START

ENGINEERING REPORT
FOR
SUBMISSION TO THE WASHINGTON STATE
DEPARTMENT OF HEALTH

SANITARY WASTEWATER SYSTEM FOR THE 242-A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY

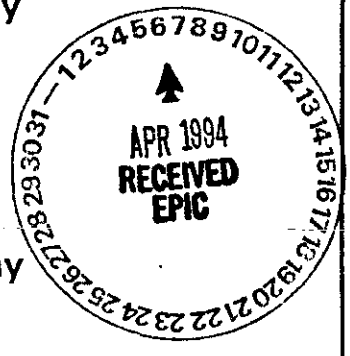
PROJECT C-018H

Prepared for

Westinghouse Hanford Company

February 1994

For the U.S. Department of Energy
Contract DE-AC06-93RL12359



Prepared by

Kaiser Engineers Hanford Company
Richland, Washington

C018H-WSER3

KAISER ENGINEERS
HANFORD

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ORIGINAL

Date Received: 2/11/94 MLB

INFORMATION RELEASE REQUEST

Reference: WHC-CM-3-4

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ID Number (include revision, volume, etc.): WHC-SD-C018H-ER-007 Rev. 0

List attachments.

Date Release Required: 2/8/94 (11)

Title: Sanitary Wastewater System for the 242-A Evaporator/PUREX Plant Condensate Treatment Facility

Unclassified Category: UC-

Impact Level: 4

New or novel (patentable) subject matter? [X] No [ ] Yes
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CHECKLIST FOR SIGNATORIES

Review Required per WHC-CM-3-4	Yes	No	Reviewer - Signature Indicates Approval: Name (printed)	Signature	Date
Classification/Unclassified Controlled Nuclear Information	[ ]	[X]			
Patent - General Counsel	[X]	[ ]	B.D. Williamson	B.D. Williamson	2/10/94
Legal - General Counsel	[X]	[ ]	B.D. Williamson	B.D. Williamson	2/10/94
Applied Technology/Export Controlled Information or International Program	[ ]	[X]			
WHC Program/Project	[X]	[ ]	J. J. Noble	J. J. Noble	2/4/94
Communications	[ ]	[X]			
RL Program/Project	[X]	[ ]	G. R. Mezger	G. R. Mezger	2/11/94
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Other Program/Project	[ ]	[X]			

Information conforms to all applicable requirements. The above information is certified to be correct.

	Yes	No
References Available to Intended Audience	[X]	[ ]
Transmit to DOE-HQ/Office of Scientific and Technical Information	[ ]	[X]

Author/Requestor (Printed/Signature) Date
A. K. Vogt 2/4/94

Intended Audience
[ ] Internal [ ] Sponsor [X] External

Responsible Manager (Printed/Signature) Date
J. J. Noble J. J. Noble 2/4/94

INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP

Stamp is required before release. Release is contingent upon resolution of mandatory comments.

APPROVED FOR RELEASE OFFICIAL DOCUMENT MLB 2/11/94

Date Cancelled | Date Disapproved

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FEB 11 1994

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 150444

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
Distribution	Evaporator Condensate Treatment Project	NA
5. Proj./Prog./Dept./Div.:	**6. Cog. Engr.:**	**7. Purchase Order No.:**
C-018H/Projects	A. K. Vogt	NA
8. Originator Remarks:		**9. Equip./Component No.:**
Approved for Release		NA
		10. System/Bldg./Facility:
		2025E/2025EA
11. Receiver Remarks:		**12. Major Assm. Dwg. No.:**
		NA
		13. Permit/Permit Application No.:
		NA
		14. Required Response Date:
		NA

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-C018H-ER-007		0	Sanitary Wastewater System for the 242-A Evaporator/PUREX Plant Condensate Treatment Facility	4E	2	1	

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 (see MRP 5.43)	1. Approval 4. Review 2. Release 5. Post-Review 3. Information 6. Dist. (Receipt Acknow. Required)	1. Approved 4. Reviewed no/comment 2. Approved w/comment 5. Reviewed w/comment 3. Disapproved w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Impact Level for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	1	Cog.Eng. A. K. Vogt		2/4/94							
1	1	Cog. Mgr. J. J. Noble		2/4/94							
		QA									
		Safety									
1	1	Env. K. A. Giese		2/8/94							

18.	19.	20.	21. DOE APPROVAL (if required)
Signature of EDT Originator — Date: 2/4/94	Authorized Representative for Receiving Organization — Date	Cognizant/Project Engineer's Manager — Date: 2/4/94	Ltr. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

BD-7400-172-1 (02/89)

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SUPPORTING DOCUMENT

1. Total Pages 163 (was 165) Rev

2. Title	3. Number	4. Rev No.
Sanitary Wastewater System for the 242-A Evaporator/PUREX Plant Condensate Treatment Facility	WHC-SD-C018H-ER-007	0

5. Key Words	6. Author
Sanitary Wastewater, septic system, Project C-018H, Effluent Treatment Facility, 2025E, 2025EA	Name: A. K. Vogt Signature 2/4/94 Organization/Charge Code 24350/ACT18

7. Abstract

This document is the Engineering Report for the sanitary wastewater collection and disposal system for the 2025E and 2025EA building and associated support trailer. This report meets the requirements of Washington Administrative Code 246-272.

8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform, direct, or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed.

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10. RELEASE STAMP

OFFICIAL RELEASE (23) BY WHC DATE FEB 11 1994 Sta # 10

9. Impact Level 4E

APPROVED FOR PUBLIC RELEASE

M. Boster 2/11/94

Information Release Administration

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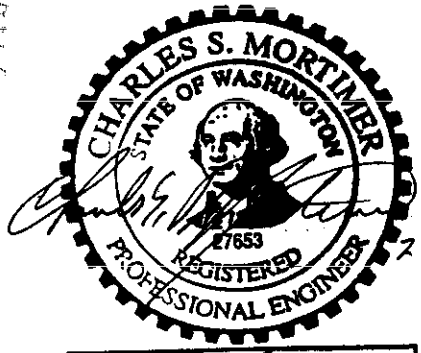
C018H-WSER3

ENGINEERING REPORT
FOR
SUBMISSION TO THE WASHINGTON STATE DEPARTMENT OF HEALTH

FOR

SANITARY WASTEWATER SYSTEM FOR THE 242-A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY

PROJECT C-018H



Prepared by

Kaiser Engineers Hanford Company
Richland, Washington

for

Westinghouse Hanford Company

R T Hallen	2/8/94	J. E. Buchanan	2-7-94
Principal Lead Engineer	Date	Technical Documents	Date
H. Schmidt	2-8-94	John O. Arp	2-7-94
Safety Engineering	Date	Environmental Engineering	Date
T.D. Hays	2-9-94	Wendy Johnson	2-9-94
Quality Engineering	Date	Project Manager	Date

Westinghouse Hanford Company

	2-9-94
Projects Department	Date

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ABBREVIATIONS

ASTM	American Society of Testing Materials
COE	U.S. Corps of Engineers
Corps	U.S. Corps of Engineers
DOE	U.S. Department of Energy
EPA	Environmental Protection Agency
ETF	Effluent Treatment Facility
NEPA	National Environmental Policy Act
PC	personal computer
STSAS	septic tank soil absorption system
WAC	Washington Administrative Code
WHC	Westinghouse Hanford Company

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ENGINEERING REPORT FOR SUBMISSION TO THE WASHINGTON STATE DEPARTMENT OF HEALTH

SANITARY WASTEWATER SYSTEM FOR THE 242-A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY

PROJECT C-018H

I. GENERAL PLAN

Proposed Project C-018H, "Effluent Treatment Facility," will be located within the 200-East Area on the Hanford Site. (See drawing H-2-88756, sh. 1 in Appendix D.) The Site is located approximately 30 miles northwest of Richland, Washington, within Benton County. The project will serve a new multi-building complex for both office and craft personnel. Major wastewater production will occur during the day, Monday through Friday. The proposed new system will provide for future expansion to 5,000 gal/day.

Project C-018H complies with NEPA requirements and has been approved by DOE. Other permits unique to construction on the Hanford Site will be obtained at the time construction commences. No other permits are required for construction on the Hanford Site.

A. WATER SOURCE

The buildings contributing to the proposed wastewater disposal system are served by a public water system operated by WHC and owned by DOE.

B. WASTEWATER COLLECTION SYSTEM

The project C-018H wastewater collection system will include both gravity-flow and pumping of raw sewage. The ETF will gravity-flow to a 3,000-gal septic tank. The Operations support facility and support trailers

sewage will gravity-flow to a 7,000-gal septic tank. A future project will provide the Construction support trailers with a grinder pump station to pump the sewage to the Operations support trailer gravity line. (A stubout will be provided for this future connection.) Future facilities will hook up to the 7,000-gal tank; no future facilities will connect to the 3,000 gal tank. Filtered effluent from both septic tanks will gravity-flow to the dosing chamber.

The proposed design will provide an adequate STSAS for the currently planned and under-construction facilities and expansion capability for future buildings. Future building projects will utilize septic tank capacity provided by this project. A STSAS was chosen due to the lack of a sanitary sewer collection system and treatment plant within an economic distance. The proposed design flow of 5,000 gal/day requires a pressure distribution system. Duplex pumps will be installed in a new dosing chamber. Effluent will be pumped to three alternating pressurized disposal fields. Space is reserved adjacent to the proposed fields for a replacement field.

II. WASTEWATER DISPOSAL SITE

A. LOCATION AND LAND USE

The proposed site for the drain field is located within the 200-East Area. (See drawing H-2-88756, sh 1.) The topography of the drain field site ranges in elevation from approximately 592 ft above mean sea level on the east end to 593 ft on the west. The area slopes less than 0.5%. There is no vegetation. The shortest distance from the drain field to the Columbia River is more than 6 miles.

The climate at the Hanford Site is semi-arid with an annual average precipitation of 6.3 in. Temperatures have ranged from a winter extreme of -27°F to a summer extreme of 115°F.

B. GEOLOGY/GROUND WATER

The geology of the site consists of unconsolidated sediments overlying basalt. These sediments are composed of fluvial and glacio-fluvial materials deposited when ice dams failed and released enormous amounts of meltwater.

The surface of the unconfined aquifer has been defined by groundwater investigations. The water table is approximately 190 ft below the proposed drain field in the sediments overlying the basalt.

The probable maximum flood for the Columbia River below Priest Rapids Dam was calculated by the Corps as 1,440,000 ft^3/sec (40,000 m^3/sec) (COE 1951, 1969). The Corps defined this flood as an estimate "representing flood discharge that may be expected from the most severe combination of meteorological and hydrological conditions that are reasonably possible in the region." This estimate was determined from factors including the upper limit of precipitation falling on a drainage area, antecedent moisture conditions, snow melt, and tributary conditions. The flood plain associated with this flood exceeds the area which would be inundated during a 100-yr flood. The site of the drain field would not be affected by the probable maximum flood.

The largest historical flood of the Columbia River occurred on June 7, 1894. The estimated peak flowrate was approximately 742,000 ft^3/sec which would produce a flood plain that is less than the calculated probable maximum flood.

The other potential source of flooding is run-off from a large precipitation event in the watershed of ephemeral Cold Creek. Skaggs and Walters (1981) estimated the probable maximum flood using conservative values of precipitation, infiltration, and topography. The resulting flood area would not affect the drain field.

C. SOIL

On March 4, 1993, a soils investigation consisting of two test pits was performed. Type 1 soils were identified. This finding was confirmed with an additional test pit dug November 24, 1993, 150 ft due west of the previous test pits, and in the area for the proposed redesigned drain fields. Therefore, a sand bed (ASTM C 33) is required in each drain field to ensure waste water treatment. The EPA established the absorption rate for sand beds as 1.2 gal/day/ft^2.

III. DESIGN CRITERIA

A. SCOPE

Personnel loads and conservative expected flowrates for each of the planned buildings were furnished by WHC. These figures are conservative relative to daily flows based on EPA published figures, and yielded a total flow of 3,240 gal/day. The septic tanks and drain field were sized to handle a daily flow of 5,000 gal/day in accordance with the direction from WHC.

B. DRAIN FIELD

The disposal system consists of three individual drain fields, each having a capacity of 50% of the maximum daily flow (5,000 gal). A reserve area with a capacity of 50% of the maximum daily flow is also provided adjacent to the drain field site. This reserve area will not be constructed at this time.

Based on the soils classification, a bed-type drain field with ASTM C 33 sand filters was chosen to ensure treatment and for ease of construction and a smaller total land area occupancy. A dual-manifold design was selected to minimize lateral length within the four narrow beds in each 50% field. Each manifold serves 1/8 of a 50% field. A lateral spacing of 3-1/2 ft with an orifice spacing of 3 ft was chosen. The lateral diameter

and manifold diameter was chosen utilizing PC-based "MathCAD" to analyze various options for size. The orifice diameter was also analyzed. Based on the analysis, 1-in. laterals with 3/16-in. orifices were chosen, served by 2-in. manifolds. Orifices are oriented in the 12 o'clock position except for the first, middle, and last orifices of each lateral which are inverted to the 6 o'clock position for lateral drainage.

A 1-ft layer of washed drain rock, 3/4- to 1-1/2-in., will be placed above the sand filter media with the distribution pipes centered within the drain rock. Geotextile fabric will be installed on top of the drain rock to minimize infiltration of native backfill into the soil absorption bed. Four-in. PVC monitor ports will be installed near the ends of or centered within four beds in each 50% field. The monitor ports are to be perforated within the drain rock and include a threaded cap.

The system flow will be approximately 242 gal/min with a minimum residual head at the orifices of 2-1/2 ft. A theoretical difference of 15% or less in orifice discharge will exist within each 50% field. Supporting calculations are shown in Appendix A.

A dose frequency of four per day was selected due to the soil type. Because the daily flow is divided between two 50% fields each day, the effective dosing frequency is eight per day. The resulting dose volume is 625 gal.

A timer will be used to deliver a dose every 3 hrs for approximately 2-1/2 minutes, provided an adequate volume of effluent has reached the dosing chamber. A system of switches will prevent the timer from starting without adequate effluent for a full dose and will also bypass the timer and start the pumps if the timer fails.

C. SEPTIC TANK AND DOSING CHAMBER

Domestic sewage generated by planned buildings will be collected by both gravity and pressure collection systems. A 3,000-gal septic tank receives flow from the ETF. A 7,000-gal tank will be added adjacent to the planned support facility to receive sewage from the support facility and the planned support trailers. Capacity is included for future tie-ins by the Construction support trailers and future facilities.

Filtered effluent from both septic tanks will gravity-flow to the new dosing chamber which provides a reserve capacity of 1,330 gal, or 26% of the maximum daily flow. Two dosing cycles can be missed without activating the alarm.

Duplex pumps discharge to the drain field through a valve vault to direct flow to the appropriate drain fields.

IV. QUALITY ASSURANCE/QUALITY CONTROL

Project C-018H will be constructed under the construction management of Kaiser Engineers Hanford Company. Applicable Quality Services procedures to be utilized during project construction include the following:

- QS 7.4, "Construction Management Quality Engineering"
- QS 9.0, "Quality Services Planning"
- QS 10.3, "Open Item Reporting"
- QS 10.4, "Project Punchlist"
- CV 2, "Backfilling"
- CV 3, "Concrete Placement"
- QS 10.16, "Official Acceptance of Construction"
- QS 17.0, "QS Records and Documentation"

V. OPERATION AND MAINTENANCE

The operating contractor has a maintenance program in place to inspect septic tanks on an annual basis and pump and/or clean the tanks as prescribed in the preventive maintenance procedure (see Appendix B). Proposed additions to the procedure for inspecting the soil absorption beds and dosing and resting the beds are included.

VI. REFERENCES

In addition to the references listed in Appendix A, the following documents are referenced.

1. WAC 173-240-070, "Submission of Plans and Reports for Construction of Wastewater Facilities, Plans and Specifications."

2. DOE 5440.1E, "National Environmental Policy Act."

3. 42 U.S.C. 4321 et seq., "National Environmental Policy Act."

VII. OWNERSHIP

Owner: U.S. Department of Energy
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Attn: A.L. Rodriguez
Telephone: (509) 372-0277

Design Engineer: Kaiser Engineers Hanford Company
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Richland, WA 99352
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Telephone: (509) 376-7228

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APPENDIX A

Design Calculations

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KAISER ENGINEERS HANFORD

CALCULATION IDENTIFICATION AND INDEX

Page 1 of 3

Date 2-2-94

This sheet shows the status and description of the attached Design Analysis sheets.

Discipline Envr. Engr WO/Job No. CRJ708/C-0184 Calculation No. C-018-25

Project No. & Name ETF Sanitary Waste water

Calculation Item Invert for decay tank

These calculations apply to:

Dwg. No. H-2-88758 sh 2 Rev. No. (1)

Dwg. No. _____ Rev. No. _____

Other (Study, CDR) _____

_____ Rev. No. _____

The status of these calculations is:

☐ Preliminary Calculations

☒ Final Calculations

☐ Check Calculations (On Calculation Dated _____)

☐ Void Calculation (Reason Voided _____

_____)

Incorporated in Final Drawings? ☒ Yes ☐ No

This calculation verified by independent "check" calculations? ☐ Yes ☐ No

Original and Revised Calculation Approvals:

	Rev. 0 Signature/Date	Rev. 1 Signature/Date	Rev. 2 Signature/Date
Originator	2.2.94		
Checked by	2.2.94		
Approved by	RL Newell 2.2.94		
Checked Against Approved Vendor Data			

INDEX

Design Analysis Page No.	Description

KEH 0378.00 (06/92)

KAISER ENGINEERS
HANFORD

DESIGN ANALYSIS

Client WHC
Subject ETF Septic (Dosing Inverts)
Location 200E / ETF

WO/Job No. CR1208 / C-018H
Date 2-2-94 By [signature]
Checked 2-2-94 By [signature]
Revised By

OBJECTIVE: TO DETERMINE INVERTS OF GRAVITY LINE FROM THE NEW SEPTIC TANK SOUTH OF THE ETF OPERATIONS SUPPORT FACILITY TO THE EXISTING 2000 GALLON DOSING TANK AT THE ETF.

REFERENCES:

1. H-2-89039 REV 2, BY JGC/ADTECHS
2. H-2-88756 SH 2, REV 0, BY KEH
3. HANDBOOK OF PVC PIPE, UNIBELL PVC PIPE ASSOCIATION, 3RD EDITION, 1991
4. KEH Survey, File Number 1226-070, 12/15/93
5. Yakima Precast Submittals, #100.1 and #100.2
6. DOE-RL Order 6430.1A

ORIGIN = 1

From Ref 1, the approximate elevation at the west edge of the pavement near the crossing is 588.8. There is a x-section depicting a 1.0' ditch depicted at the edge of the road. Evaluate effects of this 1.0' ditch and of a 0.2' ditch.

Distances are defined as follows (Ref 2):

d1	– from septic tank to edge of asphalt	d1 = 123.30
d2	– from edge of asphalt to 12" waterline	d2 = 33.8
d3	– from 12" waterline to edge of dosing tank	d3 = 33.1

Elevation of bottom of ditch:

asphalt elevation: $ae := 588.8$ ditch depth: $i := 1..2$ $dd_i =$

$$\begin{pmatrix} 0.2 \\ 1.0 \end{pmatrix}$$

bottom of ditch: $bd_i := ae - dd_i$ $bd = \begin{pmatrix} 588.6 & 0.2' \\ 587.8 & 1.0 \end{pmatrix}$

Required coverage to top of sewer pipe: $cov := 2.5$

Elevation of top of sewer pipe at ditch crossing:

$topsnsditch_i := bd_i - cov$ $topsnsditch = \begin{pmatrix} 586.1 & 0.2' \\ 585.3 & 1.0 \end{pmatrix}$

Septic tank effluent invert: Tank inlet is 587.8 (Ref 2), minimum drop across the tank is 0.25." Pipe will be 4" ASTM 3034 PVC; pipe data from Ref 3:

Top of pipe at septic outlet:

dimension of the 4" pipe from top of pipe, outside, to invert, converted to feet (pipe data from Ref 3): $w := \frac{4.215 - 12}{12}$ $w = 0.34$

$inlet_{inv} = 587.8$

$outlet_{inv} = inlet_{inv} - .25$

$outlet_{top} = outlet_{inv} + w$ $outlet_{top} = 587.89$

KEH-0037.00 (07/82)

KAISER ENGINEERS HANFORD

DESIGN ANALYSIS

Calc. No. C018-
Revision 0
Page No. 2 of 2

Client WHC | WO/Job No. CR1208 / C-018-H
Subject ETF Septic (Dosing Inserts) | Date 2.2.94 By
Checked 2.2.94 By
Location | Revised By

Determine slope from tank to curb:

$$s1_i := \frac{outlet_{top} - topsnsditch_i}{d1} \qquad s1 = \begin{pmatrix} 0.0145 \\ 0.021 \end{pmatrix} \begin{matrix} 0.2' \\ 1.0 \end{matrix} \qquad > 0.004 \text{ ft/ft}$$

MAINTAIN THIS SLOPE FULL LENGTH OF THIS SECTION OF PIPE

Check top of sewer pipe at the 12" waterline crossing:

$$topsns12_i := topsnsditch_i - (s1_i \cdot d2) \qquad topsns12 = \begin{pmatrix} 585.61 \\ 584.59 \end{pmatrix} \begin{matrix} 0.2' \\ 1.0 \end{matrix}$$

Check clearance:

The top of the 12" pipe at the crossing is (Ref 4): $top_{12} := 585.51$

Clearance between top of 12" and the top of the sewer:

$$clearance_i := topsns12_i - top_{12}$$

$$clearance = \begin{pmatrix} 0.1 \\ -0.92 \end{pmatrix}$$

Determine elevation of top of sewer at the dosing tank:

$$snstanktop_i := outlet_{top} - (d1 + d2 + d3) \cdot s1_i \qquad snstanktop = \begin{pmatrix} 585.13 \\ 583.89 \end{pmatrix} \begin{matrix} 0.2' \\ 1.0 \end{matrix}$$

From Ref 4: top of dosing tank: $tanktop := 587.565$

From Ref 5, tank depth from outside top to invert: $td := \frac{76 - 4}{12}$ $td = 6$

Tank invert is therefore: $dosetank_{inv} := tanktop - td$ $dosetank_{inv} = 581.57$

dose tank inlet invert: $doseinletinv_i := snstanktop_i - w$

$$doseinletinv = \begin{pmatrix} 584.79 \\ 583.55 \end{pmatrix}$$

Remaining fluid depth capacity of tank:

$$depthcap_i := snstanktop_i - w - dosetank_{inv} \qquad depthcap = \begin{pmatrix} 3.22 \\ 1.99 \end{pmatrix}$$

SUMMARY:

The above options each use the ditch invert as a controlling elevation, based upon freeze protection requirements of 2.5'. Each also runs into the 12" waterline; it is not a clearance problem in that the requisite 18" is lacking, it is a clearance problem in that the SNS hits the waterpipe. The 0.2' ditch option will be selected to allow use of a 2150 gallon additional dosing tank, rather than a 3000 gallon additional dosing tank. A sketch of the tank layout is attached. Results are shown in H-2-88757 sh2.

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KAISER ENGINEERS HANFORD

CALCULATION IDENTIFICATION AND INDEX

WO/Job No. CA12C81 C-018H

Date 12-20-93

This sheet shows the status and description of the attached Design Analysis sheets.

Discipline 22- Environmental Engineering

Project No. & Name C-018H Septic Tank Soil Absorption System

Calculation Item STSAS DISTR

These calculations apply to:

Dwg. No. H-2-84756 → H-2-84759, all shts Rev. No. 0

Dwg. No. _____ Rev. No. _____

Other (Study, CDR) C-018H-CG

_____ Rev. No. _____

The status of these calculations is:

- ☐ Preliminary Calculations
- ☒ Final Calculations
- ☐ Check Calculations (On Calculation Dated _____)
- ☐ Void Calculation (Reason Voided _____)

Incorporated in Final Drawings? ☒ Yes ☐ No

This calculation verified by independent "check" calculations? ☐ Yes ☒ No

Original and Revised Calculation Approvals:

	Rev. 0 Signature / Date	Rev. 1 Signature / Date	Rev. 2 Signature / Date
Originator	J.D. 12-20-93		
Checked by	R.H. Wollenbeck 12-21-93		
Approved by	R.L. Newell 2-2-94		
Checked Against Approved Vendor Data			

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Design Analysis Page No.	Description

KEH-378 (2-83)

KAISER ENGINEERS HANFORD

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DESIGN ANALYSIS

Client WHC
Subject STSAS
Location 200E

WO/Job No. CR1208 - C-018H
Date 12.20.93 By JD ayD
Checked 12-21-93 By RG Hollenbeck
Revised By

ORIGIN = 1

OBJECTIVE: DESIGN A 5,000 GALLON/DAY SEPTIC TANK SOIL ABSORPTION SYSTEM (STSAS) TO SERVE THE ETF AND NEARBY SUPPORT FACILITIES.

REFERENCES

1. ONSITE WASTEWATER TREATMENT AND DISPOSAL SYSTEMS, EPA 625/1-80-012 (REFERENCED BY 6430.1A).
2. DESIGN GUIDELINES FOR LARGER ON-SITE SEWAGE SYSTEMS WITH DESIGN FLOWS GREATER THAN 3500 GALLONS PER DAY by WASHINGTON STATE DOE & DSHS, 1987
3. GUIDELINES FOR THE USE OF PRESSURE DISTRIBUTION SYSTEMS by WASHINGTON STATE DSHS, SEPT, 1984
4. HANDBOOK OF PVC PIPE - DESIGN & CONSTRUCTION by UNI-BELL PVC PIPE ASSOCIATION, Third Edition, Sept. 1991
5. DESIGN OF PRESSURE DISTRIBUTION NETWORKS FOR SEPTIC TANK-SOIL ABSORPTION SYSTEMS by RICHARD J. OTIS, SMALL SCALE WASTE MANAGEMENT PROJECT, UNIV. OF WISCONSIN JAN, 1981
6. LETTER OF MARCH 18, 1993, LISA BROWN, WDOH, TO A.L. RODRIQUEZ, DOE-RL, "PROJECT C-018H SOIL INVESTIGATION."
7. FLOW OF FLUIDS THROUGH VALVES, FITTINGS, AND PIPE, CRANE CO. TECHNICAL PAPER NO. 410, 1988.
8. WASTEWATER ENGINEERING: COLLECTION AND PUMPING OF WASTEWATER. METCALF AND EDDY, INC, 1981.
9. LETTER OF INSTRUCTION "200 EAST EFFLUENT OPERATIONS SUPPORT FACILITY," A.K. VOGT, WHC, TO C.J. DENSON, KEH, WHC LETTER NUMBER 9359894 REVISION 1, 11/17/93.
10. GUIDELINES FOR SAND FILTERS, WDOH ENVIRONMENTAL HEALTH PROGRAMS, TECHNICAL REVIEW COMMITTEE, AUGUST 1989.
11. ON-SITE SEWAGE DISPOSAL SYSTEM, STANDARDS FOR DESIGN AND CONSTRUCTION, BFHD, 1986

PIPE DATA:

Unless otherwise noted, all piping will be Pressure Rated 125 SDR 32.5 (IPS O.D.) per ASTM D 2241.
HAZEN - WILLIAMS 'C' FOR PVC PIPE C := 150 (Ref 4 pg 275)
FRICTION LOSS THROUGH PIPE FITTINGS IS DETERMINED USING EQUIVALENT PIPE LENGTHS (IN FEET) FROM THE NOMOGRAPH IN REF 4 PAGE 280.

