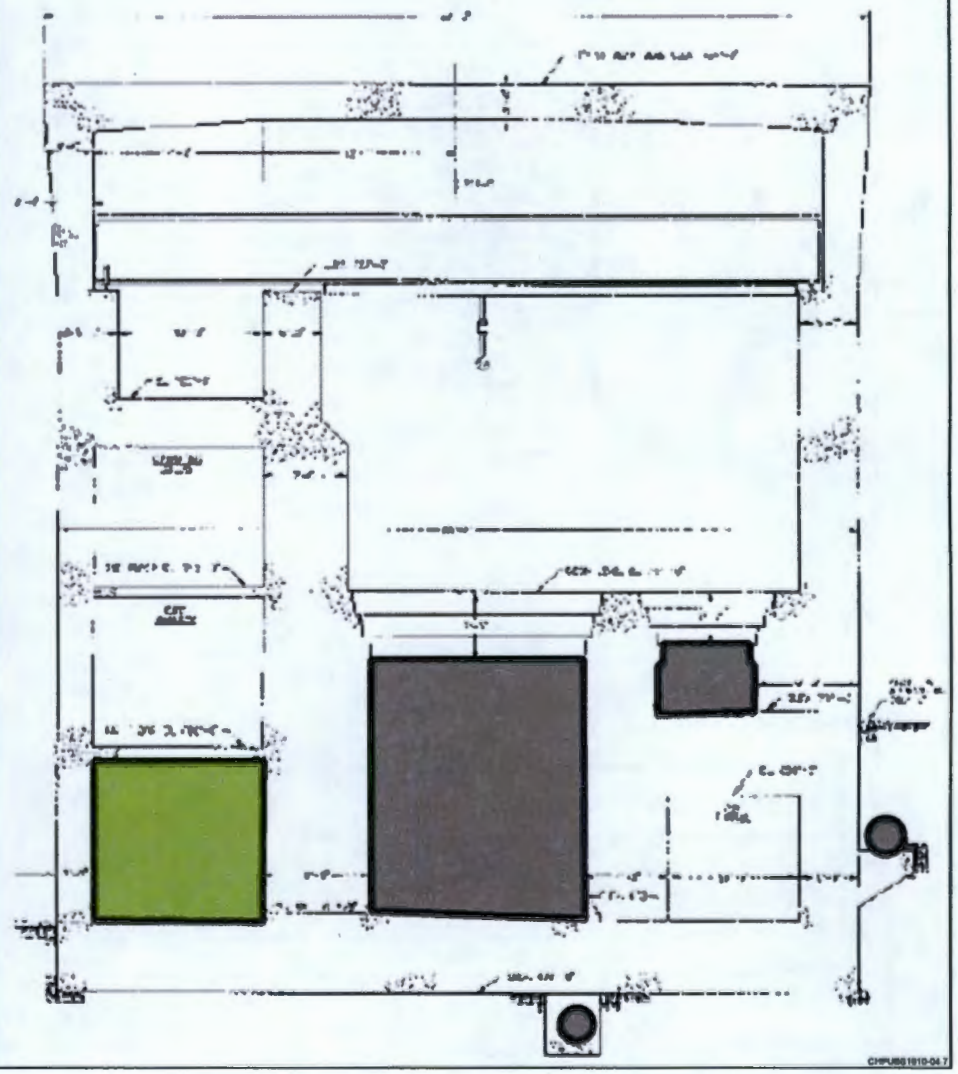


Figure 9. Location of Electrical Gallery

Piping Gallery

Can be completed in parallel with the Process Cells

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	**4,314 CY**
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

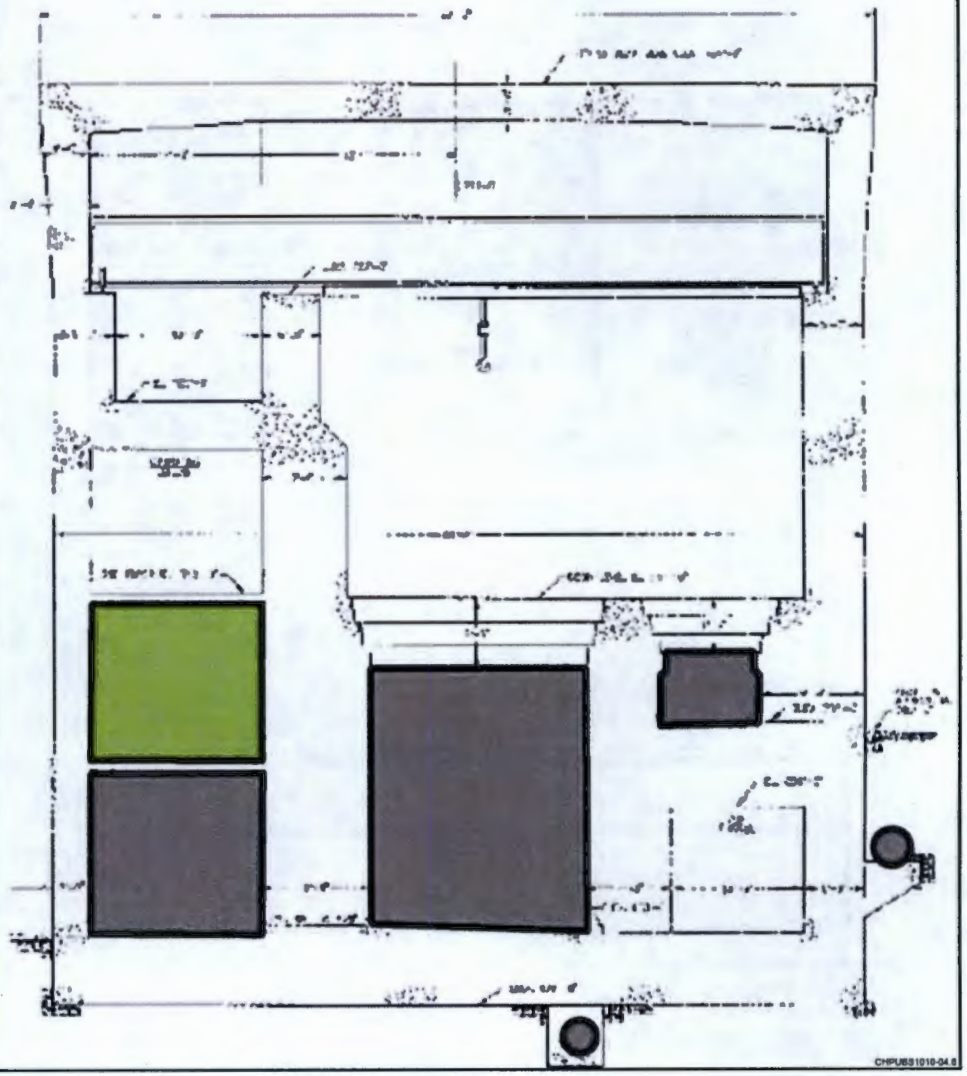


Figure 10. Location of Pipe Gallery

Ventilation Tunnel

Remote Access Only

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	**2,940 CY**
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

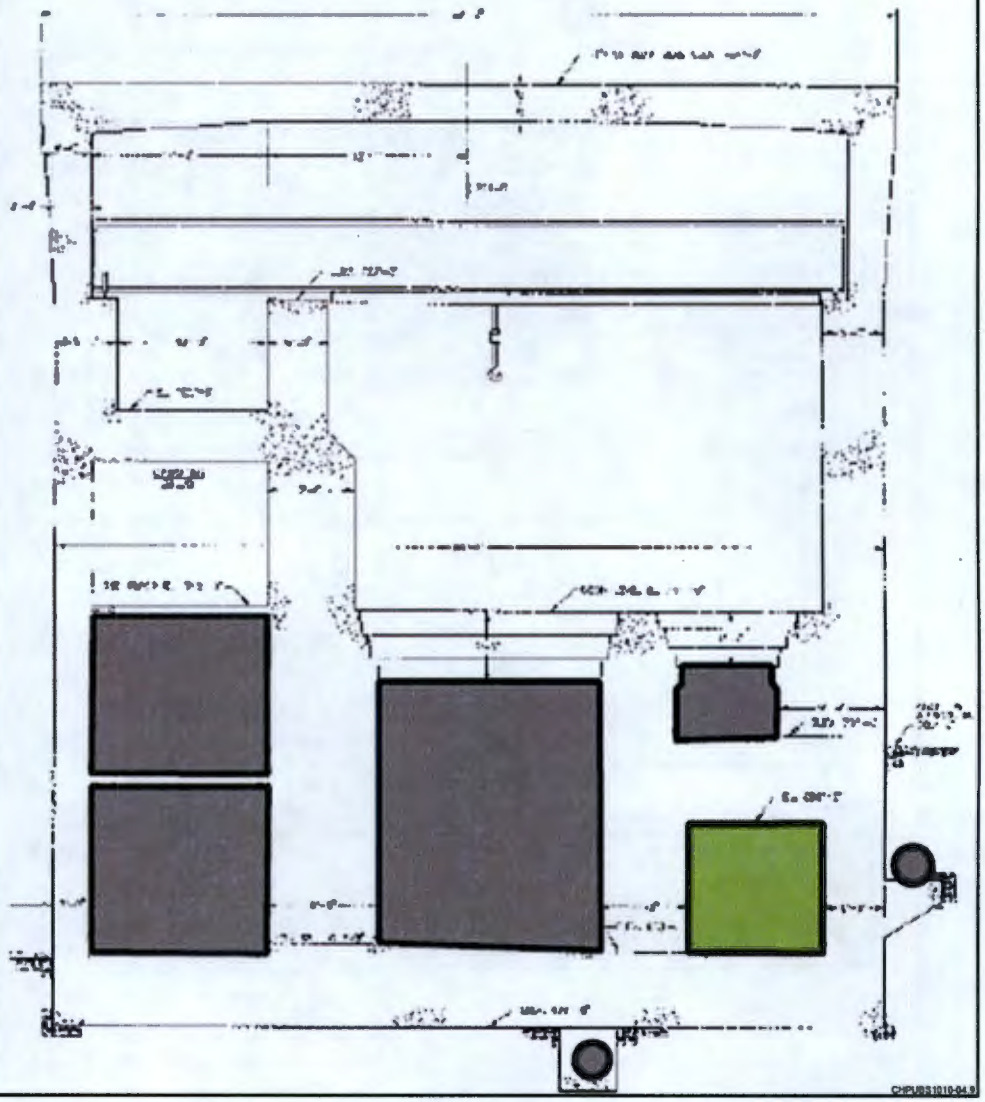


Figure 11. Location of Ventilation Tunnel

Vent Ducts to Stack

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	**581 CY***
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

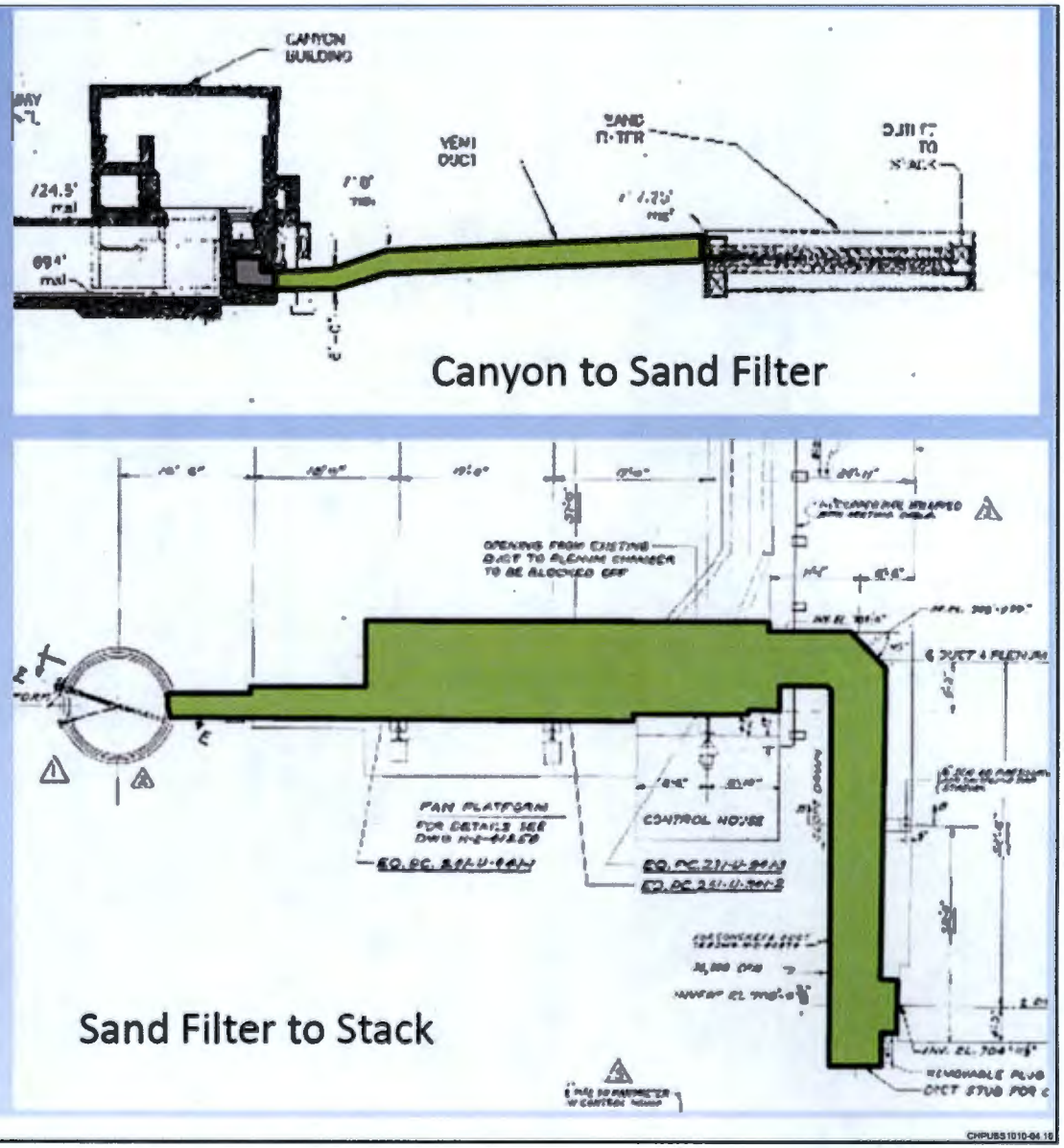


Figure 12. Location of Vent Ducts to Stack and Sand Filter

The vent ducts will be accessed through holes drilled in the roof of the vent ducts. Grout will be delivered through these access points along the length of the duct. Further evaluation will be necessary for disposition of the sand filter as it is identified through the TPA as a waste site. Additional access points will be drilled in the ducts between the sand filter and the stack and filled with grout.

4 References

ASTM C31/C31M–09, 2009, *Standard Practice for Making and Curing Concrete Test Specimens in the Field*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM C33/C33M–08, 2008, *Standard Specification for Concrete Aggregates*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM C39/C39M–09a, 2009, *Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens*, West Conshohocken, Pennsylvania.

ASTM C94/C94M–10, 2010, *Standard Specification for Ready-Mixed Concrete*, West Conshohocken, Pennsylvania.

ASTM C150/C150M–09, 2009, *Standard Specification for Portland Cement*, West Conshohocken, Pennsylvania.

ASTM C192/C192M–07, 2007, *Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory*, West Conshohocken, Pennsylvania.

ASTM C311–07, 2007, *Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete*, West Conshohocken, Pennsylvania.

ASTM C403/C403M–08, 2008, *Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance*, West Conshohocken, Pennsylvania.

ASTM C494/C494M–10, 2010, *Standard Specification for Chemical Admixtures for Concrete*, West Conshohocken, Pennsylvania.

ASTM C618–08a, 2008, *Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete*, West Conshohocken, Pennsylvania.

ASTM C1077–10c, 2010, *Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation*, West Conshohocken, Pennsylvania.

Bond, Rick and Craig Cameron, 2010, "Joint Regulatory Agency Approval of 90% Design for Equipment Size Reduction and Placement in Cells within the 221-U Facility" (letter to Al Farabee, U.S. Department of Energy, Richland, Washington), U.S. Environmental Protection Agency and Washington State Department of Ecology, June 30. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=1007020362.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

DOE/RL-2006-21, 2008, *Remedial Design/Remedial Action Work Plan for the 221-U Facility*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0902180737.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=81.

EPA, DOE, and Ecology, 2005, *Record of Decision 221-U Facility (Canyon Disposition Initiative) Hanford Site, Washington*, U.S. Environmental Protection Agency, U.S. Department of Energy, and Washington State Department of Ecology, Olympia, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA01060264.

Appendix A

90% Summary Design Presentation

Grout for 221-U Canyon Facility Voids 90% Design Summary Level Description

Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Grouting Summary

The chosen approach for grouting the canyon is to grout a test cell then to grout the most contaminated areas first, beginning with grouting of the cell drain header, the process cells, hot pipe trench, the electrical and piping galleries and completing with the ventilation tunnel, vent duct, sand filter cap, and vent ducts to the stack.

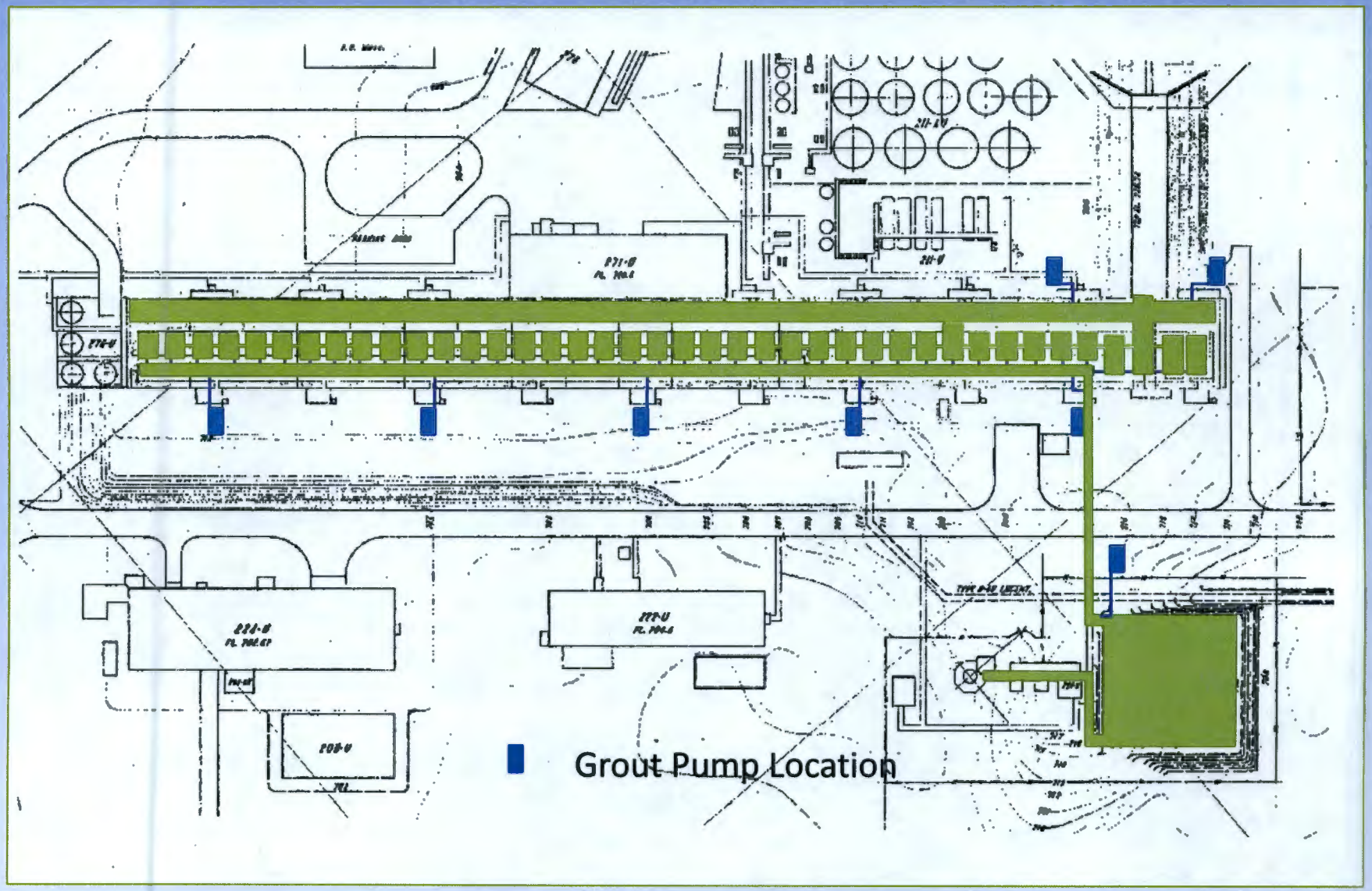
Cell 10, the internal sump cell, will be grouted first to allow for the grouting of the drain header. The cavities of equipment with large voids shall be grouted to prevent buoyancy during flood grouting of the process cells through the key block opening. After the equipment cavities are grouted, CHPRC will grout the cells in the most efficient sequence. Cell 30 and Cell 3 shall be scheduled to be grouted as allowed by the disposition of Tank D10. The hot pipe trench ventilation pipes will be plugged with selected risers installed. The ventilation pipe extensions (risers) will permit grouting the hot pipe trench while the ventilation system continues operating. The galleries shall be grouted beginning with the electrical gallery and followed by the pipe gallery. The galleries may be grouted in parallel with the process cells to maximize efficiencies. The ventilation tunnel shall be grouted last, through ventilation pipes in the hot pipe trench or from the ventilation duct outside the canyon.

Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Grouting Methodology

The higher contaminated areas of the canyon structure shall be grouted first to encapsulate the worst radiological hazards and residual waste. The cell drain header, process cells and bottom of the hot pipe trench shall be grouted after the equipment on the deck has been placed into the cells. After equipment disposition, one cover block can be left off each of the process cells and the canyon cells can be flood grouted sequentially.

The connecting pipes and other small openings between these larger canyon voids shall be filled with flowing grout using careful planning. The sequence of grouting is dependent on access to the voids to insert grout and vent entrapped air. Grout access and air vents shall be identified and grouted in a sequence that will not block grout from flowing into all the voids. The order of grouting shall ensure that all the voids in the canyon are filled to the maximum extent practical.


Grout Pump Location

Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Drain Header

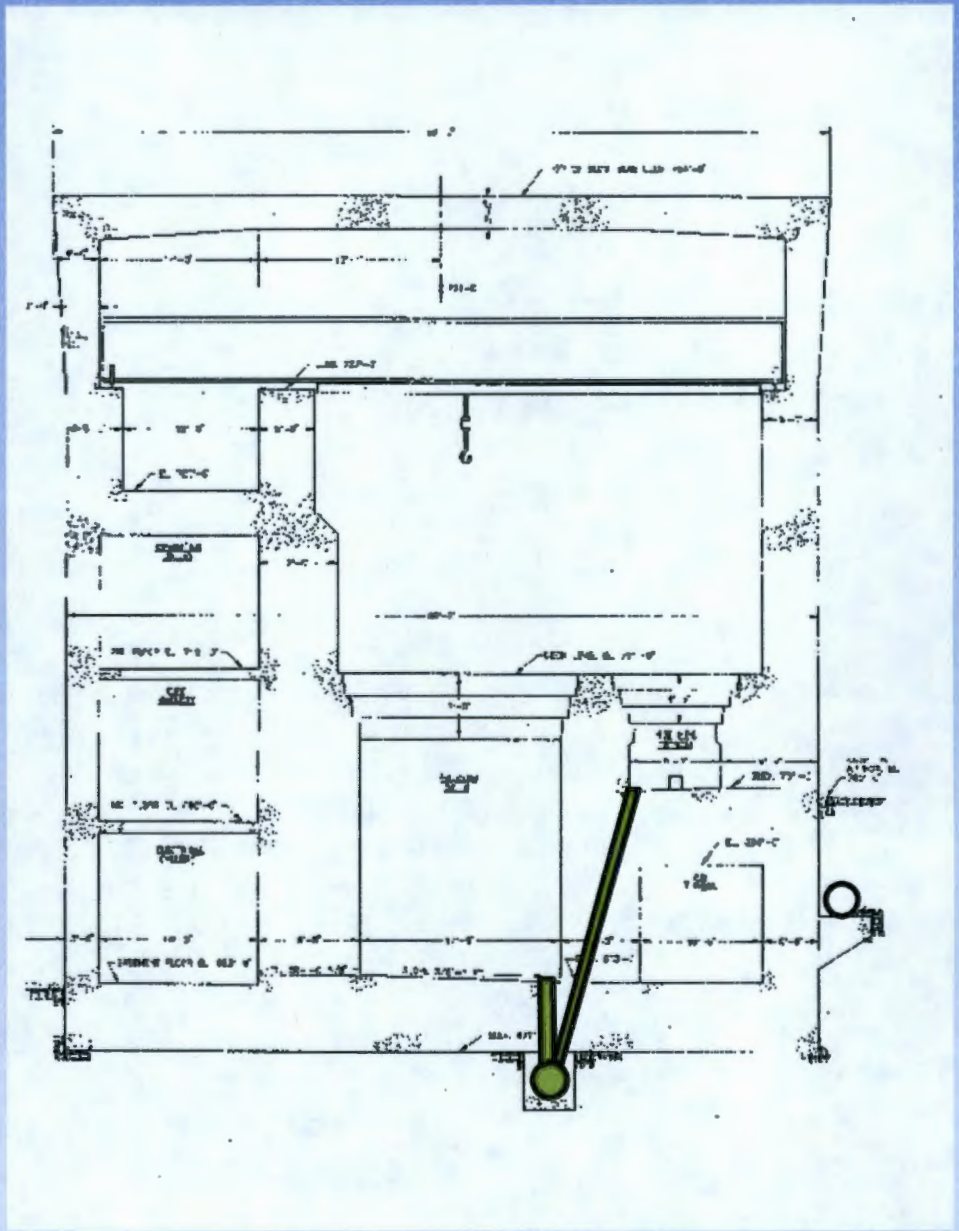
The drain header shall be grouted prior to process cell grouting. The reason for this is to ensure that the cell drains are fully grouted prior to grouting the cells. This will prevent uncontrolled flow of contaminated materials from the cells into the cell drains. If equipment is placed into the cells prior to drain header grouting, access to the cell drains will have to be provided around the equipment in the cells. A plug in the cell drain outlet in Cell 10 can force grout through the header upward until it surfaces in the cell drains. Once grout surfaces in the drains in the cells, the cell drain header can be considered fully grouted. Flowable grout will be pumped into the drain header through the cell drains. Accessing the cell drains will be difficult where cell equipment is in the way.

Drain Header

Remote Access Only
Low Point of the Canyon

Drain Header	**110 CY**
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap



Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Process Sewer

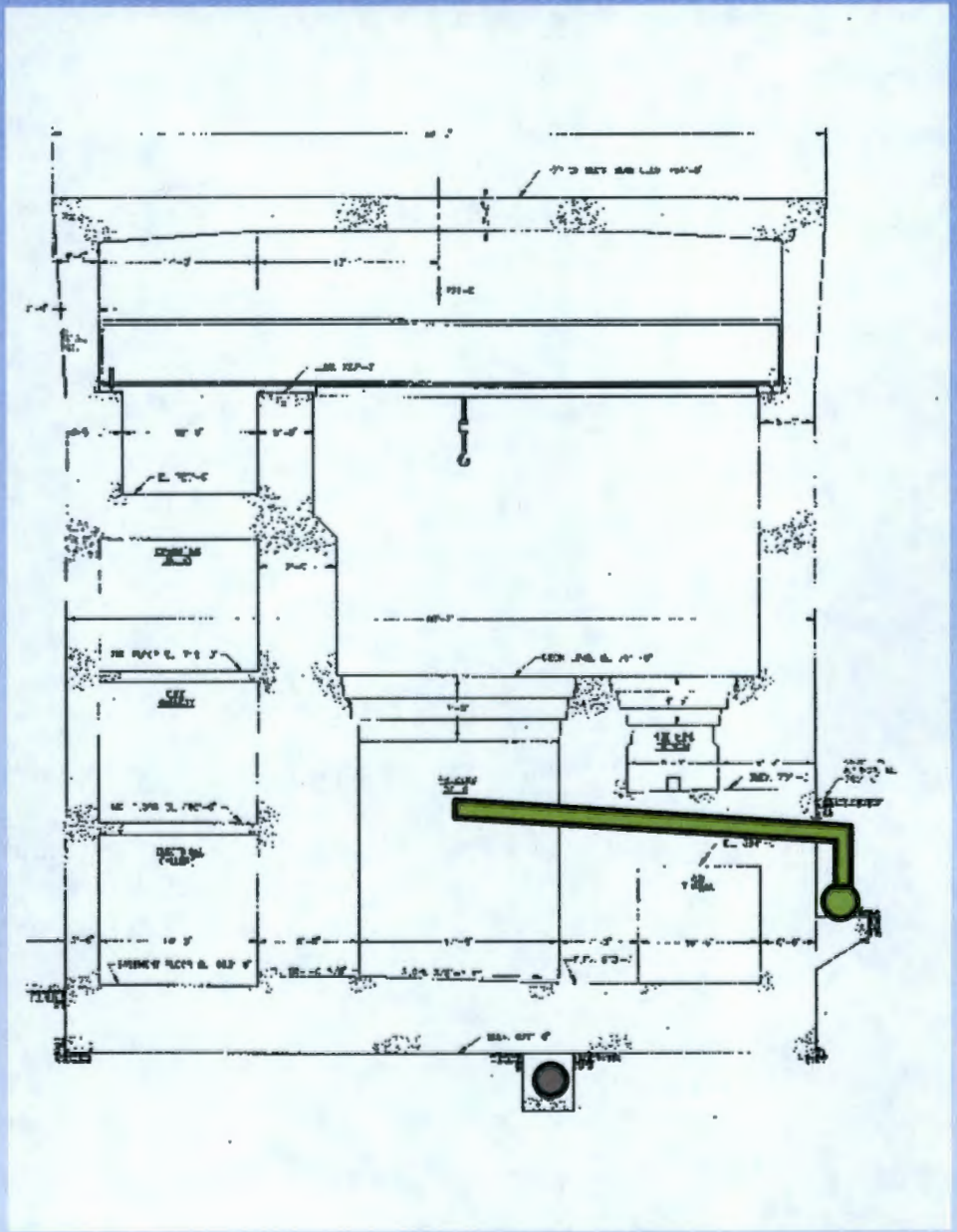
The exterior 24-in. diameter process sewer pipe which runs the entire east length of the facility shall be excavated and exposed at the low end of the sewer to the southwest of 221-U. The approach to grouting the process sewer is to pressure pump the grout into tremie pipes in the exposed pipe end. A plug in the process sewer outlet in the excavation with a series of tremie pipes can force grout through the header upward until it surfaces in the individual 6-in. diameter sewer pipes in the process cells. Once grout surfaces in monitored cells, the process sewer can be considered fully grouted.