Side-discharge tees:

1.25":	t125 := 7.5
1.5":	t15 := 9
2":	t2 := 12
3":	t3 := 17.5
4":	t4 := 22
6":	t6 := 34
8":	t8 := 44.5

90-degree elbows:

EL6 := 16	EL2 := 5.47
EL8 := 21	EL25 := 6.5
EL10 := 26	EL3 := 8
EL12 := 32	
EL4 := 11	

Expansions:

d/D = 6/8	x1 := 3.5
d/D = 8/10	x2 := 3.8
d/D = 8/12	x3 := 5.6

Reducers:

d/D= 1/2	r0 := 0.99
d/D = 1/1.5	r1 := 0.73
d/D = 4/6	r2 := 2.75
d/D = 4/8	r3 := 3.75
d/D = 6/8	r4 := 4.25
d/D = 2/4	r5 := 1.8
d/D = 4/8	r6 := 3.8
d/D = 4/10	r7 := 4.1
d/D = 2/3	r8 := 1.4
d/D = 6/10	r9 := 4.25

KAISER ENGINEERS HANFORD

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Revision 0
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DESIGN ANALYSIS

Client WHC	WO/Job No. CR1208 / C-018H	
Subject STSAS	Date 12-20-93	By JD Gee
	Checked 12-21-93	By RG Hollenbeck
Location 200E	Revised	By

CALCULATIONS:

TOTAL FLOW CAPACITY (Ref 9): $Qt := 5000$ GPD

Absorption beds will be lined with ASTM C-33 sand IAW Ref 6. Per Ref 10 page 11, select a loading rate of 1.0 gpd/ft^2, conservatively. Ref 3 page 19 recommends 4 doses per day for medium sands. Ref 2 page 20 requires the daily Q be split and delivered to two 50% fields. The effective dose per day is therefore 8.

DF is set to 8 because sand filters require 4 doses per day, per 50% field

LOADING RATE $LR := 1.0$ GALLONS

Dose/day: $d := 8$ DOSE VOLUME: $dv := \frac{Qt}{d}$ $dv = 625$

DRAINFIELD CONFIGURATION: IAW Ref 2 page 20, construct three pressure-distribution fields, each sized for 50% of the daily flow, with two in use at a time, on an annual rotation.

AREA: $A := \frac{Qt}{LR} \cdot 1.5 \cdot 0.50$ $A = 3750$ SQUARE FEET/50% FIELD

Number of beds: $NB := 4$ Bed width: $BW := 10$ *beds shall be as long and narrow as possible (Ref 3 pg 8).*

BED LENGTH: $BL := \frac{A}{BW \cdot NB}$ $BL = 93.75$ set $BL := 94$ ft

TOTAL LAND AREA USED: Lengthwise,with bed: $BL \cdot 4 + 2 \cdot 15 + 20 = 426$ FEET

Across beds: $(NB - 1) \cdot 15 + NB \cdot BW = 85$ FEET

LATERAL DESIGN

- LATERAL LENGTH MUST BE WITHIN 1/2 THE ORIFICE SPACING TO 6" SHORTER THAN THE BED LENGTH. (REF 3 PAGE 8 STEP A-2.1).
- SELECT A DUAL-MANIFOLD LAYOUT TO DIVIDE LATERALS INTO FOUR SECTIONS LENGTHWISE.

LATERAL LENGTH: $LL := \frac{BL - 3}{4}$ $LL = 22.75$ FEET *The minus 3' is for a 1' clearance at each end and 1' in the middle.*

LATERALS PER BED

Beds can use lateral spacings of 3' to 6' (Ref 3 pg 8). Select a lateral spacing of 3.5', leaving 1.5' between the outside laterals and the bed walls.

Laterals per bed: 3 wide by 4 long implies: $NL := 12$

ORIFICE SPACING: $Y := 3.0$ FEET - MAX FOR SAND FILTERS (REF 3 P.11 STEP A-3)

NUMBER OF ORIFICES/LATERAL: $N := \frac{LL}{Y}$ $N = 7.583$

SET $N := 7$

KAISER ENGINEERS HANFORD

DESIGN ANALYSIS

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JDA

Client WHC
Subject STSAS
Location 200E

WO/Job No. CR1208 / C-018H
Date 12-20-93 By J.D. Alford
Checked 12-21-93 By R.G. Hollenbeck
Revised By

SELECT LATERAL DIAMETER AND ORIFICE DIAMETER.

Evaluate several pipe & orifice sizes to optimize the system. Orifice diameters can vary from 3/16 to 9/32 inches. 1" pipe will be pressure rated 160 as 1" is not available in PR 125. Sizes from Ref 4 pg 439:

$p := 1..4$ $o := 1..4$

$D_p :=$	
1.195	1"
1.54	1.25"
1.78	1.5"
2.229	2"

$d_o :=$	ORIFICE DIAMETER
0.1875	3/16"
0.21875	7/32"
0.25	1/4"
0.2813	9/32"

ORIFICE DISCHARGE HEADS $h := 2..7$ feet

ORIFICE DISCHARGE RATES - GPM -

$q_{o,h} := 11.79 \cdot (d_o)^2 \cdot h^{0.5}$ REF 3 PAGE 39

GPM

	h = 2	3	4	5	6	7	d =
q =	0 0.586	0.718	0.829	0.927	1.015	1.097	3/16
	0 0.798	0.977	1.128	1.262	1.382	1.493	7/32
	0 1.042	1.276	1.474	1.648	1.805	1.95	1/4
	0 1.319	1.616	1.866	2.086	2.285	2.468	9/32

discharge/orifice

LATERAL DISCHARGE RATE - GPM $QL_{o,h} := N \cdot q_{o,h}$

	h = 2	3	4	5	6	7	d =
QL =	0 4.103	5.025	5.803	6.488	7.107	7.677	3/16
	0 5.585	6.84	7.898	8.831	9.673	10.449	7/32
	0 7.295	8.934	10.316	11.534	12.635	13.647	1/4
	0 9.236	11.311	13.061	14.603	15.997	17.278	9/32

discharge/header

LATERAL FRICTION LOSSES: SELECT 1" LATERALS. INCLUDE SADDLE/TEE & REDUCER EQ. LENGTH. CONFIRM AND ADJUST EQ. LENGTH ONLY IF NECESSARY: $p = 1$

EQUIVALENT LENGTH: $L := LL + t2 + r0$ $L = 35.74$

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DESIGN ANALYSIS

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Client WHC
Subject STSAS
Location 200E

WO/Job No. CR1208 / C-018H
Date 12-20-93 By J.D. Aard
Checked 12-21-93 By R.G. Hollenbeck
Revised By

USE HAZEN-WILLIAMS' EQUATION (REF 3 PG 40) TO COMPUTE THE FRICTION LOSSES OVER THE LENGTH OF THE LATERAL. SUBTRACT THIS FROM 'h,' THE HEAD DELIVERED TO THE SADDLE, YIELDING NET HEAD AVAILABLE AT THE DISTAL ORIFICE, 'NHA.'

$$NHA_{o,h} = h - \frac{10.46 \cdot L \cdot (QL_{o,h})^{1.85}}{C^{1.85} \cdot (D_p)^{4.87}} \cdot \frac{1}{3}$$

Losses are reduced by 2/3 due to equal-spaced orifices - ref 3 pg 20

h = 2 3 4 5 6 7

$$NHA = \begin{bmatrix} 0 & 1.933 & 2.902 & 3.872 & 4.843 & 5.814 & 6.786 \\ 0 & 1.881 & 2.827 & 3.774 & 4.723 & 5.672 & 6.621 \\ 0 & 1.805 & 2.717 & 3.63 & 4.545 & 5.462 & 6.379 \\ 0 & 1.699 & 2.561 & 3.428 & 4.297 & 5.167 & 6.04 \end{bmatrix}$$

d = 3/16, 7/32, 1/4, 9/32

Net head at distal orifice neglecting losses in header.

REF 3, Section III.A.2.c, requires 2' of head throughout the system. Ref 5 pg 10 recommends 2.5 feet. The remaining calcs are based on 1" laterals and 3/16" orifices.

p = 1 o = 1

LATERAL VELOCITY:

$$VL_{o,h} = \frac{QL_{o,h}}{\left(\frac{D_p}{24}\right)^2 \cdot \pi \cdot 7.48 \cdot 60}$$

h = 2 3 4 5 6 7

VL = (0 1.174 1.438 1.66 1.856 2.033 2.196) fps

DISCHARGE VARIATION, TYPICAL LATERAL:

NET DISCHARGE AT DISTAL ORIFICE, ND:

$$ND_{o,h} = 11.79 \cdot (d_o)^2 \cdot (NHA_{o,h})^{0.5}$$

h = 2 3 4 5 6 7

ND = (0 0.576 0.706 0.816 0.912 0.999 1.08) GPM at distal orifice

VARIATION OF DISCHARGE, NEAREST/FURTHEST ORIFICES (VOD<1.1 - REF 5 PG 7).

$$VOD_{o,h} = \frac{q_{o,h}}{ND_{o,h}}$$

h = 2 3 4 5 6 7

VOD = (0 1.0172 1.0167 1.0163 1.0161 1.0158 1.0157)

This demonstrates that for any lateral in the system, delivery of between 2 and 7 feet of head results in a variation of discharge less than 10%. For conservatism, no head loss was factored into the flowrate for the near orifice, 'qo'.

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DESIGN ANALYSIS

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Client WHC
Subject STSAS
Location 200E

WO/Job No. CR120X / C-018H
Date 12-20-93 By [illegible]
Checked 12-21-93 By R G Hollenbeck
Revised By

DOSE/PIPE VOLUME RATIO, DVR

LATERAL VOLUME IN GALLONS. INCLUDE 1/2 THE HEADER (ASSUME A 2" HEADER, REVISE IF NECESSARY):

$$LV_p = \left(\frac{D_p}{24}\right)^2 \cdot \pi \cdot (LL) \cdot NL \cdot NB \cdot 7.48 + \frac{\left(\frac{2.229}{24}\right)^2 \cdot \pi \cdot (32 \cdot 4) \cdot 7.48}{2} \qquad LV = 76.592$$

$$DVR_p := \frac{dv}{LV_p} \qquad DVR = 8.16 \qquad \text{MUST BE > 7. (REF 3 PAGE 19)}$$

CONCLUSIONS:

The use of 22.75' long, 1" diameter laterals with 7 3/16" dia. orifices meets all DVR and discharge variation criteria.

DESIGN THE HEADER (g/8)

HEADER EQUIVALENT LENGTH: $HL := 16 + t2$ $HL = 28$ feet
includes 2" tee

DISCHARGE RATE PER HEADER: $Q8_{o,h} := \frac{q_{o,h} \cdot N \cdot NL \cdot NB}{8}$
each header serves 1/2 a bed, or 6 laterals

$q_{o,h}$
0.586
0.718
0.829
0.927
1.015
1.097

h = 2 3 4 5 6 7

Q8 = (0 24.62 30.153 34.817 38.927 42.642 46.059) gpm

HEADER DIAMETER: TRY FOUR SIZES: $k := 1..4$ $HD_k :=$

REF 4 PG 439

4.224	4"
3.284	3"
2.699	2.5"
2.229	2"

HEAD AVAILABLE TO LAST LATERAL: $HA_{k,h} := h - \frac{10.46 \cdot HL \cdot (Q8_{o,h})^{1.85}}{C^{1.85} \cdot (HD_k)^{4.87}} \cdot \frac{1}{3}$

h = 2 3 4 5 6 7

$$HA = \begin{bmatrix} 0 & 1.997 & 2.995 & 3.994 & 4.993 & 5.991 & 6.99 \\ 0 & 1.989 & 2.985 & 3.98 & 4.975 & 5.971 & 6.966 \\ 0 & 1.973 & 2.96 & 3.948 & 4.936 & 5.924 & 6.913 \\ 0 & 1.93 & 2.899 & 3.868 & 4.838 & 5.808 & 6.778 \end{bmatrix} \begin{matrix} 4" \\ 3" \\ 2.5" \\ 2" \end{matrix}$$

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DESIGN ANALYSIS

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Client WHC
Subject
Location 200E

WO/Job No. CR1208 / C-018H
Date 12-20-93 By [illegible]
Checked 12-21-93 By R G Hollenbeck
Revised By

CHECK VELOCITY (FPS):

The last lateral receives 2.899' if it receives 3' of head. Therefore, set h = 3.

$$V_k := \frac{Q8_{o,3}}{\left(\frac{HD_k}{2\cdot 12}\right)^2 \cdot \pi \cdot 7.48 \cdot 60} \qquad V = \begin{bmatrix} 0.69 \\ 1.142 \\ 1.691 \\ 2.479 \end{bmatrix} \begin{matrix} 4" \\ 3" \\ 2.5" \\ 2" \end{matrix}$$

It was demonstrated that lateral discharge variation is acceptable for delivered heads between 2 and 7. Therefore, select a 2" header, which delivers 2.9' to the distal lateral if it receives 3' of head at it's start.

CHECK SYSTEM DISCHARGE VARIATIONS:

Ref 5 pg 7 and pg 8 allow a discharge variation of 15% within a bed. Because the 50% fields in this design consist of 8 symmetrical sections, the following calc also checks the variation in a typical 50% field.

Discharge at distal orifice, last lateral.

$$NA_{o,h} := HA_{k,h} - \frac{10.46 \cdot L \cdot (QL_{o,h})^{1.85}}{C^{1.85} \cdot (D)^{4.87}} \cdot \frac{1}{3}$$

$$qlast_{o,h} := 11.79 \cdot (d_o)^2 \cdot (NA_{o,h})^{0.5}$$

Head available is recalculated to account for header losses. "h" is the head delivered to the start of the distal lateral.

h = 2 3 4 5 6 7

NA = (0 1.863 2.801 3.74 4.681 5.622 6.564)

h = 2 3 4 5 6 7

qlast = (0 0.566 0.694 0.802 0.897 0.983 1.062)

NEAR ORIFICE: USE q, WITHOUT ACCOUNTING FOR HEAD LOSSES, TO YIELD A CONSERVATIVE VOD.

VARIATION OF DISCHARGE PER 50% FIELD:

$$VOD_{o,h} := \frac{q_{o,h}}{qlast_{o,h}}$$

h = 2 3 4 5 6 7

VOD = (0 1.04 1.03 1.03 1.03 1.03 1.03)

CONCLUSION:

A 2" header maintains an acceptable VOD (below 15%) if it receives from 2-7 feet of head.

Select head required at header start: ht := 3

Select flowrate: at 3' received head, calcs above show each header to have a flowrate of Q8 := 30.2 gpm.

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DESIGN ANALYSIS

Client WHC | WO/Job No. CR 208 / C-018H
Subject SISAS | Date 12-20-93 By JD Gilbert
Checked 12-21-93 By RG Hollenbeck
Location 200 E | Revised By

DESIGN q/4 LINES:

DIAMETER: TRY FOUR SIZES: $k := 1..4$ $HD_k :=$

REF 4 PG 439

4.224	4"
3.284	3"
2.699	2.5"
2.229	2"

LENGTH: includes 4" tee, 4" 90-degree elbow and reducer to 2"

$L := 23.25 + EL4 + r5 + t4 + 1$ $L = 59.05$

FLOWRATE: Flowrate will be twice that of a header: $Q4 := 2 \cdot Q8$ $Q4 = 60.4$

HEAD REQUIRED: Includes the head required at the header tee ('ht') and the head losses through the q/4 line.

$$RH_k := \frac{10.46 \cdot L \cdot (Q4)^{1.85}}{C^{1.85} \cdot (HD_k)^{4.87}} + ht$$

$RH =$

3.103	4"
3.351	3"
3.912	2.5"
5.315	2"

CHECK VELOCITY:

$$V_k := \frac{Q4}{\left(\frac{HD_k}{2 \cdot 12}\right)^2 \cdot \pi \cdot 7.48 \cdot 60}$$

$V =$

1.383	4"
2.288	3"
3.387	2.5"
4.966	2"

Select a 4" line. Head required at start of q/4 line is $ht := 3.103$ feet.

Include 1' riser from invert of Q/4 to invert of Q/8: $ht := ht + 1$ $ht = 4.103$

DESIGN q/2 LINES:

DIAMETER: TRY THREE SIZES: $k := 1..3$ $HD_k :=$

REF 4 PG 439

4.224	4"
6.217	6"
8.095	8"

LENGTH: includes 6" tee and a 6" to 4" reducer.

$L := 25 + t6 + r2$ $L = 61.75$

FLOWRATE: Flowrate will be twice that of a q/4 line: $Q2 := 2 \cdot Q4$ $Q2 = 120.8$

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DESIGN ANALYSIS

Client	WHC	WO/Job No.	CR1208 / C-018H
Subject	STSAS	Date	12-20-93 By J.D. Gill
		Checked	12-21-93 By R.G. Hollenbeck
Location	200 E	Revised	By

HEAD REQUIRED: Includes the head required at the q/2 tee ('ht') and the head losses through the q/2 line.

$$RH_k = \frac{10.46 \cdot L \cdot (Q2)^{1.85}}{C^{1.85} \cdot (HD_k)^{4.87}} + ht$$

RH_k	
4.491	4"
4.162	6"
4.119	8"

CHECK VELOCITY:

$$V_k := \frac{Q2}{\left(\frac{HD_k}{2 \cdot 12}\right)^2 \cdot \pi \cdot 7.48 \cdot 60}$$

V_k	
2.766	4"
1.277	6"
0.753	8"

Select a 6" line. Head required at start of q/2 line is $ht = 4.162$ feet.

DESIGN q/1 LINES:

Each line is designed separately. Length is from valve vault to q/2 tee, and includes reducers to match the 6" q/2 lines, as needed.

L1 := 60 + r4	L1 = 64.25
L2 := 169 + r4	L2 = 173.25
L3 := 278 + r4	L3 = 282.25
L4 := 387 + r4	L4 = 391.25

Select a 8" line for all fields. Further select 8" valve vault piping. Therefore, all lines will require an 8" to 6" reducer at the branch tee.

ELEVATION GAIN OR LOSS FROM THE VALVE VAULT TO EACH 50% FIELD: **Site is flat.**

PIPE DIAMETERS: $l := 1..3$ $TD_l :=$

REF 4 PG 439

6.217	6"
8.095	8"
10.088	10"

FLOWRATE: PER 50% UNIT = TWICE Q2 : $Q = 2 \cdot Q2$ $Q = 241.6$

REQUIRED HEAD AT VALVE VAULT EXIT:

FIELD 1:

$$L1_l := \frac{10.46 \cdot (L1) \cdot (Q)^{1.85}}{C^{1.85} \cdot (TD_l)^{4.87}} + ht$$

FIELD 2:

$$L2_l := \frac{10.46 \cdot (L2) \cdot (Q)^{1.85}}{C^{1.85} \cdot (TD_l)^{4.87}} + ht$$

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DESIGN ANALYSIS

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50.A

Client WHC
Subject STEAS
Location 200E

WO/Job No. CB1208 / C018H
Date 12-20-93 By JDA
Checked 12-21-93 By RG Hollenbeck
Revised By

FIELD 3:

$$L3_1 := \frac{10.46\cdot(L3)\cdot(Q)^{1.85}}{C^{1.85}\cdot(TD_1)^{4.87}} + ht$$

FIELD 4:

$$L4_1 := \frac{10.46\cdot(L4)\cdot(Q)^{1.85}}{C^{1.85}\cdot(TD_1)^{4.87}} + ht$$

$$L1 = \begin{pmatrix} 4.4 \\ 4.2 \\ 4.2 \end{pmatrix} \quad L2 = \begin{pmatrix} 4.8 \\ 4.3 \\ 4.2 \end{pmatrix} \quad L3 = \begin{pmatrix} 5.1 \\ 4.4 \\ 4.3 \end{pmatrix} \quad L4 = \begin{pmatrix} 5.5 \\ 4.5 \\ 4.3 \end{pmatrix} \begin{matrix} 6" \\ 8" \\ 10" \end{matrix}$$

CHECK VELOCITIES:

$$VT_1 := \frac{Q}{\left(\frac{TD_1}{2\cdot 12}\right)^2 \cdot \pi \cdot 7.48 \cdot 60}$$

$$VT = \begin{pmatrix} 2.554 \\ 1.506 \\ 0.97 \end{pmatrix} \begin{matrix} 6" \\ 8" \\ 10" \end{matrix}$$

CONCLUSIONS: Use 8."

Required feet of head out of valve vault exit: ho := 4.5

VALVE VAULT PIPING:

EQUIVALENT LENGTH VALUES FOR FITTINGS ARE FOUND IN REF 7 PAGE A30, USING THE NOMOGRAPH. L/D FOR EACH FITTING MUST BE KNOWN TO ACCESS THE NOMOGRAPH. THESE VALUES ARE GIVEN ON PAGES A26 -A29, AND ARE BASED ON SCHEDULE 40 GALVANIZED PIPE, SUITABLE FOR PIPE CLASS 300 AND LOWER (PAGE 2-10 OF REF 7).

DETERMINE HAZEN-WILLIAMS 'C': FOR GALVANIZED PIPE:

CONSIDER 3 DIAMETERS, (inches) $i := 1..3$

Ref 7 pg B-17

$VPD_i :=$

4	4.026
6	6.065
8	7.981

Hazen-Williams 'C' for galvanized is not found in available references. Therefore, derive it from Manning's 'n.' See Ref 8, pgs 25 and pg 27

Manning's "n:": n := 0.013

$$c_i := \left[\frac{4.73\cdot\left(\frac{VPD_i}{12}\right)^{.13}\cdot\left(\frac{VPD_i}{12}\right)^{\frac{1}{3}}}{4.66\cdot n^2\cdot(Q\cdot.002228044)^{0.15}}\right]^{\frac{1}{1.85}}$$

$$c = \begin{pmatrix} 88.206 \\ 97.739 \\ 104.696 \end{pmatrix} \begin{matrix} 4 \\ 6 \\ 8 \end{matrix}$$

LET HAZEN-WILLIAMS 'c' BE: c := 105

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HANFORD

DESIGN ANALYSIS

Client WHC
Subject STSAS
Location 200E

WO/Job No. CK12081 C-018H
Date 2-2-94 By
Checked 2.2.94 By
Revised By

VALVE EQUIVALENT LENGTHS: Try three sizes of each valve: v := 1 .. 3

BTRFLY VLV (L/D = 45)

$BV_v :=$

15.1	4"
22.9	6"
30	8"

TEE, RUN (L/D = 20)

$Tr_v :=$

6.7	4"
10	6"
13	8"

90-DEG EL (L/D = 30)

$EL_v :=$

10.1	4"
16.2	6"
20	8"

GATE VLV (L/D = 8)

$GV_v :=$

2.75	4"
4	6"
5.25	8"

TEE, SIDE (L/D = 60)

$Ts_v :=$

20.5	4"
31.1	6"
40.5	8"

CHK VLV (L/D = 50)

$CV_v :=$

16.5	4"
26.2	6"
33	8"

ROUTE LENGTHS: EVALUATE THE LONGEST ROUTE ONLY

THE LONGEST ROUTE IS PUMP 1 TO BED 2

$LR_v := 4 \cdot BV_v + 1 \cdot Tr_v + 2 \cdot Ts_v + 10 + CV_v$

$LR =$

134.6	4"
204	6"
257	8"

The 10' is an allowance for the miscellaneous piping within the valve vault.

hi: Head required at valve vault entrance. Include the head required at the valve vault exit.

$$hi_i := \frac{10.46 \cdot LR_i \cdot (Q)^{1.85}}{C^{1.85} \cdot (VPD_i)^{4.87}} + ho$$

$hi =$

11.954	4"
6.036	6"
5.008	8"

CONCLUSIONS: Use 8" galvanized Schedule 40 steel pipe in vault vault. No changes are necessary to previous calculated pipe sizes.

Required feet of head at the valve vault entrance: hi := 5.008

DESIGN LINES FROM PUMPS TO VALVE VAULT

Equivelant length: $l := 193.8 + 115 + EL_8 + CV_3 + GV_3$ $l = 368.05$ feet

Select 8" fittings; confirm and change if necessary.

Determine static head: Lateral invert (H-2-88757): li := 590.5 *lateral invert equals bed invert of 588 plus 2' of sand plus 0.5' of drainrock*

Impeller Invert: (H-2-88758 sh2): ii := 581.3 *impeller is set 1' above the dosing chamber*

Static Head: $sh := li - ii$ $sh = 9.2$

KAISER ENGINEERS
HANFORD

Page No. 11 of 2
Calc. No. C018-28
Revision 0a

DESIGN ANALYSIS

Client WHC
Subject STEAS
Location 200E

WO/Job No. CR1208 / C-018H
Date 2-2-94 By
Checked 2.2.94 By
Revised By

$i := 1..3$ $dl_i :=$

6.217 — 6"
8.095 — 8"
10.088 — 10"

$$th_i := \frac{10.46 \cdot (1)^{1.85} \cdot (Q)^{1.85}}{C^{1.85} \cdot (dl_i)^{4.87}} + hi + sh \qquad th = \begin{pmatrix} 15.478 \\ 14.559 \\ 14.328 \end{pmatrix} \begin{matrix} 6" \\ 8" \\ 10" \end{matrix}$$

CHECK VELOCITIES:

$$VT_i := \frac{Q}{\left(\frac{dl_i}{2 \cdot 12}\right)^2 \cdot \pi \cdot 7.48 \cdot 60} \qquad VT = \begin{pmatrix} 2.554 \\ 1.506 \\ 0.97 \end{pmatrix} \begin{matrix} 6" \\ 8" \\ 10" \end{matrix}$$

SELECT 8" PIPE: THEREFORE: TDH = 14.6

Dose Tank Volume:
Ref 1 pg 328 suggests a reserve equal to daily Q for residences, but allows a reduction for larger systems and those using duplex pumps. Ref 3 pg 25 also suggests reserve equal to daily Q but allows a reduction for for systems with continuous operation and maintenance entities. Ref 11 pg 12 suggests reserve volumes of 75 gallons per bedroom for residential applications, and calculates daily Q based upon 120 gallons per day per bedroom. Given this means of determining reserve volume and meeting criteria for reducing reserve below daily Q, the dosing tank reserve volume shall be:

$$DTV := \frac{75}{120} \cdot Qt + dv \qquad DTV = 3750$$

Conclusion: Dose tank minimum volume shall be 3750 gallons.

Existing tank is a 2150 gallon precast unit from Yakima Precast Incorporated. Dimensions are from C-018H Submittal 100.2.

Gallons per foot: $gpf := 6 \cdot 11.25 \cdot 1 \cdot 7.48$ $gpf = 504.9$

Per drawing H-2-88758a sh2, this existing tank will be joined by three 8" lines to a Yakima Precast 2000 gallon tank, to function as a single dosing chamber. From the Submittal, the horizontal dimiensions are the same for both tanks. Therefore:

$gpf := 2 \cdot gpf$ $gpf = 1009.8$

Installing second tank as shown on H-2-88758 sh2, with the new tank 1.5' below the old, leaves a total usable volume of:

$TV := (584.78 - 581.57) \cdot gpf + 1.5 \cdot \frac{gpf}{2}$ $TV = 3998.808$ > 3750, therefore acceptable

SET SWITCH HEIGHTS:

Select OFF switch height of 1.25 from invert of second tank, to provide impeller coverage> OFF := 1.25

Set ON switch to provide the correct dose of 625 gallons: $ON := OFF + \frac{dv}{gpf}$ $ON = 1.869$

Set ON: ON = 1.9

KAISER ENGINEERS HANFORD

Calc. No. C018-28
Revision 0a

DESIGN ANALYSIS

Client WHC | WO/Job No. CR12081 C-984
Subject STSAS | Date 2.2.94 By
Checked 2.2.94 By
Location 200E | Revised By

Set ALARM to go off 2 doses after a regular dose fails to be delivered:

$$ALARM = ON + 2\cdot\frac{dv}{gpf} \qquad ALARM = 3.138 \qquad ALARM = 3.1$$

Set Emergency Start switch 2 doses above the alarm switch:

$$ES = ALARM + 2\cdot\frac{dv}{gpf} \qquad ES = 4.338 \qquad ES = 4.3$$

SUMMARY:

FIELD LAYOUT: Four 50% fields (one in reserve), each consisting of 4 beds 10' x 94', 2' deep ASTM C-33 filters.

DISTRIBUTION NETWORK: Each bed has twelve 1" laterals, 22.75' long. Distribution is by 2" headers, fed by 4" lines, 6" lines, and 8" lines from the valve vault.

VALVE VAULT PIPING: 8" galvanized Sch. 40 steel pipe and valves.

PUMP TO VALVE VAULT: 8" PVC.

FLOWRATE AND DOSING: Daily Q = 5000 gallons. Four dose/day to sand filters in 50% units implies dose volume of Q/8 = 625 gallons.

TOTAL REQUIRED DOSING CHAMBER VOLUME: 3750 gallons, usable.

PUMPS: TDH = 14.6 GPM = 242 (equals flow in Q/1 lines)

PUMP RUN TIME PER DOSE: $\frac{625}{242} = 2.583$ minutes

APPENDIX B

Operation and Maintenance Manual

(Draft)

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OPERATION AND MAINTENANCE MANUAL

for

SANITARY WASTEWATER SYSTEM

PROJECT C-018H

February 1994

Prepared by
Kaiser Engineers Hanford Company

OMM-140

APPROVAL:

Kaiser Engineers Hanford Company

Charles S. Mortimer, Project Engineer — Date

Westinghouse Hanford Company

Projects — Date

Environmental — Date

Sanitary Systems Maintenance — Date

Compliance with this document is required to meet Washington Administrative Code (WAC) 246-272 criteria. Any changes to this document must have the concurrence of the Washington State Department of Health and the Kaiser Engineers Hanford Company Project Engineer.

TABLE OF CONTENTS

APPENDICES

INTRODUCTION

This manual was prepared to provide detailed information for the operation and maintenance of the C-018H septic tank soil absorption system. Included are procedures for both normal system operation and off-normal operation. The procedures include type and frequency of required maintenance and corrective actions to return an off-normal condition to normal operation.

SYSTEM DESCRIPTION

The wastewater treatment facility consists of a two septic tanks, a dosing/pumping chamber, and three pressure distribution soil absorption fields. Each soil absorption field is designed to accept 50% of the maximum daily flow. Two of the three constructed fields are in operation at any one time. The design provides for the future construction of a fourth field if one of the constructed fields fails. The maximum daily design flow is 5,000 gal. The system location is shown on the Site Plan (see Appendix A).

SYSTEM OPERATION

A. NORMAL OPERATING CONDITIONS

Raw sewage enters the septic tanks and departs through installed effluent filters to the dosing/pumping chamber. Each duplex alternating pump pressurizes one 50% soil absorption field. Flow is directed to the soil absorption fields through the valve vault. Pump control is through timers with liquid-level-sensor over-ride.

Operation Sequence

- Effluent enters the dosing chamber. Simultaneously, the dose clock commences a 24-hour cycle.

- A dose volume of 625 gal energizes the liquid-level sensor switch.

- If the dose clock indicates a 3-hour or greater elapsed time since the last pumping cycle, the primary pump is activated and operates for a period of approximately 2-1/2 minutes. If a pump run timer malfunctions, the liquid-level sensor will shut off the pump before the pump runs dry.

- Upon completion of the pumping cycle, the pump alternator selects the other pump as the primary pump. The dose clock is reset to zero elapsed time.

- The cycle is repeated.

- The primary pump will not run unless both the dose clock and the dose volume liquid-level switch are activated. This ensures a uniform distribution to the two active soil absorption fields.

- The dosing chamber is sized to accept a total effluent volume of 2,955 gal prior to activating an alarm signal. This volume provides storage for peak flow periods between timed dose cycles and a power or pump failure occurrence.

B. OFF-NORMAL OPERATING CONDITIONS

An accumulation of more than 2,955 gal of effluent in the dosing/pumping chamber will activate an alarm signal. The signal is a local audible alarm and magenta strobe light. Continued filling of the dosing/pumping chamber will activate the second pump, which will then pump the contents of the dosing chamber into the soil absorption field.

Two possibilities exist for this off-normal event: 1) an extreme peak flow within the 24-hour timed cycle; 2) failure of the primary pump. The second possibility is the most probable. Corrective action should commence as follows:

- Attempt to manually operate the primary pump. Successful pump operation in the manual mode would indicate a malfunction in either the floats, the dose timer, or the pump run clock.

- Failure of the pump to operate in the manual mode would indicate either an absence of power to the pump or a mechanical problem possibly necessitating the removal of the pump for repair.

If mechanical failure of both pumps occurs, emergency pumping of the dosing chamber by pumper truck(s) must be initiated immediately and the Manager of Sanitary Systems Maintenance notified. The Manager of Maintenance Integration and Material Support will

be notified to reduce or stop all discharge to minimize pumping costs during repairs. (Buildings served are listed in Appendix B). Pumper truck disposal of the effluent must then be continued until at least one pump is restored to normal service. It is important to restore both pumps to normal service at the earliest possible time to minimize the overloading of one of the soil absorption fields.

Any off-normal event shall be reported immediately to the Washington State Department of Health, 924 West Sinto, Spokane, WA 99201-2595, telephone (509) 456-2490.

PERIODIC INSPECTION

Regular inspection of key system components is necessary to ensure the system integrity for the system design life. These periodic inspections are recorded on an Inspection Record Form (Figure 1). These inspection points are described as follows.

Pumps

Visual Inspection: Observe the control panel for a seal failure warning. If active, pump service is required. Remove pump and service per manufacturer's direction.

Pump Controls and Electrical Panel

Liquid Level Sensor: Inspect/test in accordance with the manufacturer's instructions.

Timer Operation: Verify that both timer relays are operating as designed.

- The "Interval On" timer is to be set at 7 minutes. Verify that the adjustable settings on the face of the timer are properly set.

- The "On Delay" timer is to be set at 24 hours. Verify that the adjustable settings on the face of the timer are properly set.

Manually Operate Controls: Operate each pump "Off-On-Auto" switch. Determine that the switch functions as designed, i.e., the connection is broken in the "Off" position, the pump actually starts in the "On" position, and the pump circuits are active and waiting for the other controls to start the pump in the "Auto" position.

INSPECTION RECORD FORM

Component/Task	Frequency	Date	Date	Date
Pumps				
Visual Inspection	Monthly			
Pump Controls and Electrical Panel				
Check Level Sensor Operation	Annually			
Check Timer Operation	Annually			
Manually Operate Controls	Annually			
Check for Moisture and Corrosion	Annually			
Distribution System and Drain Fields				
Inspect Monitor Ports	Monthly			
Inspect Valves for Corrosion	Semi-annually			
Exercise all Valves	Annually			
Switch Fields in Operation	Semi-annually			
Septic Tank				
Check Sludge Level	Annually			
Check Floating Solids Level	Annually			
Clean Effluent Filters	Annually			
Check Inlets and Outlets	Annually			
Cycle Counters				
Record Pump Cycles				
Pump 1	Weekly			
Pump 2	Weekly			
Average Daily Flow	Weekly			

FIGURE 1

Check for Moisture and Corrosion: Visually inspect the control panel cabinet for moisture intrusion. Visually observe all wire connection points within the control cabinet for visible corrosion. Report any evidence of moisture intrusion, electrolysis, and/or corrosion, noting specific wire connection points via wire numbers.

Distribution System and Drain Fields

Soil Absorption Monitor Ports: Four monitor ports are located in each 50% soil absorption field. Follow Preventive Maintenance Procedures, "Septic Tank Inspection and Drainfield Integrity," paragraph 3.2. (See Appendix C.)

Inspect Valves for Corrosion: The valve vault contains nine valves. These valves are normally only operated semi-annually. Visually observe each valve for evidence of electrolysis, rust, and/or corrosion. Report all evidence of electrolysis, rust, and/or corrosion by valve number attached to each valve.

Note: The valve vault is defined as a confined space. Follow the requirements of WHC-CM-4-3, Standard W-13, Rev 1 and Guide W-13, "Confined Space Entry," for entry into the vault.

Exercise All Valves: The valves are lever-lock quarter-turn butterfly valves. Prior to exercising all valves, lock and tag both pumps off to prevent undue pressure accumulation during the valve exercising. Remove lock and tag when valve exercise is complete.

Switch Fields in Operation: Observe valve position at the outset of this operation. From the operations schedule in Appendix E and/or the operations schedule posted in the valve vault, determine the field cycle in service. Reset valves to the succeeding field cycle.

Septic Tank

Sludge Level and Tank Floating Solids: Follow Preventive Maintenance Procedure, "Septic Tank Inspection and Drainfield Integrity," paragraph 3.1. (See Appendix C.)

Effluent Filters: Check and clean in accordance with manufacturer's recommendation. (See Appendix D.)

Inlets and Outlets: Visually inspect the inlet and outlet device(s) within the septic tank. Ensure that the devices are in place and functioning with no visible clogging or physical damage.

Cycle Counters

Pump Cycles: Record the total number of cycles for each pump on the Inspection Record Form.

Average Daily Flow: Compute the total volume of wastewater processed during the interval to ensure that the daily design capacity has not been exceeded. The following is an example:

C = Total cycles for both pumps
Q = Average daily flow in gallons
V = 625 gal discharged per cycle
D = 5,000 gpd (design capacity)

Q = C·V/number of days between readings

Example Problem:
Assume: Pump 1 cycle counter reads 196 and Pump 2 cycle counter reads 197 on a Monday morning.

The following Monday morning, Pump 1 cycle counter reads 221 and Pump 2 cycle counter reads 222.

Therefore, the total cycles for the 7-day period is 50.

Q = 50·625/7

Q = 4464 gpd

Conclusion: The system is operating within the daily design flow of 5,000 gpd.

Submit the completed Inspection Record Form annually to the Washington State Department of Health, 924 West Sinto, Spokane, WA 99201-2595.

REFERENCES

1. Preventive Maintenance Procedure, "Septic Tank Pumping," prepared by Westinghouse Hanford Company Maintenance Engineering Services, Document No. 1231, Rev. 0, Change A.

2. Preventive Maintenance Procedure, "Septic Tank Inspection," prepared by Westinghouse Hanford Company Maintenance Engineering Services, Document No. 1233, Rev. 0, Change A.

Appendix A

Site Plan

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Appendix B

Building List

Effluent Treatment Facility

Effluent Treatment Facility Operations Support Facility

Effluent Treatment Facility Operations Support Trailers

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Appendix C

Procedure

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MAINTENANCE ENGINEERING SERVICES
PREVENTIVE MAINTENANCE PROCEDURES
SEPTIC TANK INSPECTION AND DRAINFIELD INTEGRITY

1.0 PURPOSE

Establish uniform criteria for septic tank inspection in order to determine tank integrity and need for pump out. Drainfield inspection shall reveal its level of performance.

2.0 GENERAL REQUIREMENTS

2.1 GENERAL SAFETY

2.1.1 A septic tank is a confined space. Follow the requirements of WHC-CM-4-3, Standard W-13, Rev 1 and Guide W-13, Confined Space Entry (KEH Procedure IS 10C) for entry into the vault.

2.2 EQUIPMENT REQUIREMENTS

2.2.1 Scum measurement device (see Attachment 1).

2.2.2 Sludge measurement device (see Attachment 2).

2.2.3 Tape measure.

2.2.4 Flashlight.

2.3 REFERENCES

2.3.1 Onsite Wastewater Treatment and Disposal Systems, EPA 625/1-80-012.

2.3.3 Manual of Septic Tank Practice, U. S. Dept. of Health Education & Welfare.

3.0 PROCESS

3.1 SEPTIC TANK INSPECTION

3.1.1 Remove riser cover adjacent to the compartment divider (see Attachment 3). Depending on the septic tank configuration, there may be more than three risers. Perform visual inspection to determine if PVC effluent outlet (see Attachment 3) exists and is in good condition.

3.1.2 Insert scum measurement device with hinge closed, cord pulled taut and the flap facing toward the drain field into the septic tank approximately 8' from the top of the riser.

3.1.3 Release the cord to open the flap and raise the device until resistance is felt from the bottom of the effluent outlet (see Attachment 3). Obtain measurement to the top of the riser and record the value in number 1 on the Septic Tank/Drainfield Evaluation Form (Attachment 4).

3.1.4 Turn scum measurement device 180 degrees and raise gently until resistance is felt by the bottom of the scum layer (see Attachment 3). Obtain a measurement to the opening of the septic tank riser and record this value in number 2 of the Septic Tank/Drainfield Evaluation Form.

3.1.5 Insert sludge measurement device to the bottom of the septic tank. Hold in place for a few minutes to allow sludge to absorb into the towel.

3.1.6 Remove device and measure the depth to which sludge absorbed into the towel. Record this value in number 4 of the Septic Tank/Drainfield Evaluation Form.

3.1.7 If the value for number 3 on the Septic Tank/Drainfield Evaluation Form is 3" or less or the value for number 4 is 8" or more then pump septic tank.

3.1.8 Restore site.

3.2 DRAINFIELD INSPECTION

3.2.1 Conduct walkdown to visually inspect field to ensure no saturated areas and locate monitor tubes (see Appendix A).

3.2.2 Remove cap and using a strong light source (sun directed via a mirror works best) observe the presence or absence of moisture at the bottom of the monitor tube. Through the monitor tubes, visually inspect liquid levels in the bed and record condition on the Septic Tank/Drainfield Evaluation Form.

3.2.3 If standing liquid exists, remedial action may be required. Notify Maintenance Engineering for further evaluation and an action plan.

3.3 DISPOSITION

3.3.1 Return Septic Tank/Drainfield Evaluation Form to the Maintenance Manager.

3.3.2 If septic tank pumping is required, maintenance must ensure that backflushing of the septic tank also occurs to remove all sludge and scum.

4.0 RECORDS

Document	QAR/ NQAR	Record Submittal Responsibility	Record Retention Responsibility
Septic Tank/Drainfield Evaluation Form	NQAR	Performing Organization	Environmental Engineering

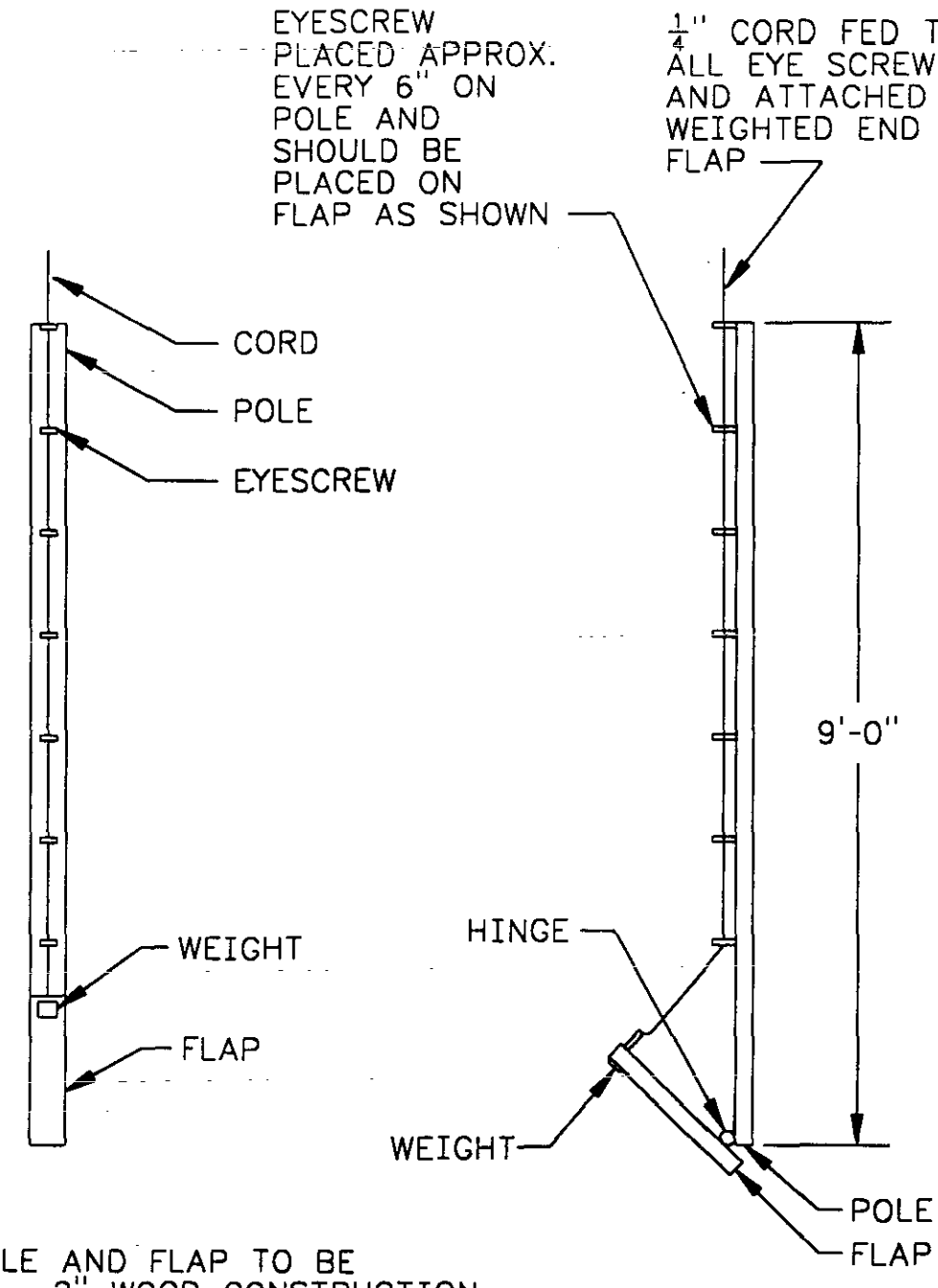
5.0 ATTACHMENTS

1 Scum Measurement Device

2 Sludge Measurement Device

3 Septic Tank Profile

4 Septic Tank/Drainfield Evaluation Form



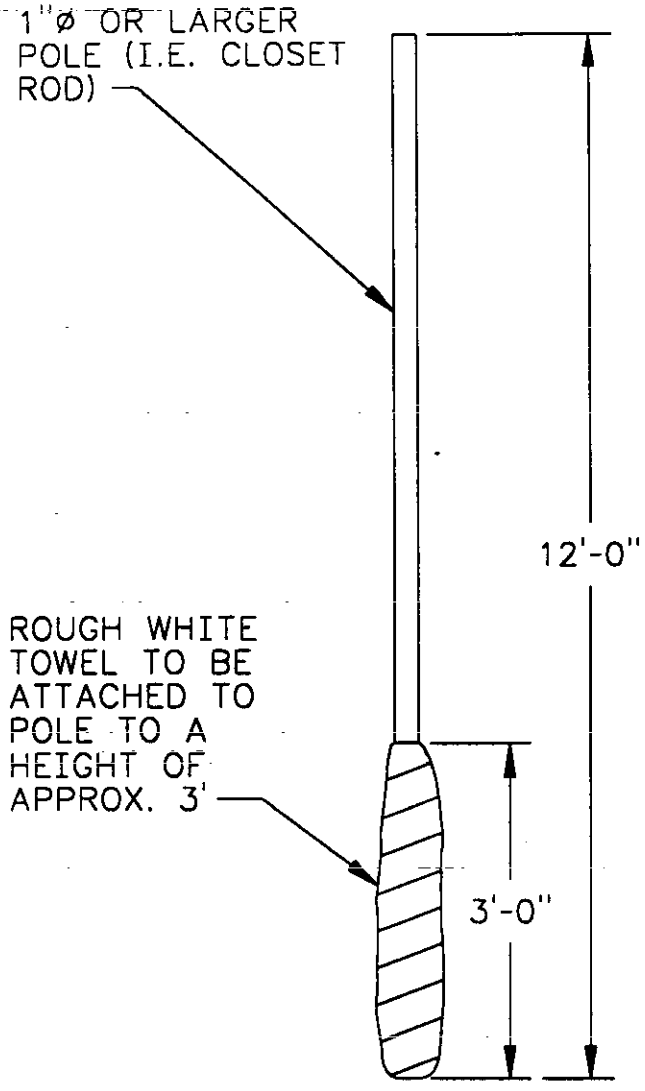
NOTES:

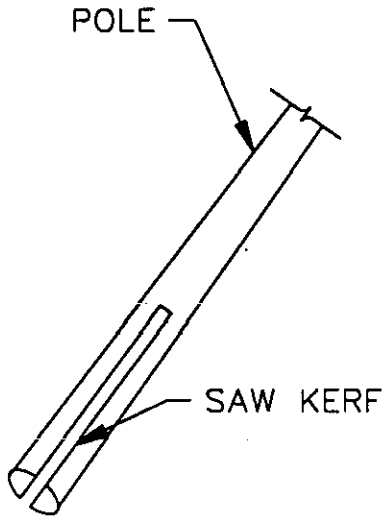
1. POLE AND FLAP TO BE 1" x 2" WOOD CONSTRUCTION.
2. MEASURING TAPE SHALL BE ATTACHED TO POLE WITH THE ORIGIN AT THE HINGED END.

SCUM MEASUREMENT DEVICE

NTS

Attachment 1





SUGGESTED ATTACHMENT

INSERT TOWEL THROUGH KERF AND WRAP TIGHTLY AROUND. SECURE LOOSE END WITH ELECTRICAL TAPE.

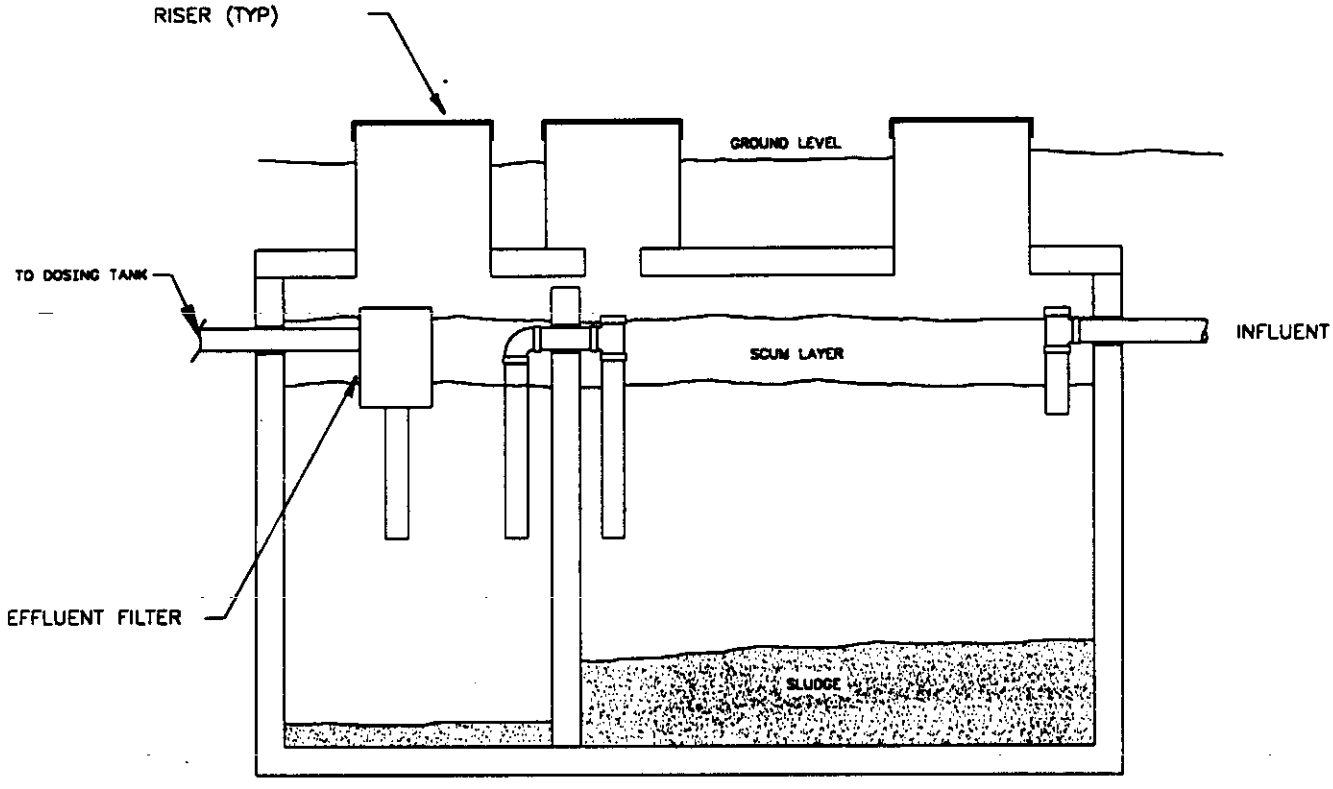
NOTES:

1. TOWEL TO BE REPLACED AFTER EACH USE.

SLUDGE MEASUREMENT DEVICE

NTS

Attachment 2



SEPTIC TANK PROFILE
NTS

Attachment 3

SEPTIC TANK/DRAINFIELD EVALUATION FORM

Date_____

Location_____

Personnel performing inspection_____

1. Depth to bottom of effluent outlet _____

2. Depth to bottom of scum _____

3. Distance of scum from bottom of baffle (subtract #2 from #1) _____

4. Depth of sludge _____

5. Vault integrity _____

6. Liquid depth in monitor tubes

Location	Condition (i.e., dry, moist, liquid depth)

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Appendix D

Septic Tank Effluent Filters

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Appendix E

Valve Vault

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Appendix F

Pump Controls

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Appendix G

Pumps

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Appendix H

Drawings

H-2-88756 sh 1	Key Map and Drawing List
H-2-88756 sh 2	Civil, Sewage Disposal System Site Plan
H-2-88757	Civil, Sewage Disposal System Sections and Details
H-2-88758 sh 1	Civil, Sewage Disposal System Sections and Details
H-2-88758 sh 2	Civil, Sewage Disposal System Sections and Details
H-2-88759,	Electrical, Disposal System One Line Diagram, Plan and Details

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APPENDIX C

Construction Specification

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C-018H-C9
Revision 0

CONSTRUCTION SPECIFICATION

200 AREA EFFLUENT TREATMENT FACILITY SEPTIC SYSTEM

Work Order CR9583

Prepared By:
Kaiser Engineers Hanford Company
Richland, Washington

For the US Department of Energy
Contract DE-AC06-93RL12359

APPROVED

Kaiser Engineers Hanford Company (KEH)

R T Hall	2/3/94	M. A. Fischer	2/2/94
Principal Lead Engineer	Date	Technical Documents	Date
[signature]	2-3-94	[signature]	2-3-94
Safety	Date	Environmental Engineering	Date
T. D. Haug	2-3-94	R T Hall for K D Ricken	2/3/94
Quality Engineering	Date	Construction	Date
[signature]	2-4-94		
Project Management	Date		

Westinghouse Hanford Company (WHC)

J. D. Voogd	2/4/94
Projects Department	Date

OFFICIAL RELEASE
BY KAISER ENGINEERS HANFORD
DATE 2-7-94
STATION 37 CLERK 69

RELEASED FOR CONSTRUCTION

D. R. Mezger	2/4/94
US Department of Energy	Date

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CONSTRUCTION SPECIFICATION

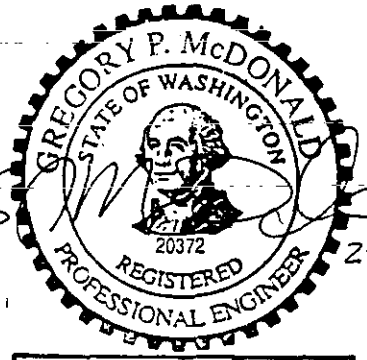
200 AREA EFFLUENT TREATMENT FACILITY
SEPTIC SYSTEM

Prepared by:

Kaiser Engineers Hanford Company
Richland, Washington

CERTIFICATION

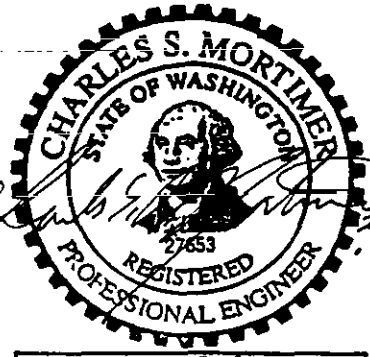
I certify that the indicated sections of this Specification were prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Washington.