Process Sewer

External Access by Manholes
Low Point of the Canyon

Drain Header	110 CY
Process Sewer	**93 CY**
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**
TOTAL	**21,093 CY**

*Includes Sand Filter Cap



Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Buoyant Vessels

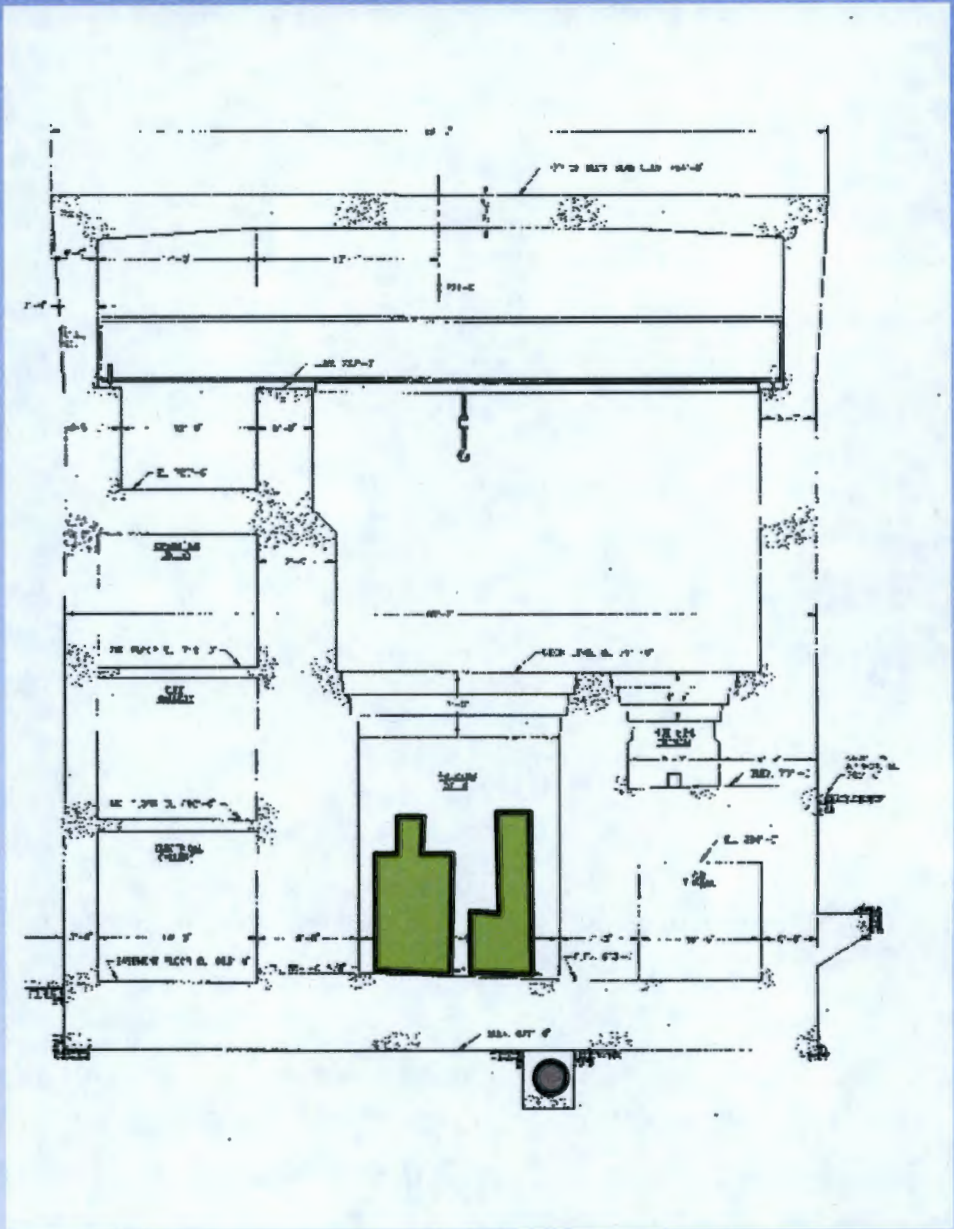
The selected approach to process cell grouting is to place a free-flowing grout into the open tops of buoyant vessels in the process cells to ensure filling of internal voids and to prevent floating during the flood grout operation.

Buoyant Vessels

Remote Access Only
FNAVFS Required

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	**670 CY**
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap



Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Process Cells

The process cells shall be grouted after the cell drain header and process sewer are grouted. The canyon crane will be operational to support grouting operations. The canyon overhead bridge crane can be utilized to direct grout from hoses into the process cells. A fixed steel pipe (slick line) can deliver grout to within several feet of the cell being grouted. A flexible hose can be affixed to the slick line and manipulated by the crane into the cell. The grout transfer lines shall be kept as short as practical to facilitate pumping.

After specified equipment in the cells is filled with grout, approximately three to six feet of grout shall be placed in the bottom of the process cells as a first lift. The grout shall then be placed in a second lift to just above the level of the vent pipes to the ventilation tunnel and allowed to set. This will prevent overflow of process cell grout through the vent pipes filling the ventilation tunnel prematurely. After the grout has set above the top of the vent pipe opening, the cells can be filled to the 90 percent level below the bottom of the cover blocks, taking care to prevent breakthrough into the ventilation tunnel. Three cover blocks can be replaced in their normal position and the remainder of the cell can be filled to just below bottom of the cover blocks. After that has set, a final lift of non-aggregate grout can be poured to a few inches above the bottom of the cover blocks and the key block can be replaced. This will permit the grout to fill the air ventilation voids between the cover blocks and seal them into the concrete monolith.

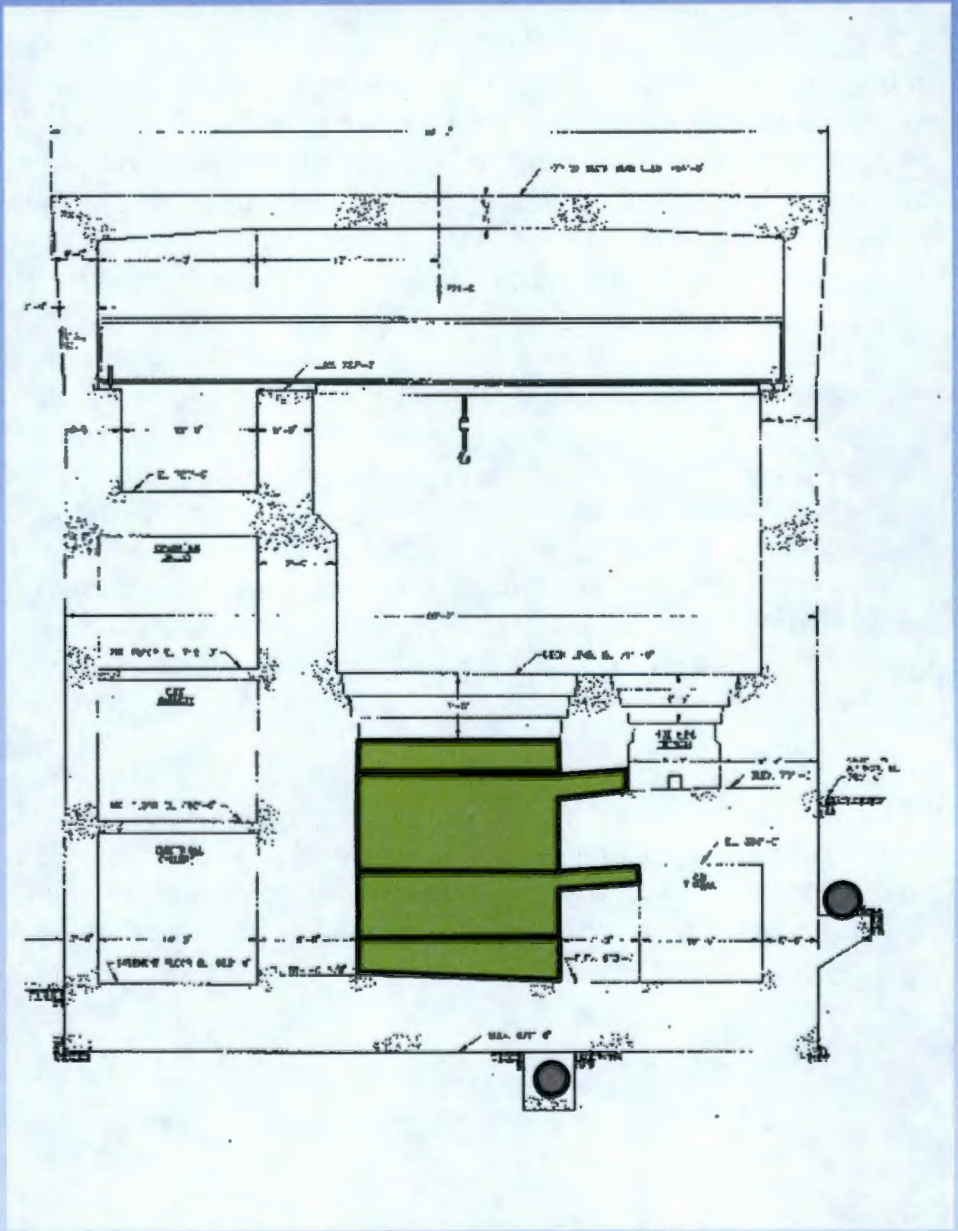
Cells 2 and 4 through 39 can be grouted through the open top after necessary cover blocks have been removed with the canyon crane. Cell 3 is open to the rail tunnel and cannot be grouted separately from the tunnel without placement of a form to hold the grout in the cell. The present configuration of the canyon bridge cranes will not permit lifting of the cover blocks on Cells 1 and 40. Cell 1 can be grouted through the opening connected to Cell 2. Trapped air should vent from Cell 1 between the cover blocks. The slave crane is currently located over Cell 40, blocking access to the cover blocks for the large crane. Holes can be drilled into the cover block to insert grout into the cell.

Process Cells

Buoyant Vessels Filled First
Remote Access Only
Placed in Lifts

▪ Drain Header	110 CY
▪ Process Sewer	93 CY
▪ Buoyant Vessels	670 CY
▪ **Process Cells**	**6,084 CY**
▪ Hot Pipe Trench	1,029 CY
▪ Electrical Gallery	4,497 CY
▪ Piping Gallery	4,314 CY
▪ Ventilation Tunnel	2,940 CY
▪ Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap



Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Hot Pipe Trench

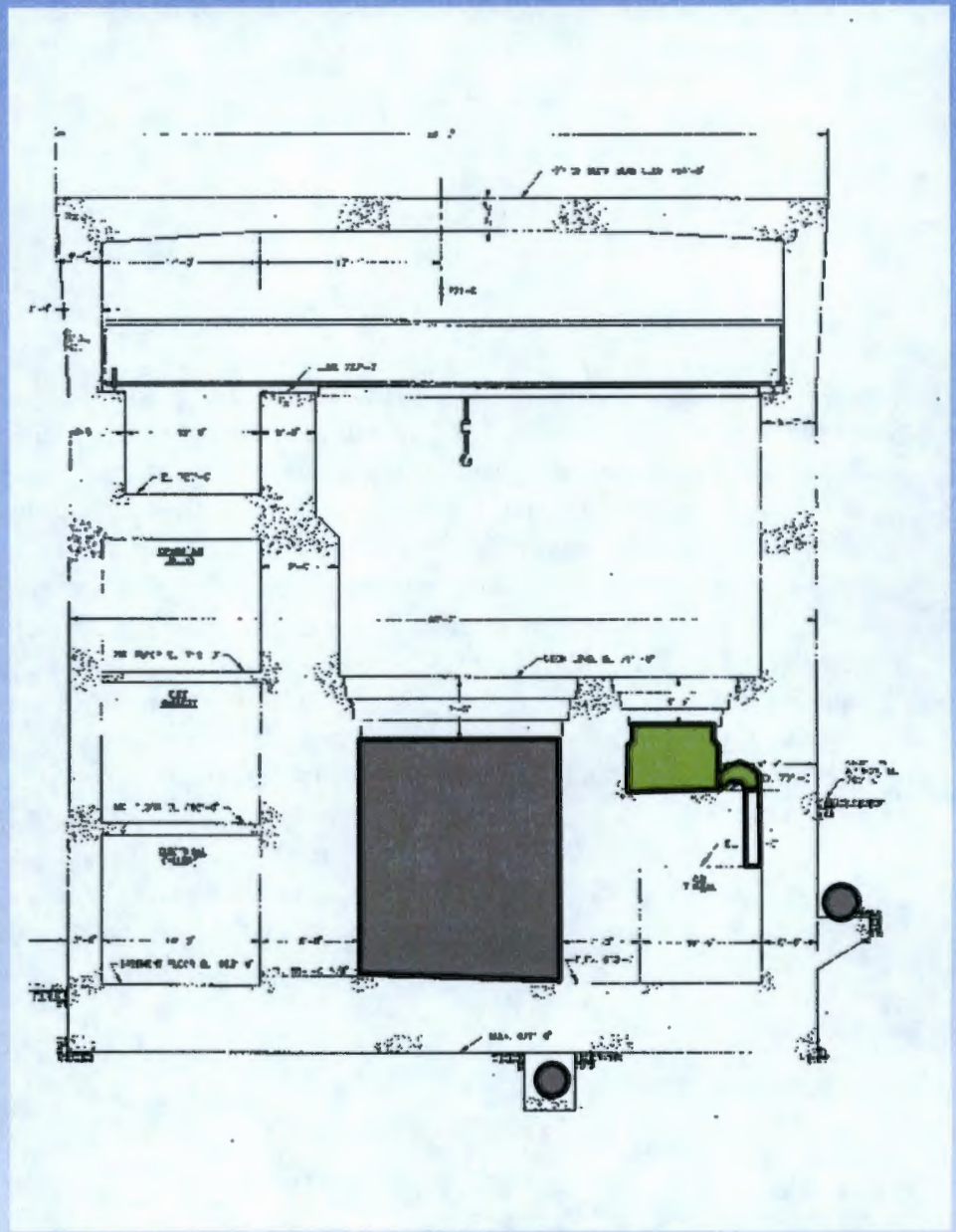
Due to its relatively high levels of contamination, the hot pipe trench shall be the next remaining void to be grouted after the process cells. Since the hot pipe trench and the ventilation tunnel are connected by vent pipes, it will be difficult to grout the two voids separately. Grout may flow into the ventilation tunnel uncontrolled through these pipes if they are grouted rapidly with a flowable grout. This premature filling of the ventilation tunnel would shut down the canyon exhaust system. Careful plugging of these vent pipes will prevent premature grouting of the vent tunnel by overflow as the hot pipe trench is grouted. The ventilation pipes exhausting the hot pipe trench form a sort of trap with an inverted U between the trench and tunnel below. Extra care and control of grout flow is needed to keep grout out of the ventilation tunnel. The bottom one or two feet of the hot pipe trench can be grouted to fix the worst contamination without grout flowing into the ventilation tunnel. The vent pipes can be plugged with a foam or low slump concrete to allow the hot pipe trench to be grouted full without simultaneously grouting the ventilation tunnel. Selected vent pipes can be extended out of the hot pipe trench above the canyon deck level with angled 10-in. pipes to provide air vents to the ventilation tunnel. These vents will permit air flow to the ventilation tunnel after the hot pipe trench has been grouted or to inject grout into the ventilation tunnel as it is grouted later if tremie pipes from the southwestern end of the ventilation tunnel fail. The spacing of these riser pipes may need to be approximately 50 ft apart.

Hot Pipe Trench

Access to Ventilation Tunnel by Core Drilling

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	**1,029 CY**
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap



Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Galleries

The low-hazard galleries shall be grouted in a sequence from the lowest elevation level (electrical gallery) to the higher elevation level (pipe gallery). The galleries can be easily filled from the bottom to top with a flowable grout through openings between the two galleries. Grout placement slick line pipes with several outlets can be installed into the galleries through the stairwells or canyon end walls onto the operating gallery down the openings to the pipe gallery and electrical gallery. Lifts of grout will flow laterally from these outlets throughout the gallery by gravity. After the lowest gallery is completely filled, the grout pipe can be abandoned and a new pipe placed into the pipe gallery. Air entrapped in the lower galleries can easily vent into the operating gallery.

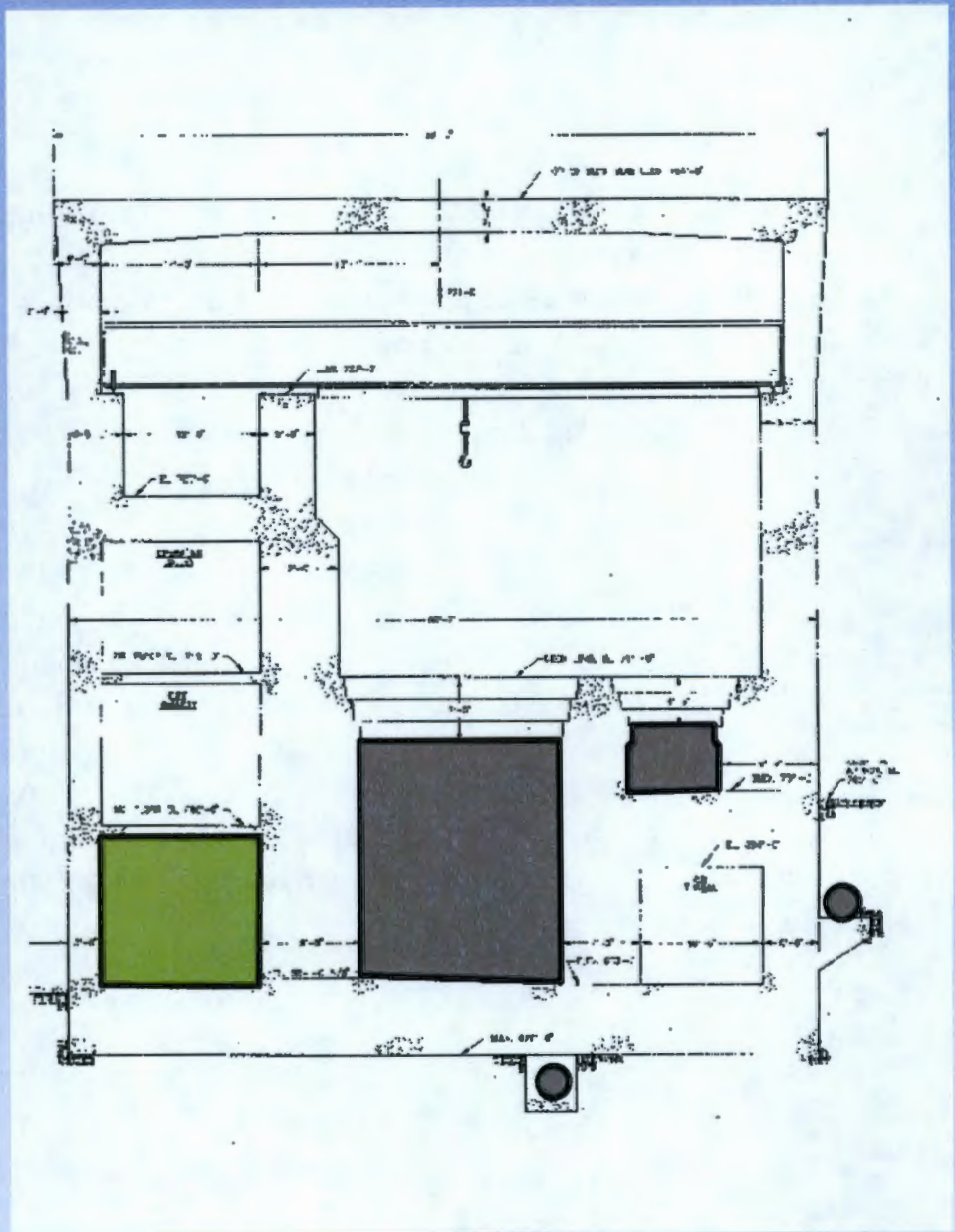
Care shall be used while grouting the galleries to prevent potential damage to the outer 3-foot wall of the galleries. Structural analysis indicates that a 14-foot deep lift of fluid grout can induce stresses above the allowable limit for an unsupported wall. The grout will need to be poured in lifts, or poured slowly to permit the lower grout to develop cohesive strength to prevent potential outward collapse. It would be very impractical to attempt to grout a gallery continuously. Practical constraints of grout mixing and transport will virtually ensure that the lower lifts of grout have set up before two or three feet of grout have been poured in a shift.

Electrical Gallery

Can be completed in parallel with the Process Cells

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	**4,497 CY**
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap

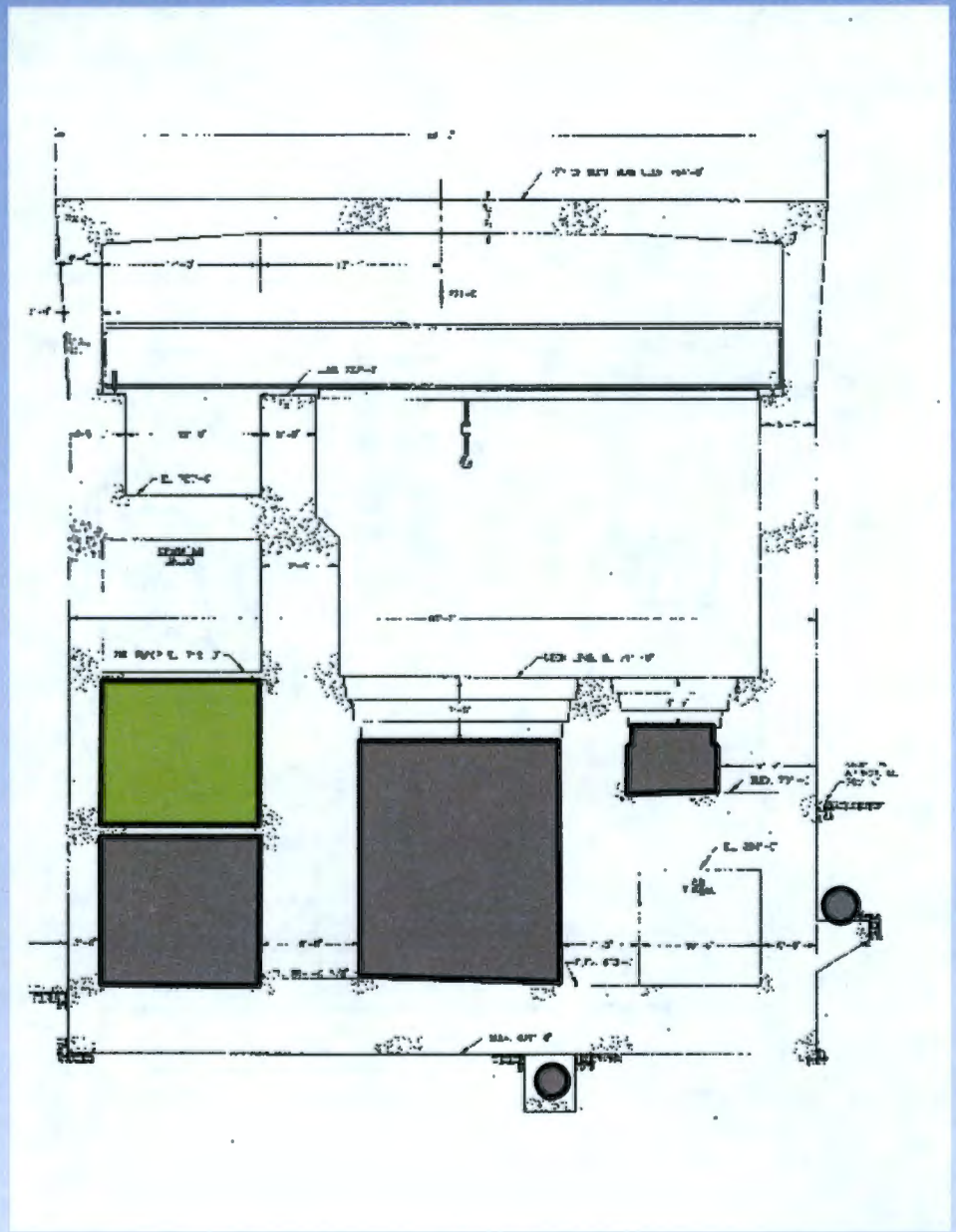


Piping Gallery

Can be completed in parallel with the Process Cells

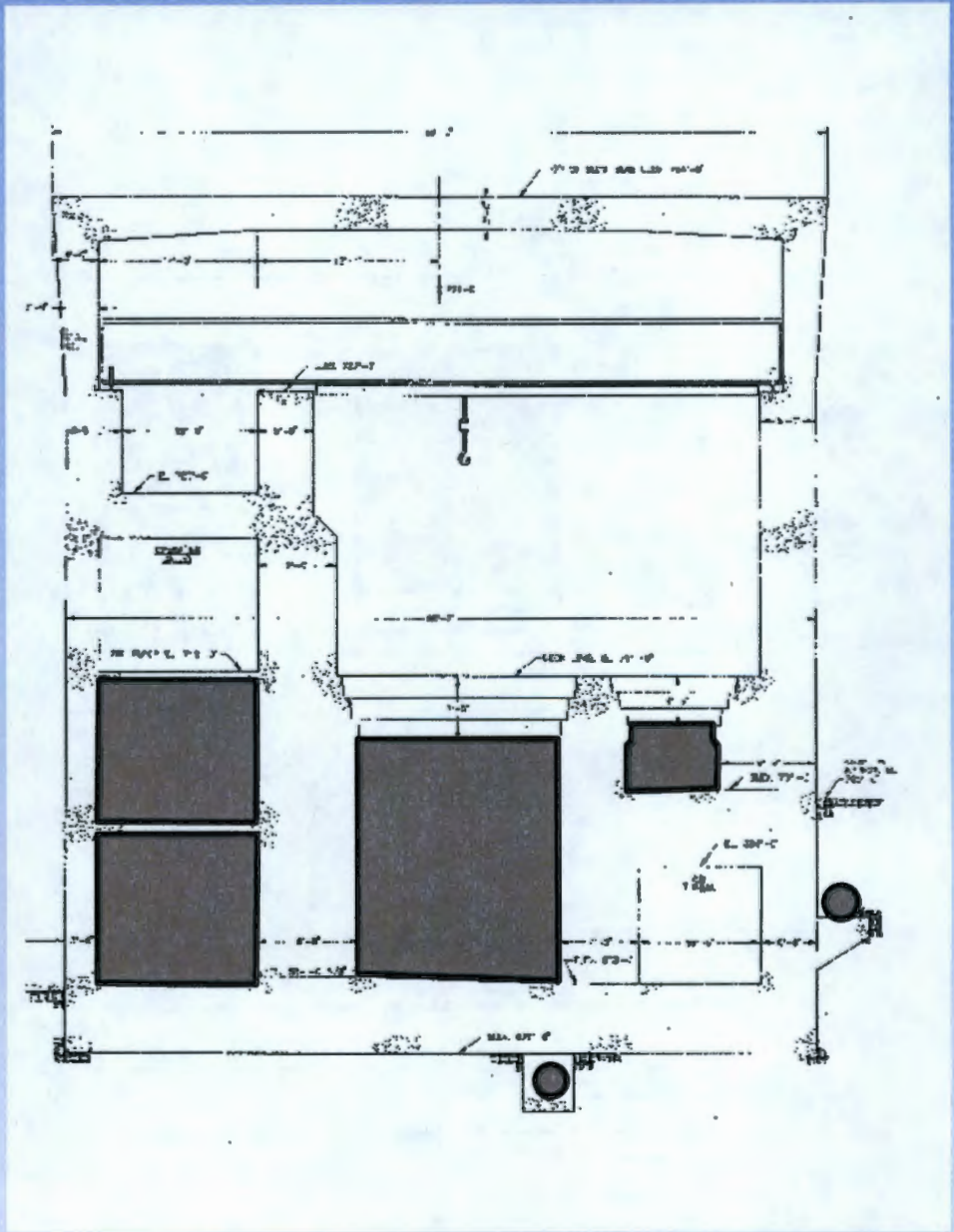
Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	**4,314 CY**
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap



Operating Gallery (Optional)

To be demolished



Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Ventilation Tunnel

The bottom of the hot pipe trench shall be grouted to encapsulate the worst contamination. Since the hot pipe trench is connected to the ventilation tunnel with ventilation pipes, it will be difficult to grout the upper portion of the hot pipe trench without grout flowing through the vent pipes and filling the ventilation tunnel. A good option is to fill the ventilation tunnel with grout through one of these hot pipe trench vent pipes at the southwest end of the ventilation tunnel and let the grout flow toward the ventilation duct. These ventilation pipes also provide an outlet for trapped air as the ventilation tunnel is grouted. The top section of the hot pipe trench will be flood grouted subsequent to the filing of the ventilation tunnel.