2-4-94

EXPIRES 5/30/95

Electrical



2-3-94

EXPIRES 5/27/ 94

Civil

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TABLE OF CONTENTS

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SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 INTRODUCTION

1.1.1 Project C-018H for construction of the Effluent Treatment Facility is located in the Controlled Access Area of the Hanford Site, approximately 30 road miles north of Richland, Washington.

1.1.2 This Specification is for installation of portions of the facility. Portions included are the modification of existing underground tanks and installation of gravity sewer service lines, a new septic tank, an additional dosing tank with pumps, and a pressurized distribution system.

1.2 STATEMENT OF WORK

1.2.1 Scope: Work consists of furnishing labor, equipment, and materials to provide an operable facility in accordance with the Contract Documents.

1.2.2 Work Included: The following itemization is intended to be broad in scope, identifying major work elements only, and is not all inclusive.

1.2.2.1 Construction of sewer lines.

1.2.2.2 Excavating to existing 3000 gallon septic tank. Removing top, installing interior plumbing, and installing new KEH furnished top.

1.2.2.3 Furnishing and installing a new septic tank.

1.2.2.4 Construction of 3 pressure distribution drainfields (4 beds in each field).

1.2.2.5 Furnishing and installing a dosing chamber, pumps, and pump control panel.

1.2.2.6 Furnishing and installing a valve vault and plumbing within the vault.

1.2.2.7 Furnishing fittings and lowering 12-inch water line.

1.2.3 Work Not Included: The following work elements are part of the Project, are covered by other documents noted, and will be done concurrently with work included in the Contract Documents.

1.2.3.1 Electrical service to dosing pump control panel will be provided by others.

1.2.3.2 Items shown on the Drawings to be done by others.

1.3 DRAWINGS

1.3.1 Drawings which show work required by the Contract Documents are listed in the Schedule of Drawings.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01027

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 FORMAT

1.3.1 Complete Form KEH-1026, Progress Estimate Backup, sample included. A Contractor developed substitute for this form may be used, with prior approval by KEH.

1.3.2 Complete Form KEH-0959, Monthly Estimate of Work Completed, sample included, or include the following in a letter requesting payment.

Subtotal Value of All Pay Items Completed to date (Include modifications)		$X,XXX.XX
Allowance for Material Stored on Site:		
Previous Net Allowance	$X,XXX.XX	
Minus Materials Placed	$X,XXX.XX	
Plus Materials Stored	$X,XXX.XX	
Net Allowance		$X,XXX.XX
Subtotal Value Completed to Date		$X,XXX.XX
Less Previous Payments	$X,XXX.XX	
Less Other Charges from KEH	$X,XXX.XX	
Subtotal Deductions		$X,XXX.XX
Total Payment Requested		$X,XXX.XX
Less Retainage at ___%		$X,XXX.XX
Total Payment Allowed		$X,XXX.XX

1.4 APPLICATION PROCEDURE

1.4.1 Payments to the Contractor, specified in Section 15 of the Contract General Conditions, are initiated by Contractor applications, as follows.

1.4.1.1 Begin each application by completing Form KEH-1026. For lump sum contracts each application shall include, as a minimum, a breakdown of the Contract price for items scheduled and reported as required by Section 01315, and percent complete for each item.

1.4.1.2 Review backup sheets with KEH approximately 5 days before the ends of pay periods, and adjust data as required by KEH.

1.4.1.3 Finalize each application as specified in 1.3.2.

1.5 PAYMENT PROCEDURE

1.5.1 Upon receipt of each application, KEH will audit data, and check for compliance with the requirements of Sections 01300, 01315, 01630, and 01720. When KEH is satisfied that Contract requirements are up-to-date, Form KEH-0959 will be signed.

1.5.2 Copies of signed forms, showing amounts of payments to be made, will be returned to the Contractor.

1.5.3 KEH will mail checks to the Contractor's designated address.

1.6 ADDITIONAL DATA REQUIRED

1.6.1 When processing applications for payment and preparing payment documents, KEH may require data to substantiate and justify amounts requested. Processing of payment documents may be delayed if data is not forwarded expeditiously to KEH.

1.6.2 Requests for payment for products the Contractor has received, but has not applied or installed, shall be accompanied by invoices or other data to provide evidence that title to those products is held by the Contractor.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

KAISER ENGINEERS
HANFORD

PROGRESS ESTIMATE BACKUP

Sheet ____ of ____

Contractor:	Contract No.:
Subject:	
Backup for Progress Estimate No.:	Dated:

Item	Description	Estimated Cost	Weighted Percent	Percent Complete to Date	W'T'D % Complete to Date	Total $ to Date

KEH-1026.00 (03-87)

KAISER ENGINEERS HANFORD	MONTHLY ESTIMATE OF WORK COMPLETED	
Contract or P O No	Estimate No.	Date
Name of Contractor		
Address		
Nature of Work		
Initial Amount of Contract $	Total Amount of Modifications to Date $	Total Adjusted Contract Amount $

Description			Amount	
Estimated Work Completed to (Date)				
Less: Previous Payments	$			
Other Charges (Explain Below)	$			
Total Deductions			($	)
Adjusted Payment Requested			$	
Less Retainage @ _____ %			$	
Total Payment Allowed			$	

SAMPLE

I certify that I have verified this periodical estimate dated _____ for $ _____ and that to the best of my knowledge and belief it is a true and correct statement of work performed and that the contractor's statement of his account and amount due him is correct and just, and the quantities included in this estimate have been performed in full accordance with the terms and conditions of the corresponding construction documents.

FOR THE CONTRACTOR

By _____

KAISER ENGINEERS HANFORD COMPANY

By _____
Project Manager

By _____
Field Contract Engineer

KEH-0959.00 (02/90)

END OF SECTION

SECTION 01040

COORDINATION

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 CONSTRUCTION ACTIVITIES

1.3.1 Coordinate construction activities to ensure efficient and orderly sequence of work, with provisions for accommodating items to be installed later.

1.3.2 As noted in Section 29 of the Contract General Conditions, other contracts may be under construction concurrently with the Work included in this Specification. Coordinate activities with other contractors for mutual benefit. Coordination meetings may be required in addition to progress meetings to keep parties informed of scheduled activities at interface points.

1.4 WORK IN EXISTING FACILITIES

1.4.1 Access to work area will be as directed by KEH to minimize disruptions to work force.

1.4.2 Keep work area safe and orderly for construction and operating personnel. Clean work area after each work period and stack tools and materials away from traffic areas.

1.5 CONNECTIONS TO EXISTING SYSTEMS

1.5.1 Advance notice of work that will affect existing systems shall be given to KEH. Careful planning and scheduling of work is required to coordinate operations of existing systems to keep disruptions at minimum.

1.5.2 As required in subsection 50.8 of the Contract General Conditions, connections to existing systems shall be scheduled one week in advance for work to be done. KEH will coordinate schedule with Contractor and other contractors.

1.6 ACCESS TO WORK AFTER POSSESSION

1.6.1 Access to warranty work as specified in Section 24 of the Contract General Conditions or access to work after possession as specified in Section 20 of the Contract General Conditions will be coordinated by KEH with other contractors, and users of facility. Notify KEH in advance of proposed work to minimize disruptions.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01043

JOB SITE ADMINISTRATION

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 WORKING HOURS

1.3.1 Regular day shift working hours are from 7:00 am to 3:30 pm, Monday through Friday, excluding holidays.

1.3.2 For other than regular day shift work refer to Section 51 of the Contract General Conditions.

1.4 BADGE, DOSIMETER, AND ORIENTATION

1.4.1 For work within the Controlled Access Area of Hanford Site, but outside Limited Areas, badge and orientation requirements will be in accordance with Section 56 of the Contract General Conditions.

1.4.2 Work Authority Badges are sufficient inside Property Protection Areas, and Security Escorts are not required.

1.4.3 Badges will not be provided until notice to proceed letter has been signed and returned to KEH, supervisors have attended KEH safety training course, requirements of Section 55 of the Contract General Conditions have been received and approved by KEH, and site labor conference and preconstruction meeting specified in Section 01200 have been completed.

1.5 EMERGENCY RESPONSE DRILLS

1.5.1 Personnel working on Hanford Site shall participate in emergency response drills held approximately once each calendar quarter and lasting approximately one hour.

1.5.2 Maintain daily log or other suitable record of personnel, including subcontractors, working on Hanford Site.

1.6 WORK ON OR NEAR ELECTRICAL LINES OR UTILITY POLES

1.6.1 In addition to requirements of subsection 50.2 of the Contract General Conditions, whenever work is performed under, adjacent to, or on overhead electrical lines or utility poles, notify KEH at least 3 working days before work commences. Notification shall include names and qualifications of personnel performing work, and the methods and equipment that will be used. KEH will coordinate with the Site Utility Organization and notify the Contractor of special safety or operational requirements.

1.6.2 Some work will require attendance of a standby lineman. The lineman will be furnished by KEH.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

SECTION 01050

FIELD ENGINEERING

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 QUALITY CONTROL

1.3.1 Establishing alignment, support location, and grades shall be the responsibility of a Land Surveyor registered in the State of Washington and acceptable to KEH.

1.3.2 Deliver field notes, records, and documentation to KEH to review and verify procedures used and accuracy of work.

1.4 SURVEY DATA

1.4.1 Basic reference points with coordinate descriptions and bench mark with elevation identified will be located adjacent to the work area.

1.4.2 Preserve bench marks and reference points, including stakes or other markers established until removal is authorized by KEH.

1.4.3 From information and dimensions shown on the Drawings, perform survey/layout required by the Work.

1.5 PROCEDURES

1.5.1 Before initial layout, field verify horizontal and vertical data. Report discrepancies to KEH before proceeding.

1.5.2 Establish adequate permanent reference points to be used during construction, referenced to original control points. Record locations with horizontal and vertical data on Project record documents.

1.5.3 Protect and preserve control and reference points until Work is complete. Report loss or destruction of control points to KEH. Report relocation or change in data affecting reference points.

1.5.4 Periodically verify data for control and reference points, and construction stakes to maintain construction accuracy.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01065

PERMITS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 FEDERAL, STATE, AND MUNICIPAL LAWS, CODES, AND REGULATIONS

1.3.1 Required permits or licenses to do business are the Contractor's responsibility, as specified in Section 6 of the Contract General Conditions.

1.4 HANFORD SITE PERMITS

1.4.1 General: Before certain types of work can be done at Hanford, the Contractor is required to have a permit. Permits are provided by KEH at no cost. Notify KEH in advance of work requiring permits and furnish the information required. Meet the requirements and restrictions set forth in each permit. Keep permits posted in visible locations at sites of work being performed.

1.4.2 Excavation Permit: Do not excavate without the permit specified in subsection 50.10 of the Contract General Conditions. Permit is included with Contract Documents.

1.4.3 Backfil Permit: Each element of fill and backfill requires a permit. Permits are good for 5 days, or duration of work element provided Work does not stop for 5 consecutive days. Complete permit form, furnished by KEH, and return to KEH for approval before starting work.

1.4.4 Tie-in Permit: Each utility tie-in requires a permit. Permits are valid until tie-in is complete. Permits will be furnished by KEH, and require 5 days notice before tie-ins.

1.4.5 Hazardous Work Permit: Start no work without a permit. The permit will provide personnel protection requirements and restrictions for work involving welding and cutting, confined spaces, hazardous materials, or other hazardous working conditions. Permit is good for duration of Contract.

1.4.6 Solid Waste Disposal Permit: See Section 01500. This permit is required for disposal of nonhazardous waste on the Hanford Site. Obtain form from KEH, complete, and return to KEH for approval before moving waste to the disposal site.

1.4.10 Nonemergency Hydrant Tie-In Permit: Complete a permit for each hydrant tie-in. Obtain approval signatures on permits as directed by KEH. Approval to utilize hydrants will not be granted until checklist items have been verified by KEH. Permits will be furnished by KEH, and require 5 days notice before tie-ins.

1.4.12 Oversize Load Permit: In addition to Washington State permit, obtain permits for each movement of each oversize vehicle or load within the Hanford Site. Permits will be furnished by KEH with 48 hour notice of width, height, and length of oversized load and proposed route of travel. Verify proposed route has been traveled and limitations have been identified. See Section 01500 for additional requirements.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01110

CONSTRUCTION SAFETY

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

{Obtain dates for the references (or revision letters for Federal references) and revision, reaffirmation, addenda, or amendment status from KEH-MA-21, Reference Standards, and add them to the listings as shown in that Directory.}

1.1.1.1 American National Standards Institute (ANSI)

Z41-	Personnel Protection - Protective Footwear
Z87.1-	Practice for Occupational and Educational Eye and Face Protection

1.1.1.2 Code of Federal Regulations (CFR)

Title 29	Labor
Part 1910	Occupational Safety and Health Standards

1.1.1.3 Washington Administrative Code (WAC)

Title 296	Labor and Industries
Chapter 296-155	Safety Standards for Construction Work

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Control of Hazardous Energy: Five days before starting work, submit the procedures and certifications specified in 1.5.2.

1.2.3 Approval Not Required: None

1.3 SAFETY APPAREL

1.3.1 Personnel shall not be allowed in construction areas without approved safety apparel. Personnel are required to wear the following in construction areas, and KEH's shops and yards.

1.3.1.1 Steel-toed type shoes meeting the requirements of ANSI Z41. Steel-toed shoes shall be constructed of substantial material (preferably leather), and be in good condition. Damaged footwear, impaired in the performance of it's protective function, is not acceptable. Tennis shoes, canvas type shoes, or other athletic type shoes, including those with steel toe protection, are not acceptable.

1.3.1.2 Eye protection with eye shield devices meeting the requirements of ANSI Z87.1.

1.3.1.3 Hardhats, and clothing that prevents direct exposure to the construction environment. Tank-top type shirts, sleeveless shirts, dresses or other than full length pants are not allowed.

1.3.1.4 Exceptions to these requirements, for specific work tasks, require prior KEH approval.

1.4 HAZARD IDENTIFICATION

1.4.1 Job Safety Analysis: Prepare as required in subsection 55.2 of the Contract General Conditions. The Job Safety Analysis shall address the following work items.

1.4.1.1 Excavations.

1.4.1.2 Shoring.

1.4.1.3 Hoisting and rigging.

1.4.1.4 Controls to prevent two blocking.

1.4.1.5 Welding or cutting.

1.4.1.6 Hazardous materials.

1.4.1.7 Paint/coatings.

1.4.1.8 Confined spaces.

1.4.1.9 Lockout and tagout procedures.

1.4.2 Weekly Safety Meetings: Conduct weekly walkaround safety inspections and safety meetings in accordance with WAC 296-155-110. Prepare meeting minutes, and provide KEH with a copy, as completed.

1.5 BARRICADES

1.5.1 Provide adequate barricades at the worksite, to define construction boundaries, in accordance with WAC 296-155.

1.5.2 Post barricades with adequately sized signs, containing the necessary legends, for deterrence of unauthorized personnel.

1.6 EXCAVATIONS

1.6.1 Perform excavation, trenching, and shoring in accordance with WAC 296-155, Part N. Use certified trench boxes, or other shoring systems, to hold materials and surcharge pressure for the full depth of trenches.

1.6.2 Prepare excavations or trenches that are not shored, and are greater than 4 feet deep, in accordance with WAC 296-155, Figures N-11 and N-12, with maximum side slopes of 1-1/2 horizontal to 1 vertical.

1.6.3 Do not store excavated or other materials closer than 2 feet from the edges of excavations or trenches, unless a barrier is erected to retain them. Store and maintain materials in a manner that will prevent them from falling or sliding into excavations or trenches.

1.7 EQUIPMENT SAFETY

1.7.1 Periodic Equipment Inspections: Document initial and followup periodic heavy equipment inspections by the Contractor. Provide KEH with a copy, as completed.

1.7.2 Core Drills: Equip with kill switches to stop drills upon hitting metal. Demonstrate that switches are operational before drilling.

1.8 CONTROL OF HAZARDOUS ENERGY

1.8.1 Conform to lockout/tagout requirements of 29 CFR 1910.147.

1.8.2 Establish an energy procedure and training plan with provisions for the following.

1.8.2.1 Isolation or inactivation of hazardous energy sources before performing work thereon. A hazardous energy source is defined as a machine or equipment item with the potential for causing injury by unexpected energizing, startup, or stored energy release.

1.8.2.2 Certification of the accomplishment and currency of appropriate training. Certification shall include employee's names and training completion dates.

1.8.3 Coordinate lockout/tagout operations with KEH.

1.9 FIRE SAFETY

1.9.1 Address fire safety as part of construction safety plan required by Section 55 of the Contract General Conditions. Incorporate following requirements into plan.

a. Utilizing portable shields wherever welding, cutting, or grinding.

b. Maintaining fire watch minimum 1/2 hour after welding, cutting, or grinding.

c. Having fully charged fire extinguisher available whenever welding, cutting, or grinding.

d. Method to prevent ignition of brush fires.

1.9.2 See Section 01130 for off-road driving and grass or brush fire prevention requirements.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01120

INDUSTRIAL HYGIENE

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Conference of Governmental Industrial Hygienists (ACGIH)

Threshold Limit Values and Biological Exposure Indicies	1992-1993

1.1.1.2 Code of Federal Regulations (CFR)

Title 29	Labor
Part 1910	Occupational Safety and Health Standards
Part 1926	Safety and Health Regulations for Construction

1.1.1.3 Federal Standards (FED STD)

FED-STD-313	Material Safety Data, Transportation Data, And Disposal Data For Hazardous Materials Furnished To Government Activities

1.1.1.4 Washington Administrative Code (WAC)

Title 296	Department of Labor and Industries
Chapter 296-62	Occupational Health Standards - Safety Standards for Carcinogens
Chapter 296-155	Safety Standards for Construction Work

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Hazardous Material Procedures: Five days before initial delivery, submit the procedures specified in 1.3.1.

1.2.2.2 Bituminous material application procedure: Ten working days before initial use, submit the procedure specified in 1.5.1.

1.2.2.3 Lead Removal Compliance Program: Ten working days before starting removal, submit the program specified in 1.6.1.

1.2.3 Approval Not Required

1.2.3.1 Monitoring and Sampling Reports: Coincident with the start of work, submit the reports specified in 1.4.6.

1.2.3.2 Blood Sampling Results: Ten working days before starting removal, submit copies of the results specified in 1.6.1.2.

1.3 HAZARDOUS MATERIALS

1.3.1 Hazardous materials, defined in Section 111 of the Contract General Conditions, delivered to the worksite by the Contractor or Suppliers, shall be governed by requirements of FED-STD-313 and Section 111 of the Contract General Conditions. Prepare documented procedures for handling and storage of such materials.

1.3.2 The Contractor shall meet industrial hygiene requirements during performance of the work, in accordance with occupational health standards identified in this section. Work may include potentially hazardous operations, involving potential exposure to hazardous materials, including the following.

1.3.2.1 Welding/cutting fumes and byproducts, such as those from TIG/MIG welding on stainless steel, resulting in ozone production.

1.3.2.2 Solvents and toxic polymer reagents, in liquid or vapor form, from cleaning, painting or coating products.

1.3.2.3 Bituminous materials, from roofing, piping component coating, or concreting operations.

1.3.2.4 Crystalline silica particulates from concrete work, during demolition and surface preparation.

1.3.2.5 Glass and resin particulates from fiberglass.

1.3.2.6 Lead and lead compound particulates from solder and coatings.

1.3.2.7 Asbestos particulates from insulation.

1.3.3 Address potential hazards as part of prejob planning and Job Safety Analysis, as required by Section 55 of the Contract General Conditions.

1.3.4 Comply with occupational health standards 29 CFR 1910 and 1926, WAC 296-62 and 296-155, and ACGIH Threshold Limit Values and Biological Exposure Indicies.

1.3.5 Material Safety Data Sheets (MSDS), as required by Section 111 of the Contract General Conditions, shall be legible and current. Manufacturer's creation or revision dates shall be within the past 3 years.

1.4 HAZARDOUS MATERIAL PROTECTION

1.4.1 Hazardous materials and processes that are part of the work shall be reviewed by a Certified Industrial Hygienist (CIH), or other qualified health professional. The review shall determine specific engineering controls, work practices, and personal protective equipment (PPE), such as respiratory protection and chemically resistant gloves and clothing, required to minimize employee exposure.

1.4.2 The Industrial Hygiene Hazard Analysis, engineering controls, work practices, PPE requirements, and MSDSs will be reviewed by KEH before performance of work associated with the identified hazardous materials.

1.4.3 Institute feasible engineering controls to minimize airborne contamination and subsequent worker exposure. Examples: 1) Substitution of a less hazardous material (petroleum based instead of coal tar based pitch products); 2) Substitution of an application method producing less hazardous conditions (brushing instead of spraying paint); 3) Use of wet methods, or local exhaust ventilation, to minimize toxic dust exposure.

1.4.4 Contractors whose employees require respiratory protection shall meet the requirements of 29 CFR 1910.134. Requirements include having a documented program, using only NIOSH/MSHA approved equipment, training of affected employees, medical qualifications, evaluation of the respiratory hazard, and selection and maintenance of respiratory protection equipment.

1.4.5 If a supplied air system is required, air shall be minimum Breathing Air Quality Grade D, and the system shall comply with 29 CFR 1910.134. Air quality shall be certified. Confined space entry requiring supplied air shall have an emergency five minute escape bottle.

1.4.6 Perform air monitoring and personal sampling to determine the extent of employee exposure, and appropriate respiratory protection required for the following operations: 1) Concrete demolition (silica); 2) Welding (welding fumes and ozone where applicable); 3) Painting/coating/roofing operations (organic solvents, sensitizers, known human carcinogens); 4) Materials containing known human carcinogens. Document the results in reports.

1.5 BITUMINOUS MATERIAL PROTECTION

1.5.1 A procedure is required for application of bituminous materials (known carcinogens) that will reduce worker exposure to as low as reasonably achievable.

1.5.2 The procedure shall cover each type of application, such as roofing, pipe component coating, or concreting, required for the project.

1.6 LEAD AND LEADED MATERIAL PROTECTION

1.6.1 A documented Compliance Program is required for each job involving lead or lead compound removal, in accordance with 29 CFR 1926.62.

1.6.1.1 As a part of employee training, communicate information concerning the hazards associated with lead in accordance with 29 CFR 1910.134, 1926.59, 1926.62, and the results of medical monitoring and use of chelating agents. Training is required annually.

1.6.1.2 Obtain an initial biological sample, for blood lead concentration determination, from each employee who will or may be exposed to lead or lead compounds. Samples shall be taken no earlier than 30 days before starting lead removal operations. Additional samples may be required if sampling results show significant lead exposure.

1.6.1.3 Post signs in each work area reading "Warning - Lead work area, Poison, No smoking or eating".

1.6.1.4 Respiratory protection required is a half-mask with HEPA filters. Respiratory protection will not be down graded until monitoring results are received by KEH, and conditions indicate down grading is appropriate. Persons requiring the use of respirators shall have been fit tested (Quantitative or Qualitative) within the last 6 months, and meet the additional requirements of 29 CFR 1910.134.

1.6.2 Perform lead removal and welding on coated steel in accordance with 29 CFR 1926.62. Existing coatings shall be assumed to contain lead unless shown otherwise by analysis.

1.6.3 Welding operations involving previously coated steel require local exhaust ventilation with a device such as a HEPA filter to prevent airborne contamination of the area with lead particulates or fumes.

1.6.4 Personal sampling/monitoring is required during lead coating removal and welding on material previously coated with lead. Samples shall be analyzed at an AIHA accredited laboratory. The method of monitoring and analysis shall have a ± 25% accuracy.

1.6.5 Remove coatings 4-6 inches minimum from the sides of weld points. Removal choices are as follows.

1.6.5.1 Paint strippers/caustic paste materials. The removal material shall not contain methylene chloride, or other chlorinated hydrocarbons. Remove paint and the removal system with a putty knife or similar tool. Residues may be removed with rags. Chemical resistant gloves, compatible with the chosen product, shall be worn.

1.6.5.2 Other methods that minimize exposure to airborne lead particulates, such as needle guns used along with water mist. Local HEPA filtered air exhaust, or work within a glove bag, may be necessary to control lead particulates.

1.6.5.3 Dry grinding on coating materials is not acceptable.

1.6.6 Personal protective clothing (respirators, gloves, and disposable exterior coveralls) shall be removed in the designated change area, and disposed of at the end of the shift, or stored to prevent contamination of workers street clothes.

1.6.7 Provide showers or other facilities for washing hands and faces.

1.7 ASBESTOS HANDLING PROTECTION

1.7.1 Materials Containing Asbestos

1.7.1.1 It is not anticipated that the Contractor will encounter materials containing asbestos. However, asbestos which is not readily identifiable may be present in some materials, in and around the work area. Examples include:

a. Floor tile.

b. Floor tile adhesive.

c. Transite siding.

d. Transite pipe.

e. Roofing shingles and matting.

f. Electrical insulation.

g. Gasket materials.

1.7.1.2 Materials suspected of containing asbestos shall not be disturbed. Contact KEH for direction before proceeding with work which would disturb these materials.

1.7.2 Employees working with asbestos bearing material shall be certified by the State of Washington as "Qualified Workers." (Supervisors shall be certified by the State of Washington as "Competent Person.") Deliver copies of certifications for employees (and supervisors) to KEH.

1.7.3 Respirators, certified by manufacturer for asbestos use, shall fit properly and provide protection to employees in accordance with applicable safety regulations. Each user shall be trained in care and use of respirator. Provide certification of personnel respirator fit, testing, and training.

1.7.4 Medical examinations are required for asbestos workers and will be provided by KEH as specified in Section 57 of the Contract General Conditions. Examinations require approximately 8 hours for each individual and are normally completed in one working day. Request examinations at least 5 working days before start of work.

1.7.5 Contractor shall have industrial hygiene survey performed by American Industrial Health Association (AIHA) accredited agency to ensure potential exposures and requirements are being met. Agency shall provide

48 hour turnaround for sampling results. Provide copy of sampling results to KEH. AIHA accredited Agencies are:

NHS, Incorporated 805 Goethals Richland, Washington 99352 (509) 943-0802	University of Washington 400 15th Avenue Northeast Seattle, Washington 98105 (206) 543-2100

1.7.6 Provide protective coveralls, head covering, gloves, shoe coverings, and respirators. Use of disposable clothing is recommended to eliminate additional requirements for laundering of asbestos-contaminated clothing and providing separate changeroom facilities.

1.7.7 Provide facilities for personnel to decontaminate upon leaving asbestos area.

1.7.8 Keep potential exposure log and deliver to KEH for record. Minimum entry requirements are employee name, social security number or other identifier, personal protective equipment worn, date of potential exposure, and total time of exposure.

1.7.9 Control dust during asbestos removal to protect employees and others working adjacent to site from asbestos fibers. Use special temporary plastic "greenhouses", isolation curtains, glovebags, negative air machine, wet method, or other approved methods of dust control.

1.7.10 Display signs at entrance of work area during cutting and removal of asbestos material, 20 by 14 inches, containing following wording.

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE

CLOTHING REQUIRED

1.7.11 Dispose of asbestos material in impermeable plastic bags, wetted, and tied shut to prevent release of airborne fibers and to protect personnel handling it. Further protect bags of asbestos by placing into another impermeable plastic bag and tie shut, or into other approved closable and impermeable container. Wrap and seal large sheets of asbestos bearing material in 2 layers of plastic material instead of plastic bags. Affix a warning label to the outer bag. Complete Asbestos Disposal Request, Form BC-6700-194, and dispose of bagged or wrapped material at the disposal location shown on the form. Forms and warning labels are available from KEH.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

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SECTION 01130

ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 Washington Administrative Code (WAC)

Title 173	Department of Ecology
Chapter 173-303	Dangerous Waste Regulations
Chapter 173-307	Plans

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Hazardous Waste Minimization Plan: Five days before starting work, submit the plan specified in 1.3.1.