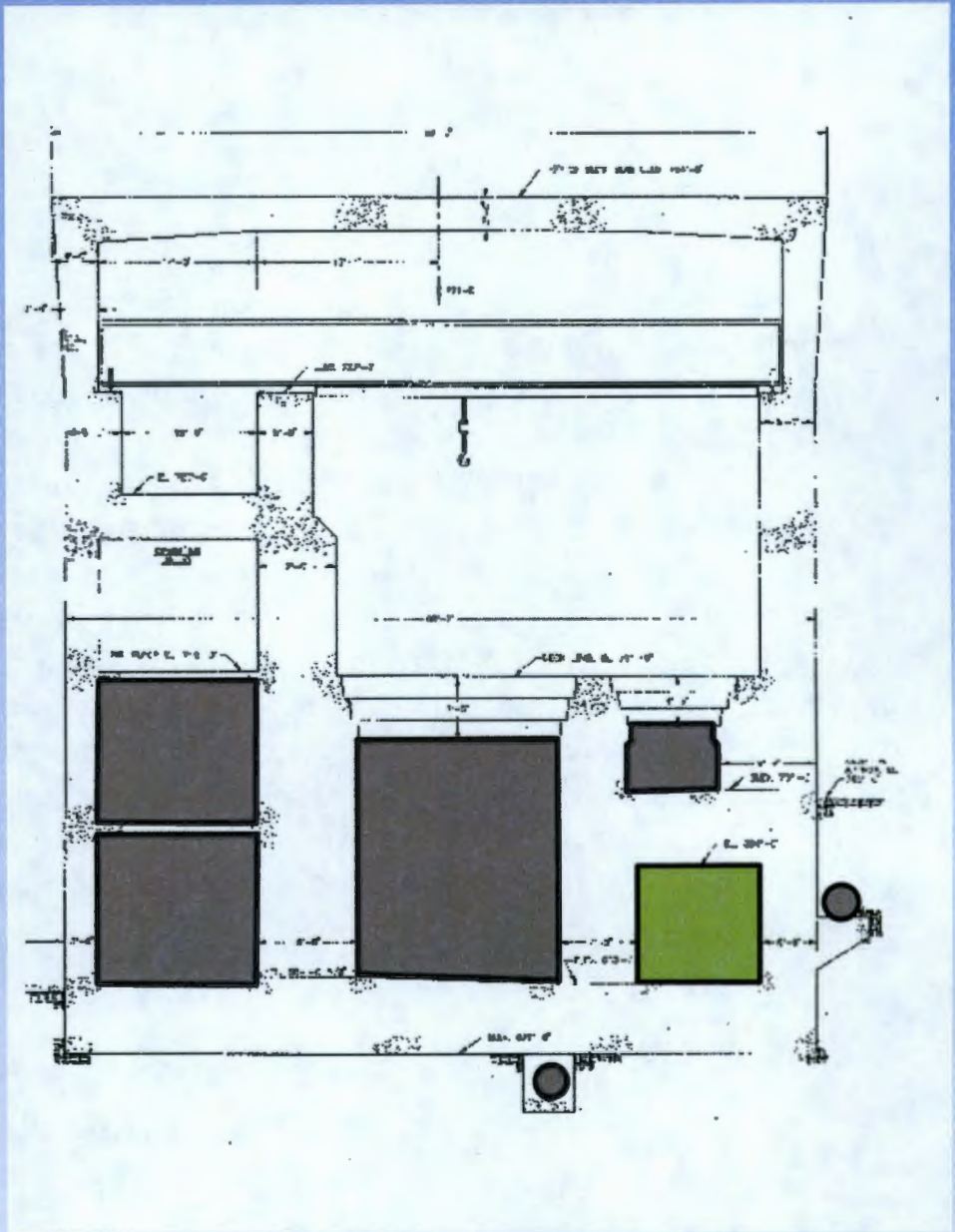
The ventilation system will be kept operational as long as possible for contamination control and worker comfort in the canyon. Grouting the ventilation tunnel after the most contaminated areas have been grouted will provide airflow and heat dissipation from the canyon work areas while providing contamination control for work in the canyon. The ventilation tunnel shall be grouted as the last large open void space in the canyon structure after the galleries and other canyon grouting is complete.

Ventilation Tunnel

Remote Access Only

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	**2,940 CY**
Vent Ducts to Stack	581 CY*
TOTAL	**20,318 CY**

*Includes Sand Filter Cap



Grout for 221-U Canyon Facility Voids
90% Design Summary Level Description

Vent Duct, Sand Filter Cap, Vent Ducts to Stack

The below-grade, external ventilation duct to the sand filter shall be grouted with grout after the ventilation tunnel is grouted. Access and vent holes will likely need to be drilled in the roof of the duct for grouting. A blank or concrete plug shall be inserted or poured at the access point to the sand filter to eliminate grout entering into the sand filter.

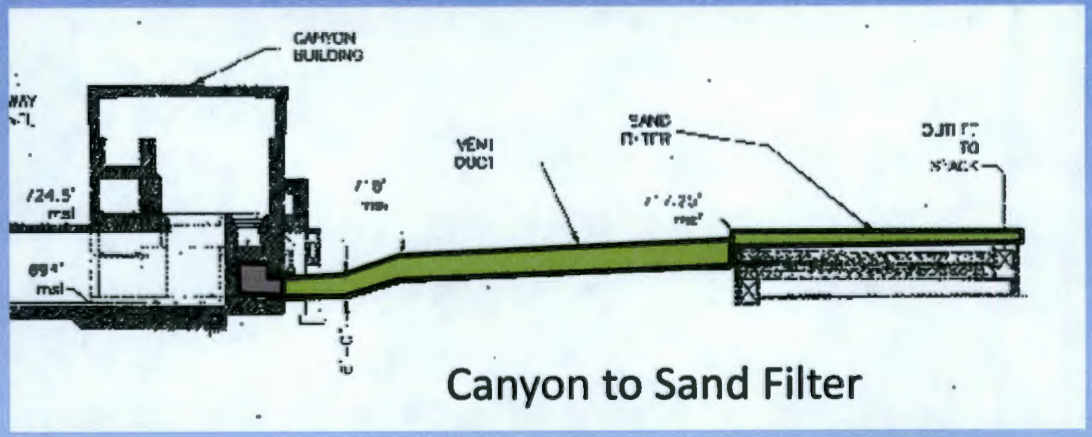
A minimum 6-in. thick grout cap over the sand filter shall be placed. The edges shall be thickened to 12 in. and shall extend from the sand filter by 1 ft in all directions creating a 98-ft wide by 98-ft long slab. The placement plan for this grout cap shall take crack control measures into consideration.

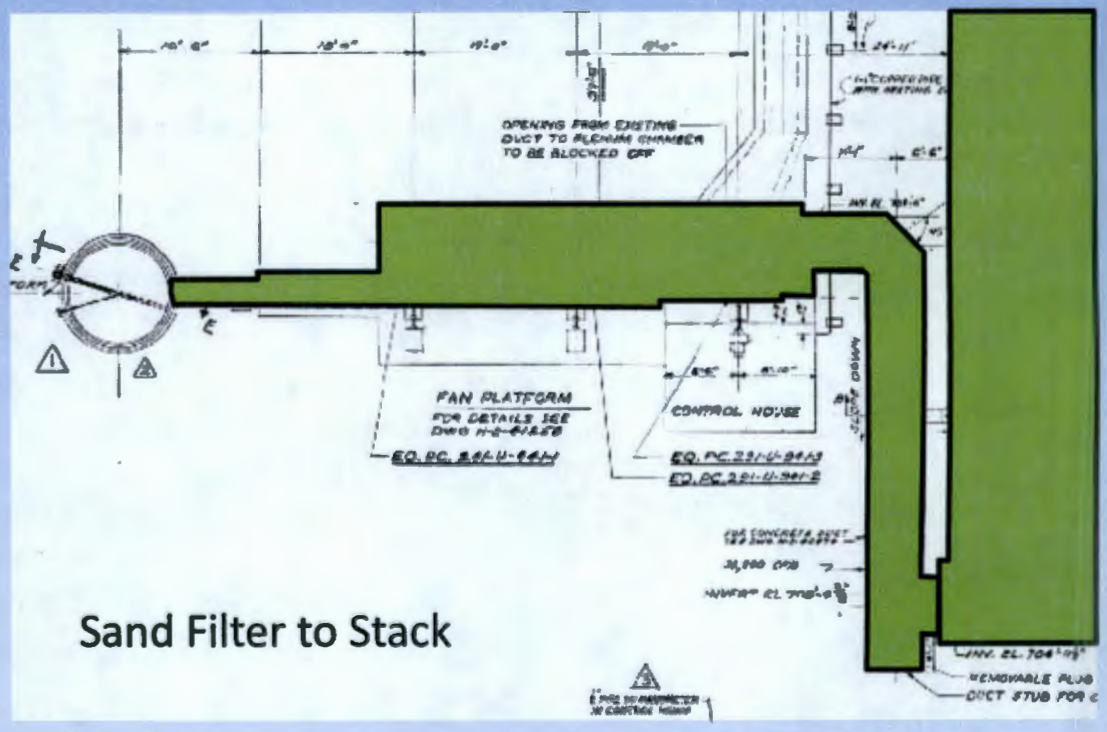
The below-grade, sand filter to exhaust stack duct shall be grouted. Access and vent holes will need to be drilled in the roof of the duct for grouting. A blank or concrete plug shall be inserted or poured at the access point to the Sand Filter and at the Stack to eliminate grout entering those structures.

Vent Ducts to Stack

Drain Header	110 CY
Process Sewer	93 CY
Buoyant Vessels	670 CY
Process Cells	6,084 CY
Hot Pipe Trench	1,029 CY
Electrical Gallery	4,497 CY
Piping Gallery	4,314 CY
Ventilation Tunnel	2,940 CY
Vent Ducts to Stack	**581 CY***
TOTAL	**20,318 CY**

*Includes Sand Filter Cap





End of Presentation

Grout for 221-U Canyon Facility Voids 90% Design Summary Level Description

Appendix B

Scope and Technical Specification of the Request for Proposal

Reprint of Statement of Work Number 209175, *Grout for 221-U Canyon Facility Voids*, Rev. 2, Published July 6, 2010

Part I

Non –Hazardous Statement of Work for

Grout for 221-U Canyon Facility Voids

Revision 2

July 6, 2010

Prepared by: A.D. Moles

APPROVALS	PRINT NAME	SIGNATURE
BTR*	E.R. Jacobs	
CAM / Project Controls**	S.V. Doebler	
Contract Officer***	M.N. Keith	

* Approval for technical content ** Approval for funding availability ***Approval for contractibility

SUPPLEMENTAL TECHNICAL APPROVAL PAGE

SIGNATURE REQUIRED	SIGNATURE NOT REQUIRED	ORGANIZATION	PRINT NAME	SIGNATURE
x		End-User / Requestor	E. R. Jacobs	
x		End-User / Requesting Manager (Project or Functional Director)	S. V. Doebler	
x		Design Authority / System Engineer	C. B. Herzog	
x		Operations Manager	B. D. Skeels	
x		Quality Assurance Engineer	H. E. Rew	
x		Environmental	G. J. LeBaron	
x		Nuclear Safety	E. N. Dodd	
x		Radiation Protection	G. S. Hauger	
x		Occupational Safety	D. L. Wright	
x		Industrial Hygiene	S. M. Wilkerson	
	x	Fire Protection	N/A	
	x	Chemical Management	N/A	
	x	Emergency Preparedness	N/A	
	x	Hoisting & Rigging	N/A	
	x	Project Operations Center	N/A	
	x	Waste Management/Transportation	N/A	
	x	Transportation Safety Organization	N/A	

PART I - STATEMENT OF WORK

1.0 INTRODUCTION / BACKGROUND

As a prime contractor to the U.S. Department of Energy (DOE), CHPRC is focusing on the safe, environmental cleanup of the Central Plateau of DOE's Hanford Site. CHPRC's scope of work includes treatment and disposal of various radioactive waste streams, groundwater, management of spent nuclear fuel, disposal or disposition of nuclear materials, and non-reactor nuclear facilities, and environmental remediation activities currently funded through DOE's Office of Environmental Management.

The Contractor works for CHPRC and is the company responsible for performing the work scope in accordance with a Statement of Work (SOW). This SOW identifies the Contractor's scope as it relates to supplying grout for filling the 221-U canyon facility voids.

Additionally specific unique work environment/conditions/circumstances which may be encountered during execution of the work scope include sampling and testing from potential aggregate borrow areas on the Hanford Site Central Plateau.

1.1 Facility Remediation

In September 2005, the U.S. Environmental Protection Agency (EPA) issued a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) Record of Decision (ROD) for the final remediation of the Hanford site 221-U Facility. The selected remedial action calls for consolidating and grouting equipment currently in the 221-U canyon into the process cells, filling the process cells, operation, piping and electrical galleries, hot pipe trench, ventilation tunnel, drains and other voids below the operating deck and crane way deck levels with grout prior to demolition of the canyon roof and walls to the approximate level of the canyon deck, and burial of the remaining canyon structure beneath an engineered barrier.

The CERCLA ROD describes the grouting activity as follows: Cementitious grout will be pumped into the galleries, cell drain header, process cells, and tanks to the maximum extent practical, to minimize the potential for void spaces and to reduce the mobility, solubility, and/or toxicity of the residual waste. Grout amendments, such as fly ash or zeolite clays, and the cost–benefit of using a soil-cement grout mixture will be considered during final design for grouting activities to reduce the potential for leaching of radioactive isotopes, while maintaining desirable properties of Portland cement (e.g., a flowable, structural grout with good compressive strength).

In February 2009, the *Remedial Design/Remedial Action Work Plan for the 221-U Facility* (RD/RAWP), DOE/RL-2006-21 was approved. The RD/RAWP describes the design and implementation of the remedial action process for remediation of the 221-U Facility pursuant to the ROD. The RD/RAWP outlines and discusses grouting of canyon in greater detail.

The 221-U facility is shown in an aerial photo in Figure 1.

Figure 1 221-U Facility

1.2 Facility Background and Description

The 221-U building (U Plant), located in the 200 West Area of the Hanford site, is one of three nearly identical Hanford site chemical separations plants constructed from 1943 through 1945 to support the World War II defense mission. These massive concrete buildings were referred to as "canyons" because of the expansive main room extending the length of the buildings. The canyon building is approximately 810 feet (ft) long and 68 ft wide. 40 process cells, which contain deactivated process equipment, run along one side of

the canyon and are shielded with interlocking concrete cover blocks. A hot-pipe trench which runs along the other side of the canyon contains radiologically contaminated inter-cell section transfer piping and is shielded with concrete cover blocks.

The location of the 200 West Area on the Hanford site is shown in Figure 2 and the location of U Plant in the 200 West Area is shown in Figure 3. A 221-U site plan is shown in Figure 4.

Figure 2. Hanford Site

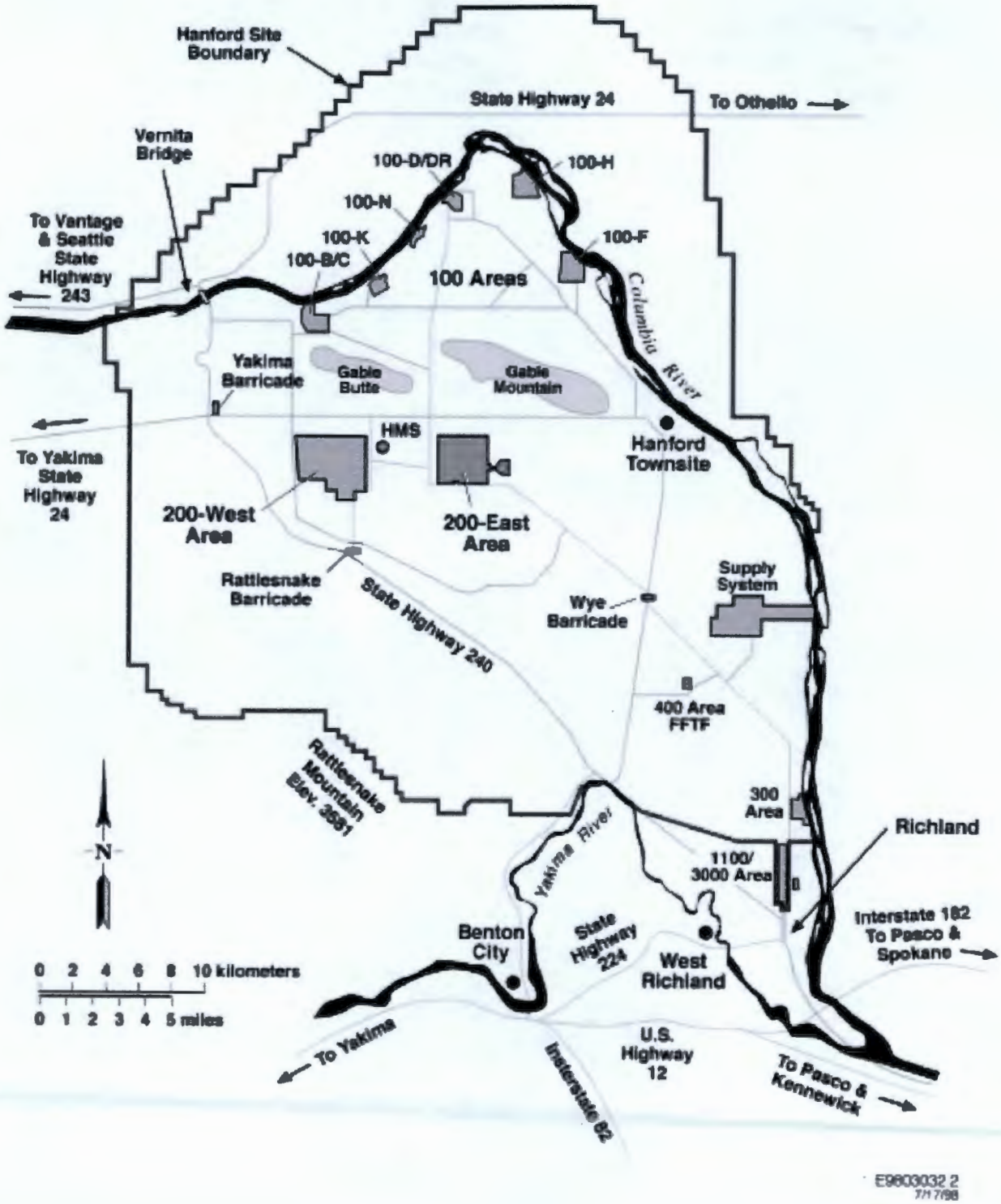
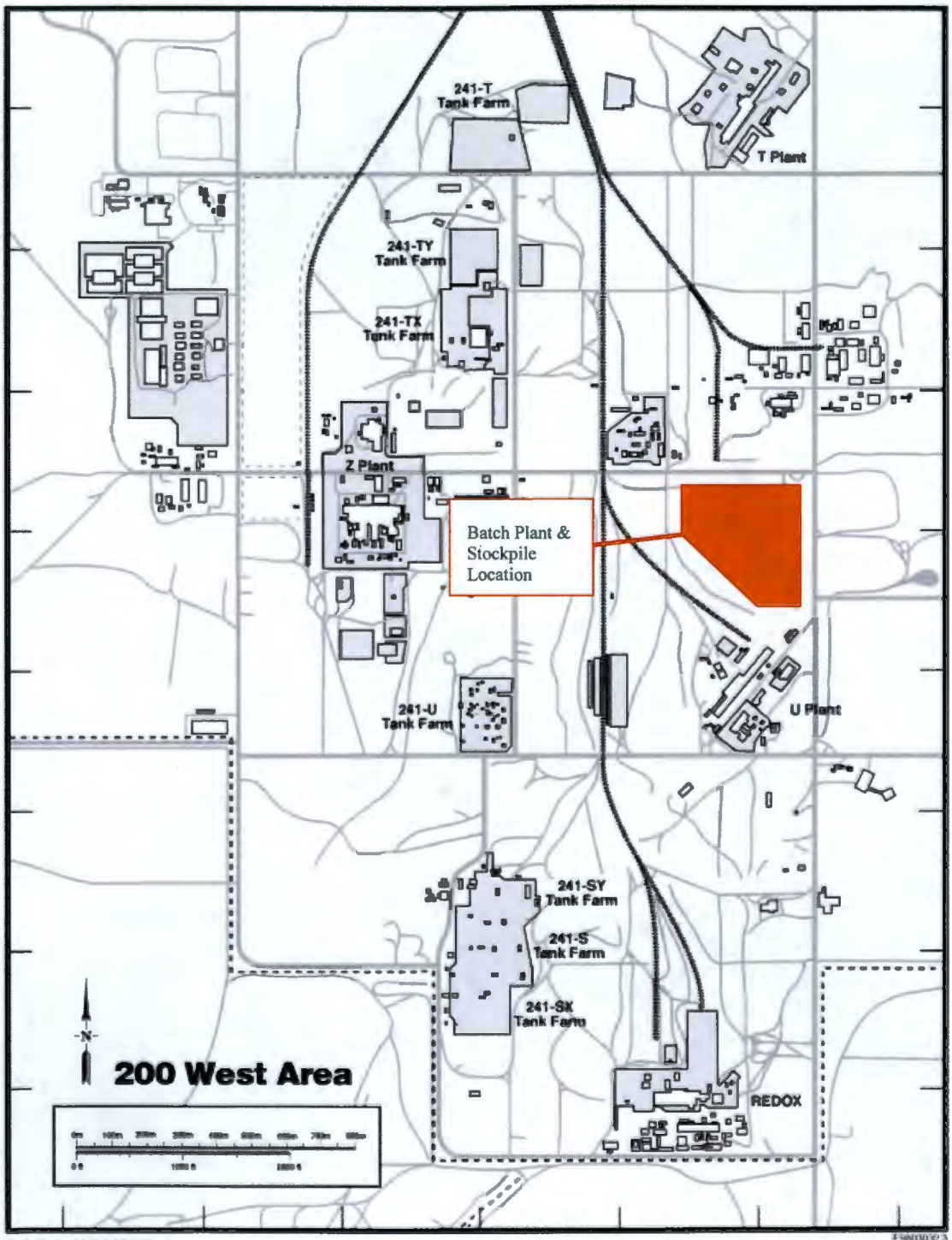
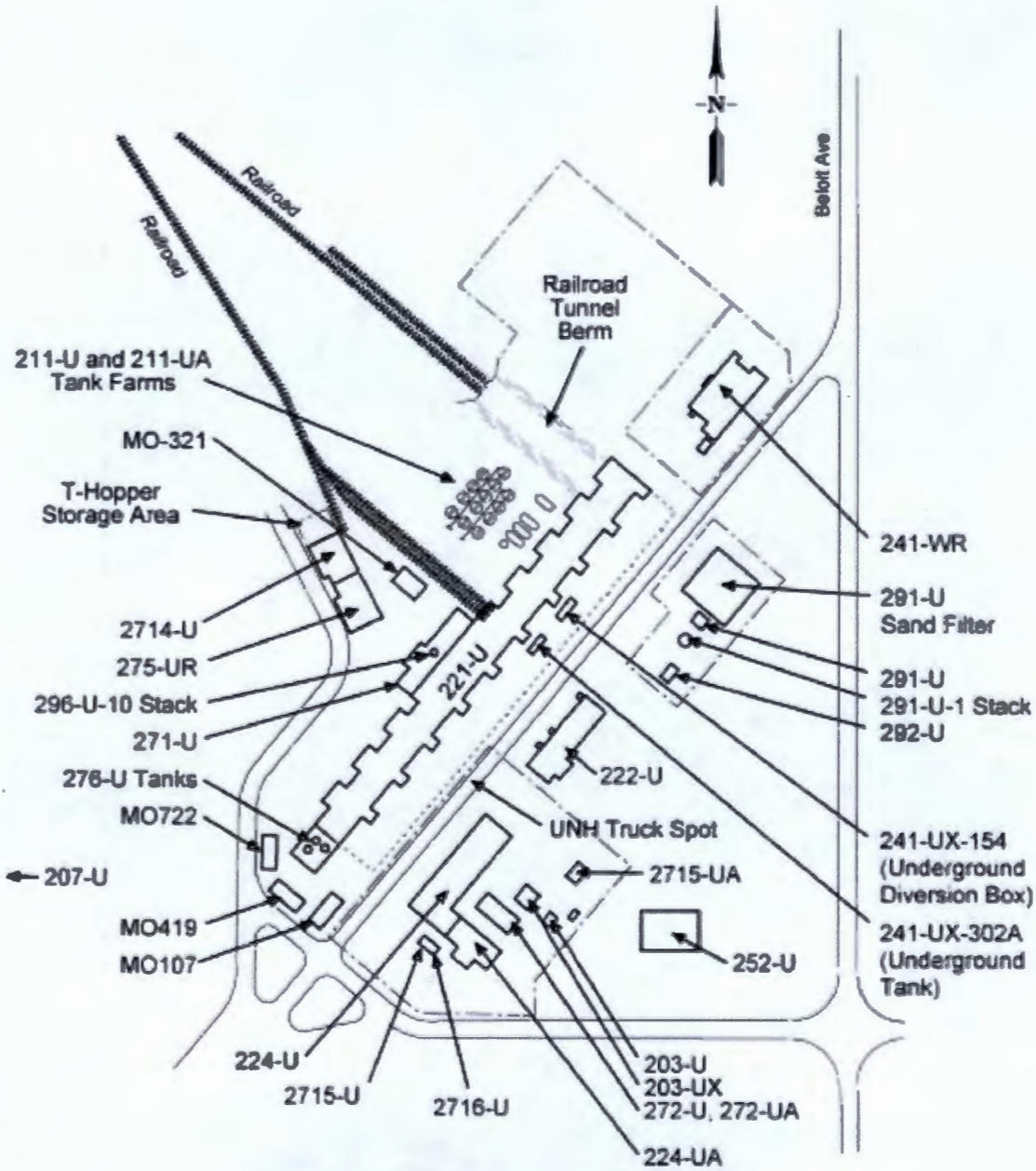


Figure 3. 200 West Area



Ref: Dwg. H-2-817865
Map M-2600W

Figure 4. 221-U Site Plan



* Note: Buildings and structure addressed by the SAR include: 221-U, 271-U, 276-U, 211-U, 211-UA, 291-U, 292-U, 276-UR, MO-321, 241-WR, 203-U, 203-UX, 207-U, 224-U, 224-UA, 252-U, 272-U, 272-UA, 2714-U, 2715-U, 2715-UA, 2716-U, and UNH Truck Spot

**Note: 2726 is not shown, as it is a concrete pad

Ref. Dwg. H-2-44511 - Sh. 67, 68, 76

E0008097 1
6/11/99

1.3 Existing Facility Utilities

1.3.1 Power, Lighting and Communications

Electrical power is supplied to 221-U building by a single 13.8-kilovolt (kV) line that supplies 13.8-kV/480-volt (V)/277-V transformers. The transformers are located on the west side of 221-U building. CHPRC will provide and install the electrical power cable from the transformers to disconnect provided by the Contractor at the batch plant site. The Contractor is responsible for connecting the electrical power cable to the disconnect. CHPRC will not meter or charge for the electricity used by the Contractor's batch plant.

Workers communicate via portable devices such as radios, pagers, or cellular phones, in accordance with approved access control procedures.

1.3.2 Water Supply

CHPRC will provide the connection to the existing 12-inch potable water line and the piping to the Contractor's batch plant. The Contractor shall install an isolation valve and connect the potable water supply to Contractor's batch plant. CHPRC will not meter or charge for the potable water used by the Contractor's batch plant.

2.0 DESCRIPTION OF WORK – GENERAL

The Contractor shall provide grout for the filling of existing voids in Building 221-U. In this Statement of Work, grout and concrete are used interchangeably. The Contractor shall provide technically qualified persons that work as part of a team under the general supervision of CHPRC. Contractor's employees shall be responsible for planning, organizing and performing a wide variety of non-hazardous specialized administrative/technical duties in support of the successful completion of goals and deliverables. The Contractor shall furnish all necessary labor, technical and professional services, supervision, materials, tools, equipment, transportation, consumables, and payment of any applicable taxes to perform all operations necessary and required to perform scope as directed by CHPRC.

Unless otherwise approved, the Contractor shall work in accordance with CHPRC contract requirements, operating policies and procedures and shall be responsible for execution of the work in accordance with the quality standards and requirements specified for assigned project and facility.

This is a general description of work to be performed under the SOW. Specific contract release requirements will be defined in the contract releases. The provisions are applicable to all contract releases and tasks, and will not be reiterated in individual contract releases.

2.1 General Scope

CHPRC requires the Contractor to perform the following general scope which consists of three sequential scope tasks which will be individually awarded and released.

Task 1 On-Site Batch Plant and Stockpile Supply and Installation

Contractor shall design, supply, deliver, and install start- up and test an on-site batch plant and associated material stockpiles near 221-U facility as indicated on the attached drawings and in Section 4.0, Technical Requirements.

Task 2 Grout Mix Design and Test Results

Contractor shall prepare grout mix design based upon the grout performance criteria included with this SOW. Documentation of test result for the grout mix and performance criteria shall be provided as specified in Section 4.0, Technical Requirements.

Task 3 Batch Plant and Stockpile Operation and Maintenance

Contractor shall operate and maintain the on-site grout batch plant, associated material stockpiles, supply and deliver grout in accordance with Section 4.0, Technical Requirements.

Task 4 Grout Pumping Equipment Operation and Maintenance

Contractor shall supply, deliver, operate and maintain grout pumping equipment capable of individually delivering grout at the minimum rate of 80 cubic yards per hour. Pumping locations and minimum number of pumps required are described in Sections 3.0 and 4.0. Contractor will also provide the conveyance system as required in Section 4.0.

3.0 DESCRIPTION OF WORK – SPECIFIC

The work products and services to be provided, including any specific CHPRC standards and requirements for the successful completion of this work activity include the following specific scope:

3.1 Task Descriptions

The following sequential work scope tasks will be individually awarded and released with authorization to proceed.

3.1.1 Task 1 – On-Site Batch Plant and Stockpile Supply and Installation

The Contractor shall provide an on-site batch plant and on-site stockpile to support the grouting the 221-U Facility voids. The Contractor shall prepare supply and installation plans to supply and install the on-site batch plant and stockpile facility. At a minimum, the following shall be addressed in the supply and installation plans.

3.1.1.1 Batch Plant and Stockpile Area Site Layout

The on-site batch plant and stockpile shall be located near the 221-U facility as indicated on the attached drawings. The Contractor shall prepare batch plant and stockpile area location and layout drawings and equipment arrangement drawings, sufficiently detailing the placement of all batch plant and stockpile area equipment.

3.1.1.2 Site Preparation

The Contractor shall prepare site preparation specifications and drawings and perform clearing, grubbing, grading, fencing and haul roads for the batch plant and stockpile areas.

3.1.1.3 Erection

The Contractor shall prepare erection plans for the on-site batch plant and stockpile area equipment installation prior to mobilization. Crane lifts shall be identified and properly documented.

3.1.1.4 Mobilization

The Contractor shall perform mobilization and installation of the on-site batch plant and stockpile area, including transportation, trucks, cranes, forklifts, equipment, tools, supervision and labor for the delivery and installation of the batch plant and stockpile area.

3.1.1.5 Initiation, Start-Up and Commissioning

The Contractor shall perform initiation, start-up and commissioning of the on-site batch plant and stockpile area. The Contractor shall prepare an Initiation, Start-Up and Commissioning Plan which identifies the sequence and schedule of the steps and critical points that shall be followed for the initiation, startup and commissioning to be performed, including grouting of a test cell.

3.1.1.6 Batch Plant Test Cell

The Contractor shall provide the grout, operate the pump, and CHPRC will install the conveyance system and place the grout in Electrical Gallery (Test Cell) which is located on the northwest corner of Building 221-U. The Contractor shall perform grouting of a test cell with appropriate quality control tests to ensure that the batch plant is operating within defined parameters. The test cell shall be completed on-site and a full set of tests and a minimum of 15 cylinders shall be created. Refer to Section 4 for detail quality control testing requirements.

3.1.1.7 Utilities

The Contractor shall identify all utilities that the on-site batch plant and stockpile area will require so that the appropriate permits can be obtained prior to mobilization.

A. Water

The Contractor shall provide estimated daily maximum and minimum water supply requirements, which includes all rinse water and mix water needs.

B. Wastewater

The Contractor shall prepare a Wastewater Management Plan and manage each waste water stream. Contractor shall coordinate the Waste Water Management with the CHPRC. CHPRC will be responsible for disposition of collected rinse wastewater.

C. Solid Waste

The Contractor shall prepare a Solid Waste Management Plan and manage solid waste (refuse/trash). CHPRC will be responsible for disposition of collected solid waste.

D. Electrical

The Contractor shall provide a detailed breakdown, both volts and amps, of electrical power needs for the on-site batch plant and stockpile area including all equipment. The Contractor will be responsible for the transformer required to step down the 480 volt supply to Contractor needs.

3.1.1.8 Grout Quality Control

The Contractor shall prepare a Quality Control Plan (QCP) based on minimum requirements in Section 4. The QCP shall detail how quality control will be maintained on all products that the Contractor provides. The QCP shall also identify the line of authority that the QC Manager has to rectify any issues with any products during the course of the project. The Contractor's QC Manager shall be on site during placement of the grout.

3.1.1.9 Safety Plan

The Contractor shall comply with all Hanford safety requirements and shall prepare Safety Plan for review and approval.

3.1.1.10 Stockpile Material and Grout Delivery

The Contractor shall prepare a procedure to be followed for the receipt of stockpile materials through the Hanford Site security checkpoint and at the stockpile location. The Contractor shall test and verify all materials prior to use in the batch plant in accordance with the described testing approach. The Contractor shall not use the bottom 6 inches of the course and fine aggregate stockpiles.

3.1.1.11 Demobilization

The Contractor shall perform demobilization of the on-site batch plant and stockpile area including all pickup, transportation, trucks, cranes, forklifts, equipment, tools, supervision and labor for the dismantling, cleanup and

removal of the batch plant and stockpile from the site. Site restoration will be performed by CHPRC.

3.1.2 Task 2 - Grout Mix Design and Test Results

3.1.2.1 Grout Design Development

The Contractor shall prepare and submit relevant, verified, available grout mix design that complies with the grout performance criteria, quantity and quality requirements specified in Section 4.0. If Contractor's existing grout mix designs which satisfy the specified criteria are not available, the Contractor shall work with CHPRC to develop a grout mix design and perform testing and supply documentation verifying compliance with the specified performance criteria.

3.1.2.2 Grout Performance Criteria

The grout shall have a 28 day minimum compressive strength of 1,500 psi, low heat of hydration equal to or less than 13 degrees Fahrenheit per 100 pounds of cement, a minimum flow distance of 80 feet, maximum size of rounded course aggregate shall be ½ inch, and rounded fine aggregate sand. Manufactured sand shall not be used. Refer to Section 4.0 for additional technical requirements.

3.1.2.3 Grout Quantities

For each of the locations indicated below. The amount of grout placed each day will vary based on the production rate of the batch plant, and shall be placed in lifts that vary in location each day. Estimated grout quantities that will be supplied by the Contractor are as follows:

Location	Quantity Cubic Yards
Process Cells	6,957
Hot Pipe Trench	1,029
Ventilation Tunnel	2,940
Electrical Gallery	4,497
Piping Gallery	4,314
Ventilation Tunnel to Sand Filter	167

Sand Filter Cap	185
Sand Filter Duct to Stack	229
TOTAL	20,318 CY

The estimated quantities of grout provided can vary by plus 25 percent or minus 25 percent.

3.1.2.4 Grout Quality Verification Documentation

Conformance of the quality of the grout mix designs to the specified performance criteria shall be verified by performing grout testing and submitting verification documentation. Verification documentation is described in more detail in Section 4.

3.1.3 Task 3 - Batch Plant and Stockpile Operation and Maintenance

The Contractor shall operate and maintain the on-site batch plant and on-site stockpile area to supply grout for the conveyance and placement by CHPRC in the 221-U facility voids. Grout types to be produced shall be those approved at the conclusion of Task 1. The Contractor shall not use the bottom 6 inches of the course and fine aggregate stockpiles.

CHPRC will provide a two day advance notification for ordering grout deliveries.

The O&M time for the completion of the project is estimated at 45 weeks.

3.1.4 Task 4 – Grout Pumping Equipment Operation and Maintenance

The Contractor shall supply, deliver, operate and maintain three (3) grout pumps and equipment capable of individually delivering grout at the minimum rate of 80 cubic yards per hour. One of the three grout pumps shall be a standby pump and shall be onsite during pumping for redundancy to assure completion of grout placement each day in case of primary pumping equipment breaks down. The standby pump shall be equivalent to the primary pumps. All grout pumps used shall be able to connect to pipe/hose diameter of 5 inches. The Contractor shall provide a conveyance system to include pipe, couplers, elbows, anchors, pipe brackets, quick disconnects, pressure relief systems, and all parts required to form a functioning conveyance system from the pump to the point of discharge as described in Section 4.0 and the associated drawings. The Contractor shall have on-site and shall immediately replace pumping equipment and conveyance materials and equipment that are not functioning properly or become plugged. Contractor shall not use aluminum conveying devices.

3.1.3.1 Canyon Area Conveying Piping

The Contractor shall provide all piping required to deliver the grout to the discharge points within 221-U. All piping and connection components used in the Canyon Area shall be new. Connection flanges and component

hardware damaged in shipment to the site shall be rejected. The Contractor shall provide a connection between the piping that is outside of the canyon area of 221-U and the piping placed inside the canyon area. The canyon area includes the process cells, hot pipe trench, ventilation tunnel, and all other contaminated areas. For additional requirements, see Section 4.0.

3.1.3.2 Gallery Area Conveying Piping

The Contractor shall provide all piping required to deliver the grout to the gallery discharge locations. All piping and connection components used in the Gallery Area shall be new. Connection flanges and component hardware damaged in shipment to the site shall be rejected. The Contractor shall provide a connection between the piping that is outside of the gallery area of 221-U and the piping placed inside the canyon area. For additional requirements, see Section 4.0.

3.1.3.3 Exterior Area Conveying Piping

The Contractor shall provide all piping required to deliver the grout to the discharge locations in the exterior area. All piping and connection components used in the exterior area shall be new. Connection flanges and component hardware damaged in shipment to the site shall be rejected. For additional requirements, see Section 4.0.

3.1.3.3 Cleaning of Conveying Pipe

The Contractor shall use air and foam pigs to clean the conveying pipe at the end of each day or on an as needed basis to maintain the pump and conveyance system. This will minimize the amount of water that is generated on the site.

3.2 Work Not Included

Work not included in this Contract includes assembly and disassembly of grout conveyance and placement at the 221-U facility which will be performed by CHPRC.

Radiological and Industrial Health oversight, and other similar support required for implementation at the Hanford Site will be performed by CHPRC.

3.3 Government Furnished Materials and Equipment

CHPRC will provide the following at no cost to the Contractor:

- CHPRC will make potable water source tie-ins available for on-site batch plant grout production operations and equipment rinsing.
- CHPRC will be responsible for disposition of collected rinse water waste and solid waste.
- In the interest of simplifying safety, security and environmental issues, all Contractor equipment that requires diesel fuel and that remains on-site during the duration of the

contract shall be permitted to be fueled by CHPRC at no expense to the Contractor. Costs for this fuel shall not be included in the Contractor's proposal. All vehicles or equipment that does not remain onsite overnight such as personal vehicles, or delivery trucks shall be fueled by the Contractor at the Contractor's expense.

- CHPRC will provide an area(s) adjacent to the 221-U facility for the staging, installation and operation of the Contractor's on-site grout batch plant, materials stockpile, equipment yard, parking and field office trailer facilities.
- CHPRC will provide one (1) portable toilet facility per ten (10) Contractor personnel.
- CHPRC will provide on-site personnel dosimeters, and radiological and industrial health surveys of the facility and of the Contractor's on-site personnel, batch plant, facilities, equipment, tools, materials and waste.

3.4 Preparation Activities

The Contractor shall be responsible for the following functions, requirements, and design criteria preparatory activities:

A. All submittals required prior to start of work shall be submitted to CHPRC in accordance with Section 7.
B. The Contractor shall ensure equipment, materials, and personnel are ready for the execution of the applicable contract release.
C. The Contractor shall ensure that suspect/counterfeit items (S/CI), such as non-compliant fasteners with head marks shown on the S/CI fastener head work list are not brought onto the Hanford Site.
D. The Contractor shall ensure that all supplied tools and equipment are in good working order and free form obvious and known defects, malfunctions and disrepair (e.g., oil leaks, broken and/or missing parts) upon arrival at the job site.
E. Prior to mobilization, the Contractor shall submit all Material Safety Data Sheets (MSDS) sheets and Chemical Inventory sheets as required in accordance with Section 6.2 and 7.2.
F. Prior to start, the Contractor shall demonstrate compliance with training requirements in accordance with Section 5.
G. The Contractor shall secure all necessary registrations, personnel dosimeters from CHPRC, and training required prior to performing any on-site work.
H. Before proceeding with on-site work, the Contractor shall obtain necessary permits from CHPRC.

3.5 Mobilization

A. The Contractor shall mobilize required labor, equipment, and materials to the work site.

B. The Contractor shall comply with access controls to the work site.

C. The Contractor shall coordinate site set-up with CHPRC to ensure compliance with traffic area restrictions around the work site associated with other activities at the site.

D. The Contractor shall comply with required personal protective equipment (e.g., hard hat, safety glasses, hearing protection, and footwear) for the job site.

E. The Contractor shall comply with signage and radiological postings established by CHPRC.

F. All required permits will be provided by CHPRC through the Buyer's Technical Representative (BTR). The Contractor shall comply with, and maintain a copy of all permits required by this SOW or the BTR on the work site. The permits applicable to this scope include those denoted below:

Permit Title	Referenced Document
Non-Emergency Hydrant Tie-In Permit	MSC-RD-8589

G. The batch plant and material stock pile site shall be subject to CHPRC's review and approval. The Contractor shall:

1. Post appropriate signs (e.g., hard hat, safety glasses, hearing protection, and footwear) for the job site
2. Comply with all radiological postings established by CHPRC
3. Control access to the batch plant work site and material stock piles.
4. Coordinate site setup with the CHPRC Field Work Supervisor (FWS) to ensure compliance with traffic area restrictions around the site.

3.6 Equipment and Materials

The Contractor is responsible for providing all equipment, tools, materials, supplies, and each and every item of expense associated with identified Contractor work scope. All Contractor-supplied and operated equipment shall be inspected, maintained and repaired by the Contractor.

The following equipment and materials is a non-inclusive list:

- Water recycle tanks and pumps
- Hoppers, bins, screens, chutes and other grout materials handling, mixing and conveyance equipment
- Grout mixers
- Grout pumps
- Grout piping systems exterior and interior to the canyon
- Air compressors
- Grout delivery trucks
- Cleaning equipment to rinse grout materials handling, mixing and conveyance equipment
- All industrial safety equipment for Contractor personnel (e.g., eye protection, hard hats, safety footwear, hearing protection, safety glasses, puncture resistant gloves, etc.)
- Cellular telephone or other communication device capable of initiating emergency notifications at remote work sites

- Field office trailer(s) for Contractor personnel
- Drinking water for Contractor personnel
- Fire extinguishers for Contractor field office trailer(s) and equipment
- Fencing, gates, signs, t-posts, ropes, barricades, etc. for the batch plant and stockpile areas.
- Light plant(s) for batch plant and stockpile areas site illumination, as needed.

3.7 Delivery of Materials, Supplies, and Coordination of Subcontractors

Regarding deliveries of materials and supplies, and the Coordination of Subcontractors while on the CHPRC Site, the Contractor shall:

A. Coordinate work or delivery of material and equipment with CHPRC at least 2 weeks in advance.
B. Arrange for security badges through the Contract Specialist.
C. Communicate any special hazards associated with the delivery or the work (e.g., safety, security)
D. CHPRC will meet the Contractor or lower-tier subcontractor at the designated rendezvous point. The individual designated to meet the Contractor or lower-tier contractor is called the DPOC or POC (Delivery Point of Contact, or Point of Contact)
E. Escort the delivery vehicle to the specified work location.
F. Conduct a pre-delivery walk down of the work location prior to commencing delivery or work.
G. Be physically present at the delivery site for the entire time a delivery or work is being executed to ensure that it is performed safely and in accordance with contract requirements. Alternate arrangements may also be made only with the approval and concurrence of the CHPRC and are subject to a hazard evaluation and review by CHPRC.
H. At completion of the delivery or work, direct the delivery driver or lower-tier contractor to exit the Site in a timely manner.

3.8 Handling and Storage of Materials, and Hand Protection

A. The Contractor shall use all means necessary to protect construction materials before and during operations. All materials shall be stored in their original containers until needed. The Contractor shall not use the bottom 6 inches of the course and fine aggregate stockpiles.

B. The Contractor shall utilize gloves that are rated as cut/puncture-resistant for all activities that present the potential for a cut or puncture to the hand. Leather gloves are not rated as cut/puncture-resistant, and not permitted. The Contractor shall still use gloves (e.g., leather, canvas, cotton, etc. as appropriate for the work activity) to prevent and/or protect the hand from abrasions and contusions. Cut-resistant gloves come in different performance strengths; and the Contractor needs to exercise the right amount of care to ensure they have selected the proper type of gloves for the hazard to be encountered. CHPRC does not specify or recommend any brand-name gloves; but does require these gloves to be rated as cut/puncture resistant.

3.9 Demobilization

The Contractor shall perform demobilization of equipment and materials from the site. Site restoration will be performed by CHPRC. The Contractor shall remove the course and fine aggregates to within 6 inches of existing grade.

3.10 Acceptance Criteria

All work shall conform to the requirements of the General Provisions, Master Contract, and individual Contract Release.

3.11 Waste Handling

A. As applicable and directed, if responsible for packaging and for handling all wastes generated during scope activities, must be in accordance with the Waste Management procedures. CHPRC shall coordinate and transport all regulated waste. The basic waste handling strategy is as follows:

   1. The Contractor shall provide and/or coordinate through CHPRC Waste Management for waste relocation where necessary.
   2. The Contractor is responsible to minimize waste generation.
   3. All waste water resulting from grout equipment rinsing, wash down or cleanout which cannot be recycled shall be deposited in a rinse waste water collection system for further disposal.

B. CHPRC is responsible for disposal of any spill waste cleanup that has contacted the soil. The Contractor is responsible to clean up any and all waste generated from spills that have not come in contact with the soil (i.e., hydraulic fluid, oil, fuel). In the event of a spill, the Contractor shall immediately notify the FWS and shall clean up and properly package the material. The Contractor will be responsible for the disposal of spill cleanup wastes that have not contacted the soil.

3.12 Site Conditions and Known Hazards

Health and safety requirements specific to the 221-U facility are addressed in CP-40329, *Site-Specific Health and Safety Plan for the 221-U Facility* (HASP). The Contractor shall comply with the requirements of this document for all work performed on-site.

No equipment that is potentially contaminated will be returned to the Contractor without thorough radiological monitoring to ensure that it is free of contamination. If radiological contamination cannot be removed, equipment, tools and other materials may not be recoverable by the Contractor. Prices for such equipment will be as required by the Contract, Part II, Financial Terms.

3.13 Organizational Interface

The Contractor shall interface with various CHPRC organizations through the CHPRC Contracting Officer or BTR, as required.

3.14 Interfaces and Site Coordination Requirements

A. The Contractor shall interface with various CHPRC organizations through the CHPRC's Contract Specialist or BTR, as required.

B. The BTR designated for the Contract is Edward Jacobs, phone: 509-376-2859. The BTR is responsible for monitoring and providing technical guidance for this Contract and should be contacted regarding questions or problems of a technical nature. The BTR is also responsible for appropriate surveillance of the Contractor's representatives while on site. In no event, however, will an understanding or agreement, modification, change order, or any deviation from the terms of this Contract be effective or binding upon CHPRC unless formalized by proper Contract documents executed by the Contract Specialist prior to completion of this Contract. On all matters that pertain to Contract terms, the Contractor shall contact the Contract Specialist specified within this Contract. When in the opinion of the Contractor, the BTR requests or directs efforts outside the existing scope of the Contract; the Contractor shall promptly notify the Contract Specialist in writing. The BTR does not possess any explicit, apparent or implied authority to modify the Contract. No action should be taken until the Contract Specialist makes a determination and/or modifies the Contract.

C. CHPRC's designated FWS is responsible for all on-site field activities and will provide appropriate surveillance, direction and coordination of the Contractor's activities while on site. The Contractor shall interface with CHPRC's FWS for direction and coordination with all on-site field activities. Lock-out/tag-out performed by the Contractor shall be performed with the oversight of CHPRC's controlling organization representative.

D. The work may be inspected daily by the BTR, FWS and CHPRC Industrial Safety and Quality Assurance representative or designee.

E. The Contractor shall immediately notify the FWS (who will contact CHPRC Health and Safety) of any injuries or incidents; to include damage to Contractor-owned property or equipment. The Contractor will follow this up within 24 hours with a written explanation to the Contract Specialist of the occurrence.

F. In the event that there is an abnormal or unusual situation associated with this contract work scope, the Contractor shall immediately contact the FWS. If, after several attempts, the Contractor is unable to contact the FWS, the Contractor shall contact CHPRC Occurrence Notification Center at (509) 376-2900, which is available 24 hours a day, seven days a week, and provide them with: Contract Number, Contract Specialist's name, BTR's name and a short summary of the abnormal or unusual situation. If after making contact with CHPRC, the Contractor is advised to suspend activities, the Contractor shall not proceed until such direction to proceed has been expressly issued by the Contract Specialist. If there is an emergency situation, the Contractor is to make the appropriate immediate emergency call to 911 or 373-0911 for cell phones and then make the notifications to CHPRC as set forth herein.

4.0 TECHNICAL REQUIREMENTS

All Work shall be performed in strict accordance with requirements, design criteria, codes and standards, specifications, drawings, exhibits, and any other documents, which by this reference are made a part of the Statement of Work.

All inspection of the Work by CHPRC or required by governmental agencies shall be arranged jointly by CHPRC and the Contractor. The Contractor shall request such inspection through CHPRC only after the Work is ready for inspection.

4.1 Preliminary Grout Mix Design

The following are suggested materials and quantities for use in the grout mix. The Contractor is to determine the final mix design in accordance with specified grout performance criteria.

Material	Specification	Amount
Cement	ASTM C150, Type II only, low heat of hydration	175 lbs/cy
Fly Ash	ASTM C618, Class F only	150 lbs/cy
Water/Cement Ratio	NA	0.4, cement content = cement wt. plus fly ash wt.
Course Aggregate (See Note 1)	ASTM C33, Natural gravels only, Crushed gravels are not allowed.	
Fine Aggregate (See Note 1)	ASTM C33, Manufactured sand is not allowed	Materials passing 200 sieve: 4 percent maximum
Water Reducing Admixture (See Note 2)	ASTM C494, Type A or Type D	
High Range Water Reducing Admixture (HRWRA) (See Note 3)	ASTM C494/C494M, Type F or Type G	

Note 1: The Contractor shall not use the bottom 6 inches of the course and fine aggregate stockpiles.

Note 2: Acceptable water reducing admixture manufacturer's are BASF Admixtures Inc., Shakopee, MN; Pozzolith or Polyheed; W.R. Grace & Co., Cambridge, MA, WRDA with HYCOL; or Euclid Chemical Co., Cleveland, OH, Eucon WR-91.

Note 3: Acceptable HRWRA manufacturers are BASF Admixtures Inc., Shakopee, MN, Rheobuild or Polyheed; W.R. Grace & Co., Cambridge, MA, Daracem 100; or Euclid Chemical Co., Cleveland, OH, Eucon 537. Use anti-washout admixture in accordance with manufacturer's recommendations.

Performance Criteria	
Minimum Compressive	1500 psi at 28 Days

Strength	
Minimum Flow Distance	80 Feet
Maximum Heat of Hydration	≤13F° for 100lbs of Cement

4.2 Grout Pumping

Contractor shall include in the bid the cost of purchasing the piping described in this section. Piping used in the Canyon shall remain the property of CHPRC. The maximum length of each pipe segment shall be 10 feet. Safety straps shall be provided at each piping joint. Contractor shall be responsible for purchasing pipe with a pressure rating that matches the pressure rating of the pumping equipment. The Contractor shall provide CHPRC staff with training on assembly and disassembly of the grout conveyance piping. Contractor shall determine if the piping and elbows used on the Canyon floor can be provided with lifting handles that can be used by the overhead crane to facilitate movement of the pipe. The following is a list of materials for the grout conveyance system. This list is not an exhaustive list, but represents the minimum working materials and equipment that will be required for performance of the work.

Item #	Equipment Description	Unit Rate	Qty
1	Grout Pump	Day	3
2	5" Rigid Pipe – 10'	EA	70
3	5" Flex Hose - 10'	EA	7
4	5" Flex Hose - 30'	EA	8
5	5" Flex Hose - 50'	EA	6
6	5" Flex Hose - 70'	EA	6
7	5" Flex Hose - 90'	EA	12
8	5" Two Bolt Coupler	EA	250
9	5" Snap Coupler	EA	50
10	5" Coupler Gasket	EA	300
11	5" 90 Elbow	EA	45
12	5" Pressure Relief Valves	EA	16
13	Pipe Bracket	EA	120
14	Hold Down Clamp	EA	120
15	Anchor Block	EA	16
16	5" Hammer Shut Off Valve	EA	16
17	Pump Primer Mix Pail	EA	36
18	Clean Out Balls (Pigs)	EA	200

4.2.1 Equipment Specification

1. Grout Pump:

   Grout Pump shall be capable of pumping a minimum of 80 CY/hour. A trailer mounted pump equal to or greater than a Putzmeister - BSA 2110 HP-D pump shall be provided. Two pumps shall be used primarily and the third pump shall

be onsite for emergency replacement purposes. During critical pours the third pump may be used concurrently with the two primary pumps to increase efficiency. Notice for the additional third crew shall be provided to the Contractor in sufficient advance for training and scheduling purposes.

2. 5" Rigid Pipe:

   5" Rigid Pipe shall have a minimum working pressure of 500psi and a minimum burst pressure of 1400 psi. The pipe shall be compatible with the coupler systems and shall be able to be attached vertically and horizontally to control slugging and movement by means of pipe bracket and hold down clamps.

3. 5" Flex Hose:

   5" Flex Hose shall have a minimum working pressure of 500psi and a minimum burst pressure of 1400 psi. The pipe shall be compatible with the coupler systems and shall be able to be attached vertically and horizontally to control slugging and movement by means of pipe bracket and hold down clamps. Lifting straps shall be attached so that the hose may be controlled by the crane when remote control is required for placement.

4. 5" Two Bolt Coupler:

   5" Two Bolt Coupler shall have minimum working pressures to match the pipe and hose in items 2 and 3. Weight, working pressure, manufacturer and size shall be cast into the coupling.

5. 5" Snap Coupler:

   5" Snap Coupler shall have minimum working pressures to match the pipe and hose in items 2 and 3. Weight, working pressure, manufacturer and size shall be cast into the coupling. The snap coupler shall be used as a quick connect system between the flex hose and the rigid pipe, therefore the snap coupler must be compatible between these systems.

6. 5" Coupler Gasket:

   The 5" Coupler Gaskets shall be compatible for use for rigid pipe and flex hose and well as the two bolt coupler and the snap coupler. The gaskets shall have minimum working pressures to match the pipe and hose conveyance system.

7. 5" 90 Elbow:

   The 5" 90 Elbow shall have a minimum working pressure of 500psi and a minimum burst pressure of 1400 psi. The elbow shall be compatible with the coupler systems and shall be able to be attached vertically and horizontally to control slugging and movement by means of pipe bracket and hold down clamps.

8. 5" Pressure Relief Valve:

The 5" Pressure Relief Valve shall have a minimum working pressure

9. Pipe Bracket:

   Pipe Bracket shall be compatible with the pipe, hose and elbow conveyance system and shall be able to be mounted both vertically and horizontally for pipe support.