1.2.2.2 Contingency Plan: Five days before starting work, submit the contingency plan and emergency procedures required in WAC 173-303-350.

1.2.3 Approval Not Required

1.2.3.1 Hazardous Waste: Five days before starting work, submit physical descriptions and quantities of waste and waste containers to be generated.

1.2.3.2 Hazardous Waste Handlers: Five days before starting work, submit a list of personnel who will handle waste.

1.2.3.3 Recycling: Five days before starting work, submit a list of waste that will be recycled, including names of recycling firms.

1.2.3.4 Recycling Records: At contract completion, submit records of amounts, methods, and types, of waste recycled.

1.3 HAZARDOUS WASTE MINIMIZATION

1.3.1 Prepare a plan indicating how hazardous (dangerous) waste, generated at the worksite during construction, will be minimized in accordance with WAC 173-303 and 173-307. Other waste minimization requirements that shall be included are the following.

1.3.1.1 Material substitution: Replacement of hazardous materials with nonhazardous or less hazardous materials.

1.3.1.2 Inventory reduction: Minimization of chemical inventory on hand, which in turn reduces the undue accumulation of partially used or unused materials requiring disposal upon expiration.

1.3.1.3 Procurement modifications: Minimization of the variety of chemicals used to perform the same or similar processes, and incorporation into procurement specifications of provisions for the return of unused chemical stock and empty, unrinsed containers.

1.3.1.4 Waste segregation: Separation of hazardous and nonhazardous materials to avoid creating additional hazardous waste, and to avoid creating mixtures for which recycling may not be practical.

1.3.1.5 Process modification: Streamlining of processes for more efficient operation and less waste generation.

1.3.2 Inspections: Provision for KEH inspections of the Contractor's waste management practices and waste minimization efforts.

1.4 HAZARDOUS WASTE PREPARATION FOR DISPOSAL

1.4.1 Hazardous (dangerous) waste, defined in WAC 173-303, generated by the Contractor at the worksite, shall be turned over to KEH after preparation for disposal.

1.4.1.1 Prior to generating waste, the Contractor shall establish an acceptable satellite accumulation area at the worksite. Drums for waste disposal will be furnished by KEH. Drums shall be labeled "Hazardous Waste," with a drum tracking number furnished by KEH, and with the appropriate physical and chemical hazards. The Contractor shall keep an inventory, on logsheets furnished by KEH, of amounts and types of waste deposited in the drums.

1.4.1.2 The Contractor shall designate personnel who will be responsible for managing the satellite accumulation area in accordance with training given by KEH. Provide a phone number for contacting the responsible personnel.

1.4.1.3 Include required records (labels, inventory, tracking numbers) with each drum as it is turned over to KEH. Failure to provide records of drum contents will result in a $2,500 charge to the Contractor.

1.4.2 The Contractor's superintendent, and designated personnel who handle, transfer, accumulate, or otherwise work with hazardous waste shall be trained by KEH (4 hours for each person) and adhere to the requirements of WAC 173-303-330. Other waste management requirements, covered in the KEH training, that shall be followed include the following.

1.4.2.1 Select compatible waste containers. Container integrity is, in part, dependent upon waste physical and chemical properties.

1.4.2.2 Contractor personnel shall call the KEH Hazardous Waste Coordinator (HWC) to receive container numbers which will be permanently marked on containers for tracking purposes.

1.4.2.3 Contractor personnel shall contact KEH HWC for specific instructions on completing Hazardous Waste labels and markings, and attaching them to containers.

1.4.2.4 Weekly inspections of the satellite accumulation area, by the Contractor's trained waste handler, are required. Reports of the inspections, on Form KEH-2035 (sample included), shall be forwarded to KEH within 3 working days after each inspection. Forms will be provided by KEH.

1.4.2.5 As waste is accumulated in a container, a Waste Container Log, Form KEH-0844 (sample included) shall be filled out. Forms will be provided by KEH.

1.4.2.6 A full container date shall be recorded when accumulated waste reaches 55 gallons for solids, and 50 gallons for liquids. The container shall be sealed at that time. The Contractor shall notify KEH by forwarding the waste container log within 4 hours after a waste container is full.

1.4.3 Report hazardous waste or hazardous material spills to KEH immediately. KEH will provide drums and direction for disposal. The Contractor shall provide labor and equipment for cleaning up spills, and transporting drums to a location designated by KEH. The Contractor shall also provide a written inventory of drum contents. Waste will be disposed of by KEH at no charge for properly reported spills. For unreported spills, the Contractor will be charged $1,000 for each drum.

1.4.4 Inspections: Provide for KEH inspections of the Contractor's waste management practices.

1.5 NONHAZARDOUS WASTE DISPOSAL

1.5.1 Radiation Survey Release: Waste generated during construction, including excess excavation, shall be surveyed by onsite technicians for radiation contamination, and formally released before transport off the worksite. Contact KEH to schedule a technician. Allow 4 hours for completion of the survey.

1.5.2 Disposal Site: Dispose of construction debris (excess excavation, broken asphalt, and broken concrete) at the Hanford Site Central Landfill, approximately 10 road miles from the worksite. Complete a Solid Waste Disposal Request, and have it signed by the Radiation Technician, before taking waste to the disposal site. Forms are available from KEH. The disposal site is open from 8:30 a.m. to 2:30 p.m.

1.5.3 Dispose of broken asphalt at Pit Number 10, located approximately 15 miles from the worksite.

1.6 REUSE AND RECYCLING

1.6.1 Extend the useful life of materials whenever possible, to delay final disposition as waste. Reuse materials such as plastic drop cloths, application tools, and rags as much as possible to reduce the volume of waste generated.

1.6.2 Reuse materials designated as waste to the maximum feasible extent. If reuse is not feasible, recycle whenever the means for recycling are available.

1.7 FIRE PREVENTION

1.7.1 To reduce the potential for grass or brush fires, keep off-road driving to a minimum.

1.7.2 Vehicles driving off-road or to remote locations shall carry a 10-pound minimum ABC dry chemical, portable fire extinguisher, a 2-way radio or mobile phone (CB type radios are not acceptable), and a shovel.

1.7.3 Report fires to the nearest Hanford Patrol and Hanford Fire Department immediately.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

WEEKLY WASTE STORAGE FACILITY INSPECTION REPORT
KEH-2035.00 (01/91)

WASTE CONTAINER LOG
KEH-0844.00 (10/89)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 PROCEDURES

1.3.1 Representatives from KEH, Contractor, and major subcontractors shall participate in project meetings. Representatives from Operating Contractor and DOE may attend as required by items to be discussed.

1.3.2 Meeting times and locations shall be mutually agreed to by Contractor and KEH and will be held at the Hanford Site in Richland, Washington, except informal design reviews. KEH will issue notices of meetings and prepare meeting minutes which will be distributed to project participants.

1.4 SITE LABOR CONFERENCE

1.4.1 Before starting construction onsite, conduct informational conference on Hanford Site labor requirements applicable to Project. KEH will provide meeting notice to representatives from labor organizations, identified by Contractor, whose members may be utilized in construction and are to attend conference. Contractor shall present proposed work plan and craft utilization, and review Contract General Conditions relating to labor.

1.5 PRECONSTRUCTION

1.5.1 Meeting will be scheduled by KEH before start of onsite work. Authorized representatives of Contractor and major subcontractors shall attend and KEH will advise others having interest in Work. Meeting will be chaired by KEH.

1.5.2 Following items, as minimum, will be incorporated into agenda for meeting.

1.5.2.1 Point of contact and key personnel representing Operating Contractor, Safety, QA/QC, Acceptance Inspectors, and Construction Engineers.

1.5.2.2 Schedule requirements and restraints, submittals and work limitations.

1.5.2.3 Safety, construction progress meetings and frequency, and certified payrolls.

1.5.2.4 Report requirements and frequency.

1.5.2.5 Quality requirements.

1.5.2.6 Major material and equipment lists.

1.5.2.7 Other pertinent items.

1.6 CONSTRUCTION PROGRESS

1.6.1 Meetings held biweekly at time and location determined at preconstruction meeting will be approximately one hour long.

1.6.2 KEH will chair meeting and request attendance of key personnel required. Authorized representatives of Contractor and pertinent subcontractors shall attend.

1.6.3 Purpose of meetings is to monitor status and provide forum for exchange of pertinent information related to the Work. Major topics may include, but not be limited to, following.

1.6.3.1 Schedule, cost, and construction status.

1.6.3.2 Design and scope changes.

1.6.3.3 Submittal status, key material, and equipment delivery status.

1.6.3.4 Potential problem areas.

1.6.3.5 Inspection and testing status.

1.6.3.6 Action item status, goals for next meeting.

1.6.3.7 Other appropriate items.

1.6.4 Meeting minutes will be issued by KEH as promptly as possible following meeting. Action items will be identified with assigned follow-up. Issues resolved will be reported in minutes, as well as closed action items.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 SUBMITTAL CONDITIONS

1.1.1 Materials and equipment fabricated or installed without required approved submittals, or which differ from approved Drawings or vendor data, are subject to rejection and replacement at the Contractor's expense.

1.1.2 Delays arising from failure to submit required Drawings and other related data described in Contract Documents, in a timely manner, will not constitute excusable delays for extensions, unless excusable under other provisions of the Contract.

1.2 SUBMITTALS REQUIRED

1.2.1 Required submittals are defined in Part 1, Article 1.2 of the specification sections.

1.2.2 Submittals are divided into two types; those requiring approval, and those not requiring approval. Included in the former are submittals of architectural material samples, where KEH reserves the right to make final selections.

1.2.3 Send submittals to KEH no later than the times indicated. Those requiring KEH approval must be approved before further submittal related procurement, fabrication, or construction is accomplished. This also applies for KEH selections made from samples submitted.

1.3 SUBMITTAL REVIEWS

1.3.1 Submittals requiring approval will be reviewed to verify completeness and conformance to requirements. Appropriate dispositions will be made in accordance with 1.4 below.

1.3.2 Allow 21 calendar days for KEH review and disposition of submittals. This time period will be measured from date of submittal receipt in KEH's office to date of return mailing.

1.3.3 Submittals not requiring approval will be reviewed to verify completeness and adequacy for their intended purposes. If acceptable, these items are filed, and finally delivered to the Operating Contractor. Unacceptable items will be handled in accordance with 1.4.5.

1.3.4 If a submittal not requiring approval has not been returned within the time period specified in 1.3.2, and KEH has not informed the Contractor that additional review time is necessary, the Contractor may consider it accepted by KEH.

1.4 SUBMITTAL PROCEDURE

1.4.1 Transmit submittals using form KEH-1838, Data Transmittal/Review, sample included.

1.4.2 Identify each submittal by Section/Paragraph Number and Submittal Title. The number of copies required includes 2 copies for return to the Contractor. If necessary, provide additional copies required for return to the Contractor.

1.4.2.1 Approval Data (for products): Mark each line item package with the specification section and paragraph numbers specifying the product.

1.4.2.2 Vendor Information (for products): Mark each line item package with the specification section and paragraph numbers specifying the product, and the item name, manufacturer's name, model or part number, and KEH tag number (if specified).

1.4.2.3 Items that require approval: Submit 6 copies, including one reproducible.

1.4.2.4 Samples for selections: Submit as required by the Sections of this Specification.

1.4.2.5 Items that do not require approval: Submit 6 copies.

1.4.3 Review each submittal for completeness, compliance with Contract Documents, and proper identification before sending to KEH. Submittal data shall either be stamped, showing the review process has taken place, or the Data Transmittal form may be stamped "Reviewed for Compliance," and signed. Submittals not stamped or signed will be returned without consideration.

1.4.4 Submittals requiring approval will be stamped by KEH, and marked "Approved", "Approved with Exception" or "Not Approved, Revise and Resubmit." Approval of submittals does not relieve the Contractor of responsibility for errors contained therein.

1.4.4.1 Approved submittals are identified by the submittal stamp, with either the "Approved" or "Approved with Exception" box checked. "Approved" signifies general concurrence of submittal conformance with Project design concepts and compliance with Contract Document requirements. "Approved with Exception" signifies general concurrence, with noteworthy comments or clarifications. Approval of a specific item shall not be construed as approval of the system or assembly of which that item is a component.

1.4.4.2 A submittal which is not approved is identified as "Not Approved, Revise and Resubmit." The submittal is considered technically deficient, or incomplete, and therefore unacceptable. Resubmittal is required, hence fabrication, procurement, or performance of procedures shall not proceed.

1.4.4.3 Upon receipt of deficient submittal data, make corrections noted on the transmittal, and resubmit data to KEH.

1.4.5 Submittals not requiring approval that are found to be incomplete or inadequate will be returned marked "Resubmit." An explanation of the deficiencies will be included, for corrective action by the Contractor. Resubmit in accordance with 1.4.4.3.

1.4.6 Procedures for performing certain types of work must be submitted for approval before work is commenced. Such procedures which have previously been approved by KEH, for work similar to that to be accomplished on this Project, may not need to be reapproved. Forward 1 copy of previously approved procedures to KEH, by Data Transmittal form, and identify each by Section/Paragraph Number, Title, and either procedure number or project number for which the procedure was approved. Submittals will be reviewed by KEH and, if acceptable, retained for record. If a previously approved procedure is not acceptable, the submittal will be returned, with requirements for resubmittal.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

KAISER ENGINEERS HANFORD

DATA TRANSMITTAL/REVIEW

Submittal No. _____

To | From | Sheet _____ of _____

Project Title | Date

PO No.	Project No.	WO No.	Bldg. No.

Subcontract No. | Subcontractor or Supplier

☐ Pre-Purchase Evaluation ☐ Approval Data ☐ VI ☐ Information/Record

Paragraph	Section	Specification

Description of Item Submitted

Special Instructions:

☐ Resubmit ☐ Substitution
☐ Additional Info. ☐ As Specified Material

DISTRIBUTION

Data Furn.	Data Description	Disposition: Not Recvd.	Data Incompl.	Appd.	App/X	Not Appd.	Resub. Reqrd.
	Dimensional Drawings						
	Equipment Weights						
	Specifications						
	Material Description						
	Performance Data						
	Circ./Control Diagram						
	Data Sheets						
	Illustrative Cuts						
	Install Instructions						
	Operat. Instructions						
	Maint. Instructions						
	Spare Parts List						

Date

Submittal proposes deviations from contract documents? ☐ Yes ☐ No

To | From

☐ Appd. ☐ Not Appd. ☐ Appd./X ☐ Resub. ☐ Inform./Record

Changes Required to Contract Documents? ☐ Yes ☐ No

Released By | Date

KEH-1838.01 (10/91)

KAISER ENGINEERS HANFORD	DATA TRANSMITTAL/REVIEW	Submittal No. _____
Project Title		Sheet _____ of _____

PO No.	Project No.	WO No.	Bldg. No.	Date

Subcontract No.	Subcontractor or Supplier

Comments:

KEH-1838.02 (10/91)

END OF SECTION

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SECTION 01310

PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Initial Three Week Work Schedule: 10 days after the notice of award, submit the schedule required in 1.4.

1.2.2.2 Project Schedule: 30 days after the notice of award, submit the schedule required in 1.3.

1.2.2.3 Subsequent Three Week Work Schedules: Beginning on the Friday following the tenth day after the notice of award, submit schedules required in 1.4

1.2.3 Approval Not Required: None

1.3 PROJECT SCHEDULE

1.3.1 Prepare schedule identifying activities which include logical sequence and relationship of activities for engineering, design, submittals, procurement, fabrication, delivery, erection, installation, and testing of work covered by Contract.

1.3.2 Activity durations shall be working days. Subdivide activities exceeding 20 working days by identifying logical subactivities. Activity titles shall be self-explanatory with abbreviations shown in legend on document. Show early start, early finish, late start, late finish, restraining activities, and total float for activities. Highlight critical path activities to identify Project's critical path.

1.3.3 Schedule shall include, but not be limited to, following activities.

1.3.3.1 Significant engineering functions performed before fabrication such as specific procedures, and shop and field drawings, submitted for approval and approved.

1.3.3.2 Major material acquisitions and delivery.

1.3.3.3 Offsite fabrication and delivery schedules.

1.3.3.4 Subcontractor activities.

1.3.3.5 Field installation and nondestructive examination activities.

1.3.3.6 Indications that work for each activity will be performed during periods of time other than regular day shift hours as indicated in Section 01043.

1.3.3.7 Identification of inspection hold points.

1.3.3.8 Manpower loading and leveling.

1.3.3.9 Milestones indicating interface requirements with construction activities performed by others.

1.4 THREE WEEK WORK SCHEDULE

1.4.1 Prepare initial and subsequent detailed schedules of next three week's work. The three week work schedule shall be updated weekly. Schedule shall include following as minimum.

1.4.1.1 Work description.

1.4.1.2 Location of work.

1.4.1.3 Work involving outages, overtime, weekends, etc.

1.5 REVISIONS TO SCHEDULES

1.5.1 Whenever KEH determines there are significant variances between actual and scheduled progress, endangering completion within Contract completion time, Contractor may be required to prepare and submit revised schedules.

1.5.2 Show progress to date of submittal and projected completion date of each activity. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

1.5.3 Provide narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken, or proposed, and its effect, including changes on schedules of separate contractors.

1.5.4 Distribute copies of revised schedules to KEH Project file, subcontractors, suppliers, and other concerned entities. Instruct recipients to promptly report, in writing, problems anticipated by projections in revised schedules.

1.5.5 If the Contractor fails to submit progress schedule specified in 1.3.1 within prescribed time, or revised schedules specified in 1.6.1, within requested time, KEH may withhold approval of progress payments until time Contractor submits required schedules.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

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SECTION 01400

QUALITY ASSURANCE

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 Kaiser Engineers Hanford (KEH)

GG-DETE-01	Detection and Exclusion of Misrepresented Products

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Quality Assurance/Quality Control System: Submit quality assurance/control procedures meeting the requirements of Section 14 of the Contract General Conditions, and specific Contractor procedure requirements contained herein.

1.3 CONTRACTOR QUALITY REQUIREMENTS

1.3.1 Requirements apply to all work elements of this contract.

1.3.2 Provide documented quality procedures which satisfy the following criteria. If the contractor has an existing documented program or existing procedures, furnish a matrix which cross-references the submitted data with corresponding requirements listed.

1.3.2.1 Document control: Provide procedures to ensure that the latest approved issues of Contract Documents, approved design documents and applicable contractor submittals and procedures are used for procurement, fabrication, assembly/installation, inspection, and testing.

1.3.2.2 Identification and control of items:

a. Controls shall include provisions for detection and exclusion of misrepresented products. As a minimum, these controls shall include the applicable requirements of Article 1.4.

b. Items shall have identification maintained and be controlled to ensure that only correct and acceptable items are available for installation.

1.3.2.3 Inspection and Testing:

a. Perform inspections and tests required by Contract documents and the approved design documents.

b. Inspection and test requirements shall be described by clear, complete, and current procedures and instructions. Test procedures shall include test objectives and provisions for ensuring that prerequisites for inspections and tests have been met.

c. Document and review inspections and testing for compliance with requirements. Documented inspections and tests shall report the true physical/functional condition of activity, provide sufficient detail to describe inspections and testing performed, applicable Contract requirements referenced, and the results and determinations of inspections and tests shown. Records shall be legible, accurate, complete, and protected against damage, deterioration, or loss. Documentation of inspections and tests shall be delivered as required by Contract requirements.

d. Complete required inspections and tests, and have documentation available for review, before requesting overview inspection by KEH.

1.3.2.4 Control of nonconforming items:

a. Provide a method of notification for all construction items and activities which do not conform to requirements. Notification and documentation shall be given to the KEH Field Construction Engineer.

1.3.3 KEH may review/audit Contractor compliance approved quality procedures and Contract Documents.

1.4 EXCLUDING MISREPRESENTED PRODUCTS

1.4.1 Take measures to prevent incorporation of misrepresented products (ie, suspect/counterfeit) products into the work. Forms of misrepresentation the Contractor may encounter include:

1.4.1.1 Falsified product sources (counterfeits).

1.4.1.2 Falsified (modified or counterfeit) quality assurance records.

1.4.1.3 False marking as to Class, Type, or Grade.

1.4.1.4 False labeling as to qualification or acceptance by testing/certifying organizations.

1.4.1.5 Used products misrepresented as new products.

1.4.2 Methods to Detect and Exclude Misrepresented Products

1.4.2.1 Obtain products from original manufacturers, their authorized distributors, or other established and reliable sources only.

1.4.2.2 During the initial stages of procurement, the Contractor should be suspicious of quoted prices significantly lower, or delivery times significantly shorter, than those of other competitors. Such quotations may be an indication that misrepresented products are being offered.

1.4.2.3 Products received should be in boxes or containers bearing original manufacturers labels, except for bulk or lot materials that are repackaged for shipment in quantities ordered.

1.4.2.4 Screen procured products and products in stock using screening information provided in KEH GG-DETE-01. Screening activities should, at a minimum, include the following.

a. Identify the source of the products (manufacturer, authorized distributor, or other reliable source).

b. False marking as to class, type or grade. See KEH GG-DETE-01, Paragraph 4.4.

c. False labeling indicating qualification or approval by nationally recognized agencies (eg. UL Listed). See KEH GG-DETE-01, Paragraph 6.3

d. Products being represented a new. See KEH-GG-DETE-01, Paragraph 3.2.

e. Falsified quality affecting documentation (eg, Certified Material Test Reports) being used as the basis for product acceptance. See KEH-DETE-01, Paragraph 4.3.

1.4.3 Documentation

1.4.3.1 Invoices and shipping documentation should be addressed to the contractor and should indicate that products were procured from the original manufacturer, authorized distributors, or other established/reliable sources.

1.4.4 Products identified in GG-DETE-01, Attachment A, are considered unacceptable and shall not be used in Contract work.

1.4.5 Upon detection of suspect products, provide notification and document deficiency to KEH in accordance with Section 2.0 of KEH-G-DETE-01. Segregate suspect products and maintain control to prohibit use in contract work. Disposal of suspect products shall be per KEH direction.

1.4.5.1 If the contractor has concerns, questions or inconclusive results, contact the KEH Field Construction Engineer for assistance.

1.5 INSPECTION AND TESTING

1.5.1 In accordance with Section 19 of the Contract General Conditions, perform the following.

1.5.1.1 Leak-pressure testing of relocated 12" raw water line.

1.5.1.2 Leak-pressure testing of sewer system.

1.5.1.3 Leak testing of septic and dosing tanks

1.5.1.4 Electrical testing

1.5.2 In accordance with Section 19 of the Contract General Conditions, KEH will perform inspection/testing and overview verifications at stipulated stages during the Contract. Minimum activities will be as follows:

1.5.2.1 Sampling and testing of compacted structural fill and backfill

1.5.2.2 Witness specific inspection and witness points.

1.5.2.6 Perform final acceptance inspection.

1.5.3 Specific Inspection Points: Adhere to inspection points. Ensure that personnel have completed inspections of, and approved portions of work in accordance with Contract requirements before notifying KEH.

1.5.3.1 Specific inspection points are defined as follows.

a. Construction inspection (H): Required for witnessing of specific construction features, before further construction is allowed to proceed.

b. Receiving (R): Special items of fabrication, equipment, or material scheduled to be delivered to the Project site, or other designated location, which require inspection upon arrival and before installation. Notify KEH within four hours after item arrival.

c. Witness (W): Selected for inspection at the option of KEH. Work may proceed upon verbal release by KEH or upon expiration of one hour beyond scheduled time of witnessing.

1.5.3.2 Inspection points will apply to onsite work. Except where a longer period is specified, notify KEH at least four working hours before each point for onsite work.

1.5.3.3 Inspection points are listed in Article 1.7.

1.6 OPEN ITEM REPORTING

1.6.1 KEH utilizes Open Item Reports to document deviations from Contract requirements.

1.6.1.1 Open Item Reporting: Open items are documented on the Open Item Reports available from KEH. Open items are identified by white open item tags. Correction shall bring item into compliance with Contract requirements, using approved rework procedures or standards, without violating Contract requirements.

1.6.2 The Contractor shall ensure its organization is represented by individuals with sufficient authority to commit the Contractor to corrective action requirements identified by KEH.

1.6.3 Open items reported during performance of the Contract require resolution before completion and final payment.

1.7 SCHEDULE FOR H, R, AND W POINTS

Section Number	Subject	Type	Offsite	Onsite
EARTHWORK				
02200-1	Initial Excavation	W		X
02200-2	Compaction Procedure Demonstration	H		X
02200-3	Placement of Backfill	W		X
FIRE WATER SYSTEMS				
02668-1	Initial Excavation of Existing Line	W		X
02668-2	Placement of Thrust Restraints	W		X
02668-3	Leak Testing	H		X
PRESSURIZED SEPTIC SYSTEMS				
02745-1	Initial Installation of Dosing Tank, Valve Vault, and Disposal Bed Piping	W		X
02745-2	Before Initial Installation of Sand Bed for Disposal Beds	H*		X
02745-3	Initial Installation of Drain Rock	W		X
02745-4	Installation of Geotextile	W		X
02745-5	Leak Pressure Testing of New Septic Tank and Dosing Chamber	H*		X

Section Number	Subject	Type	Offsite	Onsite
02745-6	Leak Testing of Existing Septic Tank, Connecting Pipe and Dosing Chamber	H		X
02745-7	System Pressure Testing	H**		X
16400	SERVICE AND DISTRIBUTION			
16400-1	Arrival of Septic Tank Control Panel	R		X
16400-2	Splices, Taps, and Cable Terminations	W		X
16400-3	Megger Testing	H		X
16400-4	Other Electrical Testing	W		X

* Requires a minimum of 24 hours advance notice.
** Requires a minimum of 5 working days advance notice.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 National Fire Protection Association (NFPA)

701 (1989)	Methods of Fire Tests for Flame-Resistant Textiles and Films

1.1.1.2 Washington State Department of Transportation (WSDOT)

M41-10-91	Road, Bridge, and Municipal Construction

1.2 SUBMITTALS: Not Used

1.3 CONSTRUCTION FACILITIES

1.3.1 First Aid: Facilities are available at Building 2719EA in the 200 East Area to provide first line medical attention. In emergency, dial 373-3800 if using a cellular phone. If using a fixed phone, or using two-way radio to contact an office, dial 911. Emergencies can also be reported directly to 373-3800.

1.3.2 Operation and Storage Areas: Confine worksite operations, including storage of materials, to areas designated by KEH.

1.4 TEMPORARY UTILITIES

1.4.1 Water

1.4.1.1 Construction: Available from an existing fire hydrant in the vicinity of the work. Furnish labor, materials, and equipment necessary for each connection.

a. Connect a 4-1/2-inch, National Standard Thread, 1/4-turn ball valve with female swivel to a 4-inch sexless "Snap-Tite/Storz" quick connect coupling to a 4-1/2-inch port for fire department use.

b. The Contractor shall not open or close the hydrant. Notify KEH 24 hours before each required hydrant opening or closing. The hydrant shall be closed at the end of each work day.

c. Furnish freeze protection for the hydrant and temporary piping or hoses.

d. Remove piping, hoses, fittings, and valves before final acceptance of the Work.

1.4.1.2 Drinking: Furnish employees with adequate drinking water that meets health and safety requirements.

1.4.2 Electric Power: Supplied by the Contractor. No power will be available at the worksite.

1.4.3 Telephone: The Contractor shall have cellular telephones at the worksite during construction activities.

1.4.4 Sanitary Facilities: Furnish and service chemical or other approved sanitary toilets for employee use. Facilities shall meet requirements of KEH which are available upon request.

1.5 ACCESS ROADS AND PARKING AREAS

1.5.1 Parking for a limited number of Contractor's Company vehicles will be made available in vicinity of the Work. "No Parking" signs are posted to show fire and emergency lanes. No on-street parking will be permitted.