10. Hold Down Clamp:

    Hold Down Clamps shall be compatible with the pipe, hose and elbow conveyance system and shall be able to be mounted both vertically and horizontally for pipe support.

11. Anchor Block:

    Anchor Blocks shall be of sufficient size and weight to provide protection against any movements generated by thrusting or slugging of materials.

12. 5" Hammer Shut Off Valve:

    5" Hammer Shut Off Valves shall be compatible to the size and class of rigid pipe.

13. Pump Primer Mix Pail:

    Pump primer mix shall be used in preparation activities of the pump for use daily. Pump Primer mix shall not be detrimental to the mix design of the grout.

14. Clean Out Balls (Pigs):

    Clean Out Balls (Pigs) shall be compatible for both rigid and flex pipe/hose and shall not be detrimental to the grout mix design since the clean out balls shall be left inside the canyon after each use.

4.3 Quality Control

Contractor's Quality Control Plan (QCP) shall detail how quality control will be maintained on all products that the Contractor provides. The QCP shall include an inspection and test plan as delineated in Section 6.4, Quality Assurance/Inspection Requirements. The QCP shall also identify the line of authority that the QC Manager has to rectify any issues with any products during the course of the project.

4.3.1 Field Testing – At a minimum, the QCP shall be based on the following minimum requirements. The Contractor's QC Manager shall be on site during placement of the grout

- One (1) set of compressive tests shall be taken from the first placement each day.
- One (1) set of compressive tests shall be taken for each 100 cubic yards of grout placed each day.

- Stockpile sampling of combined aggregate graduation shall be taken for each 100 tons of combined aggregate used.
- Provide adequate facilities for safe storage and proper curing of grout test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
- Provide grout for testing and for making cylinders from the point of discharge into the grout pump.
- Evaluation will be in accordance with ACI 301 and Specifications.
- Specimens shall be made, cured, and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.
- Frequency of testing may be changed at discretion of CHPRC.
- Pumped Grout: Take grout samples for testing and test cylinders (ASTM C31/C31M and ASTM C39/C39M).
- Reject grout represented by cylinders failing to meet strength.
- High Range Water Reducer (Super plasticizer) Admixture Segregation Test: The Contractor's Quality Control Plan shall address the test specification and frequency to be performed in order to maintain quality control of the grout.
- Provide equipment for control of grout redosing for air entrainment or high range water reducing admixture (super plasticizers) at Site to maintain proper slump and air content if so needed
- Segregation Test Objective: Grout must stay together when slumped. Segregation is assumed to cause mortar to flow out of mix even though aggregate may stay piled enough to meet slump test. The Contractor's Quality Control Plan shall address the test specification and frequency to be performed in order to maintain quality control of the grout.
    1. Test Procedure: Check for excessive slump and observe to see if mortar or moisture flows from slumped grout.
    2. Reject grout if mortar or moisture separates and flows out of mix.

4.3.2 Manufacturer's Services

Provide the following representative at Site. Field Services, for installation assistance, inspection, and certification of proper installation for grout ingredients, mix design, mixing, and placement.

The Contractor shall provide a Batch Plant Representative to observe performance of the grout mix. Be present during first placement of each type of grout mix. Assist with grout mix design, performance, placement, weather problems, and problems as may occur with grout mix throughout Contract. Establish control limits on grout mix design. The Contractor shall also provide an Admixture Manufacturer's Representative to demonstrate special features, product performance, product mixing, testing, and placement or installation for each type of admixture. Observe how grout mixes are performing, be present during first placement of each type of grout mix, and assist with grout mix design, performance, placement, weather problems, and problems as may occur with grout mix throughout Project, including instructions for redosing.

4.4 Batch Plant Capacity

The on-site batch plant shall be capable of delivering a minimum of 160 CY of grout per hour.

Batch Plant Inspection: Engineer shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in these Specifications.

Weighing Scales: Tested and certified within tolerances set forth in the NIST Handbook No. 44.

Batch Plant Equipment: Either semiautomatic or fully automatic in accordance with ASTM C94/C94M

4.5 Codes and Standards

The following latest version of the codes, standards, and requirements included below, are hereby incorporated into and made a part of this SOW, as applicable. They shall have the same force and effect as if written into the body of the SOW.

American Concrete Institute (ACI)

- ACI 207. 1R, *Guide to Mass Concrete*
- ACI 207.2R, *Report on Thermal and Volume Change Effects on Cracking of Mass Concrete*
- ACI 207.4R, *Cooling and Insulating Systems for Mass Concrete*
- ACI 211.1, *Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.*
- ACI 224R, *Control of Cracking in Concrete Structures*
- ACI 301, *Specifications for Structural Concrete*
- ACI 305R-99, *Hot Weather Concreting*
- ACI 304R, *Guide for Measuring, Mixing, Transporting, and Placing Concrete*
- ACI 304.2R, *Placing Concrete by Pumping Methods*
- ACI 318, *Building Code Requirements for Structural Concrete and Commentary*
- ACI 349-01, *Code Requirements for Nuclear Safety Related Concrete Structures*

American Society for Testing and Materials (ASTM)

- ASTM C31/C31M, *Standard Practice for Making and Curing Concrete Test Specimens in the Field*
- ASTM C33, *Standard Specification for Concrete Aggregates*
- ASTM C39/C39M, *Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens*
- ASTM C94/C94M, *Standard Specification for Ready-Mixed Concrete*
- ASTM C150, *Standard Specification for Portland Cement*
- ASTM C192/C192M, *Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory*

- ASTM C311, *Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete*
- ASTM C403, *Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance*
- ASTM C 1077, *Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation*

National Electric Code (NEC)

- NFPA 70

Occupational Safety and Health Standards (OSHA)

- 29 CFR 1910, *General Industry*
- 29 CFR 1926, *Labor*

Federal Regulations and Guidance

- The DOE Requirements, National Consensus Codes and Standards are hereby incorporated into and made a part of this Statement of Work. They shall have the same force and effect as if written into the body of the Statement of Work
- EPA Office of Solid Waste and Emergency Response (OSWER) Policy Directive 9487.00-2A (EPA 1986)
- *Ecology Environmental Handbook for Washington Construction Contractors*, #96-503
- DOE-0336, *Hanford Lockout/Tagout Program*

4.6 Specifications

The specifications applicable to this scope, includes the following latest version:

No.	Title
PRC-PRO-SH-40078	Contractor Safety Processes – Appendix F, Safety Program Specification for Contractors

4.7 Drawings

The drawings included below, are hereby incorporated into, and made a part of this Statement of Work. They shall have the same force and effect as if written into the body of the Statement of Work.

Drawing No.	Title
H-2-832911, Sht. 11	Potable Water Distribution 200 West (includes Site Plan & Batch Plant and Grout Delivery Location)

4.8 Exhibits

The exhibits included below, are hereby incorporated into, and made a part of this Statement of Work. They shall have the same force and effect as if written into the body of the Statement of Work.

Exhibit No.	Document No.	Title
1	Form A-6004-750	CHPRC Chemical Inventory Worksheet

Additional exhibits may be included within each Contract Release.

4.9 Electrical Safety Requirements

All electrical control panels and electrical equipment (including material, fittings, devices, appliances, luminaries, fixtures, apparatus, and the like used as a part of, or in connection with, an electrical installation) delivered or brought onto the site in performance of this contract must be labeled by an organization currently recognized by OSHA as a nationally recognized testing laboratory (NRTL).

All electrical equipment installed as part of this contract must comply with the National Electric Code (NEC), NFPA 70 and, where applicable, ANSI C2 (NESC). CHPRC reserves the right to inspect electrical equipment and installations. The Contractor is responsible for notifying CHPRC when installations are available for inspection.

Electric motors shall be labeled to be in accordance with NEMA MG-1 or listed by an organization currently recognized by OSHA as an NRTL.

Electrical equipment and devices for which there is a NRTL listing category must be listed or labeled by UL or another organization currently recognized by OSHA as an NRTL.

Electrical equipment for which there is no listing category must be evaluated or tested using a method submitted to and approved by CHPRC prior to delivery of the equipment.

All Contractor-provided equipment shall be capable of being locked out.

Electrical equipment is also subject to the "Counterfeit Suspect Item Program."

4.10 Fire Prevention Requirements

The Contractor shall comply with the location, temperature, and fire hazard specific requirements as specified by the CHPRC Project or Facilities Fire Protection/Prevention plans and/or the requirements specified by the Hanford Site Fire Marshall.

In the case of a fire, immediately contact the Hanford Site Fire Station at 509-373-3800.

4.11 Work Management Requirements

The Contractor shall identify the designated point of contact/field work lead responsible for supervising the execution of on-site field work by the Contractor.

All work performed by the Contractor at the Hanford site shall be planned, reviewed, released, executed and managed in accordance with the CHPRC's work control process,

system, documents and procedures. All work performed by the Contractor at the Hanford site shall be released in CHPRC approved work packages.

CHPRC Work Control Processes

The Contractor shall use the following CHPRC's work control process, documents and procedures:

CHPRC Work Planning Requirements

The Contractor shall participate in providing input, planning and review of detailed work instructions including specific steps for each task to be performed, CHPRC support resource requests, and work request scheduling.

Hazard Identification and Control Requirements

The Contractor shall participate in the CHPRC's job hazards analysis process.

CHPRC Work Release Requirements

Daily work will be released on approved CHPRC work release forms. The Contractor shall attend daily planning meetings and pre-job meetings. Requirements for coordinating, scheduling, and releasing work will be determined and specified by the FWS.

5.0 PERSONNEL REQUIREMENTS

5.1 Training and Qualification

The Contractor shall provide appropriately trained and qualified staff to perform the type of work associated with their craft or trade and as specified at the Hanford site. This shall include necessary expertise and training including continuing training programs to assure Contractor personnel maintain a current understanding of laws, requirements, and industry standards (e.g. skill of craft).

Contractor personnel shall be trained as required for the specific position and their assigned work. Training shall be completed prior to performing the work and training shall be documented.

Contractor shall ensure that its personnel meet and maintain the appropriate training, qualification and certification requirements. Hanford site-specific general training requirements to safely perform this work are identified below.

A. The following types of training/qualifications are required and will be communicated by the BTR in work instructions driven by an Employee Job Task Analysis (EJTA):

1. CHPRC General Employee Training (CGET) or Hanford Site Orientation.
2. Special hazard training as applicable (i.e., GERT,)
3. Facility specific training as applicable

4. Any special certifications (i.e., materials sampling and testing, equipment calibration, engineering, etc.)
5. Job specific training (i.e., journey electrician, journeyman pipefitter, heavy duty operator,)
6. "Competent and/or Qualified Person"
7. Occupational Safety and Industrial Hygiene Training (See PRC-PRO-SH-40078)

B. CHPRC will provide Contractor staff any task or facility-specific training as required for safe access and performance.

C. The following training is required for on-site Contractor personnel and is provided by CHPRC. With the exception noted below, off-site training is acceptable.

1. Safety, Environmental, and Health Orientation for Contractors/Construction Supervisors (SEHOCS) for Contractor Supervisors and Safety Representatives only (Course #6004).
2. OSHA 10-Hour Health and Safety (Course #026100)
3. Portable Ladder Safety – CBT (Course #044391)
4. OSHA Electric Cord and Power Tool Safety (Course #044480)
5. Fall Hazard Recognition and Prevention (Course #020147)
6. Hanford Site Lockout/Tagout for Authorized Worker – Initial (Course #00311I). (Off-site training is not acceptable).
7. Basic Medic First Aid/ CPR/AED (Course #170500) - One member of the Contractor's on-site field team must be First-Aid/CPR/AED qualified.
8. Heat Stress Training – CBT (Course #020193).

D. The Contractor shall maintain personnel training records and ensure that his work force remains sufficient and qualified to continue the work over the duration of the contract.

E. As soon as practical after award, the Contractor shall submit a badge request for personnel required under the various releases so that they may be scheduled for any Site training so that crews will be eligible for work on-site.

F. Contractors shall be required to follow facility-specific procedures when executing the work scope (co*pies of publicly released documents may be found on the CHPRC web site at https://www.plateauremediation.com/index.aspx?section=162 , non-released documents may be obtained from the BTR or SME when on site*):

Document Number	Title
PRC-MP-SH-32219	10 CFR-851 CHPRC Worker Safety and Health Program Description
PRC-PRO-SH-	Adverse Weather

Document Number	Title
28034	
PRC-POL-SH-5053	CHPRC Plateau Remediation Company Safety, Health, Security, Quality, and Environmental Policy
PRC-RD-SH-8801	Fall Protection
PRC-RD-SH-11827	CHPRC Hanford Electrical Safety Program Requirements
PRC-PRO-SH-121	Heat Stress Control
PRC-PRO-WKM-079	Job Hazard Analysis
PRC-RD-SH-9237	Motor Vehicle/Bicycle Safety
PRC-RD-SH-24243	Portable Ladders
Requirement documents not controlled by CHPRC	Title
DOE-0336	Hanford Lockout/Tagout Program

G. The required training shall be completed prior to work. Prior to the start of work, the Contractor shall submit documentation of successful completion of the training requirements and certification that all training is current.

H. For previous training or Contractor equivalency training to be acceptable for Hanford Site qualification, documented evidence must include type and class of equipment. For qualifications not related to equipment operation, personnel must have documented evidence of training and experience related to the activity as specified by DOE-RL-92-36.

5.2 Security and Badge Requirements

For any on site work, see Special Provisions – On Site Services SP-5 for details.

A. Contractor personnel shall wear a CHPRC-issued security identification badge. As soon as practical after award, the Contractor shall submit badge requests to CHPRC for Contractor work personnel required on-site. A minimum of two working days advance notice is needed for site badges.

B. Contractor employees shall be required to submit to vehicle searches and not personally carry or transport certain prohibited articles.

5.3 Site Access and Work Hours

A. Work shall be done on a 9/80 (8-9's) schedule. The standard workday shall consist of nine (9) hours of work between 7:00 AM and 4:30 PM, with one-half hour designated as an unpaid period for lunch. An eight (8) hour workday is substituted on alternate working Fridays. Alternate non-working Fridays, Saturdays and Sundays are worked only on a CHPRC pre-approved exception basis. CHPRC site holidays are not worked.

B. The Contractor will have access to the job site based on the terms of the individual Contract Releases.

6.0 ENVIRONMENTAL, SAFETY, HEALTH, AND QUALITY REQUIREMENTS

The Contractor shall perform work safely, in a manner that ensures adequate protection for employees, the public, and the environment, and shall be accountable for the safe performance of work. The Contractor shall comply with, and assist CHPRC in complying with Environmental, Safety, Health, and Quality (ESH&Q) requirements of all applicable laws, regulations and directives. In accordance with, Part IV of this contract, all on-site work shall be conducted in accordance with *SP-5, Special Provisions – On-Site Services*.

The Contractor shall perform work under the direction of the CHPRC Site-Specific Health and Safety Plan for this project.

6.1 Integrated Safety and Health/Environmental Management System (ISMS/EMS)

The Contractor shall perform work safely in accordance with Integrated Safety Management System (ISMS) and Environmental Management System (EMS) (ISMS/EMS) principles, in a manner that ensures adequate protection for personnel, the public, and the environment; and shall be accountable for the safe and environmentally protective performance of the Work.

The Contractor shall exercise a degree of care commensurate with the work and the associated hazards. The Contractor shall ensure that management of ES&H functions and activities is an integral and visible part of the Contractor's work planning and execution processes. As a minimum, the Contractor shall:

- Thoroughly review the defined scope of work;
- Identify hazards and ES&H requirements;
- Analyze hazards and implement controls;
- Perform work within controls; and
- Provide feedback on adequacy of controls and continue to improve safety management.

The Contractor shall flow down ESH&Q requirements to the lowest tier subcontractor performing work on the Hanford site commensurate with the risk and complexity of the work.

In addition, the following project specific safety requirements are applicable to this specific scope of work and are tailored to the hazards and controls applicable to this scope of work.

6.2 Safety Requirements

A. The Contractor shall comply with applicable Hanford site, State, Federal, and DOE safety and health requirements or regulations. The Contractor and its subcontractors shall perform work in compliance with facility-specific procedures and requirements documents applicable to the work area. These procedures and requirements comply with State, Federal, and DOE requirements or regulations. Where there is a difference in regulations or requirements, the most stringent shall apply.

B. For on-site work, Contractor and its subcontractors shall be responsible to comply with all applicable sections of both SP-05, Special Provisions – On-Site Services and *PRC-PRO-SH-40078, Contractor Safety Processes - Appendix F, Safety Program Specifications for Contractors.*

NOTE: *Both the SP-5, Special Provisions – On-Site Services and PRC-PRO-SH-40078, Contractor Safety Processes - Appendix F, Safety Program Specifications for Contractors is available at: www.plateauremediation.com/index.aspx?section=162. Also, documents are available on the www.hanford.gov internet website by clicking on Business Opportunities (under the INFORMATION heading), CHPRC Plateau Remediation Company Procurement, Continue (to leave the Department of Energy Hanford website), Reference Documents.*

C. The Contractor shall comply with the programs and processes defined in the following CHPRC documents:

DOE-0336	*Hanford Lockout/Tagout Program*
PRC-PRO-SH-40078	*Safety Program Specifications for Contractors-Appendix F*
PRC-RD-SH-8801	*Fall Protection*
PRC-RD-SH-9237	*Motor Vehicle/Bicycle Safety*
PRC-PRO-SH-121	*Heat Stress Control*
PRC-RD-SH-11183	*Personal Protection*
PRC-RD-SH-24243	*Portable Ladders*
DOE-343	*Stop Work*
PRC-RD-SH-11827	*CHPRC Hanford Electrical Safety Program Requirements*

PRC-RD-SH-29096	*Tags, Signs and Barriers*
PRC-PRO-SH-10321	*Walking/Working Surfaces*
PRC-PRO-SH-077	*Reporting, Investigating and Managing Health, Safety and Property/Vehicle Events*

D. The Contractor shall perform work in compliance with facility-specific procedures and requirements documents applicable to the work area. Health and safety requirements specific to the 221-U facility are addressed in CP-40329, *Site-Specific Health and Safety Plan for the 221-U Facility* (HASP). The Contractor shall comply with the requirements of this document for all work performed on-site.

E. The Contractor shall identify a staff member as the Designated Safety Representative prior to the start of work, if the Contractor has more than one employee working on-site in performance of this contract, in accordance with Special Provisions – On-Site Services (SP-5). The Contractor shall notify CHPRC if the name of the Designated Safety Representative changes.

F. The Contractor Designated Safety Representative will participate with CHPRC Safety and Health in routine safety inspections of Contractor's on-site worksite.

G. While working on-site, the Contractor shall be required to participate in emergency drills.

H. The Contractor shall participate in the Automated Job Hazard Analysis (AJHA) process. AJHAs will be prepared by CHPRC to address specific work activities and hazards associated with the specific work and shall be used by personnel in order to aid them in the identification, elimination or control, and response of potential hazards. An AJHA will be performed prior to work on each release to ensure proper safety planning and communication.

I. CHPRC will provide industrial hygiene technical support. Such support will require the Contractor to provide specific MSDSs to CHPRC for review and approval prior to bringing new or alternate materials on site before and during the project. CHPRC will establish exposure controls and limits, and conduct sampling and monitoring deemed necessary by the CHPRC's industrial hygienists for hazardous agents associated with the activities performed by the Contractor. Where hazards are found to be present, and cannot be mitigated through process/material(s) elimination or substitution, engineering or administrative controls, appropriate personal protective equipment (PPE) shall be required based on type of hazard, exposure potential, measured contaminant concentration(s) and fit. The required PPE shall be worn by affected personnel. The exposure controls and limits for hazardous agents (i.e. noise, chemical) and required PPE will be specified in the Site-Specific Health and Safety Plan and/or the Automated Job Hazard Analysis (AJHA). The Contractor is responsible to provide applicable and/or required PPE appropriate for the job tasks. Results of all industrial hygiene surveys and monitoring will be provided to the Contractor's Safety Representative and the Contractor's on-site designated point of contact or field work lead. The CHPRC industrial hygienists will discuss exposure monitoring results with the respective Contractor representatives and, as necessary, recommend or specify actions and

controls to reduce or control employee exposure to hazardous agents. The Contractor and CHPRC shall collaborate to implement these controls and ensure their effectiveness. The Contractor is responsible to comply with all health, safety, and industrial hygiene programs and recommendations.

J. The Contractor's Safety Plan shall include a description of how dust and airborne particulates will be controlled in the stockpile, batching and mixing operations. Of particular concern, special exposure control measures shall be taken if the amount of beryllium present in fly ash exceeds 2.0 ppm (2 ug/gm). CHPRC industrial hygienists will sample fly ash to independently verify the beryllium content.

K. In accordance with *PRC-PRO-SH-40078, Contractor Safety Processes*, when the Contractor brings chemicals on site, the activity is subject to CHPRC's Chemical Management System Program. The Contractor must fill out Form A-6004-750, Chemical Inventory Worksheet, and submit for approval to CHPRC prior to mobilization.

L. MSDS for hazardous chemicals (as defined by 29 CFR 1910.1200) which will be used during the work activity shall be provided to the FWS. The Contractor shall keep the list current and shall provide the list to the FWS when the list has been updated. Upon demobilization, the Contractor shall remove any remaining chemicals stored on site.

M. Lock-out/Tag-out performed by the Contractor shall be performed in accordance with DOE-0336, and with the oversight of CHPRC's Controlling Organization representative and BTR (See also *PRC-PRO-SH-4007, Contractor Safety Processes Appendix F – Safety Program Specifications for Contractors, Section 2.11*).

N. The Contractor shall use a fall protection system whenever the work surface is greater than 6 ft. Fall protection anchorage points shall be engineered and shall be approved by CHPRC. Approved anchorage point documentation must be readily available.

O. The Contractor shall immediately notify the FWS (who will contact CHPRC Health and Safety) of any injuries or incidents; to include damage to Contractor-owned property or equipment.

P. The Contractor shall utilize the Hanford Site Occupational Medical Provider, AdvanceMed Hanford (AMH) to obtain the identified medical examinations. The Contractor shall support CHPRC development/completion of an Employee Job Task Analysis (EJTA) for each assigned individual assigned to an on-site work location for greater than 30 days in a rolling 12 month period. Completed ETJAs will be submitted to CHPRC Health and Safety for approval. Approved EJTAs will be provided by CHPRC Health and Safety, to AMH to define required medical examination(s).

All workers with a task assignment on the Hanford site are required to have a CHPRC approved EJTA regardless of the length of the assignment. EJTAs and any required exams should normally be prepared and performed prior to the Contractor's mobilization on site. However, a person with a long term assignment that does involve one or more of the chemical/physical hazardous exposures or anticipated work assignments identified in PRC-PRO-SH-40078 can start working on site prior to obtaining an exam but must have a CHPRC approved EJTA and secure their examination during the first 30 days of assignment. If a worker has a task assignment on the Hanford site that is over 30 days where the task does not expose them to any of

the chemical/physical hazardous exposures or anticipated work assignments identified in PRC-PRO-SH-40078, no AMH physical/medical monitoring examination is required.

Q. The Contractor shall use the Hanford Occupational Medical Provider (AdvanceMed) for first aid treatment, and return to work evaluations, and the Hanford Fire Department for ambulance service for urgent medical situations requiring care and transport.

R. The Contractor shall take appropriate action, up to and including stopping work, and immediately notify CHPRC if an unplanned risk or hazard is discovered that is not covered by directions provided by CHPRC. This action includes notifying CHPRC if the work exposes their workers to hazards that require medical monitoring.

S. All services will be conducted in accordance with Hanford Site environmental, safety and health standards, security requirements, and Quality Assurance Program Plan applicable to scope.

T. The Contractor shall comply with the CHPRC ladder safety policy as described in PRC-PRO-SH-40078, *Contractor Safety Processes- Appendix F, Section 2.16*. The intent of this policy is to ensure that alternatives to portable ladders have been examined on a task specific basis. CHPRC Health and Safety concurrence shall be obtained prior to any portable ladder use by the Contractor.

U. If chemical contamination is encountered, work shall be stopped immediately, the BTR contacted and an appropriate chemical monitoring plan prepared by CHPRC.

V. For on-site work, Contractor may submit for approval to the Contract Specialist, a comprehensive OS/IH plan, or meet all applicable CHPRC OS/IH requirements including but not limited to PRC-MP-SH-32219, *10 CFR 851 CHPRC Worker Safety & Health Program Description, Appendix B*.

6.3 Quality Assurance and Control

For CHPRC purposes only, the quality level of this work is Quality Level 3.

A. The Contractor shall be responsible for performing quality workmanship and shall conduct the quality control measures necessary to ensure work conforms to requirements included in this SOW. Work shall be performed to established technical standards and administrative controls using approved instructions, procedures, or other appropriate means.

B. Plans, procedures, engineering documentation and records shall be controlled, reviewed, approved, and maintained.

C. Items shall be identified and controlled to ensure their proper use. Items shall be maintained to prevent their damage, loss, or deterioration. Applicable equipment requiring calibration shall be periodically calibrated and maintained to ensure reliable results. Calibration shall be traceable to National Institute of Standards and Technology Calibration (NIST) Standards.

D. Procured items and services shall meet established requirements and perform as specified. Prospective suppliers shall be evaluated and selected on the basis of

specified criteria. Processes to ensure that approved suppliers continue to provide acceptable items and services shall be established and implemented.

E. The Contractor shall flow-down these requirements, or applicable portions thereof, to its sub-contractors, depending on the nature and scope of their work.

6.4 Quality Assurance/Inspection Requirements

The Contractor shall be responsible for performing quality workmanship and shall perform oversight of all work including all inspection points, verification points, witness points and hold points necessary to ensure work conforms to requirements.

A. The Contractor shall submit an inspection and test plan for CHPRC approval. The Contractor shall be responsible for the performance of all inspection and testing activities associated with the design, supply, installation, testing, start-up and operation of the on-site grout batch plant and associated equipment as specified in the inspection and test plan. This plan shall indicate any and all inspections and tests that will be used to confirm compliance with specification and design requirements.

   The inspection and test plan shall identify all materials, material specifications, specifications for the testing of the materials, as well as the frequency of any and all inspections and tests that will be used to confirm compliance with specification and design requirements. The inspection and test plan shall describe how the Contractor will (1) conduct grout testing to confirm and certify that the grout complies with specified grout design requirements and performance criteria; and (2) certify the accuracy and completeness of the test results. The plan shall include a requirement that those independently verifying grout testing, and accepting/rejecting the test results, shall have the same or equivalent qualifications as those performing the testing. The plan shall also define the content and format of the Contractor's certifications specified above, including the supporting test documentation, and the schedule for their submittal to CHPRC.

B. The Contractor shall provide first line quality control testing of grout. Testing personnel shall be qualified and certified to perform the required samples and tests. The testing agency engaged in the testing and /or inspection of materials shall meet the requirements of ASTM C 1077, *Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation,* with a certificate of accreditation along with the scope of accreditation.

C. The Contractor shall submit an inspection and test report upon completion of each portion of work as identified in the scope of work (SOW). The report shall indicate completion of each and every inspection and test performed.

D. For any measuring and testing equipment (M&TE) used for acceptance testing or process verification, the Contractor shall submit certification stating that the Contractor-supplied equipment used by the Contractor in the performance of the work has been calibrated utilizing standards whose calibration is traceable to the National Institute of Standards and Technology. If no such standard(s) is available, the Contractor shall submit for review and approval, documentation stating the basis of the

equipment's calibration. This certification shall include a report of actual calibration results. The documentation shall be identifiable to the equipment being used and to any acceptance criteria listed in the procurement documents. The report shall contain the signature, with printed name, of the authorized representative of the agency who performed the calibration.

All items, operations and associated documentation are subject to review, inspection or surveillance by the CHPRC's quality assurance or engineering representative at the Contractor's facility, or any sub-tier contractor's facility. CHPRC reserves the right to make inspections at any time at the source of supply of materials, at the place of preparation of materials, at the batch plant, and during execution of all grouting work. This shall in no way relieve the Contractor of any contractual responsibilities.

CHPRC will perform testing and evaluate test results of the supplied grout at the point of delivery for compliance with specified grout performance criteria.

6.5 Environmental Requirements

Environmental support and issues shall be coordinated with the BTR or FWS, who will coordinate these items with the appropriate Environmental Compliance Officer (ECO).

The Contractor shall not perform excavations or other activities that will extend more than 12 inches below existing grade without appropriate cultural/ecological reviews and an excavation permit issued by CHPRC. The Contractor shall advise BTR or FWS at least 10 days in advance of the need to excavate and shall provide location, depth and other relevant information.

The Contractor shall submit a list of all chemicals to be brought on site with a copy of the product's MSDS and provided to CHPRC in accordance with Section 3.0 of SP-5, *Special Provisions – On-Site Services*.

The Contractor shall use best available control technology to meet emission standards for visible, particulate, fugitive, odors and hazardous air emissions during performance of this work.

The Contractor shall not dispose of wastewater generated during work on the Hanford Site without express written authorization from BTR. Disposal of water from hydro-testing or disinfection of pipe shall be in accordance with Hanford State Waste Discharge Permit ST4511 or other similar permit.

Wastewater from washing trucks, pumps and associated equipment may be discharged in a manner and at a location approved by CHPRC, after written notification to and approval from CHPRC.

Wastes generated on the Hanford Site shall be minimized and shall be managed in accordance with Section 3.0 of SP-5, *Special Provisions – On-Site Services*.

The Contractor shall manage universal waste (e.g., batteries, lamps, and thermostats), used oil, spent antifreeze, aerosol products, and shop towels in accordance with Hanford site practices when these recyclable materials are generated on the Hanford site. These

materials shall be turned over to CHPRC for disposition via recycling after initial accumulation by the Contractor.

Incidental releases from water supply hoses and connections shall be eliminated or minimized to prevent or eliminate soil erosion and ponding. If a discharge exceeds 60 gallons release to the soil, site CHPRC staff shall be notified immediately. No other discharges to the ground are allowed. Grout over pour and waste from equipment washing shall be discharged to a location provided by CHPRC.

The Contractor shall also employ methods to manage waste water resulting from washing grout equipment consistent with *Ecology Environmental Handbook for Washington Construction Contractors,* #96-503. This includes disposal of waste water into:

(1) An area where the grout wash can harden and be broken up and then sent to disposal by CHPRC.

(2) A location which is not subject to surface water runoff and is more than 50 feet from a storm drain.

(3) A designated area which will later be backfilled (a slurry pit).

6.6 Software Products and/or Services Where Software is Used –

Not used.

7.0 MEETINGS AND SUBMITTALS

7.1 Meetings

The person(s) designated by the Contractor to attend all meetings shall have all required authority to make decisions and commit the Contractor to technical decisions made during meetings.

A. Project Kickoff Meeting

After contract award, the Contractor shall participate in a Project Kickoff Meeting to be held at CHPRC's Site. The time, date and agenda for the meeting will be provided to the Contractor by CHPRC.

B. Labor Meeting Per the Site Stabilization Agreement

A pre-job conference will be held between CHPRC, the appropriate Union(s), and the Contractor before work commencement at the site in accordance with the Site Labor Agreement (Article X, Section 6).

C. Weekly Progress Meetings

1. The Contractor shall attend a weekly progress and coordination meeting at the CHPRC's facility.

D. Pre-Job/Weekly Safety Meeting

1. Pre-Job Meetings: The Contractor shall provide indoctrination and orientation of all Contractor's employees and lower tier Contractor employees prior to commencing

work at the jobsite (This includes the entire labor force and all new hires). The Contractor shall maintain a training matrix sheet to demonstrate all employees at the work site have been briefed on all applicable safety practices and permits prior to the employees beginning work. Indoctrination also applies to all vendors making site deliveries.

2. Safety Meetings: The Contractor shall attend a weekly "all hands" safety meeting. Late arrivals shall be provided with the same briefing.

E. Monthly Safety Meetings

The Contractor shall attend monthly safety meetings as directed by the BTR. The Contractor shall ensure all Contractor employees on site, are in attendance.

7.2 Submittals

A. The required submittals for this contract are listed in Attachment A, Submittal Register, which also includes a link to the Register definitions.

B. The Contractor submittals identified herein and summarized on the Submittal Register shall be submitted by the Contractor using the Contractor Document Submittal Form (CDSF) A-6003-061 and its Instructions (available at http://www.hanford.gov/pmm/downloads/download.htm#Contractor). (See also Attachment A, Contractor Submittal Requirements). Instructions for completion of the CDSF are included with the form. The quantity, frequency and type of submittal shall agree with the requirements set forth on the Submittal Register. A Submittal Number, entered on the CDSF by the Contractor in accordance with the submittal register, shall be used to identify each submittal. CDSF forms may be copied for submittals with different submittal dates. When any submission is returned to the Contractor with a request for resubmission (i.e., marked as: "B" "Minor Comments – Approved With Exceptions as Corrected Re-Submittal Required"; or "C" "Not Approved Revise and Resubmit") the Contractor shall resubmit all corrected documents within the time specified on the resubmission notice or if no time is specified therein within five (5) working days from the disposition date. New submittals shall require the Contractor to contact the Contract Officer if additional Submittal Numbers are required.

C. The Contractor shall certify each submittal has been reviewed for compliance prior to transmittal to CHPRC.

D. Task Submittals

The following items shall be submitted to CHPRC for approval in accordance with the instructions contained in the Attachment A, *Submittal Register*.

1. <u>Task 1 - Batch Plant and Stockpile Supply and Installation</u>

The Contractor shall submit an on-site batch plant and stockpile supply and installation plans including;

- Batch plant and stockpile area location, layout and equipment arrangement drawings

- Site preparation specifications and drawings
- Potable water supply requirements including the size, flow rate, and connection details
- Electrical power needs
- Diesel fuel needs for equipment that stays on site each night.
- Batch plant erection plans
- Initiation, start-up and commissioning plan
- Waste water management plan
- Solid waste management plan
- Grout quality control plan
- Safety plan
- Stockpile material receipt plan
- Grout delivery methodology and plan
- MSDS Sheets for all materials and chemical inventory
- Training records
- Equipment inspection and preventative maintenance

2. Task 2 - Grout Mix Designs and Test Results

   The Contractor shall submit grout mix design and grout quality verification documentation to CHPRC for approval.

3. Task 3- Batch Plant and Stockpile Operation and Maintenance

   The Contractor shall submit grout delivery tickets, compression test reports, and other documentation furnished with each batch of grout delivered to CHPRC for compliance with specified grout performance criteria.

4. Task 4 - Grout Pump Equipment

   - Grout pump catalog cuts
   - Grout rigid pipe catalog cuts
   - Grout flex hose catalog cuts
   - diesel fuel needs for equipment that stays on site each night
   - MSDS Sheets for all materials and chemical inventory
   - Training records
   - Equipment inspection and preventative maintenance
   - Safety plan

- Maintenance plan
- A letter designating the Field Work Lead and the Safety Representative

E. Prior to mobilizing on site, MSDS for all chemical products that will be used during the work activity shall be submitted for CHPRC approval. This will require a CHPRC MSDS number for each chemical to be brought on site and accurately maintained during fieldwork.

F. The Contractor shall submit Form A-6004-750, *CHPRC Chemical Inventory Worksheet* for any chemicals the Contractor brings on site to CHPRC for approval prior to mobilization.

G. Prior to the start of work, the Contractor shall submit documentation of successful completion of the training requirements and certification that all training is current.

H. The Contractor shall maintain and submit a program description of preventative maintenance requirements and completed equipment inspection and maintenance record logs.

I. Changes to Contractor submittals which have not been accepted by CHPRC as complete or acceptable shall be re-submitted using the CDSF form.

8.0 DELIVERABLES, PROJECT CONTROLS, MILESTONES, AND PERFORMANCE SCHEDULE REQUIREMENTS

8.1 Deliverables

See Section 3.1 for work scope task deliverables. See Section 7.2 for submittals.

8.2 Milestones

The specific milestones the Contractor must meet for this Contract are:

A. Batch plant and stockpile area layout drawings and equipment arrangement drawings based on the attached drawing = 7 days after award

B. Site preparation specifications and drawings = 14 days after award

C. Potable water supply requirements and tie-in connection details = 14 days after award

D. Electrical power needs = 14 days after award

E. Diesel fuel needs = 14 days after award

F. Erection plans = 21 days after award

G. Initiation, start-up and commissioning plan = 21 days after award

H. Waste water management plan = 28 days after award

I. Solid waste management plan = 28 days after award

J. Grout quality control plan = 28 days after award

K. Safety plan = 28 days after award

L. Stockpile material receipt plan = 28 days after award

M. Grout delivery methodology and plan = 28 days after award

N. Catalog cuts of manufacturer, make, model, and capacity of grout pumps to be used = 28 days after award

O. Catalog cuts of manufacturer, make, model, operating pressure, and test pressure of grout conveying rigid pipe and flex hose to be supplied. Included is a certification from the Contractor that the piping to be used in the Canyon stairways and on the Canyon floor is new. = 28 days after award

P. Catalog cuts of manufacturer, model, operating pressure, and test pressure for all fittings and couplers used in the Canyon stairways and on the Canyon floor. Included is a certification from the Contractor that the fittings and couplers to be used in the Canyon stairways and on the Canyon floor is new. = 28days after award

Q. Grout mix designs and grout quality verification documentation = 42 days after award

8.3 Period of Performance

Contract Period of Performance:

Start date: 7/227/2010

End date: 9/30/2011

ATTACHMENT A

SUBMITTAL REGISTER

Submittal Register Definitions

1. Numerical submittal sequence number: Example: 1, 2, 3, 4…(or organized by topics and project assigned coding structure).

2. Number of Copies and electronic and/or hard copy: Example: E (Electronic only), 6 (Six Hard Copies), or Hard, 1: E, 1 (One Hard Copy, and Electronic).

3. Format: Describes the type of submittal required:

DWG	A drawing/sketch using the conventional format
MFC	Microsoft Format Compatible application (Word, Excel, Access, PowerPoint)
GEN	General or Open Format/Media
PDF	Adobe Acrobat (Portable Document Format)

4. Submittal Type:

APW =	Approval Required Prior to Work (CHPRC must approve the Contractor's submittal prior to the Contractor being authorized to proceed with any activity/work associated with the submittal).
AP =	Approval Required (CHPRC must approve the Contractor's submittal; however, work associated with the submittal may proceed prior to CHPRC approval).

5. Vendor Information: Mark VI if yes, otherwise leave blank.

   Technical Submittal: Mark TS if yes, otherwise leave blank.

6. Description / Document Title: Title or general description of the document.

7. Submittal Date: Actual date or number of Calendar Days before or after a milestone that a submittal is due from the Contractor: Example: June 1, 2005 or CD + 60 [60 days after Conceptual Design Complete]

A	Date of Award
M	Mobilization

8. Approver Organizations: CHPRC organization for document approval

9. CHPRC Review Time (Work Days): Example: 4 Days

10. Contract Reference: Cross reference to the Contract requirement that defines this submittal: Example: SOW 3.1.2.

TITLE: Grout for 221-U Canyon Facility Voids

Submittal Register

The Contractor shall meet the required schedule and provide the documents specified in accordance with the following submittals.

Contract Number and Name:							Revision:	
1. No.	2. Number and Type of Copies	3. Submittal Type	4. Vendor Information/ Technical Information	5. Description / Document Title	6. Submittal Date (Calendar Days)	7. Approver Organizations	8. CHPRC Review Time (Work Days)	9. Contract Paragraph or Requirement Reference
1.	1,E DWG	APW	TS	Batch plant and stockpile area location and layout drawings and equipment arrangement drawings	A+7	PM,ENGR, OPS	4	SOW 3.1, 7.2
2.	1,E MFC,DWG	APW	TS	Site preparation specifications and drawings	A+14	PM,ENGR, OPS	4	SOW 3.1, 7.2
3.	1,E MFC,DWG	APW	TS	Potable water supply requirements and tie-in connection details	A+14	PM,ENGR, OPS	4	SOW 3.1, 7.2
4.	1,E MFC,DWG	APW	TS	Electrical power requirements	A+14	PM,ENGR, OPS	4	SOW 3.1, 7.2
5.	1,E MFC,	AP	TS	On-Site daily Diesel fuel requirements	A+14	PM,ENGR, OPS	4	SOW 3.3, 7.2
6.	1,E MFC,DWG	APW	TS	Batch Plant Erection plans	A+21	PM,ENGR, OPS, SAFTY	4	SOW 3.1, 7.2

7.	1, E MFC	APW		Initiation, start-up and commissioning plan	A+21	PM,ENGR, OPS	4	SOW 3.1, 7.2, 8.2
8.	1, E MFC	APW		Waste water management plan	A+28	PM,ENGR, OPS, ENV	4	SOW 7.2, 8.2
9.	1, E MFC	APW		Solid waste management plan	A+28	PM,ENGR, OPS, ENV	4	SOW 3.1, 7.2
10.	1, E MFC	APW		Grout quality control plan	A+28	PM, ENGR, QA	4	SOW 3.1, 6.4, 7.2
11.	1, E MFC	APW		Safety plan	A+28	PM, SAFTY	4	SOW 3.1, 7.2
12.	1, E MFC	APW		Stockpile material receipt plan	A+28	PM, ENGR,OPS	4	SOW 3.1, 7.2
13.	1, E MFC	APW		Grout delivery methodology and plan	A+28	PM, ENGR, OPS	4	SOW 3.1, 7.2
14.	1, E MFC,PDF	APW	TS	Grout mix designs and grout quality verification documentation	A+42	PM, ENGR, QA	4	SOW 3.1, 7.2
15	1, E, PDF	APW		Grout pump Catalog Cuts	A+28	PM, ENGR, OPS	4	SOW 4.2
16	1, E, PDF	APW		Grouting Rigid Pipe and Flex Hose Catalog Cuts	A+28	PM, ENGR, OPS	4	SOW 4.2
17.	1, E, PDF	APW		Grouting Fittings and Couplers Catalog Cuts	A+28	PM, ENGR, OPS	4	SOW 4.2

18.	1, GEN	AP	TS	Grout delivery tickets and other documentation for each batch of grout delivered	With each grout delivery	ENGR, OPS QA	4	SOW 7.2
19.	1, GEN	AP	TS	Inspection and test reports	14 days after completion of inspection or test report	ENGR, QA	4	SOW 6.4,
20.	1, E MFC,PDF	AP		MSDS and chemical inventory	M-7	SAFTY	4	SOW 3.4, 6.2, 7.2
21.	1, E MFC,PDF	AP		Training records	M-7	OPS,SAFTY	4	SOW 5.1, 7.2
22.	1, E MFC,PDF	AP	TS	Concrete testing certifications	M-7	ENGR,QA	4	SOW 6.4
23.	1, E MFC,PDF	AP	TS	M&TE calibration certifications	M-7	QA	4	SOW 6.4
24.	1, E MFC,PDF	AP		Equipment inspection and preventative maintenance	M-7	OPS,SAFTY	4	SOW 3.6, 7.2
25.	1, E MFC	AP		Letter designating Field Work Lead and Safety Representative	M-7	PM,OPS, SAFTY	4	SOW 4.13, 6.2

*For electronic submittals, the number of hard copies can be negotiated with the Contract Specialist and approved by the Project Manager.

1. Typically a numerical sequence (i.e., 1, 2, 3…). However, other numbering systems may also be used.

2. Types of submittals are: AP = for approval. APW = for approval prior to or for work. Also specify, either "E" for electronic; or "H3" for three hard copies.

3. Technical submittals are Engineering or Quality affecting submittals. The purpose of a Yes in this column is to designate the need for formalized comments, and a formalized comment disposition process by the Contractor.

This process can always be used at the option of the BTR. See PRC-PRO-AC-16405, for additional details. Select "YES" for formalized comments, otherwise Select "NO" for the more common and faster review process used by Document Control such as voting buttons, or e-mail type comments not formalized on comment disposition sheets. Examples of Technical Submittals would include Engineering or Fabrication Drawings, or Certificates of Conformance.

4. Vendor Information. Determine if there is any subset of information that needs to be retained as part of the permanent records system after contract closeout. Typically project and contract records are archived at the end of the contract/project life cycle. Facility design information, that is not captured via HNF drawing or document number at the end of the project is designated as Vendor Information at the end of the project/contract life cycle if it is needed by the program/facility/functional organization. See also PRC-PRO-EN-16406, *Vendor Information* for additional information. Select "YES" for Vendor Information, otherwise, select "No."

5. Description / Document Title. Describe submittal.

6. Required submittal date or its relationship to project milestones. Examples are July 14, 2009, or Award + 15 days, Contract Completion +30 days.

7. Specify Approver Organization. Examples are Construction Manager, Safety, Quality, Radiation Protection, and Waste Management.

8. Specify the number of Work Days required for review of the submittal.

9. Specify the requirement by reference to the Statement of Work or Specifications. Example for Training Records: Ref. SOW 5.1.

ATTACHMENT B

EXHIBIT 1

Form A-6004-750, "CHPRC Chemical Inventory Worksheet"

Doc1.docx

END OF PART I – STATEMENT OF WORK

PART II – COMMERCIAL TERMS

1.0 PRICING

The Contractor shall submit cost proposal for each of the work scope tasks listed below. See Description of Pricing for additional information.

Task Description	Unit	Price
Task 1 On-Site Batch Plant and Stockpile Supply and Installation		
Task 1.1 – Price for Batch Plant and Stockpile Drawings as described below.	LS	
Task 1.2 – Price for Operation and Maintenance Plans as described below.	LS	
Task 1.3 – Price to Mobilize, Install, and Startup of Batch Plant and Stockpile as described below	LS	
Task 1.4 – On-site Batch Plant and Stockpile Demobilization as described below	LS	
Task 2 Grout Mix Design and Test Results		
Task 2.1 – Submittal of Grout Mix Design & Test Results as described below	LS	
Task 3 Batch Plant and Stockpile Operation and Maintenance		
Task 3.1 – Batch Plant and Stockpile O&M Rate During Standby as described below	Day	
Task 3.2 – Supply and Delivery of Grout as described below	CY	
Task 4 Grout Pumping Equipment Operation and Maintenance		
Task 4.1 – Operating Rental Rate for each Grout Pump	Day	
Task 4.2 – Standby Rental Rate for Grout Pump	Day	
Task 4.3 – Purchase of Canyon Conveyance System	LS	

2.0 DESCRIPTION OF PRICING

The following is an explanation of each task listed in the Pricing. Management cost, development of schedule, WBS codes, monthly reports, profit and overhead costs associated with this SOW are to be spread over all of the subtasks listed below.

1.0 Task 1- Batch Plant and Stockpile Supply and Installation

1.1 Firm fixed price for the preparation of the on-site batch plant and stockpile supply and installation plans and drawings including:

- Batch plant and stockpile area location, layout and equipment arrangement drawings
- Site preparation specifications and drawings
- Erection plans
- Initiation, start-up and commissioning plan
- Batch plant potable water supply requirements including flow rate.

1.2 Firm Fixed Price for providing the following:

- Wastewater Management Plan
- Solid Waste Management Plan
- Electrical power requirements, both voltage and amperage
- Daily diesel fuel needs for equipment that remains on site
- Grout Quality Control Plan
- Safety Plan
- Stockpile material receipt plan
- Grout delivery plan

1.3 Firm fixed price for on-site batch plant and material stockpile delivery, mobilization, installation and startup.

1.4 Firm fixed price for the on-site batch plant and material stockpile demobilization. This price includes removal of Contractor's equipment, materials, and stockpiles down to 6 inches above existing grade.

2.0 Task 2 – Grout Mix Design and Test Results

2.1 Firm fixed price for submittal of grout mix design and grout quality verification documentation.

2.2 This task shall also include the cost for adjustment of the grout mix design and on-site batch plant to achieve the required performance, including test cell results.

3.0 Task 3 – On-Site Batch Plant and Material Stockpile Operations and Maintenance

3.1 Fixed daily unit rates for batch plant and material stockpile operations and maintenance staff and equipment for grout production standby readiness.

3.2 Fixed unit rate ($/CY) for the supply and delivery of grout to the locations indicated on the attached drawing.

4.0 Task 4 – Grout Pump Equipment

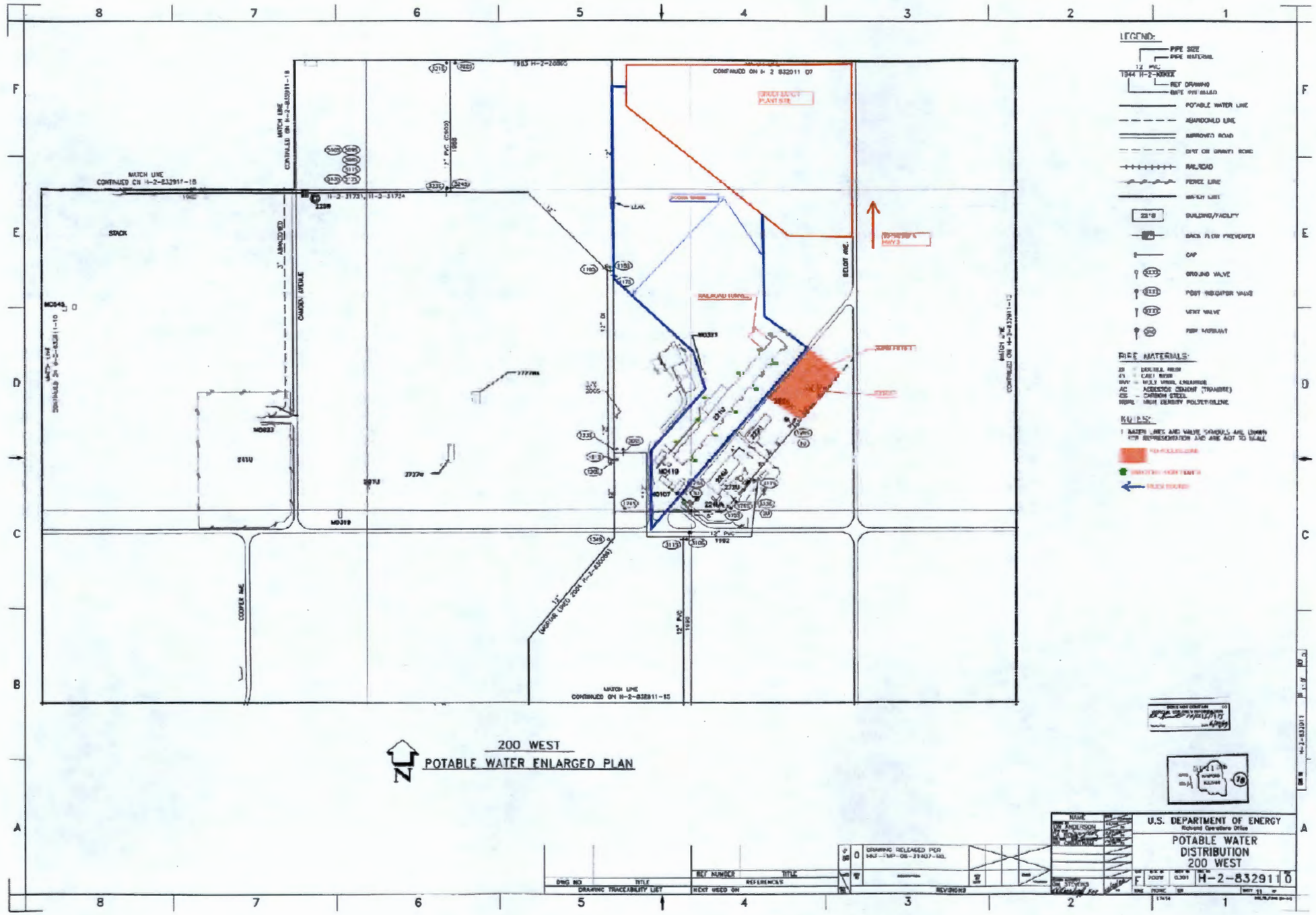
4.1 Operating rental rate for each grout pump that is provided to the project. This cost includes operation and maintenance costs. This cost also includes the cost to mobilize and demobilize the grout pump. The grout pumps shall remain on site for the duration of the work in order to reduce possible security screening delays. Diesel fuel for grouts that remain on site will be provided by CHPRC. Should a grout pump need to be removed from the site for maintenance. The replacement grout pump shall be on site before the other grout pump leaves the site. Grout pumping in the Gallery Area may use the two operating grout pumps and the standby grout pump. The standby grout pump may become the third pump. The rental rate for the third grout pump will be the same as the operating rental rate of the other grout pumps.

4.2 Operating rental rate for the standby grout pump that is in the backup mode. This cost includes maintenance costs. This cost also includes the cost to mobilize and demobilize the standby grout pump. The standby grout pump shall remain on site for the duration of the work in order to reduce possible security screening delays. Diesel fuel for standby grout pump will be provided by CHPRC. Should the standby grout pump need to be removed from the site for maintenance. A replacement standby grout pump shall be on site before the standby grout pump needing maintenance leaves the site.

4.3 Purchase of conveyance system shall be FOB to 221-U. The pipe shall be delivered in original shipping containers.

Appendix C

Supporting Engineering Design Drawings


200 WEST
POTABLE WATER ENLARGED PLAN
LEGEND:
POTABLE WATER LINE
ABANDONED LINE
BURIED LIGHT
BUILDING/FACILITY
BACK FLOW PREVENTER
CAP
GROUND VALVE
POST INDICATOR VALVE
VENT VALVE
FIRE HYDRANT
PIPE MATERIALS:
ZI - DUCTILE IRON
CI - CAST IRON
HDPE - HIGH DENSITY POLYETHYLENE
NOTES:
1. BASED LINES AND VALVE SYMBOLS ARE SHOWN FOR REPRESENTATION AND ARE NOT TO SCALE.
STACK
CANYON AVENUE
COOPER AVE.
BELOT AVE.
MATCH LINE
CONTINUED ON H-2-832911-10
CONTINUED ON H-2-832911-07
CONTINUED ON H-2-832911-12
CONTINUED ON H-2-832911-13
RAILROAD TURNOUT
LEAK
U.S. DEPARTMENT OF ENERGY
Richland Operations Office
POTABLE WATER
DISTRIBUTION
200 WEST
H-2-832911
DRAWING RELEASED PER
DRAWING TRACEABILITY LIST
REVISIONS