1.5.2 Grass Fire Prevention: To reduce potential for grass fires, keep off-road driving to a minimum. Vehicles driving off-road or to remote locations shall carry a minimum 10-pound ABC dry chemical protable fire extinguisher, communications equipment consisting of 2 way radio or mibile phone (CB type radios are not acceptable), and shovel. Report fires immediately to nearest Hanford Patrol and Hanford Fire Department.

1.6 TEMPORARY CONTROLS

1.6.1 Dust Control: Maintain work areas to prevent hazard or nuisance to others. Accomplish dust control by sprinkling or other methods approved by KEH. Repeat sprinkling at necessary intervals to keep disturbed area damp at all times. Keep sufficient equipment on Project to accomplish dust control as work proceeds and whenever dust nuisance or hazard occurs. No separate or direct payment will be made for dust control and cost shall be considered incidental to and included in Contract price.

1.6.2 Temporary Enclosures: Plastic sheeting materials used to form enclosures shall be minimum 6 mils thick and have fire retardant properties meeting the requirements of NFPA 701. Acceptable manufacturers are Winman Corp (Plastic Division), St. Cloud, Minnesota; Lancs Industries, Kirkland, Washington; and Protective Plastics, Inc, Greer, South Carolina.

1.6.3 Traffic Control: Temporary traffic control and barricades in accordance with WSDOT M41-10, Section 1-07.23(3).

1.6.3.1 Vehicle and equipment movement:

a. Slow moving vehicles and equipment shall not travel on Hanford Site roads during heavy traffic periods between 6:30 and 8:00 am, and 3:30 and 5:30 pm.

b. Do not block existing roads.

c. Do not park on roadway shoulders.

1.6.3.2 Oversized vehicles and loads:

a. Permits specified in Section 01065 are required for vehicles or loads exceeding following dimensions.

1) Width: 8'-6".

2) Height: 14 feet.

3) Length: Single unit, 40 feet.
Single trailing unit, 48 feet.

b. Additional requirements for vehicles and loads exceeding 8'-6" width.

1) Display oversize load sign on front of towing vehicle and rear of trailing unit.

2) Attach red flags to each corner.

3) Notify KEH 5 days before moving loads.

4) Travel between 9:00 am and 2:30 pm unless special arrangements are made.

c. Escort vehicle requirements.

1) Equip with oversize load signs and amber lights.

2) Vehicles or loads over 10 feet wide: Provide escort cars in front and rear on 2 lane highways.

3) Vehicles or loads over 14 feet wide: Provide escort car in rear on multiple lane highways.

4) Vehicles or loads over 20 feet wide: Provide escort cars in front and rear on multiple lane highways.

d. Electrical escort requirements: KEH will provide qualified electrical escorts, at no cost to Contractor, when load reaches height of 14 feet or more from road surface, or when clearance of at least 6 feet cannot be maintained from overhead electrical or signal lines. Notify KEH at least 3 working days before escort is required.

1.7 FIELD OFFICE

1.7.1 A field office is not required. However, keep copies of Drawings, Specifications, and other information pertinent to the Work at Project site. KEH shall have access to documents at all times. Should

Contractor elect to utilize portable or relocatable structures, requirements of 1.7.2 shall apply.

1.7.2 Anchor or tie down portable or relocatable structures, including trailers for field offices and storage, to prevent overturning or lateral movement in winds up to 70 mph. Enclose or skirt underfloor area with material that will not burn or support combustion to prevent accumulation of wind-blown debris and use of underfloor space for material storage. Complete anchoring and enclosing within 14 days after arrival at the worksite.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01630

PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Product List: Within 15 days after the notice to proceed, submit the listing described in 1.4.

1.2.2.2 Substitution Approval Request(s): Before start of construction, submit request(s) as required by 1.3.4 and 1.3.5, prepared in accordance with 1.5.

1.2.3 Approval Not Required: None

1.3 SUBSTITUTIONS

1.3.1 Products include those items identified on the Drawings as well as in Part 2 of the Specification Sections.

1.3.2 Product options given in the Specification Sections represent functionally and physically equivalent items. In addition to generic type, materials, form and size, physical equivalence includes maintainability, reliability, and durability characteristics.

1.3.3 A substitute product may be used in place of a product or the product options identified in Specification Sections, without approval, if it is functionally and physically equivalent as defined above.

1.3.4 Substitution of a product that is functionally but not physically equivalent, as defined above, requires submittal of a Substitution Approval Request.

1.3.5 Submittal of a Substitution Approval Request is also required when a product callout in the Specification Sections includes the phrase "or an approved substitute".

1.3.6 Total quantities of products required in specification sections shall be the same. Differences due to partial quantity substitutions are not acceptable.

1.3.7 Do not use materials and equipment removed from existing structure as substitutes for specified products, unless such use is required or allowed elsewhere in the Contract Documents.

1.4 LIMITATIONS ON SUBSTITUTIONS

1.4.1 Substitutions will not be considered when indicated or implied on fabricator drawings, or product data submittals, without separate Substitution Approval Requests, when requested directly by subcontractors or suppliers, or when acceptance will require substantial revision of Contract Documents.

1.4.2 Substitute products that require a substitution approval request shall not be ordered or installed before the request is approved.

1.4.3 Only one Substitution Approval Request for each product will be considered. When a substitution is not accepted, provide specified product.

1.4.4 KEH will determine acceptability of substitution approval requests.

1.5 REQUESTS FOR SUBSTITUTIONS

1.5.1 Submit a separate Substitution Approval Request for each substitution, using Form KEH-1151, sample included.

1.5.2 Identify products by Specification Section and Article or Paragraph numbers. Provide manufacturer's name and address, trade name of product, and model or catalog number. List fabricators and suppliers as appropriate.

1.5.3 To each Substitution Approval Request attach descriptive information for substitute and original products. The information shall consist of drawings, calculations, and data as appropriate to define operational and physical characteristics of products, and establish a basis for comparison.

1.5.4 Give an itemized comparison of proposed substitution with specified product, listing variations, with reference to Specification Section and Article or Paragraph numbers.

1.5.5 Give quality and performance comparisons between proposed substitution and specified product.

1.5.6 Give cost data comparing proposed substitution with specified product, showing the Contract Sum net change.

1.5.7 List availability of maintenance services and replacement materials.

1.5.8 State effect of the substitution on construction schedule, and changes required in other work or products. If a substitute product requires or necessitates revisions to structures, foundations, footings, services, systems, piping, electrical, etc., engineering costs shall be borne by Contractor. Submit drawings, calculations, and vendor data, clearly showing revisions to accommodate substitution, for approval.

1.5.9 KEH will review and disposition requests for substitutions within 10 working days, unless evaluation requires extensive comparison or consultation.

1.5.10 For accepted substitute products, make the same submittals required for the original products by 1.2 of the Sections specifying them.

1.6 CONTRACTOR REPRESENTATION

1.6.1 Request for substitution constitutes representation that Contractor has investigated proposed product, has determined that it is equal to or superior to that specified, and that cost reduction offered (if there is one) is ample justification for accepting offered substitution.

1.6.2 Provide same warranty for a substitute as for specified product.

1.6.3 Coordinate installation of accepted substitutes, making changes required for work to be completed.

1.6.4 Certify that cost data presented is complete, and includes related costs under the Contract.

1.6.5 Waive claim for additional costs related to substitutions which may later become apparent.

1.6.6 Waive claim for additional performance time resulting from product substitutions.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

KAISER ENGINEERS HANFORD	SUBSTITUTION APPROVAL REQUEST

From (Contractor) _____ Contract No. _____

Project _____

Description of Proposed Substitution _____

_____

We hereby submit for consideration the following product instead of specified item for above project:

Specification No. _____ Section _____

Drawing No. _____ Section or Zone _____

Specified Item _____

Proposed Substitution _____

Attach complete technical data, including laboratory tests and samples, as applicable.

Provide detailed comparison of the significant qualities (system performance, interface requirements, size weight, durability, performance and similar characteristics, and including visual effect where applicable) for the proposed substitution of comparison with the original requirements.

Describe other changes to drawings and specifications required by proposal as outlined below and attach additional information as necessary.

Complete Each Item

A. Changes to drawing dimensions _____

_____

B. Effect of substitution on other systems _____

_____

C. Outline differences between proposed substitution and specified item _____

_____

_____

D. Manufacturer's guarantees of proposed and specified items are:

_____ Same _____ Different (explain on attachment)

Undersigned attests function, and quality equality equivalent or superior to specified item and has reviewed General Conditions paragraph GC-13 for assignment of responsibility if the substitution is approved.

Submitted By	Signature	
Address		Date
		Phone

KEH-1151.00 (10/87)

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 Washington Administrative Code (WAC)

Title 296	Labor and Industries
Chapter 296-155	Safety Standards for Construction Work

1.2 SUBMITTALS: Not Used

1.3 RECORD REQUIREMENTS

1.3.1 Hanford site work requires that certain documents, defined herein, be used to record the construction process and administration of the Contract. KEH will assemble pertinent data for final disposition. Prepare, preserve, and deliver project record documents required by this Contract to KEH. Documents are in addition to submittals required in Section 01300.

1.3.2 Mark documents that will become project records prior to use for construction. Keep copies of project record documents in field office, and make available to KEH during progress of Work.

1.3.3 Some data required for project records shall be delivered to KEH during course of construction and contract administration, while others shall be assembled after completion of construction for delivery to KEH. Document delivery by retaining copy of reports delivered during course of work until construction completion, retaining copy of letter of transmittal itemizing delivered items, or other means acceptable to KEH.

1.3.4 When information for project records is to be recorded on standard KEH forms, copies of the forms will be supplied by KEH. Samples of the appropriate required forms are included in the specification sections.

1.4 DOCUMENT IDENTIFICATION

1.4.1 General: Documents required for project records are itemized herein. Identify complete documents by title or number. Notes or markings added by hand shall be legible utilizing permanent nonsmearing marking media, such as ink or felt tip markers, in contrasting color.

1.4.2 Storage and Marking: Store one set in the field office, apart from documents used in construction, and maintain in clean, dry, and legible condition. Legibly mark items to record actual construction, including changes to dimensions and details, manufacturer's name, catalog number, and substitute products.

1.4.3 Activity and Administrative Documents: Deliver or retain in accordance with following.

1.4.3.1 Certified Payrolls: Each week deliver certified payrolls, as required by Section 108 of Contract General Conditions, to KEH, and keep copies in the field office until Contract completion. Progress payments will not be processed unless certified payrolls for work periods have been received by KEH.

1.4.3.2 Weekly Manpower Reports: Prepare weekly manpower reports and deliver, before 10 am on Monday, for previous week, during performance of Contract. Forms will be furnished by KEH.

1.4.3.3 Subcontracting Plan Reports: Deliver reports documenting conformance with Subcontracting Plan, as required by Section 89 of Contract General Conditions.

1.4.3.4 Backfill Permit: Retain backfill permits approved for work required in Division 2.

1.4.3.5 Soil Compaction Procedure: Retain Forms KEH-0382 completed for work required in Division 2.

1.4.3.6 Trip Tickets: Deliver copies to KEH with each truck load of concrete for thrust restraints in Section 02668, and retain Contractor copies until Contract closeout. After closeout deliver them to KEH.

1.4.4 Construction, Quality Assurance, and Supporting Documents: Deliver in accordance with following when called for in specification sections.

1.4.4.1 Quality Assurance Procedures: One copy of Quality Assurance Procedure, before start of work.

1.4.4.2 Welding Procedures and Personnel Qualifications: Two copies of welding Procedures and Welding Qualifications 5 days before welding. Maintain additional copies at the project site.

1.4.4.3 Flushing Records: One copy of records verifying acceptable completion of flushing, before testing.

1.4.4.4 Leak/Pressure Testing Records: One copy of records verifying acceptable completion of leak and pressure testing, within 5 days after completion.

1.4.4.5 Electrical Testing: One copy of records verifying acceptable completion of electrical testing in accordance with 16400 within 5 days after completion.

1.4.5 Product Samples and Manufacturer's Instructions: In addition to submittals required in Section 01300, and requirements of this Section, information received by Contractor (from suppliers) that documents products used, and how they were installed, shall be delivered to KEH for Project Records.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

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SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Society for Testing and Materials (ASTM)

D 653-90	Terminology Relating to Soil, Rock, and Contained Fluids

1.1.1.2 Washington Administrative Code (WAC)

Title 296, Labor and Industries

Chapter 296-155	Safety Standards for Construction Work

1.1.1.3 Washington State Department of Transportation (WSDOT)

M41-10-91	Road, Bridge, and Municipal Construction

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Method to prevent injury or damage during excavations: Before excavation, submit procedure for proposed method(s) of excavation, trenching, and shoring as specified in 3.1.3 and for prevention of overstressing existing structures or interrupting service to existing facilities. This procedure shall identify the construction competent person(s). Shoring or use of a trenching box shall be signed by a professional engineer.

1.2.3 Approval Not Required: None

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Obtain select soils from excavation or other designated locations. Obtain worksite approval for soils.

2.1.2 Fill or Backfill

2.1.2.1 Select: Well graded soil mixtures which may contain cobbles up to 6 inches in greatest dimension if uniformly distributed, and not constituting more than 20% of volume of fill.

2.1.2.2 Common: Native excavated material not meeting requirements specified in 2.1.2.1.

2.1.3 Bedding for Underground Pipe and Conduit: In accordance with WSDOT M41-10, Section 9-03.16.

2.1.4 Plastic Sheet Marker: In accordance with WSDOT M41-10, Section 9-15.18.

PART 3 - EXECUTION

3.1 EXCAVATION

3.1.1 Obtain excavation permit before performing excavation. Excavation permits will be issued as specified in Section 01065.

3.1.2 Locate and expose underground utilities using hand tools. Use of heavy equipment and machinery is subject to approval of KEH.

3.1.3 Wherever slopes of excavations will intersect existing underground lines or structures such as building foundations, underground piping, electrical ducts or direct buried electrical lines, install shoring or other means of support to prevent overstressing existing structure or underground lines or to prevent interrupting service to existing buildings.

3.1.4 Footings, Foundations, and Buried Structures

3.1.4.1 Make excavations to depth shown on the Drawings or to further depth necessary to provide undisturbed surface. Make excavations to proper width with allowances made for forms and bracing. Make bottom of excavations compact, level, true, and free of loose material.

3.1.4.2 If over-excavation occurs, correct at time of placing concrete by extending concrete down to undisturbed earth, or by placement of backfill, compacted as specified in 3.2.1.2b, Method C.

3.1.5 Trenches for Underground Piping and Conduit

3.1.5.1 Make excavations to line and grade shown on the Drawings and wide enough to make connections. Excavate with near vertical sides from bottom of trench up to one foot above utility lines. Excavate trench deep enough to permit placement of compacted sand bedding, 4 inches minimum thickness, beneath lines except where excavation is in undisturbed sand which will serve as bedding or where lines are to be encased in concrete. Pare holes in trench bottoms for pipe couplings so pipe will bear full length of barrel or section.

3.1.5.2 If over-excavation occurs, correct by placement of select backfill compacted as specified in 3.2.1.2.b, Method B.

3.2 INSTALLATION

3.2.1 Fill and Backfill

3.2.1.1 General:

a. Backfill Permit: Obtain signatures required on backfill permit for each element to be filled or backfilled. Work not started within 5 calendar days from time permit is approved shall not be started until new permit has been approved. A continuing job that has not had backfill installed within past 5 calendar days will require new backfill permit.

b. Remove debris and organic matter from area to be filled or backfilled. No hazardous wastes shall be disposed of in the filled/ backfilled area(s).

c. Keep materials free of frozen particles, lumps, organic matter, and trash.

d. Do not place fill or backfill on frozen ground.

e. Filling or backfilling by sluicing or flooding with water will not be permitted.

f. Bring fill or backfill up evenly on sides of walls, structures, and utility lines to avoid unbalanced loading.

3.2.1.2 Select:

a. Before placement of fill or backfill, demonstrate, by physical test at the worksite, that proposed layer depths and procedure for compaction of soils will provide compaction specified. Prepare "Soil Compaction Procedure" For KEH-0382, in accordance with instructions.

b. Place backfill in accordance with WSDOT M41-10, Section 2-09.3(1)E.

c. Use select backfill around concrete tanks and for backfilling pipe trenches where lines pass beneath roadways, or future roadways, as shown on the Drawings.

3.2.1.3 Common:

a. Place fill or backfill in layers of 12 inches maximum thickness, loose measurement.

b. Compact each layer, full width, by 1 pass minimum of vibratory or rammer type compactor, pneumatic-tired roller, loaded scraper wheel, grader wheel, or power roller.

c. Mound over top layer of backfill to a depth of 1 inch for each 12 inches of trench depth to a maximum mound height of 6 inches.

3.2.1.4 Underground piping and conduit trenches:

a. Bedding placed beneath utility lines in trenches shall be material specified in 2.1.3.

b. Place and compact bedding in trench prepared as specified in 3.1.7.1 before laying utility lines. Compact bedding as specified for structural backfill.

c. Place backfill over joints in underground pipes only after pressure testing of line has been completed.

d. Backfill around sides and up to 1 foot above top of pipe or conduit with select fill. Place and compact material same as specified for structural backfill. Compact with care, to avoid misalignment of pipe and provide uniform bearing along barrel of pipe.

e. Backfill utility trenches from elevation 1 foot above top of pipe as follows.

1) For locations specified in 3.2.1.2, use select backfill.

2) Use common backfill as specified in 3.2.1.3 for other locations.

f. Do not allow heavy construction equipment and/or compaction equipment as specified in 3.2.1.3.b to pass over buried lines until at least 2 feet of backfill has been placed over line or until bridging has been placed across trenching and approved by KEH.

3.2.2 Plastic Sheet Marker: Place continuous over buried utility lines. Place marker tape directly over line and one foot below finish grade. Place marker over each outside pipe of multiple lines. Place intermediate markers 4 feet maximum apart.

3.2.3 Finish Grading and Stabilization: Rake area disturbed by work, remove surface stones larger than 6 inches and dispose of excess material and debris at area designated by KEH.

3.3 FIELD QUALITY CONTROL

3.3.1 Soil Compaction Tests: Sampling and testing of compacted fill and backfill will be performed by KEH.

SOIL COMPACTION PROCEDURE

A

Project Number	Project Title	Date

Contract Number	Procedure Number	Location of Demonstration

REQUIREMENTS	EQUIPMENT DEMONSTRATED
Applicable Spec./Dwg.	Type
Compaction Required %	Manufacturer
Maximum Lift Size	Model

B

LABORATORY SOIL TEST RESULTS

☐ Non-granular Materials (WSDOT Test Method No 609)	☐ Granular Materials (WSDOT Test Method No. 606-A)	☐ In-Situ
Maximum Density _____ Moisture % _____	☐ Density Chart Attached	Density _____

C

COMPACTION DEMONSTRATION TEST RESULTS

Formula for Percent Compaction: $\frac{\text{dry density}}{\text{max density}} \times 100 = \text{Percent Compaction}$

No. of Passes	Depth of Lift	Percent Moisture	Lbs/ft³ Dry	Maximum Density	Percent Compaction	Accept	Reject

Observations or Comments

SAMPLE

TEST METHOD USED FOR DEMONSTRATION ☐ Nuclear Gage (ASTM D2922 & D3017) ☐ Other _____

D

Contractor Representative		Date
Engineer/Constructor Inspector		Date

KEH-0382.00 (03/89)

INSTRUCTIONS

This Soil Compaction Procedure form, when approved by the Engineer/Constructor Inspector, documents witnessing and verifying the compaction procedure.

Section A is the responsibility of the Construction Contractor. It is to be completed at the time of backfill compaction demonstration and presented to the Engineer/Constructor Inspector.

Section B is completed by the Engineer/Constructor Inspector. Data entered is obtained from the agency or individual that performed testing.

Section C is completed by the Engineer/Constructor Inspector as the demonstration is performed. Using the applicable formula, the percent compaction achieved is determined and entered. Acceptance is based on the results as compared with the compaction percent required in Section A.

Section D is signed and dated by the Construction Contractor Representative acknowledging responsibility for this procedure and compliance thereto for applicable backfill operations. Section D is signed and dated by the Engineer/Constructor Inspector to signify witnessing and verification.

KEH-0382.00R (03/89)

END OF SECTION

SECTION 02668

FIRE WATER SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Concrete Institute (ACI)

211.1-89	Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
304R-89	Guide for Measuring, Mixing, Transporting and Placing Concrete

1.1.1.2 American National Standards Institute (ANSI)

A13.1-1981 (R 1985)	Scheme for the Identification of Piping Systems
Z53.1-1979	Safety Color Code for Marking Physical Hazards

1.1.1.3 American Society for Testing and Materials (ASTM)

C 94-90	Ready-Mixed Concrete
F 477-76 (1985)	Elastomeric Seals (Gaskets) for Jointing Plastic Pipe

1.1.1.4 American Water Works Association (AWWA)

C104-90	Cement-Mortar Lining for Ductile- Iron Pipe and Fittings for Water
C110-87	Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in., for Water and Other Liquids
C203-86	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-- Enamel and Tape-- Hot-Applied

	C209-90	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
	C600-87	Installation of Ductile-Iron Water Mains and Their Appurtenances
	C900-89	Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in. For Water Distribution

1.1.1.5 Factory Mutual System (FM)

1991 Edition	Approval Guide

1.1.1.6 National Fire Protection Association (NFPA)

24 (1992)	Installation of Private Fire Service Mains and Their Appurtenances

1.1.1.7 Steel Structures Painting Council (SSPC)

Surface Preparation Specifications

SSPC-SP-3-89	No. 3 Power Tool Cleaning
SSPC-SP-6-89	No. 6 Commercial Blast Cleaning

1.1.1.8 Underwriters Laboratories, Inc (UL)

1991	Fire Protection Equipment Directory

1.1.1.9 Washington State Department of Transportation (WSDOT)

M21-01-85 w/Revisions through May 1991	Standards Plans for Road, Bridge, and Municipal Construction

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Approval Data: Before delivery, submit information listed in the Approval Data List in this Section.

1.2.3 Approval not required: None

1.3 SYSTEM DESCRIPTION

1.3.1 System maximum operating pressure will be 200 psig.

1.4 QUALITY ASSURANCE

1.4.1 Components of new underground fire water system, if not designated in this Section or the Drawings by manufacturer's name and model or figure number, shall be current products of manufacturer and be listed or approved for intended use by UL or FM.

1.4.2 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to KEH in accordance with Section 01720.

Document	Paragraph
Documented Evidence of Flushing	3.2.2.4
Contractor's Material and Test Certificate	3.2.3.4

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

2.2 MATERIALS

2.2.1 Piping

2.2.1.1 Pipe, pipe joints and fittings shall meet the requirements of NFPA 24, the Drawings and this Section.

2.2.1.2 Pipe: Polyvinyl chloride (PVC), Class 200 (DR 14), meeting the requirements of AWWA C900. All pipe shall be suitable for use as pressure conduit. Provisions must be made for expansion and contraction at each joint with an elastomeric ring. The bell shall consist of an integral wall section with a factory installed, solid cross section elastomeric ring which meets the requirements of ASTM F 477. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of AWWA C900.

2.2.1.3 Fittings: Cement lined meeting the requirements of AWWA C104, with joints and pressure class ratings compatible with pipe used and shall meet the requirements of AWWA C110.

2.2.2 Bitumastic: Koppers No. 550 or Superservice Black.

2.2.3 Concrete: Minimum allowable compressive strength, 3000 psi at 28 days.

2.2.4 Cast-In-Place Concrete: The selection of proportions for concrete mixes for normal, heavyweight, and mass concrete shall comply with ACI 211.1.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Install piping and piping accessories in accordance with NFPA 24, AWWA C600, AWWA C900, the Drawings, this Section, and manufacturer's recommendations.

3.1.2 Protect pipe and fittings from impact shocks and dropping. Before laying, inspect pipe and discard damaged components. Remove damaged components from job site.

3.1.3 Keep piping systems clean during work. Once fabrication has started on length of pipe, plug or cap open ends of piping when installation is not in progress to prevent entry of dirt and other foreign material. Inner surfaces of pipe, valves, and fittings shall be smooth, clean, and free of sand, debris and dirt when installed.

3.1.4 Where piping is laid in trench, trench shall be free of frost or frozen earth and standing water.

3.1.5 Install restraints on pipe and piping components in accordance with NFPA 24, Article 8-6 and A-8-6.2. Restraining mechanical joints as listed in UL Fire Protection Equipment Directory may be substituted for conventional anchoring. Blanked flanged fittings shall have reverse anchors to allow for future expansion of line. Where thrust blocks are used, make bearing area equal to area shown in NFPA 24 Table 8-6.2.8 multiplied by a factor of 1.33.

3.1.5.1 Before placing concrete, collect "Trip Ticket" for each truck load. "Trip Ticket" shall contain information listed in ASTM C 94 subparagraphs 16.1.1 through 16.1.10 and include water/cement ratio.

3.1.5.2 Mix, transport, and place concrete in accordance with ACI 304.

3.1.6 Coat exposed areas of carbon steel accessories, which will be buried, such as tie-rods and clamps, with bitumastic. Allow time for bitumastic to dry before backfilling.

3.1.7 Excavation, backfill and grading work shall meet the requirements of Section 02200 as it applies.

3.2 FIELD QUALITY CONTROL

3.2.1 Ensure that no foreign matter enters existing or new pipe or fittings during installation.

3.2.2 Hydrostatic Testing

3.2.2.1 Perform testing in accordance with NFPA 24, Article 8-9. Minimum test pressure shall be 250 psig.

3.2.2.2 Perform testing before backfill is placed over pipe joints.

3.2.2.3 Verify that air has been expelled from piping before applying hydrostatic pressure.

3.2.2.4 Examine piping joints, fittings, and other potential leak sources during test. Leaks in piping system are not acceptable. Repair leaks and retest. Record the results using Contractor's Material and Test Certificate in accordance with NFPA 24.

Project No. C-018H-C2

Project Title

Specification Section 02668

APPROVAL DATA LIST
("X" Indicates Required Data)

1 EPN IDENTIFICATION	2 DESCRIPTION	3 REFERENCE DRAWING	4 SPECIFICATION PARAGRAPH	5 DATA									6 REMARKS
				Dimensional Drawings	Equipment Weights	Specifications	Material Description	Performance Data	Circuit or Control Diagrams	Data Sheets	Illustrative Cuts	Installation Instructions	
	Pipe		2.2.1.2				X				X		
	Fittings		2.2.1.3				X				X		

END OF SECTION
02668-6
C-73

SECTION 02745

PRESSURIZED SEPTIC SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following docuements, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Association of State Highway and Transportation Officials (AASHTO)

Highway Bridges	14th Edition (1989)

1.1.1.2 American Society for Testing and Materials (ASTM)

A 36-91	Structural Steel
A 48-92	Gray Iron Castings
A 53-90b	Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated Welded and Seamless
A 123-89a	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A 126-84	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
A 276-90a	Stainless and Heat-Resisting Steel Bars and Shapes
A 536-84	Specification for Ductile Iron Castings
A 702-89	Steel Fence Posts and Assemblies, Hot Wrought
C 177-85	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
C 272-91	Test Method for Water Absorption of Core Materials for Structural Sandwich Construction

	C 518-91	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
	C 578-92	Preformed, Cellular Polystyrene Thermal Insulation
	D 2241-89	Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
	D 2321-89	Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
	D 2466-90a	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
	D 2564-91a	Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
	D 2729-89	Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
	D 2855-90	Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
	D 3034-89	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
	D 3139-89	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
	D 3212-89	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
	F 477-76 (1985)	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
1.1.1.3	American Welding Society (AWS)	
	D1.1-92	Structural Welding Code-Steel

1.1.1.4 American Water Works Association (AWWA)

C151-91	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
C500-86	Gate Valves for Water and Sewerage Systems
C606-87	Grooved and Shouldered Joints
M23-80	Manual for PVC Pipe--Design and Installation

1.1.1.5 Federal Specifications (FS)

RR-C-271C	Chains and Attachments, Welded and Weldless
TT-E-489H	Enamel, Alkyd, Gloss (For Exterior and Interior Surfaces)

1.1.1.6 National Fire Protection Association (NFPA)

70 (1993)	National Electrical Code

1.1.1.7 Washington Administrative Code (WAC)

Title 246	Department of Health
Chapter 246-272-150	On-Site Sewage Disposal Design
Chapter 246-272-230	On-Site Sewage System, Installer Requirements

1.1.1.8 Washington State Department of Transportation (WSDOT)

M41-10-91	Road, Bridge, & Municipal Construction

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Installer Certification: Prior to notice to proceed, submit evidence that installer of septic system is certified by the Benton-Franklin Health Department in accordance with WAC 246-272-230.