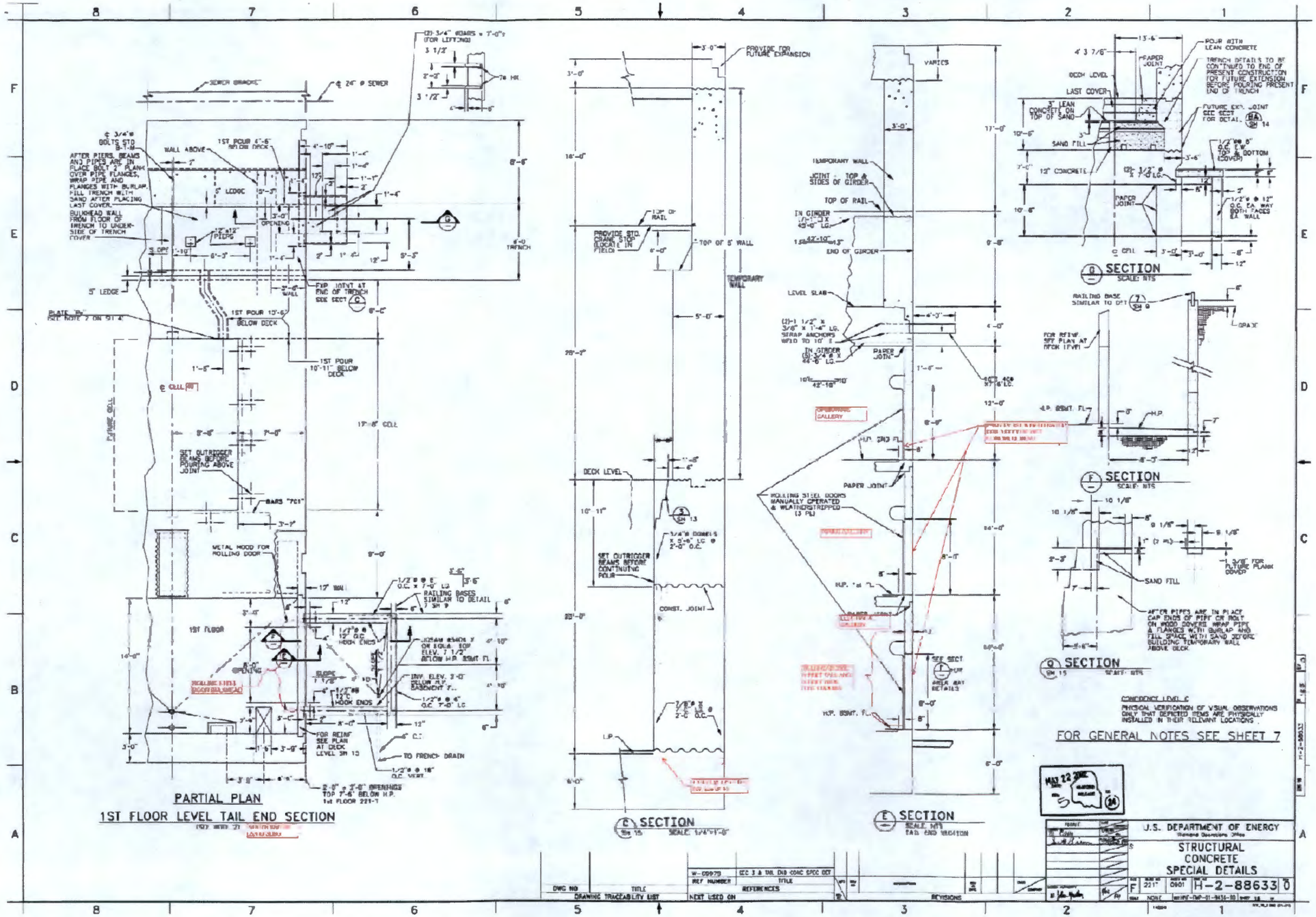


Figure C2. Rolling Steel Doors

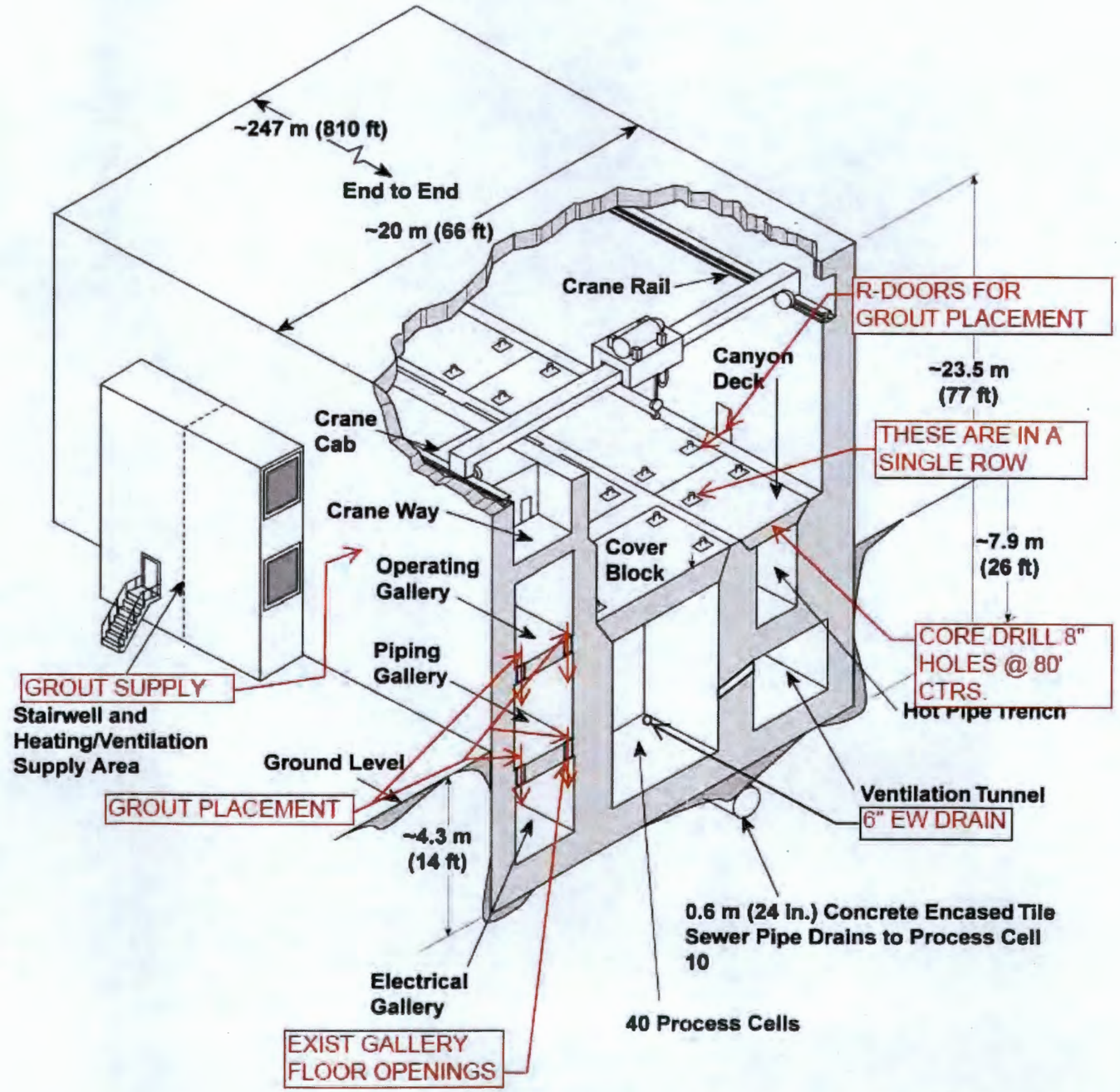


Figure C3. Grout Placement

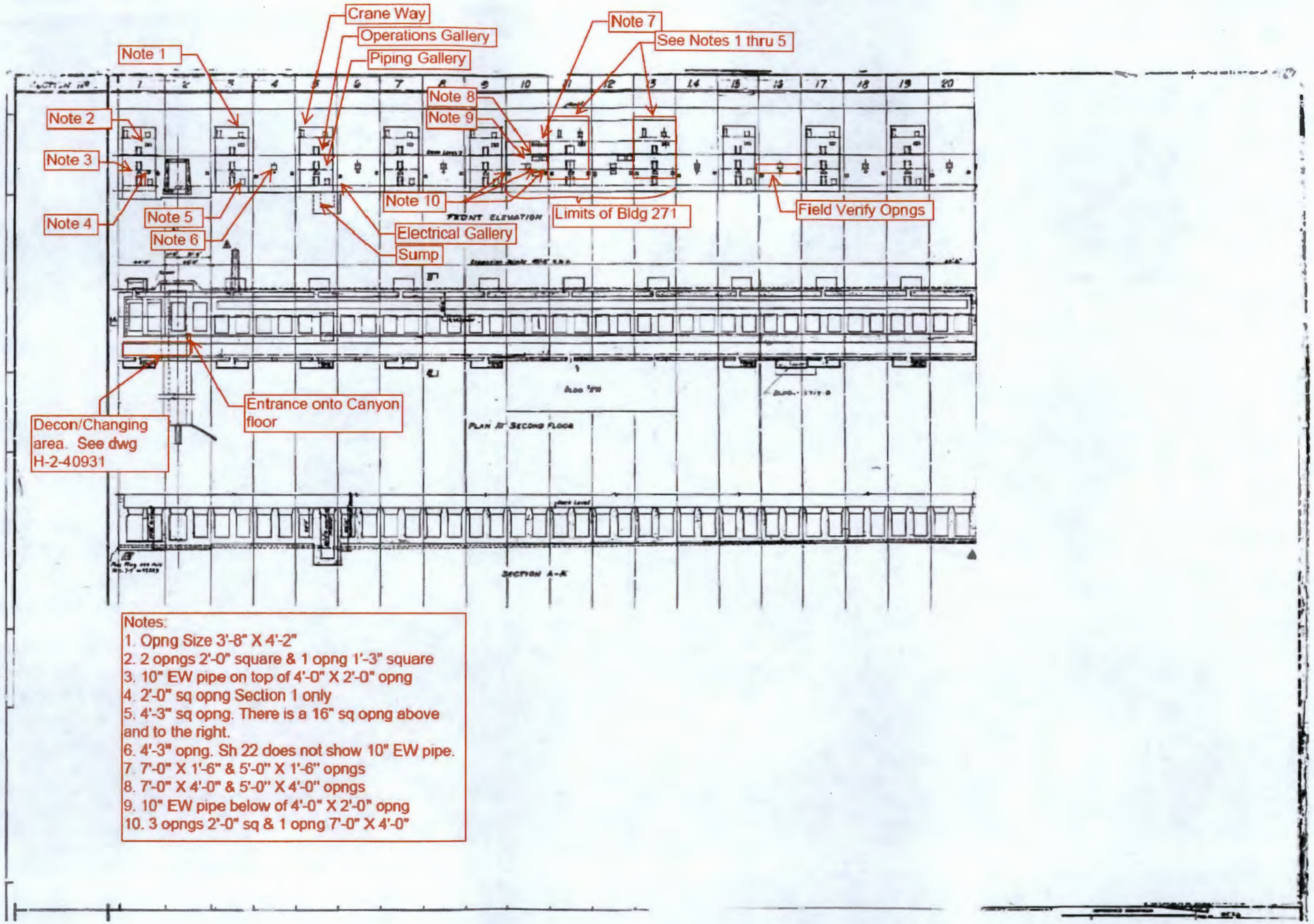


Figure C4. Gallery Opening Sizes

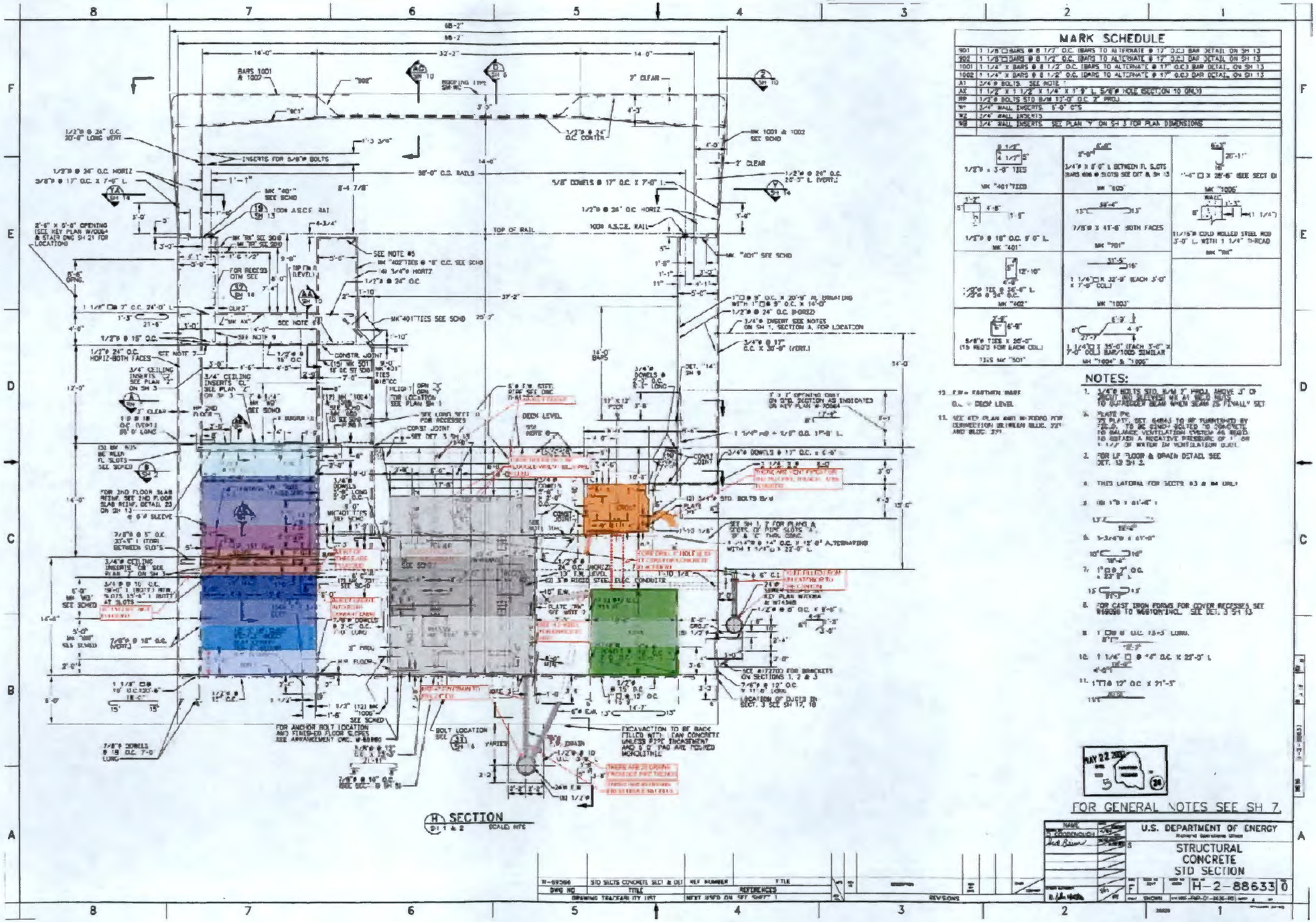


Figure C5. Gallery HPT Vent Tunnel

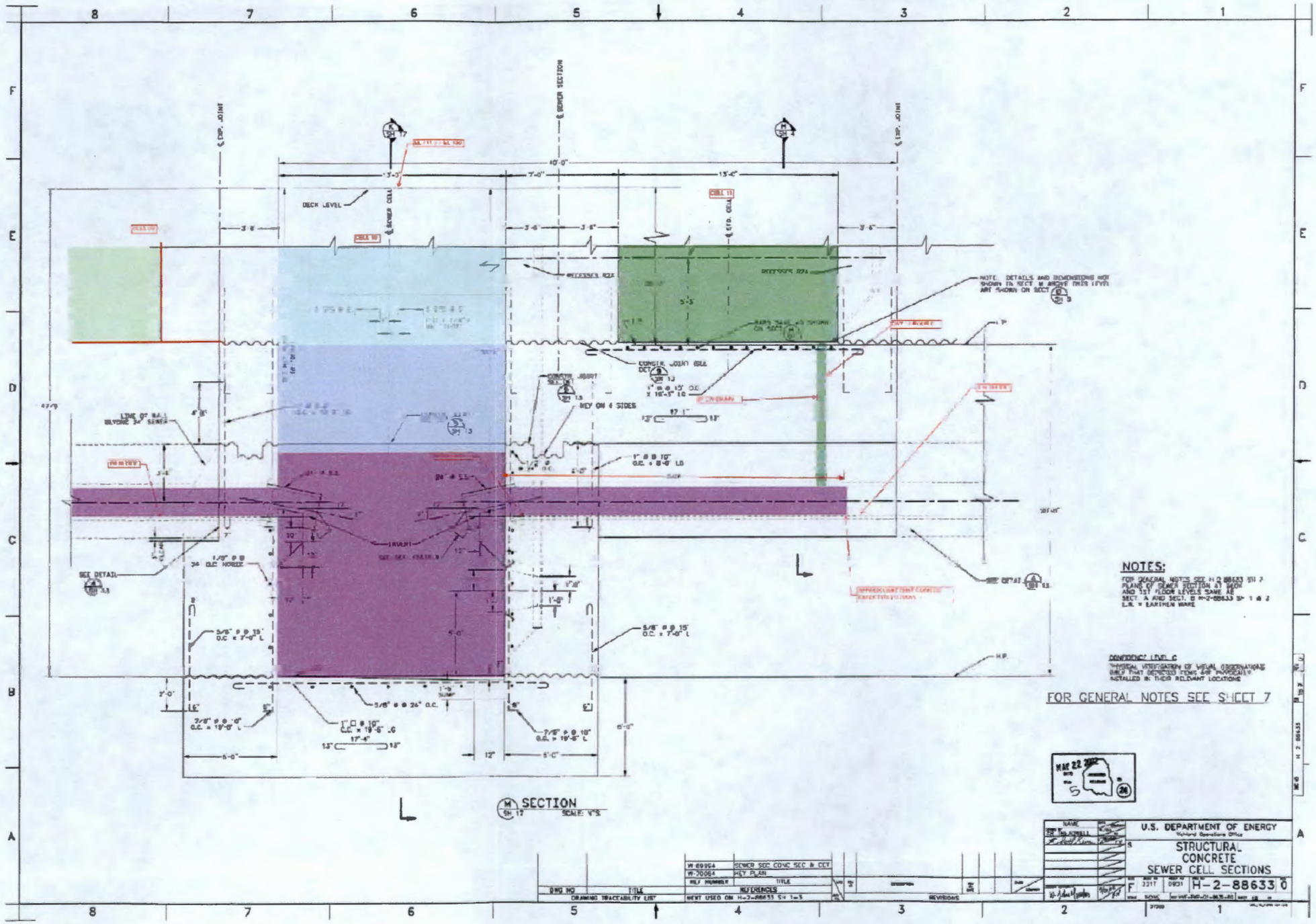
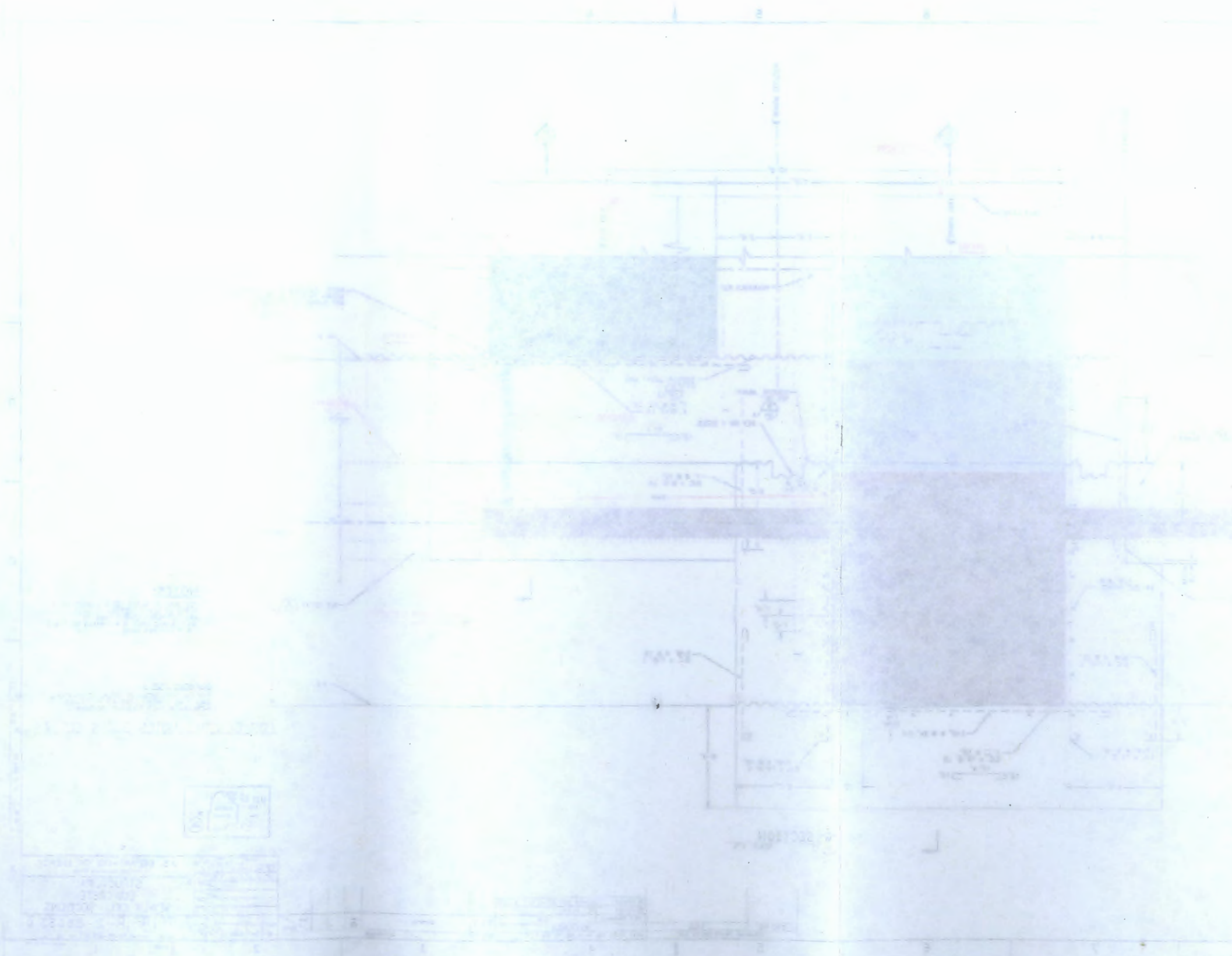