1.2.2.2 Septic Tank Plans: Before delivery, submit plans showing dimensions, reinforcement, structural calculations including certifications of tank capacity and structural capacity, and the manufacturer's installation procedures. Before submittal, documents shall be approved by

the Washington Department of Health (WaDOH), 924 W. Sinto, Spokane, WA 99201-2595.

1.2.2.3 Valve Vault Plans: Before delivery, submit plans showing dimensions, reinforcing, structural capacity. For precast vaults, include manufacturer's installation instructions.

1.2.2.4 Septic Tank Effluent Filter: Before delivery, submit manufacturer's installation instructions, catalog part numbers and maintenance instructions.

1.2.2.5 Sewage Effluent Pumps: Before Delivery, submit pump performance curves and manufacturers catalog cuts.

1.2.2.6 Gate Valves: Before delivery, submit manufacturer's catalog cuts for valves and valve boxes.

1.2.2.7 Dosing Chamber Plans: Before delivery submit plans showing dimensions, reinforcing, and structural capacity of chamber, accessway, and lids. Include manufacturer's installatin instructions. Before submittal, documents shall be approved by the Washington Department of Health (WDOH), 924 W. Sinto, Spokane, WA 99201-2595.

1.2.2.8 Filter Sand: Before delivery, submit evidence that filter sand is certified ASTM C 33 sand.

1.2.2.9 Method of Excavation: Before excavation, submit written method of excavation for beds.

1.2.3 Approval Not Required

1.2.3.1 Vendor Information: Before installation, submit information listed in the Vendor Information List in this Section.

1.2.3.2 As-Built Survey: Before final acceptance, submit as-built location (X,Y,Z) of features installed on this contract including tanks, lines (at intervals not to exceed 100 feet plus breaks in grade and/or alignment). bottom of excavation of soil absorption fields, etc. Data shall be certified by a Washington Registered Land Surveyor.

1.3 QUALITY ASSURANCE

1.3.1 Product Acceptability: See Section 01400 for required measures to prevent the use of misrepresented products.

1.3.2 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to KEH in accordance with Section 01720.

Document	Paragraph
Leak/Pressure Test Certification	3.2.1.2

1.4 WARRANTY

1.4.1 Provide a manufacturer's warranty for the sewage effluent pumps covering defects in workmanship and materials for a period of 5 years or 10,000 hours, whichever comes first. The warranty shall be in printed certificate form, and apply to similar units.

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

2.2 MATERIALS

2.2.1 Drain Rock: Washed stone or gravel of uniform size between 3/4 and 1-1/2 inches. Stone or gravel shall be naturally occurring material. Crushed stone will not be permitted. Fines shall not exceed 12% passing a No. 4 sieve, 8% passing a No. 20, 4% passing a No. 80, or 2% passing a No. 200.

2.2.2 Geotextile Fabric: Non-woven polyester or polypropylene fabric weighing 4 oz/yd^2 maximum.

2.2.3 Lateral Pipe: ASTM D 2241, 1.0-inch, Class 160, drilled with 3/16-inch holes. Finished holes shall be true, round, and free of burrs.

2.2.4 Distribution Pipe: ASTM D 2241, Class 125, with ASTM D 2672 or D 3139 joints.

2.2.5 Gravity Sewer Pipe: ASTM D 3034, with ASTM D 2855 or D 3212 joints.

2.2.6 Fittings: ASTM D 2466 or D 3034.

2.2.7 Solvent Cement: ASTM D 2564.

2.2.8 Valve Vault Pipe: ASTM A 53, Schedule 40, galvanized. Coupling products shall be ASTM A 536, and in accordance with AWWA C606.

2.2.9 Valve Vault Pipe Support: ASTM A 36, hot-dip galvanized in accordance with ASTM A 123.

2.2.10 Flexible Couplings: Sizes to match the pipe OD of each mating pipe; Rockwell (Smith-Blair) Steel Coupling, or an approved substitute.

2.2.11 Welding Electrodes: E70XX.

2.2.12 Chain Barricade

2.2.12.1 Posts: ASTM A 702, 6 feet minimum, designed for driving into earth.

2.2.12.2 Chain: FS RR-C-271, Trade No. 10 galvanized steel, jack Type II.

2.2.12.3 Signs: 0.0396-inch (20-gage) galvanized or stainless steel plate, or 0.80-inch aluminum sheet, painted with 2 coats of yellow enamel. Legend shall be "SANITARY TILE FIELD" in 1-inch high black letters.

2.2.13 Zinc-Rich Coating: Galvicon MZP metallic zinc paint or ZRC zinc rich coating.

2.2.14 Paint: FS TT-E-489, yellow and black colors.

2.2.15 Bitumastic: Koppers No. 550, Superservice Black, or an approved substitute.

2.2.16 Rigid Board Insulation: Compressive strength of 40 lb/in^2 minimum in accordance with ASTM C 578; "k" factor of 0.2 maximum in accordance with ASTM C 177 or C 518; water resistance of 1.0% maximum in accordance with ASTM C 272.

2.2.17 Filter Sand: ASTM C 33.

2.3 EQUIPMENT

2.3.1 Swing Check Valves: ASTM A 126, Class B, of Class 125 Iron, with bronze trim.

2.3.2 Butterfly Valves: ASTM A 536, body and disc. Body coating shall be epoxy, disc coating shall be Grade "E" EPDM. Stems shall be Type 316 stainless steel. Operators handles shall be multi-position locking handles, with memory stops.

2.3.3 Gate Valves: AWWA C500, with cast iron valve boxes of sliding, adjustable height type with round or oval bottom hood sections to fit over tops of valves. Top sections shall be recessed to receive close fitting "eared" lids. Internal diameter of the smallest section shall not be less than 5 inches. Minimum thickness of the metal shall be 5/16 inch. Valve boxes shall be of sufficient length to extend to grade.

2.3.4 Septic Tank: Minimum 2 compartments with a minimum fluid capacity of 7,000 gallons. Inlet compartment to be 1/2 to 2/3 total tank capacity. Tank may be precast concrete or fiberglass designed to withstand HS 20-44 load criteria given in AASHTO Figures 3.7.6B and 3.7.7A, and constructed in accordance with WAC 246-272-150.

2.3.4.1 Access: Provide at least three 24-inch diameter minimum risers with covers, to 6 inches above finish grade for access to each tank compartment. At least one access shall be over the effluent discharge, and at least 1 over the inlet point, and at least one over the primary chamber outlet. Effluent filter(s) shall be accessible through the access riser(s).

2.3.4.2 Effluent filters: Effluent filter(s) shall be located on the effluent line within the septic tanks in accordance with the manufacturer's instructions. Filter(s) shall provide 1/16-inch filtration, and have a removable, self-cleaning cartridge. Installation shall permit access to the filter(s) for maintenance. Use Zabel Industries Model A100 or an approved

substitute. The septic tank effluent filters shall have an intake point at 40% of the total liquid depth below the effluent discharge elevation.

2.3.5 Dosing Chamber: Precast concrete with 2000 gallon minimum capacity, designed to HS20-44 load criteria given in AASHTO Highway Bridges, Figures 3.7.6B and 3.7.7A. Include access way sized for pump installation and maintenance. Door leaves shall be corrosion-protected steel or aluminum diamond plate to withstand an HS-20 load. Hardware shall be stainless steel; Bilco Company model JD or an approved substitute.

2.3.6 Valve Vault: Sized as shown on the Drawings. Vault design shall be to HS 20-44 load criteria in accordance with AASHTO Highway Bridges, Figures 3.7.6B and 3.7.7A. Provide an Operations Schedule plate (Figure 1) for the north wall.

2.3.7 Risers and Lids: 24 inch diameter by 46 inch PVC risers, with insulated fiberglass lid. Orenco Systems Incorporated model RR24, FL246, and INS-2, or an approved substitute.

2.3.8 Dosing Pumps

2.3.8.1 General: Each pump shall provide a pump efficiency of 61% minimum, and be equipped with a 2 HP maximum submersible electric motor, 480 V, 3-phase, 60 Hz, 3-wire service with 50 feet minimum of power and sensor cable. Each pump shall discharge through a 4-inch mating cast iron elbow, and deliver 242 gal/min at 16.6 +/- 2 feet TDH. Each pump shall be fitted with 15 feet of stainless steel lifting cable of adequate strength to permit raising and lowering pumps from the ground surface.

2.3.8.2 Pump design:

a. Pumps shall be capable of pumping septic tank effluent. The discharge connection elbow shall be permanently installed in the dosing chamber along with the discharge piping. Pumps shall be automatically connected to the discharge elbow when lowered into place. Guide rails for raising and lowering the pumps shall be hot-dipped galvanized pipe, sized in accordance with the pump manufacturer's recommendations. Pumps shall be easily removable for inspection and service, and shall not require service personnel to enter the dosing chamber.

b. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A rail guide bracket shall be an integral part of the pump unit. The weight of the pumping unit shall be guided by 1 or more guide bars, and pressed tightly against the discharge connection elbow with metal-to-metal contact. Sealing of the discharge interface by means of a diaphragm, O-Ring, or other device is not acceptable. No portion of the pump shall bear directly on the floor of the dosing chamber. Pumps, with appurtenances and power cables, shall withstand continuous submergence underwater to a depth of 65 feet without loss of watertight integrity.

2.3.5.3 Pump construction:

a. Major pump components shall be ASTM A 48 Class 30B close-grain gray cast iron, with smooth surfaces and passages free of blow holes and other irregularities.

b. Where water tight sealing is required, O-rings shall be used. Exposed nuts and bolts shall be Type 304 stainless steel. External surfaces coming into contact with sewage, other than stainless steel fittings, shall be protected by a sewage/wastewater resistant coating.

c. Mating surfaces, where watertight sealing is required, shall be machined and fitted with nitrile rubber O-rings. Fitting shall be accomplished by metal-to-metal contact between machined surfaces, resulting in controlled compression of the nitrile rubber O-rings, without the requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used.

d. Cable entry water-tight sealing design shall exclude specific torque requirements, or epoxy, silicone, or other sealing compounds to ensure a water tight seal. Cable entry shall be comprised of an elastomer grommet, with stainless washer, having close tolerance fit, compressed by a combination sealing gland and strain relief fitting. The cable entry junction chamber shall be separated from the motor housing by an isolated terminal board.

e. Pump motors shall be of induction, squirrel-cage design, housed in an air-filled, water-tight chamber. Stator windings shall be dipped and baked to a Class F insulation rating which will resist a temperature of 311°F. Stators shall be heat shrunk fit into housings to ensure perfect alignment. The use of any other means of securing stators is not acceptable. Motors shall be designed for continuous duty, capable of sustaining 10 starts/hr. At the design point, the stator, winding temperature shall not exceed 285°F. Motors shall be non-overloading across the entire operating range without use of the service factor.

f. At maximum rated power, pumps shall be of adequate design to provide radiant cooling required by the motor. Cooling jackets or other related devices shall not be necessary for continuous pumping at a sump level below the midpoint of stator housings.

g. Motor stators shall be protected by 3 low resistant, bi-metallic thermo switches embedded into stator coil windings. Sensors shall be connected in series with motor starter coils, and used in conjunction with, and supplemental to, third leg overload protection provided by motor starters.

h. Pump shafts shall be Type 300 or 400 series stainless steel. Shafts shall rotate on 2 permanently lubricated ball bearings. Upper bearings shall be 1-row ball bearings and lower bearings 2-row, angular contact ball bearings. Shaft design shall provide for a minimum overhang to reduce shaft deflection and prolong bearing life.

i. Each pump shall be provided with a tandem mechanical shaft seal system. Upper mechanical seals shall operate entirely in an oil chamber located just below the stator housing. Upper mechanical seals shall contain one stationary stainless steel ring and one positively driven rotating carbon ring. This upper mechanical seal shall function as a secondary barrier between the pumped liquid and the stator housing. Lower set of mechanical seals shall function as the primary barrier. Lower seals shall contain one stationary silicon carbide ring and one positively driven rotating tungsten carbide ring. Both seal surfaces shall be lubricated and cooled by oil.

j. Tandem seals shall not require routine maintenance or adjustment, and shall not be damaged when pumps are run dry. When required, seal oil inspection shall be achieved without pump disassembly. Seals shall not require pumped liquid as a lubricant.

k. Shaft seals of conventional double seal design, using single or double spring action between the upper and lower seal and requiring pressure differentials to offset external pressures, are not acceptable.

l. Impellers shall be ASTM A 395 ductile iron, or ASTM A 48 Class 30 cast iron, dynamically balanced, double shrouded, with back pump out vanes, of nonclog smooth contour design without acute turns. Impellers shall be capable of handling septic tank effluent. Securing impellers to shafts shall be accomplished by means of sealing washers and Type 304 stainless steel impeller screws.

m. Impellers shall not require coating. Performance data submitted shall be based on the performance of an uncoated impeller. Attempts to improve efficiency shown on the data submitted, by coating impellers, is not be acceptable.

n. Pump volutes shall be ASTM A 48 Class 30B close-grain cast iron, single piece, nonconcentric design, and shall have smooth contoured fluid passages large enough to pass solids which may pass through impellers.

o. A wear ring system shall be installed to provide efficient sealing between volutes and impellers. The wear ring shall consist of a stationary ring of appropriate materials for the application, and shall be easily field adjustable. Rubber or other synthetic materials are not acceptable.

p. Pump motor cables shall be Ozoflex, or Type SO construction, suitable for submersion in sewage. Cable sizing shall be in accordance with NFPA 70 specifications for pump motors.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Excavate for septic tank, dosing tank, valve vault, piping, and disposal fields (4 beds in each field) to lines and grades shown on Drawings. Exposed disposal bed surfaces shall be protected from windborn debris.

3.1.2 Install tanks, vaults, pumps, and electrical panel in accordance with the Drawings.

3.1.2.1 Install valve vault pipe supports as shown on the Drawings. Make field connections as neatly as possible with joints flush and smooth. Clean field welds before painting. Perform welding of steel connections in accordance with AWS D1.1. Refinish weld surfaces in galvanized work with 2 coats of zinc-rich coating.

3.1.2.2 Install the operations schedule plate (Figure 1) on the valve vault north wall.

3.1.3 Install piping in accordance with WSDOT M-41-10, Sections 7-17.3(1)B, and 7-17.3(2)B through G, ASTM D 2321, Section 02200, and the Drawings. Run risers 1 foot minimum above grade, and temporarily cap.

3.1.4 Coat flexible couplings with bitumastic, and allow to dry before backfilling.

3.1.5 Flushing: After installation and before connecting the completed system into the existing system, and only if directed by KEH, flush piping with water until effluent is clean and contains no visible particulate matter. Obtain written approval of the method for disposal of flushing water from KEH.

3.1.6 Remove smeared or compacted surfaces of disposal beds by raking to a depth of 1 inch minimum. Install filter sand in 1 lift. Distribute and level with a minimum of equipment trafficking across the beds. Use tracked type equipment for distribution and leveling. Do not compact.

3.1.7 Place first lift of drainrock to the bottom elevation of laterals. Distribute and level with a minimum of equipment trafficking across the beds. Use tracked type equipment for distribution and leveling. Do not compact.

3.1.8 Fabricate and install laterals as shown on the Drawings.

3.1.9 Perform system pressurization test as specified in 3.2.3.

3.2.10 Complete last lift of drainrock to the design grade. Install geotextile fabric on leveled drainrock, lapping seams 2 feet minimum. Complete backfill in 1 lift and grade site using tracked type equipment for drainage away from beds.

3.1.11 Install chain barricade posts plumb and true at 20 foot maximum spacing.

3.1.11.1 Clean and paint with 2 coats of yellow enamel.

3.1.11.2 Install chain on posts.

3.1.11.3 Mount 10 signs, 3 each on the long sides and 2 each on the short sides, on posts at approximately equal intervals around the drainfield.

3.2 FIELD QUALITY CONTROL

3.2.1 Hydrostatic or Pneumatic Testing

3.2.1.1 Furnish instruments and equipment required to conduct tests.

3.2.1.2 Document leak/pressure testing of the system on "Leak/Pressure Test Certification" Form 1757.

3.2.1.3 Backfill may be completed prior to testing at the discretion of KEH.

3.2.1.4 Before applying test pressure to piping, install necessary restraining devices to prevent distortion or displacement of piping.

3.2.1.5 Test performance:

a. For hydrostatic testing, verify air has been expelled from piping before applying hydrostatic pressure. Test transport, header, riser pipes,and valve vault pipe and appurtenances, to 35 feet head, and gravity sewer line to 10 feet head, in accordance with WSDOT M41-10 Section 7-17.3(4)B.

b. For pneumatic testing, test distribution piping between dosing pump discharges and risers, and between grinder pump and septic tank, to 16 lb/in^2 gage, and test gravity sewer line pipe to 5 lb/in^2 gage. Allow air temperature to stabilize, and maintain pressure for 5 minutes.

3.2.2 Final connections to existing appurtenances, completed after testing the lines, shall be visually inspected and approved by KEH without further testing.

3.2.3 System Pressure Test

a. Before backfilling the lateral distribution lines and after pressure testing the transport, header, riser pipes, and valve vault pipe and appurtenances, test the entire system under normal operating conditions.

b. Fill the dosing chamber with clean water, with the pumps set to the automatic mode. Continue filling to activate both the alarm and the lag pump start. Operate the pumps through a complete cycle, including low water pump off.

c. Check valves for proper position before operation.

d. Observe the performance of each bed. Pumping duration, as directed by KEH, need only be long enough to confirm that the bed pressurizes uniformly.

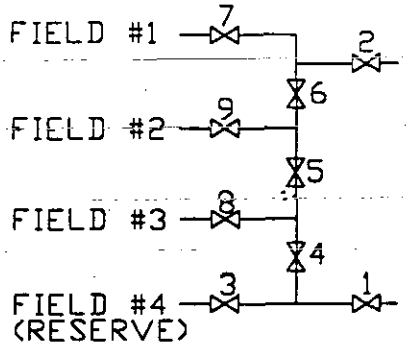
3.2.4 Tank Leakage Test

3.2.4.1 Before making leakage tests for septic tank and dosing chambers, the Contractor may fill them with clear water to permit normal absorption into the tank/chamber walls provided, however, that after so filling the tank/chamber he shall complete the leakage test within 24 hours.

3.2.4.2 Before commencing the leakage test, refill the tank/chamber with clear water. There shall be no measurable loss of liquid over a 6 hour period.

OPERATIONS SCHEDULE

VALVE DIAGRAM



FIELD ROTATION SCHEDULE

3 FIELD CYCLE	FIELDS IN SERVICE
1	1 & 2
2	1 & 3
3	2 & 3
REPEAT CYCLE	

4 FIELD CYCLE	FIELDS IN SERVICE
1	1 & 2
2	3 & 4
REPEAT CYCLE	

VALVE SCHEDULE

VALVE NO	FIELDS IN SERVICE			
	1 & 2	1 & 3	2 & 3	3 & 4
1	OPEN	OPEN	OPEN	OPEN
2	OPEN	OPEN	OPEN	OPEN
3	CLOSED	CLOSED	CLOSED	OPEN
4	OPEN	OPEN	OPEN	CLOSED
5	OPEN	CLOSED	CLOSED	OPEN
6	CLOSED	CLOSED	OPEN	OPEN
7	OPEN	OPEN	CLOSED	CLOSED
8	CLOSED	OPEN	OPEN	OPEN
9	OPEN	CLOSED	OPEN	CLOSED

30" WIDE X 32" HIGH 12 TO 18 GAUGE SST SHEET
EPOXY ENAMEL PAINT - LIGHT GREEN BACKGROUND
WITH BLACK LETTERS EXCEPT THE WORDS "CLOSED"
AND "FUTURE" SHALL BE RED. LETTERS MAY BE
EPOXY ENAMEL PAINT OR SELF-ADHESIVE VINYL.

FIGURE 1

C018HC9.SP.2528 02745-13 C-018H-C9 REV 0

PRESSURE TEST CERTIFICATION

Report No. WHC-SD-C018H-ER-007, Rev. 0

Project or W.O. No.	Title	Dwg. Reference	Test Procedure/Rev.

Construction Spec./Rev.	Code or Standard	Year	Addenda	Class	Stamp Required
					☐ Yes ☐ No

Description of System or Component(s) Test Boundaries

_____

_____

TEST PREPARATION

Notification Requirements

- ☐ Quality Control
- ☐ Acceptance Inspection
- ☐ Safety Engineer
- ☐ Customer _____
- ☐ Authorized Inspector
- ☐ _____

Valve Line-up Requirements (for permanent valves installed)

Valve I.D. _____	☐ Open	☐ Close
Valve I.D. _____	☐ Open	☐ Close
Valve I.D. _____	☐ Open	☐ Close
Valve I.D. _____	☐ Open	☐ Close
Valve I.D. _____	☐ Open	☐ Close
Valve I.D. _____	☐ Open	☐ Close

Required Test Medium	Required Test Medium Temp.	Flushing Requirements	
Medium _____	Temp. _____	Flushing _____	☐ Blue Chalking Required ☐ Soap Solution Required

Design System Pressure	Design Test Pressure	Specified Hold Time	Prepared By	Date
_____	_____	_____		

PRE-TEST CHECKLIST

Item or Requirement	Craft Release	Quality Control	
	Initials/Date	Accept	Date
Valve line-up per design requirements (see above line up).			
Flushing of system and/or component completed per design requirements.			
All lines or components not to be tested are properly isolated or disconnected.			
Vents and openings checked; proper Pressure Relief Valve installed and discharge checked.			
Test medium per design requirements; temperature equalized. Medium _____ Medium Temp. _____ (ASME only)			
Test gauge(s) correct range and currently calibrated. SN _____ Range _____ Cal. Due Date _____ SN _____ Range _____ Cal. Due Date _____ SN _____ Range _____ Cal. Due Date _____			
Pressure Relief Valve properly set and currently calibrated. SN _____ PSI Set _____ Checked Date _____ SN _____ PSI Set _____ Checked Date _____ SN _____ PSI Set _____ Checked Date _____			

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PRESSURE TEST CERTIFICATION

TEST PERFORMANCE

Item or Requirement	Craft Release Initials/Date	Quality Control Accept	Quality Control Date
Pneumatic testing - incremental pressure recorded (when required).			
50% Tp obtained and examination conducted = Tp _____			
Pressure increments at 0.10 Tp: = Tp _____			
= Tp _____			
= Tp _____			
= Tp _____			
= Tp _____			
Hydrostatic testing - areas to be inspected chalked prior to application of pressure.			
Hydrostatic testing - examination conducted while system/component pressurized. Specified Tp _____ PSI obtained at _____ a.m. p.m.			
Pneumatic testing - soap solution applied and system/components examined while pressurized. Specified Tp _____ PSI obtained at _____ a.m. p.m.			
Specified hold time attained at _____ a.m. p.m. Actual Tp during final test _____ PSI			

Pressure Test	By (Signature)	Stamp or PR No.	Date
☐ Accepted ☐ Rejected			

INSPECTION VERIFICATION

Documentation properly prepared.	☐ Yes	☐ No	Actual Tp during final inspection _____ PSI
All joints and welded attachments to pressure retaining components chalked/soaped as applicable.	☐ Yes	☐ No	Specified hold time attained ☐ Yes ☐ No
All joints and welded attachments to pressure retaining components visually inspected for leakage.	☐ Yes	☐ No	

Pressure Test	Acceptance Inspection Signature	Stamp or PR No.	Date
☐ Accepted ☐ Rejected			

OTHER

Comments

NCR No. (if applicable)	Customer Representative		Date
	Witness - ASME Authorized Inspector		Date
☐ Document Reviewed ☐ Drawings Highlighted	Construction Engineering	PR No.	Date

KEH 1757.02 (05/93)

Project No. C-018H-C9

Project Title

Specification Section 02745

VENDOR INFORMATION LIST
("X" Indicates Required Data)

1	2	3	4	5 VENDOR INFORMATION (VII)												
									Instructions							
EPN IDENTIFICATION	DESCRIPTION	REFERENCE DRAWING	SPECIFICATION PARAGRAPH	Dimensional Drawings	Equipment Weights	Specifications	Certified Test Data	Circuit or Control Diagram	Installation	Operation	Maintenance	Spare Parts List	Data Sheets	Illustrative Cuts	
	Septic Tank Effluent Filter		2.3.4.2							X	X			X	
	Valve Vault		2.3.6	X											
	Dosing Pumps		2.3.8	X		X		X	X	X	X	X		X	

END OF SECTION
02745 - 16

SECTION 16400

SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

C80.1-1990	Rigid Steel Conduit--Zinc Coated
C80.3-1983	Electrical Metallic Tubing-Zinc Coated

1.1.1.2 Factory Mutual System (FM)

Approval Guide	1993 Edition

1.1.1.3 Federal Specifications (FS)

W-C-375B Not 1	Circuit Breakers, Molded Case; Branch Circuit And Service
W-F-406E	Fittings For Cable, Power, Electrical And Conduit, Metal, Flexible
TT-S-00230C, AMD 2	Sealing Compound: Elastomeric Type, Single Component (For Calking, Sealing, And Glazing In Buildings And Other Structures)
WW-C-566C	Conduit, Metal, Flexible

1.1.1.4 National Electrical Manufacturers Association (NEMA)

FB 1-1988	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
ICS 2-1988	Industrial Control Devices, Controllers and Assemblies
ICS 6-1988 Rev 1	Enclosures for Industrial Controls and Systems
KS 1-1990	Enclosed Switches

	RN 1-1989	Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
	WD 1-1983 (R 1989)	General Requirements for Wiring Devices

1.1.1.5 National Fire Protection Association (NFPA)

70 (1993)	National Electrical Code

1.1.1.6 Underwriters Laboratories (UL)

Electrical Appliance and Utilization Equipment Directory	1993
Electrical Construction Materials Directory	1993
797-1993	Electrical Metallic Tubing
1242-1992	Intermediate Metal Conduit

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Approval data: Before delivery, submit information listed in the Approval Data List in this Section.

1.2.3 Approval Not Required

1.2.3.1 Vendor information: Before installation, submit information listed in the Vendor Information List in this Section.

1.3 QUALITY ASSURANCE

1.3.1 Product Acceptability

1.3.1.1 Products shall be identified (listed) for their intended use in one of the following, and bear the organization's label.

a. UL Electrical Construction Materials Directory

b. UL Electrical Appliance and Utilization Equipment Directory

c. FM Approval Guide

In the absence of a label, submit documentation that verifies product listing.

1.3.1.2 When products with one of the above listings are not available, products tested and certified by another agency are acceptable, provided that the following conditions are satisfied.

a. The agency has been qualified for product testing in accordance with a national code or standard.

b. Product testing was accomplished in accordance with a national code or standard.

1.3.1.3 See Section 01400 for required measures to prevent the use of misrepresented products.

1.3.2 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to KEH in accordance with Section 01720.

Document	Paragraph
Electrical Test Results	3.3.1.2

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

2.2 MATERIALS

2.2.1 Terminal Lugs: Compression, ring tongue or spade type, with turned up legs and insulated sleeves, rated for use with copper conductors.