Figure C6. Process Cell 10



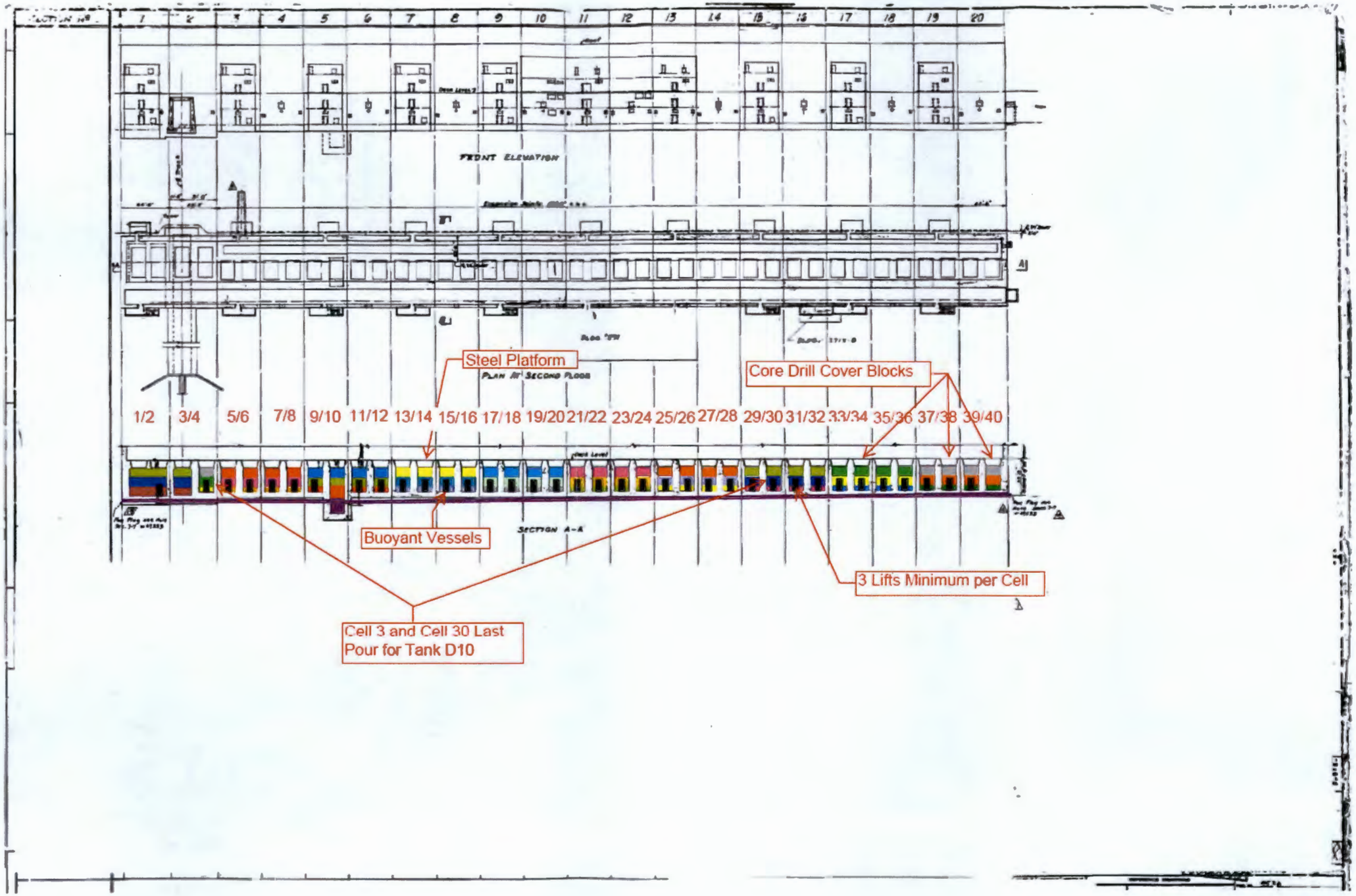


Figure C7 Canyon Pour Sequence

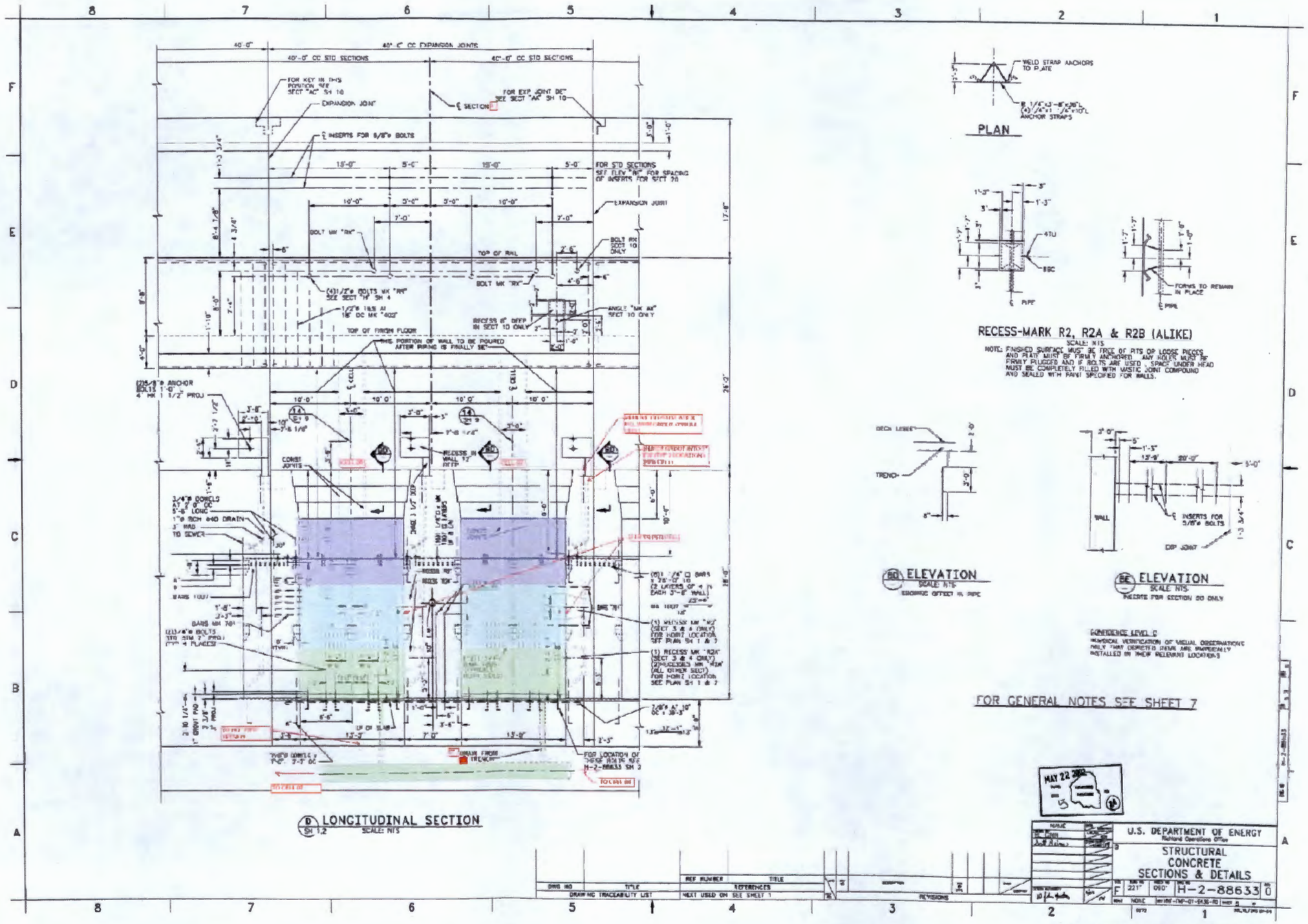


Figure C8. Typical Process Cell

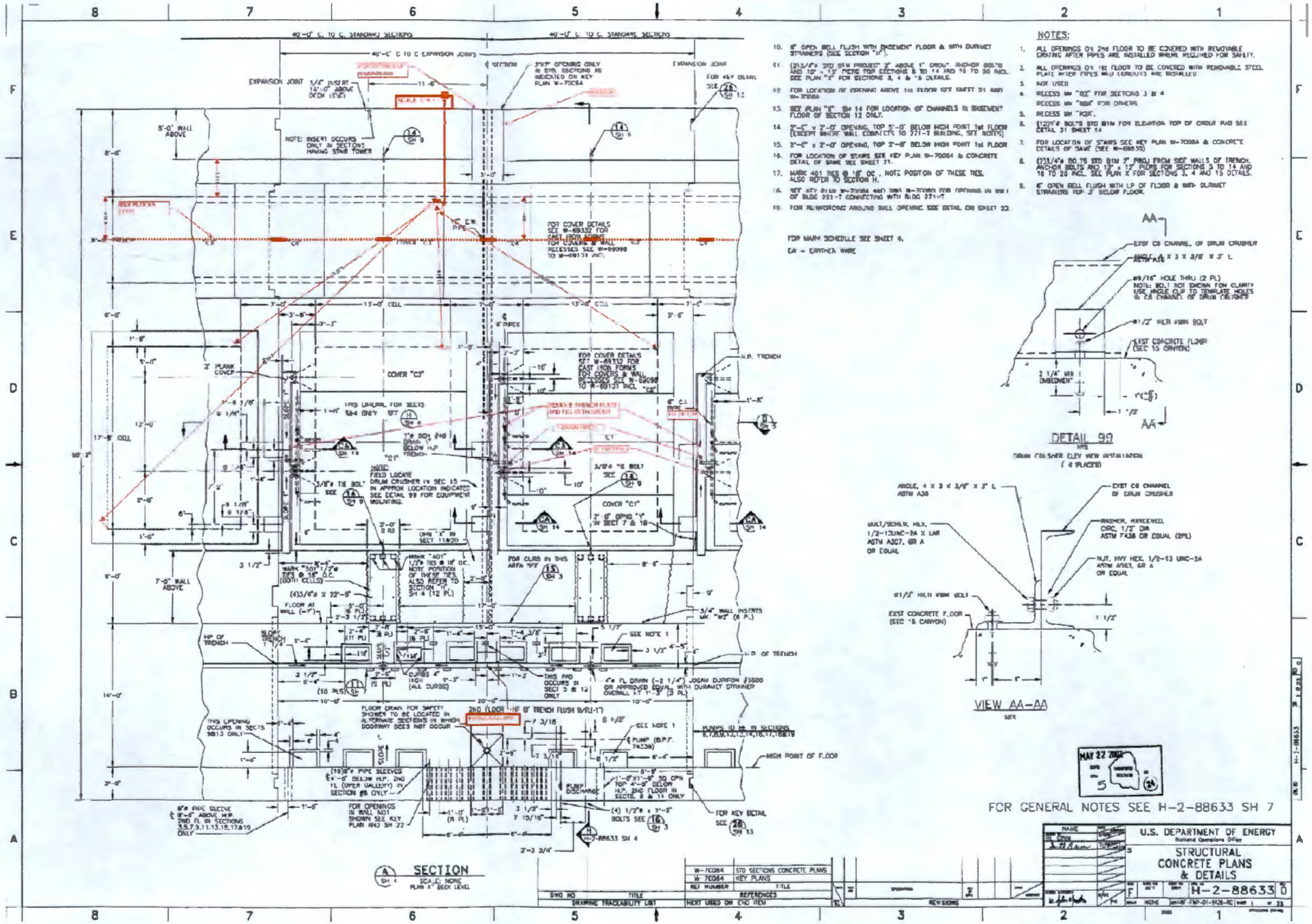
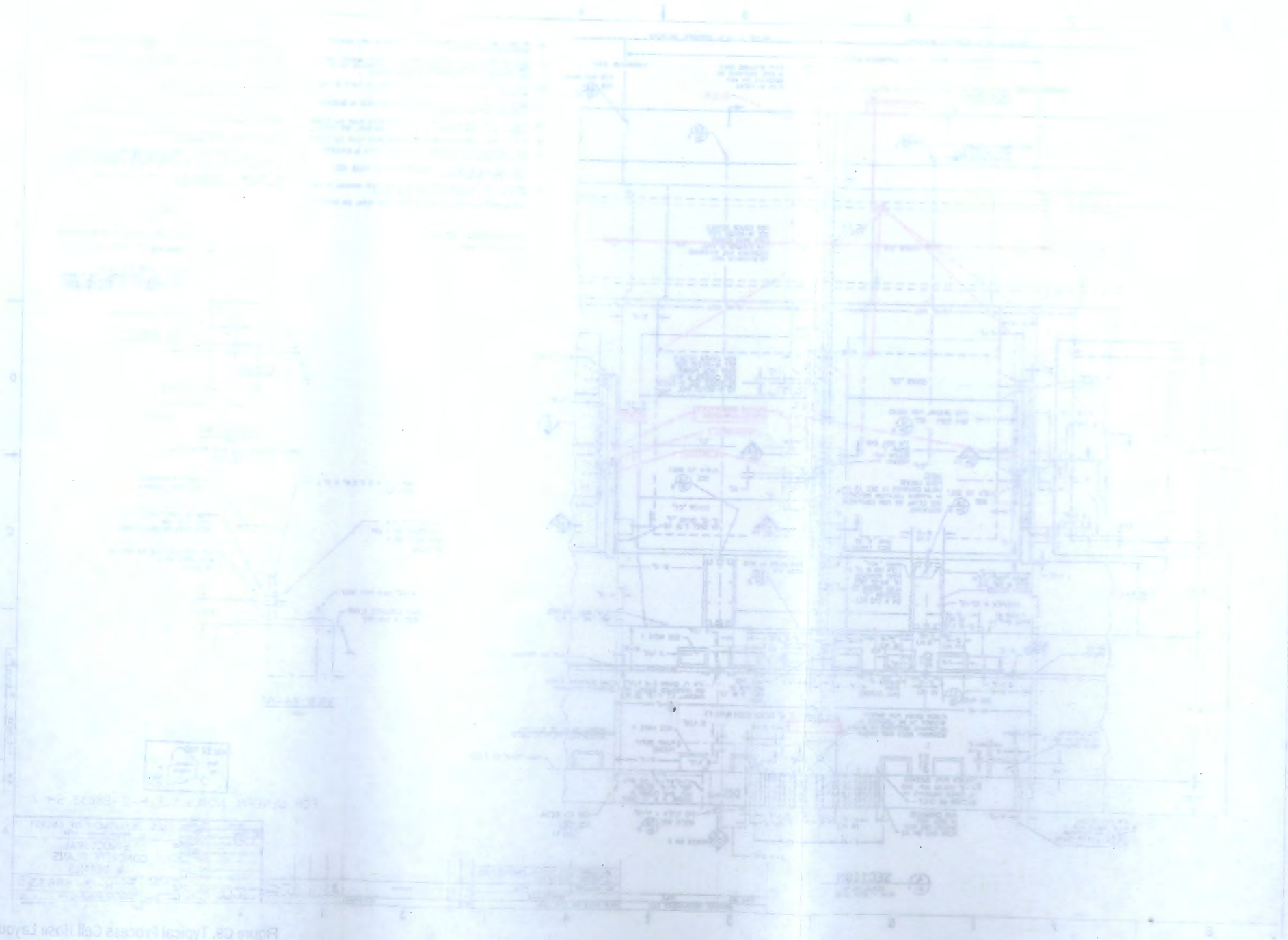


Figure C9. Typical Process Cell Hose Layout



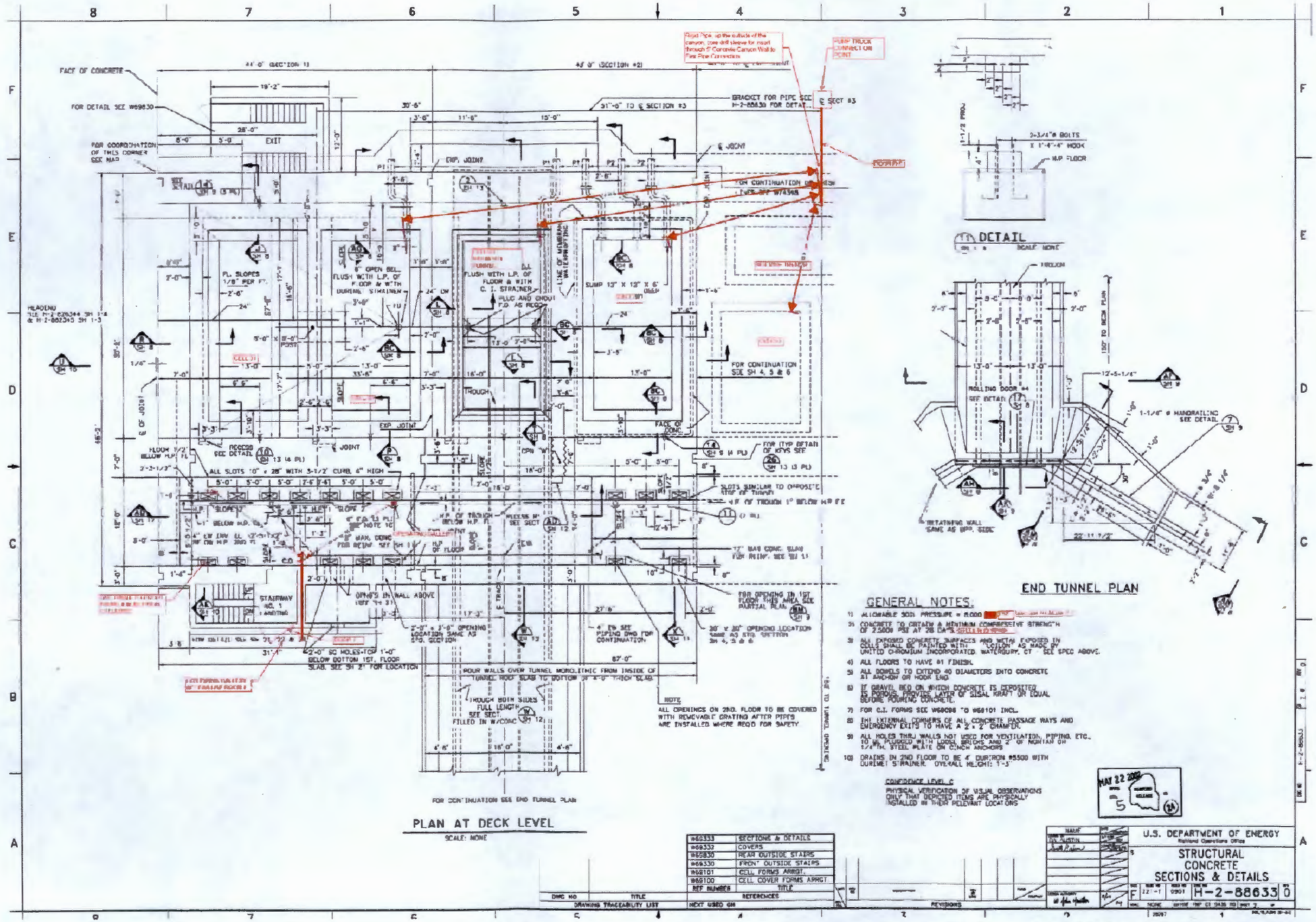


Figure C10. Process Cells 1 to 4 Hose Layout

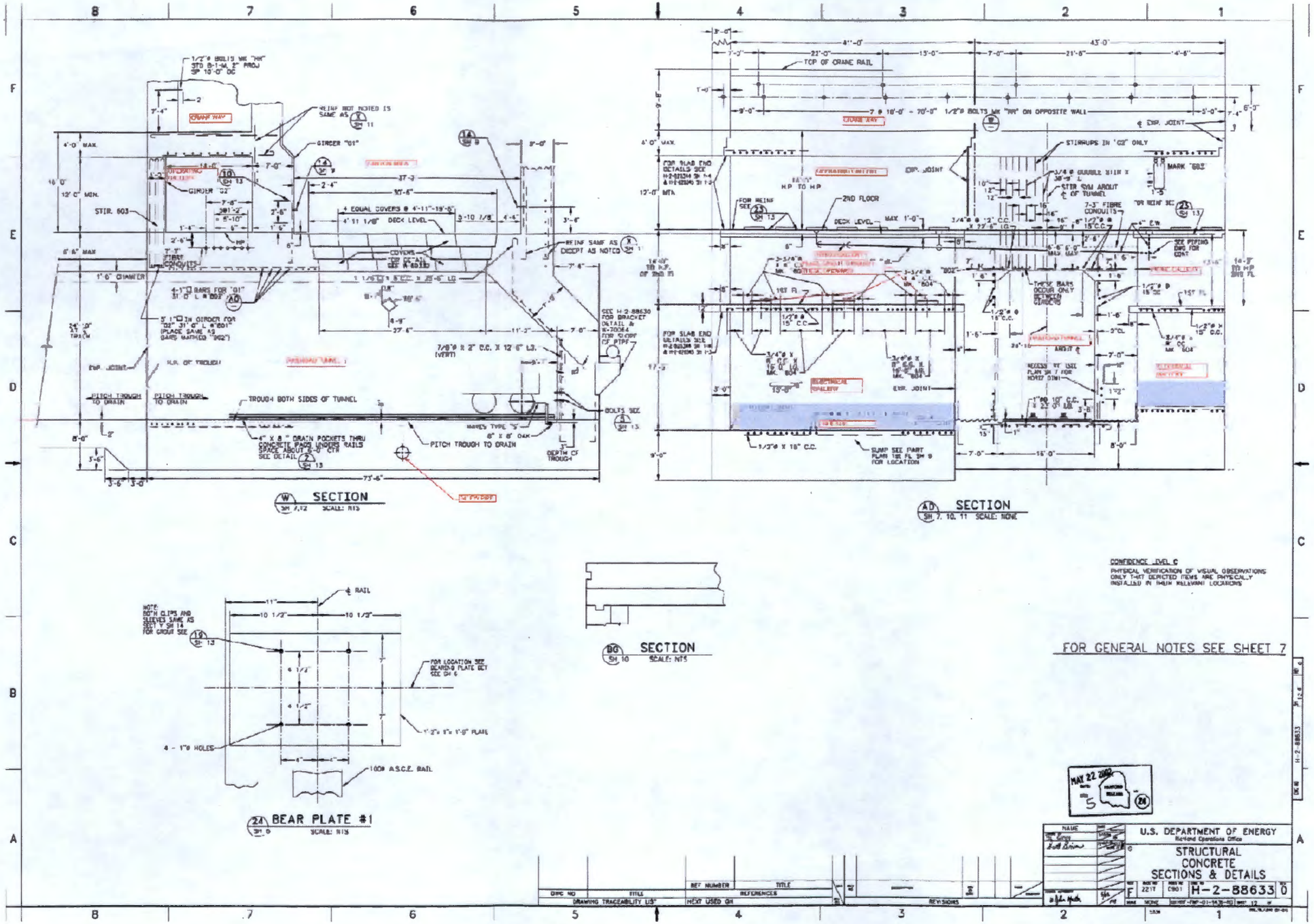


Figure C11. Electrical Gallery

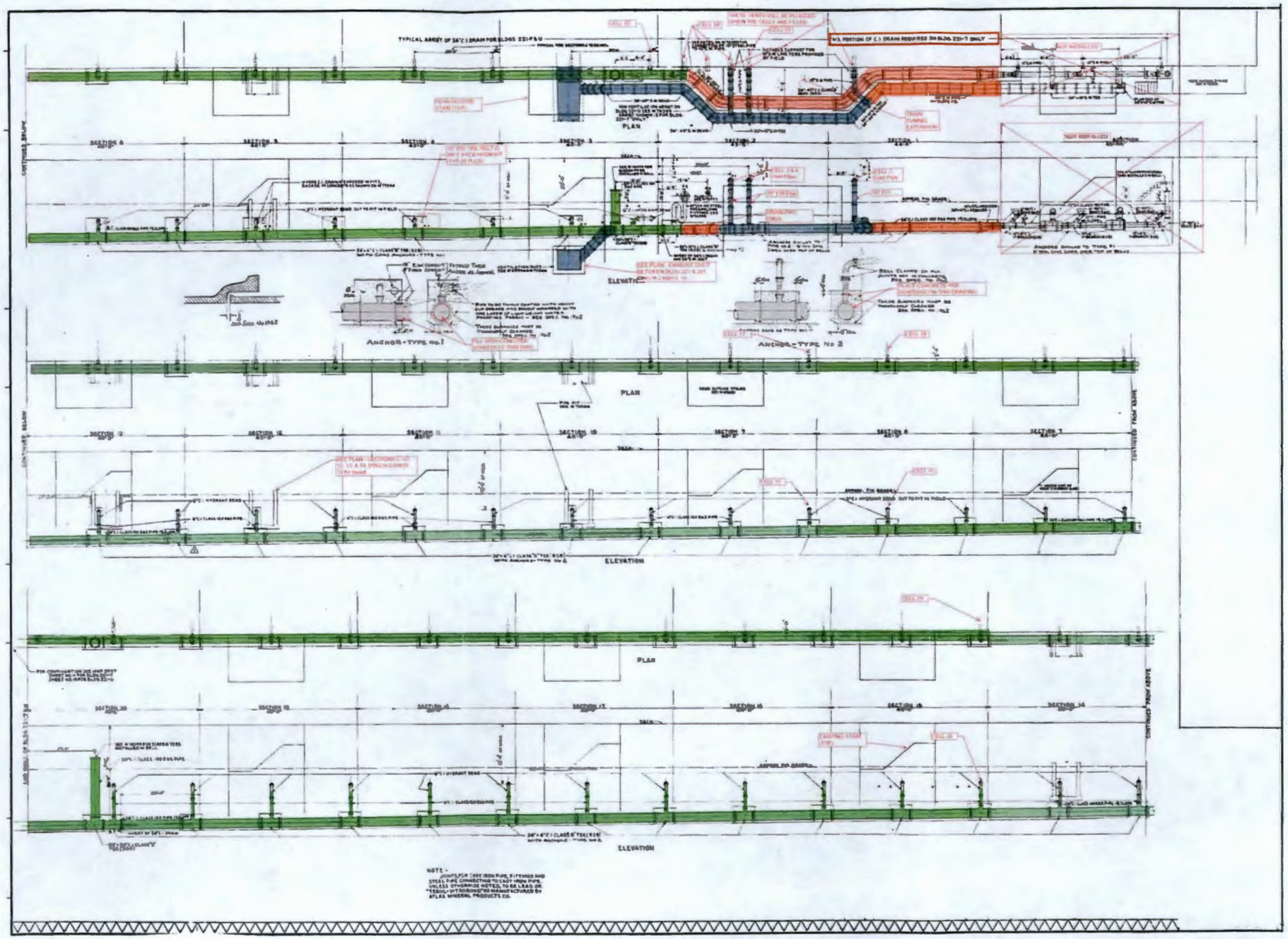


Figure C12. 24-inch CIP Layout

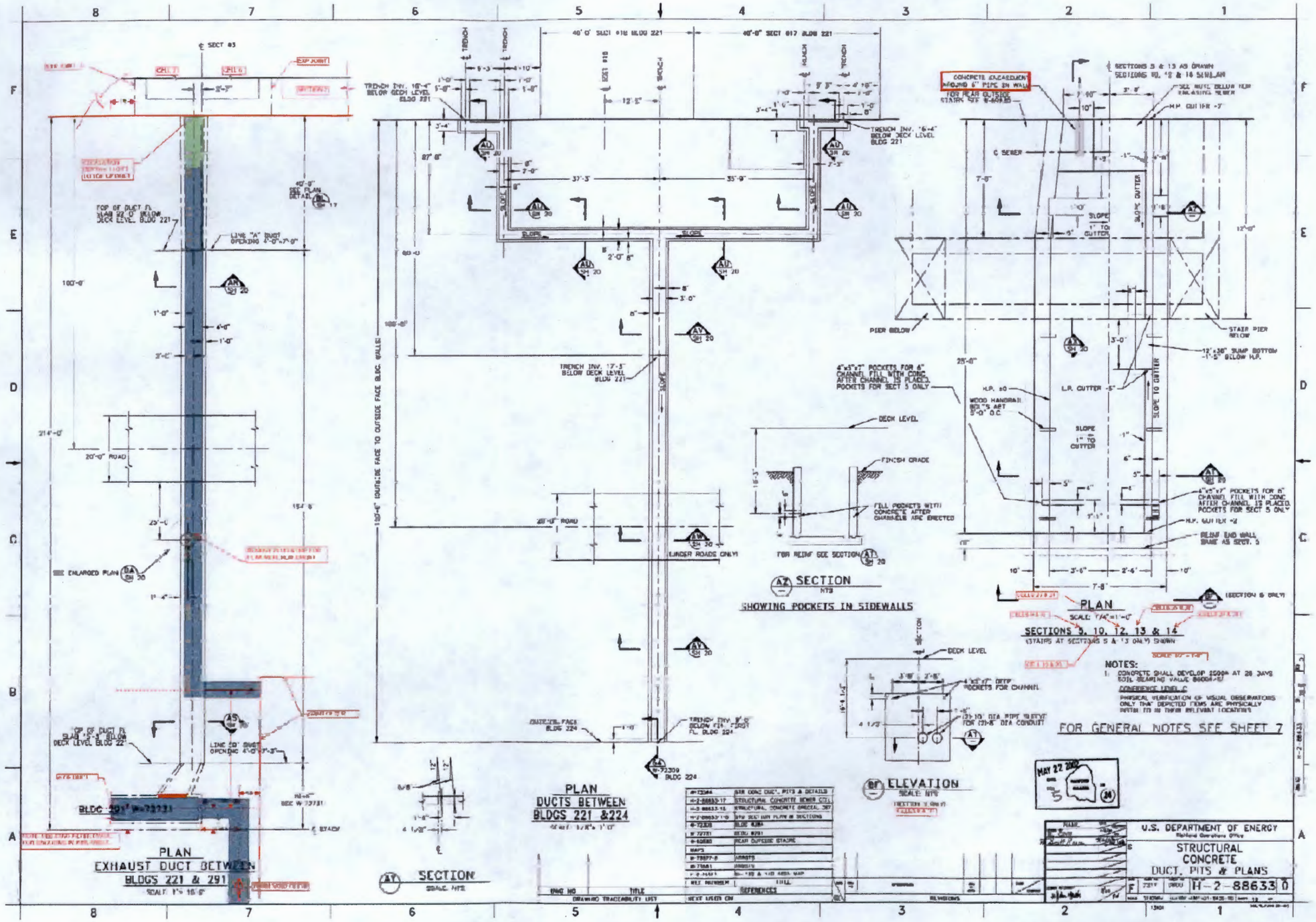
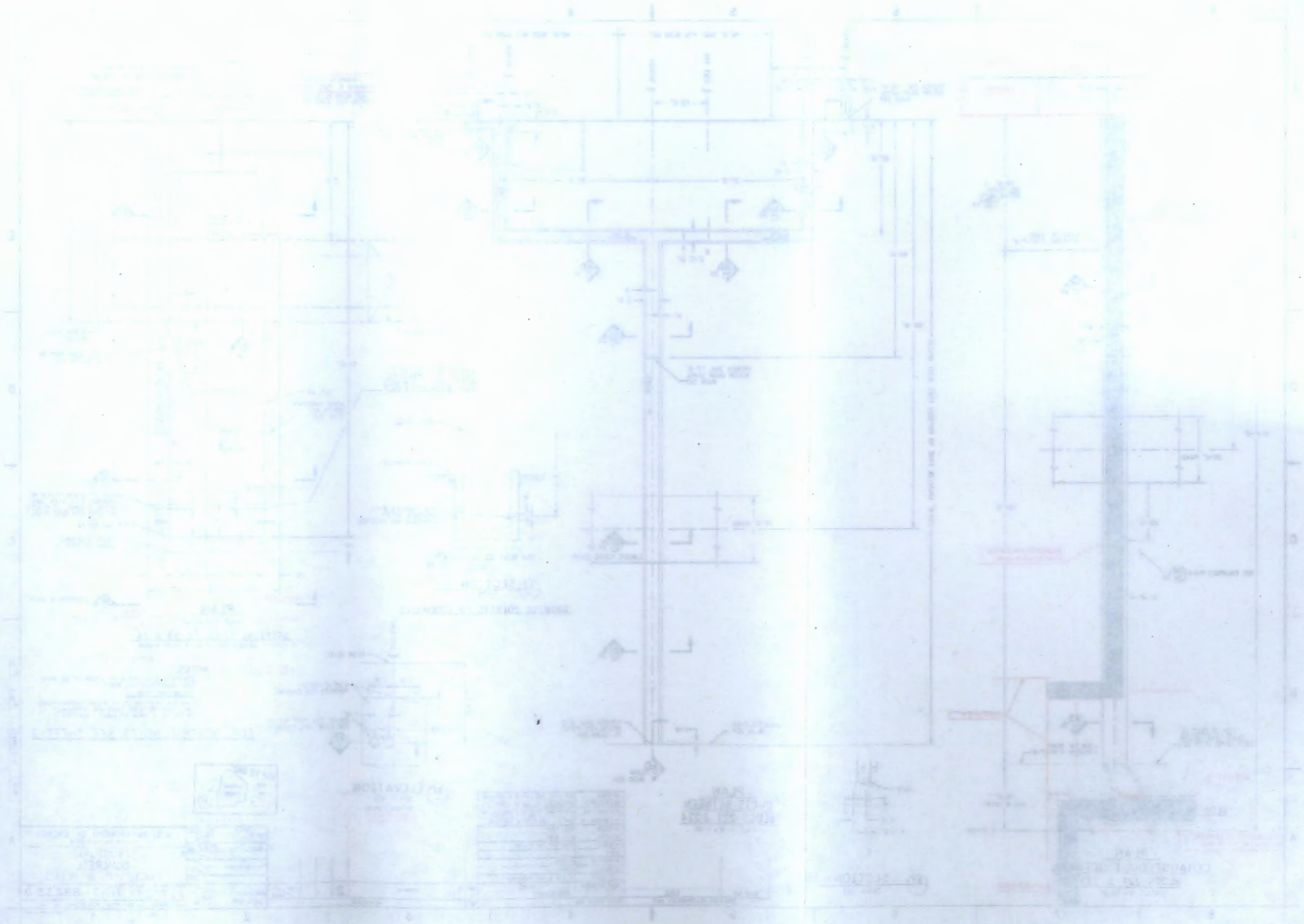


Figure C13. Ventilation Tunnel to Sand Filter



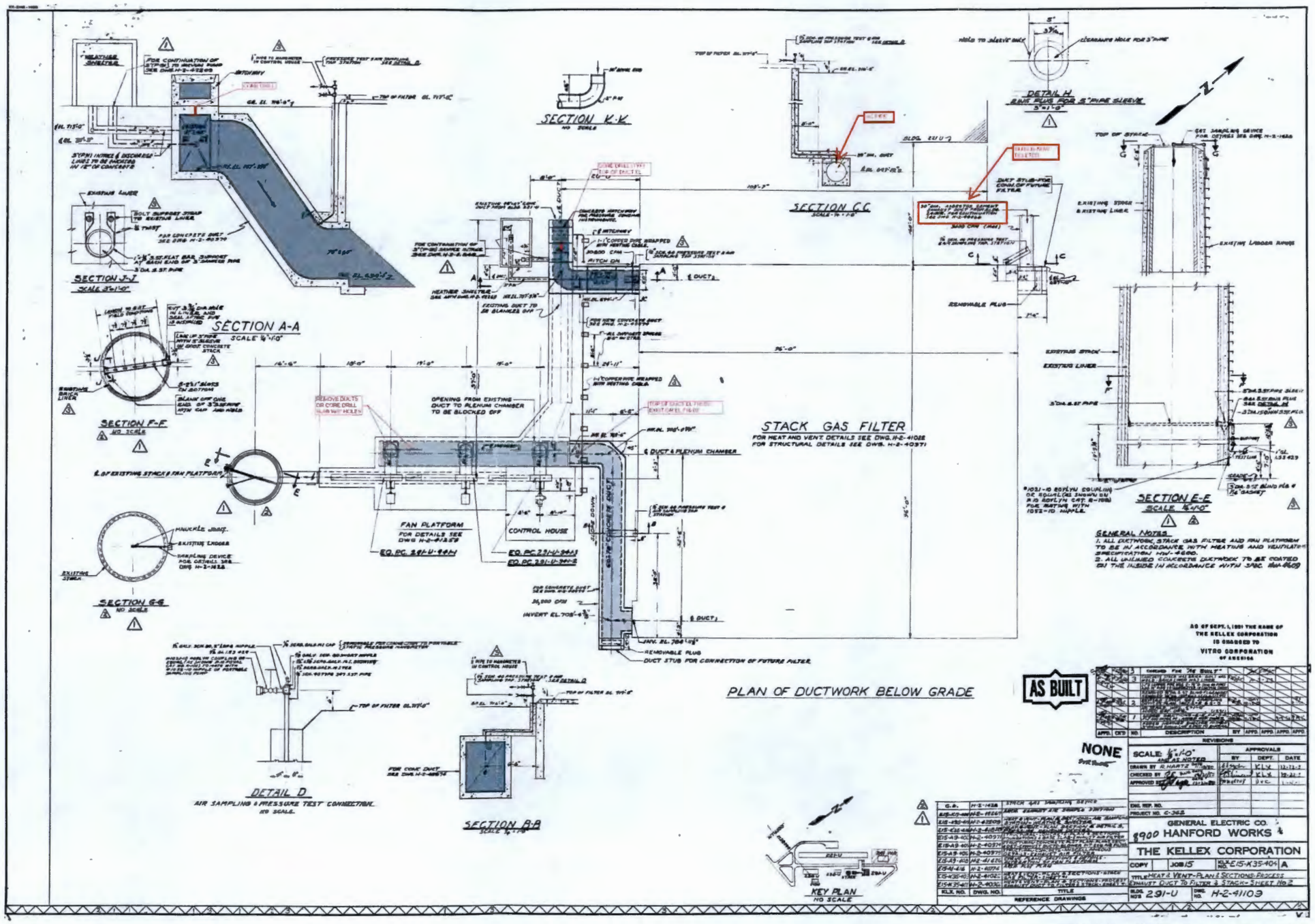


Figure C14. Ventilation Ducts to Sand Filter

Distribution

	MS
U.S. Department of Energy, Richland Operations Office	
D.H. Chapin	A5-11
O.A. Farabee	A5-11
C.S. Louie	A5-11
B.D. Williams	A4-52
W.C. Woolery	A6-33
CH2M HILL Plateau Remediation Company	
D.W. Chojnacki	S4-21
G. J. LeBaron	S2-42
D.L. Norman	T1-41
W.E. Toebe	H8-45
J.L. Westcott	T4-08
Administrative Record	H6-08
Document Clearance	H6-08