2.2.2 Solderless Connectors: Insulating caps or covers rated for system utilization voltage.

2.2.3 Conduit, Fittings, and Boxes

2.2.3.1 Conduit: ANSI C80.1, C80.3, FS WW-C-566, UL 797, and 1242.

2.2.3.2 PVC coating on rigid steel conduit: NEMA RN 1, Type A-40, factory applied.

2.2.3.3 Flexible metal conduit shall have an integral ground conductor.

2.2.3.4 Fittings for rigid steel and EMT conduit: NEMA FB 1. Use compression type, threadless fittings with EMT.

2.2.3.5 Fittings for flexible metal conduit: FS W-F-406, squeeze type.

2.2.3.6 Use "Myers" type watertight fittings, or sealing type locknuts, for conduit entries into sides or tops of NEMA ICS 6 Type 3 or 3R enclosures.

2.2.4 Conductors: Stranded copper with type THWN/THHN or XHHW insulation, of type and AWG size specified on the Drawings.

2.2.5 Wiremarkers: Imprinted tubular plastic.

2.2.6 Equipment Nameplates: Laminated plastic, 1/16-inch thick with white surface and black core. Edges beveled and smooth. Engraved nomenclature sharp and clear.

2.2.7 Wire Pulling Compound: Electro Compound Company "Y-er Eas," or American Polywater Corporation "Polywater."

2.2.8 Tape: Plastic insulating; 3M Company "Scotch No. 33+."

2.2.9 Insulating Putty: 3M Company "Scotchfil," General Electric Company No. 8389, or Kearney Company "Airseal."

2.2.10 Penetration Sealants: FS TT-S-00230, Type II, Class B polysulfide.

2.2.11 Hangers for Individual Conduits: Factory made springable wrought steel clamps, or malleable iron split and hinged rings. For suspended conduit, clamps or rings shall be bolted to, or interlocked with threaded suspension rod.

2.2.12 Concrete and Masonry Anchors: Hilti Fastening Systems "Kwik-Bolt II," or ITW-Ramset "Trubolt Wedge Anchor."

2.3 EQUIPMENT

2.3.1 Equipment enclosures: NEMA ICS 6 Type 3, 3R, and 4.

2.3.2 Dosing Chamber Pump Control Panel: Provided by the pump manufacturer, with elimination of a mercury switch or float type liquid level sensor system, consisting of the following.

2.3.2.1 NEMA Type 4 enclosure with a lockable dead front (tamperproof).

2.3.2.2 Individual pump motor circuit protector circuit breakers with panel door interlock.

2.3.2.3 Magnetic non-reversing starters with 3-leg overload protection, heaters, and overload reset pushbuttons.

2.3.2.4 Individual pump control transformers, 480-120 V ac, with primary and secondary fuses.

2.3.2.5 Single pole circuit breakers for individual protection of level controls.

2.3.2.6 HANDS-OFF-AUTO selector switches (liquid level sensor control).

2.3.2.7 Red pump operating indicating lights.

2.3.2.8 Control relays to control the logic of operation for the pumps. Interval on type timing relay with adjustable interval range of approximately 1-10 minutes, with positive adjustment to +/- 1 second. On delay type timing relay with adjustable range of approximately 1-10 hours,

with positive adjustment to +/- 1 minute. Alternate action type relay. Liquid Level control relays, induction type.

2.3.2.9 High water alarm (liquid level initiated signal) magenta strobe light (approximately 4'-0" above panel) and solid state audible warning device (68-80 dB) with warble tone, and silence switch with auto reset circuit.

2.3.2.10 Terminal blocks.

2.3.2.11 Detailed wiring diagram complete with control circuit wire numbers.

2.3.2.12 Motor cables and watertight hubs.

2.3.2.13 Event counters to record the number of times each pump cycles on.

2.3.2.14 Sequence of automatic operation:

a. The level controller shall have a "pump-off" liquid level sensor switch operated contact that prevents the pumps from running in the event the level drops below the normal operating levels.

b. The level controller shall also have a "pump-on" liquid level sensor switch operated contact indicating that the normal dose level has been achieved.

c. An "on-delay" type timing relay shall monitor the amount of time since either pump has operated. The pumps shall not run until both the "pump-on" liquid level sensor switch operated contact is on, and the "on-delay" type timing relay indicates that 6 hours have elapsed since the last operation of either pump.

d. An "interval" type timing relay shall control the length of pump operation. To achieve the correct dose quantity, pumps shall only run for 2-1/2 minutes. Each time both conditions are satisfied the pump which did not operate last shall be selected by use of an "alternate action" type relay.

e. The level controller shall have a "high alarm" liquid level sensor switch operated contact that operates the magenta colored alarm light, and the solid-state audible warning device, indicating that normal operating levels have been exceeded.

f. The level controller shall also have an "emergency pump on" liquid level sensor switch operated contact that bypasses the 6-hour delay relay, overrides the alternate action relay, and starts both pumps for the 4-minute pump cycle.

g. Event counters for each pump shall indicate the number of pump operating cycles.

2.3.3 Motor Load Fuses: NEMA FU 1, and be the following types.

2.3.3.1 250 V rated: Buss, Fusetron, Catalog No. FRN.

2.3.3.2 600 V rated: Buss, Fusetron, Catalog No. FRS.

2.3.4 Combination Motor Controllers: NEMA ICS 2-321, horsepower rated, with 2 NO and 2 NC auxiliary contacts. Bimetallic or melting alloy type overload elements are acceptable. Overload relay reset in cover. FS W-C-375 thermal magnetic trip or instantaneous motor circuit protector type circuit breakers.

2.3.5 Magnetic Contactors: NEMA ICS 2-211 Size 1, having 4 normally open contacts, and operating coil rated at 120 V ac.

2.3.6 Safety Switches: NEMA KS 1, fusible heavy duty type HD, horsepower rated for 600 V ac as noted on the Drawings. Fuses shall be NEMA FU 1 cartridge type, dual element, UL Class K5.

2.3.7 Terminal Blocks

2.3.7.1 For No. 10 AWG conductors and smaller: Either one piece or factory assembled sectional double terminal, barrier type, with binder screw terminals. Terminal ampacities shall be equal to or greater than conductor ampacities; Marathon or Buchanan.

2.3.7.2 Provide covers to cover live parts of terminations for circuits of 150 V or more to ground. Provide with means for ready inspection and full width marking areas.

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Field Measurements: Scale dimensions on Drawings show desired and approximate locations of equipment. Actual locations, distances, and levels shall be governed by field conditions.

3.2 INSTALLATION

3.2.1 General

3.2.1.1 Perform work in accordance with NFPA 70.

3.2.1.2 Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

a. Use clamping devices for attaching to structural steel, or, when clamping is impracticable, obtain written permission from KEH to weld, drill, or cut structural members for attachments.

b. Fasten equipment to concrete or masonry with expansion anchors.

c. Attach to drywall by screws into studs, and to metal wall panels by weld studs, bolts, or self-tapping metal screws.

d. Locate equipment, boxes, and conduit approximately where shown in relation to equipment served.

e. Do not install conduit raceways and boxes in positions that interfere with work done by other trades.

f. Identify components with nameplates bearing legends shown on the Drawings.

g. Attach nameplates on or near equipment, with clear RTV silicone sealant.

3.2.1.3 Use appropriate calibrated special tools when installing devices for which special installation tools are recommended by manufacturers.

3.2.2 Grounding Systems

3.2.2.1 Underground conductors, electrodes, and connections: Install in accordance with the Drawings. Make joints connecting copper and galvanized steel conductors above grade and in dry locations.

3.2.2.2 System and equipment grounding: Ground equipment in accordance with the Drawings and NFPA 70.

3.2.2.3 Static grounding: Ground steel building columns to the grid, as shown on the Drawings. Ground metal siding as noted on the Drawings.

3.2.3 Conduit

3.2.3.1 Use rigid steel or intermediate metal where subject to mechanical damage, or installed in concrete floors and walls, exposed to weather, or 4 feet maximum above floors. Electrical metallic tubing may be used elsewhere, when connecting electrical equipment separated 2 feet maximum, and when entering tops of electrical equipment 4 feet minimum above floors.

3.2.3.2 Install 14-gage galvanized steel pull wire or 1/8-inch polyethylene rope in spare conduits.

3.2.3.3 Install concealed conduits as directly as possible and with bend radii as long as possible. Install exposed conduit parallel with or at right angles to building lines. Where conditions permit, maintain continuous exposed horizontal runs along walls at 9 feet minimum above floor level or grade.

3.2.3.4 Make elbows, offsets, and bends uniform and symmetrical. Bend conduit with approved bending devices.

3.2.3.5 Cut conduit ends square, ream, and remove burrs. Conduit shall be clean, dry, and free of debris. Immediately after installation, plug or cap exposed ends with standard accessories until wires are installed.

3.2.3.6 Use galvanized steel locknuts and insulated bushings for attachment to enclosures except threaded hubs or sealing type locknuts shall be used outdoors or where moisture is present. Threadless fittings will not be permitted for rigid conduit. Use Erickson type couplings where required. Do not use running threads.

3.2.3.7 Use 1-hole clamps equipped with clampbacks, or Unistrut with clamps, to secure conduits.

3.2.3.8 Install without moisture traps wherever possible. Where practicable, provide drain holes in pullboxes or fittings at low points in raceway systems and remove burrs from drilled holes.

3.2.3.9 Flexible conduit:

a. Use to make connections to motors and other equipment subject to vibration. Use liquidtight flexible metal conduit where conduit and fittings are installed outdoors or exposed to moisture or chemical fumes indoors.

b. Use in 4 foot maximum lengths for other equipment, with approval of KEH.

3.2.3.10 Set up joints in conduit installed in concrete, underground, or exposed to weather, with high temperature, antiseize, conductive thread lubricant and sealant.

3.2.3.11 Install exposed conduit stubbing up through floor slab straight and plumb, lined up, and uniformly spaced. Install at sufficient depth below slab to eliminate part of bend above top of slab. Cap or plug stub-up before placing concrete. Verify stub-up locations with final equipment arrangements.

3.2.3.12 Wrap conduit passing from concrete to air or to direct earth burial with conduit protection tape from 3 inches in concrete to 12 inches minimum in earth, or 3 inches in air, unless conduit is PVC coated.

3.2.3.13 Seal openings around conduit at concrete or block fire walls and floor penetrations. Use fire barrier sealing compound for openings to 1/4-inch maximum, and grout for larger openings. Make seals water-proof, and finish sealant flush with surrounding wall surfaces.

3.2.3.14 Seal openings around conduit at exterior wall penetrations and penetrations of walls which form boundaries between adjoining ventilation zones, using specified sealant. Make seals waterproof, and finish sealant flush with surrounding wall surfaces.

3.2.3.15 Apply duct sealing compound after installation of conductors, at boxes, in conduits that penetrate walls or floors.

3.2.3.16 Where routing is parallel with hot water or steam pipes, maintain 6 inches minimum clearance from pipe covering. Where not run parallel with pipe, it is acceptable to run closer than 6 inches, providing conduit does not touch pipe covering.

3.2.3.17 Install PVC coated conduit in accordance with manufacturer's recommendations. Repair coating, damaged during handling or installation using PVC paint recommended by conduit manufacturer.

3.2.3.18 Field locate conduit core drill penetrations through concrete encasement of new pump chamber and dosing tank. Number and size of

penetrations shall be determined by pump equipment provided. Use 2-inch minimum conduit unless otherwise noted.

3.2.3.19 Install two 2-inch minimum conduits from the dosing chamber control panel into the new pump chamber and dosing tank concrete encasement. Install CGB cable fittings, complete with gland nuts and neoprene bushings (sizes as required), to conduit ends in the tank.

3.2.3.20 Install one conduit from the dosing chamber control panel into the new pump chamber and dosing tank concrete encasement. Install CGB cable fittings, complete with gland nuts and neoprene bushings (sizes as required), to conduit ends in the tank.

3.2.3.21 Install wire mesh cable grips (sizes as required) at CGB cable fittings.

3.2.4 Boxes, Enclosures, and Wiring Devices

3.2.4.1 Install boxes firmly in position and plumb.

3.2.4.2 Install dust covers on junction, pull, and outlet boxes, and other types of wiring outlets at initial installation. Replace with permanent covers or devices after wires are installed.

3.2.5 Conductors

3.2.5.1 Do not bend cables installed in wireways to less than manufacturer's recommended minimum bending radii. Bind power and control circuits separately with nylon cable ties, at 18-inch intervals. Lay cables in wireways in straight parallel lines, and avoid crossing.

3.2.5.2 Identify conductors, by wire numbers shown on the Drawings, with wiremarkers. Attach wiremarkers at termination points within 2 inches of wire terminations. Marker nomenclature shall be visible without moving wires or markers.

3.2.5.3 Paint or pressure-sensitive colored tape may be used for coding conductors instead of colored insulation on No. 8 AWG and larger wire for phase (ungrounded) conductors, and No. 4 AWG and larger wire for neutral conductors and equipment grounding conductors. Maintain phase color coding, in accordance with the following table, for branch and feeder circuits up to and including equipment connections.

Conductor Origin	Conductor	Insulation Color
480Y/277 V, 3-phase systems, transformers, panels, switchboards, etc.	Phase A Phase B Phase C Neutral Equipment ground	Red Yellow Blue White or Gray Green (or bare)

120/240 V, single-phase transformers, panels, switchboards, etc.	Hot Number 1 Hot Number 2 Neutral Equipment ground	Black Brown White or Gray Green (or bare)

3.2.5.4 Use lubricant recommended by the cable manufacturer, or wire pulling compound specified, when pulling wire and cable through conduit.

3.2.5.5 Do not install or handle wires with thermoplastic insulation or jacket when ambient temperature is 15°F or below.

3.2.5.6 Install and mark direct burial cable in accordance with the Drawings.

3.2.6 Splices, Taps, and Cable Terminations

3.2.6.1 Make splices and taps in building wire with solderless connectors specified in 2.2.2. Use connectors in accordance with the manufacturer's instructions.

3.2.6.2 Use plastic insulating tape for uninsulated splices and taps. Apply tape to thickness at least equal to conductor insulation. Where bolted splice or connection presents irregular surface, apply insulating putty to joints before taping.

3.2.6.3 Use crimp-on type ring or spade lugs with turned up legs for wire terminations of stranded conductors to binder screw or stud type terminals. Lugs shall have insulated sleeves.

3.2.7 Motor Operated Equipment: Install wiring to devices which do not appear on the Drawings, but are included in installation shown on the manufacturer's drawings.

3.3 FIELD QUALITY CONTROL

3.3.1 Testing

3.3.1.1 Furnish equipment and instruments required to perform testing, including temporary power from power panel inside ETF Building.

3.3.1.2 Test equipment and wiring for continuity and unintentional grounds, and verify proper phase sequence and voltage at equipment served before attempts are made to operate equipment. Notify KEH before start of tests. Record the results.

3.3.1.3 Motors: Check for correct rotation.

3.3.2 Reconnect devices disconnected during testing.

Project No. C-018H-C9

Project Title

Specification Section 16400

APPROVAL DATA LIST
("X" Indicates Required Data)

1 EPN IDENTIFICATION	2 DESCRIPTION	3 REFERENCE DRAWING	4 SPECIFICATION PARAGRAPH	5 DATA									6 REMARKS
				Dimensional Drawings	Equipment Weights	Specifications	Material Description	Performance Data	Circuit or Control Diagrams	Data Sheets	Illustrative Cuts	Installation Instructions	
	Dosing Chamber Pump Control Panel		2.3.3	X		X			X		X		

C018HC9.SP.2528

16400 - 11

C-100

C-018H-C9
Rev 0

WHC-SD-C018H-ER-007, Rev. 0

KEH 1986.00 (03/89) KEF038

Project No. C-018H-C9

Project Title

Specification Section 16400

VENDOR INFORMATION LIST
("X" Indicates Required Data)

1	2	3	4	5 VENDOR INFORMATION (VI)												
									Instructions							
EPN IDENTIFICATION	DESCRIPTION	REFERENCE DRAWING	SPECIFICATION PARAGRAPH	Dimensional Drawings	Equipment Weights	Specifications	Certified Test Data	Circuit or Control Diagram	Installation	Operation	Maintenance	Spare Parts List	Data Sheets	Illustrative Cuts		
	Dosing Chamber Pump Control Panel		2.3.3						X	X	X	X	X			

END OF SECTION 16400 - 12

APPENDIX D

Drawings

H-2-88756, sh 1	Key Map and Drawing List
H-2-88756, sh 2	Civil - Sewage Disposal System Site Plan
H-2-88757, sh 1	Civil - Sewage Disposal System Sections & Details
H-2-88758, sh 1	Civil - Sewage Disposal System Sections & Details
H-2-88758, sh 2	Civil - Sewage Disposal System Sections & Details
H-2-88759, sh 1	Electrical - Sewage Disposal System One Line Diag. Plan & Detail

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PROJECT TITLE:

C-018H 242A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY

SANITARY WASTEWATER SYSTEM

FOR:

WESTINGHOUSE HANFORD COMPANY

BY:

KAISER ENGINEERS HANFORD

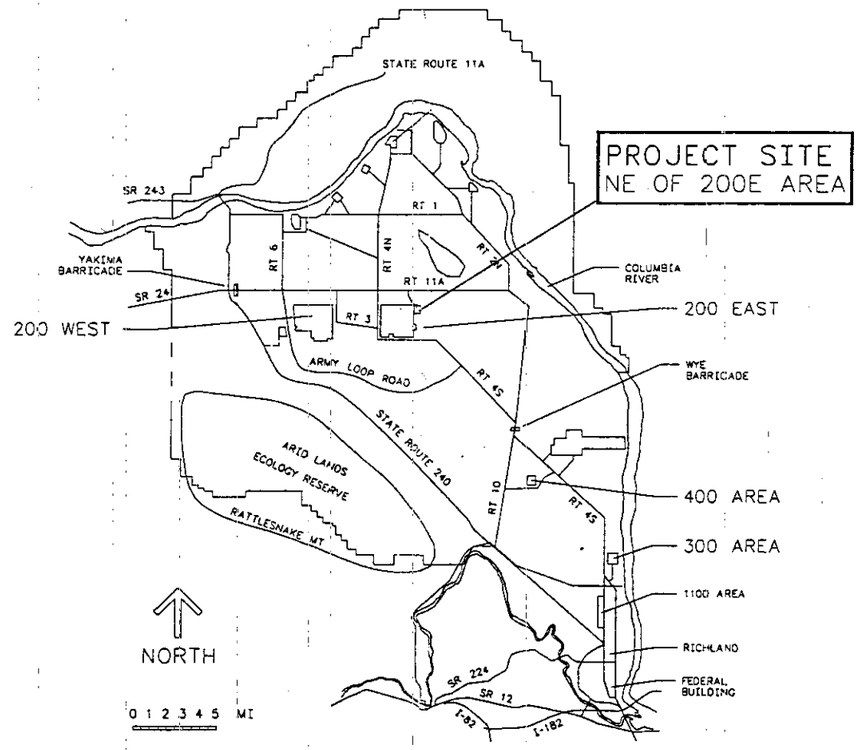
DRAWING LIST

CIVIL

DRAWING NO.	INDEX	TITLE
H-2-88756, 1 OF 2	0101	KEY MAP AND DRAWING LIST
H-2-88756, 2 OF 2	0400	CIVIL SEWAGE DISPOSAL SYSTEM SITE PLAN
H-2-88757	0400	CIVIL SEWAGE DISPOSAL SYSTEM SECTIONS & DETAILS
H-2-88758, 1 OF 2	0400	CIVIL SEWAGE DISPOSAL SYSTEM SECTIONS & DETAILS
H-2-88758, 2 OF 2	0400	CIVIL SEWAGE DISPOSAL SYSTEM SECTIONS & DETAILS

ELECTRICAL

DRAWING NO.	INDEX	TITLE
H-2-88759	7201/7301	ELECTRICAL DISPOSAL SYSTEM ONE-LINE DIAGRAM, PLAN & DETAILS



KEY MAP

2-7-94

U.S. DEPARTMENT OF ENERGY
RICHLAND FIELD OFFICE
KAISER ENGINEERS HANFORD COMPANY

K E Y M A P
A N D
D R A W I N G L I S T

PROJECT C-018H 242A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY

H-2-88756 | 0

SCALE: SHOWN | JOB NO. CR1208 | SHEET 1 OF 2

2 PLOT SCALE: 1=1 | KEHCAD

D-1

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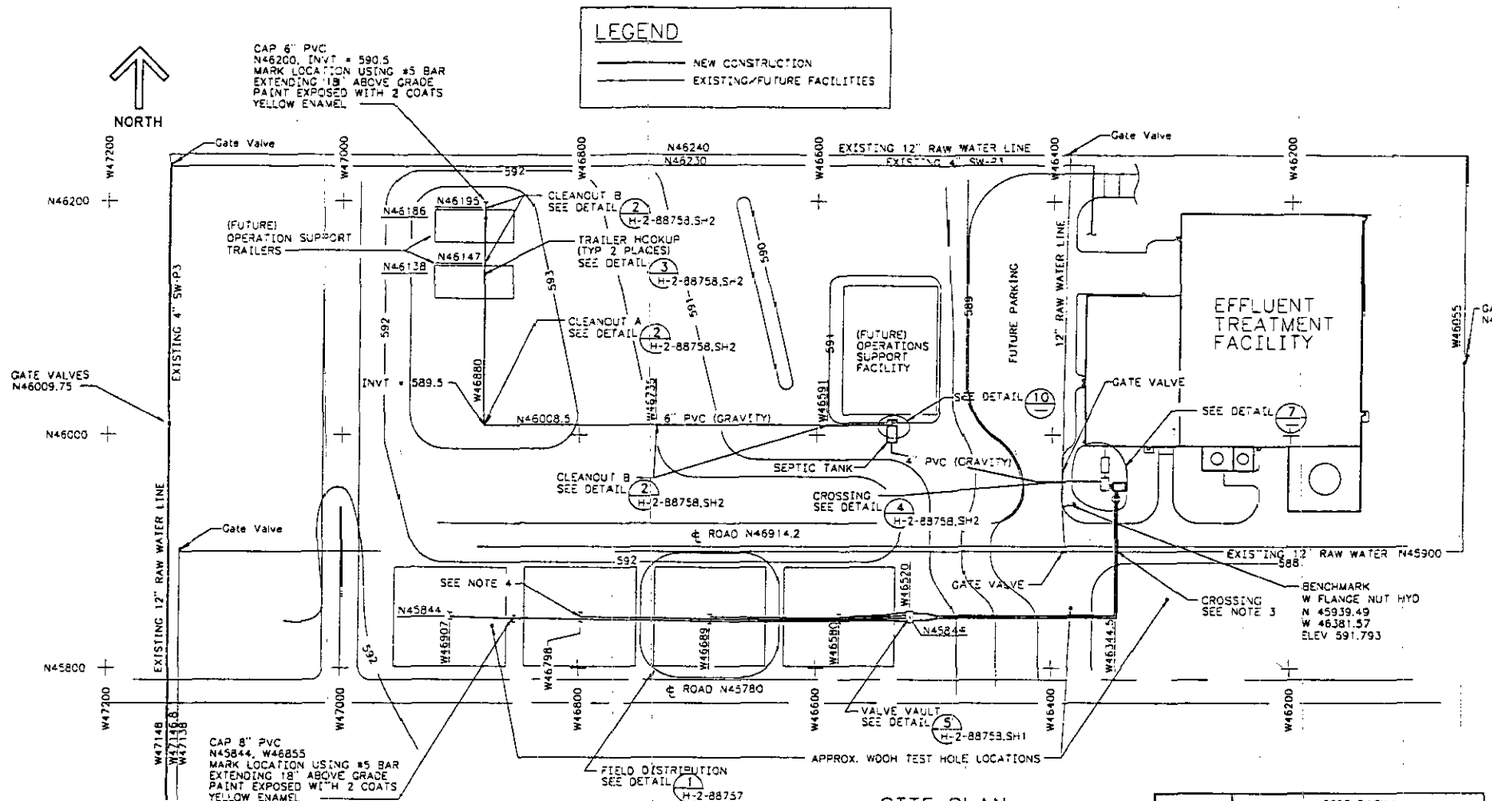

SITE PLAN

0 50 100 150
SCALE IN FEET

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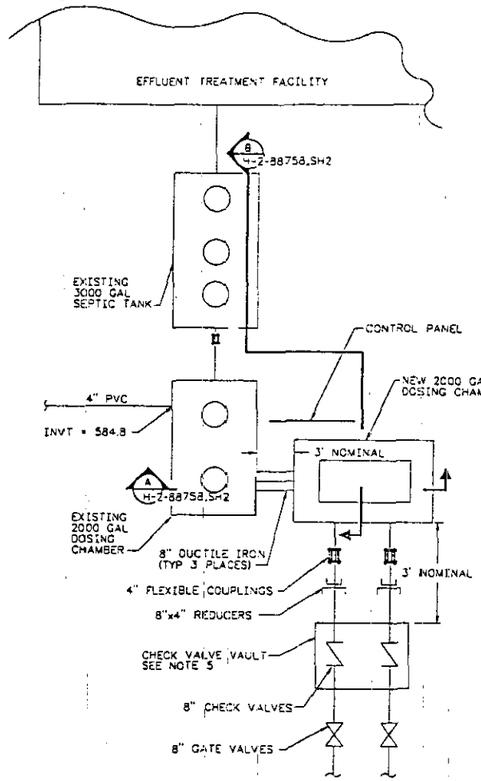
2E-102	45752.29	45686.49	592.32



DETAIL (7)
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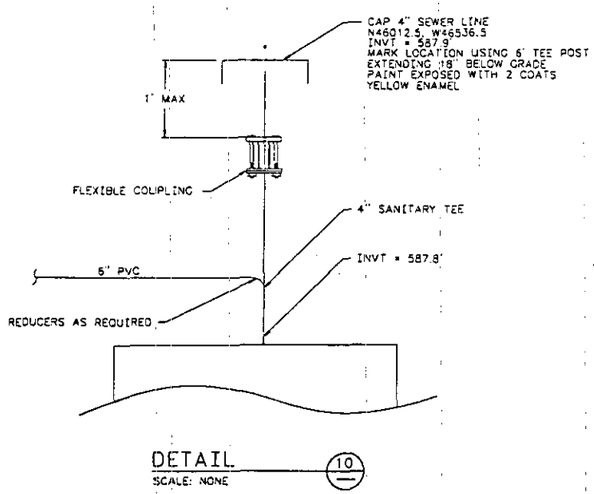

DETAIL (10)
SCALE: NONE

NOTES:

1. SEE DWG H-2-88757 FOR FOR FIELD DETAILS
2. EXCESS EXCAVATED MATERIAL SHALL BE HAULED TO A LOCATION WITHIN 2 MILES, AS DIRECTED BY KEH.
3. SEWER SHALL CROSS BENEATH 12" WATERLINE. CROSSING SHALL CONSIST OF 20 FEET OF DUCTILE IRON PIPE WITH A MINIMUM 24" CLEARANCE FROM TOP OF DUCTILE IRON TO THE BOTTOM OF THE 12" WATERLINE (ELEV = 584.51). D.I. PIPE SHALL BE CENTERED UNDER WATERLINE.
4. ALIGN PIPING TO PLACE TEES ON N45844.
5. LAYOUT IS BASED ON THE USE OF A PRECAST VAULT BY PIPE, INC., #544-LA, WITH A #64-2-232-AL COVER AND EXTENSIONS AS REQUIRED. FOR L.O.D. INSULATION DETAILS, SEE SECTION D, H-2-88758 SHEET 1.

2-7-94
37 69

DESIGNED JD AXFORD DATE 2-7-94 | SAFETY CLASS 3

U.S. DEPARTMENT OF ENERGY
RICHLAND FIELD OFFICE
KAISER ENGINEERS HANFORD COMPANY

CIVIL
SEWAGE DISPOSAL SYSTEM
SITE PLAN

PROJECT C-018H 242A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY

SIZE	DRAWING NO.	REV. NO.
F	H-2-88756	0

SCALE SHOWN | JOB NO. CR1208 | SHEET 2 OF 2

2 PLOT SCALE: 1=50 | KEHCAD

D-2

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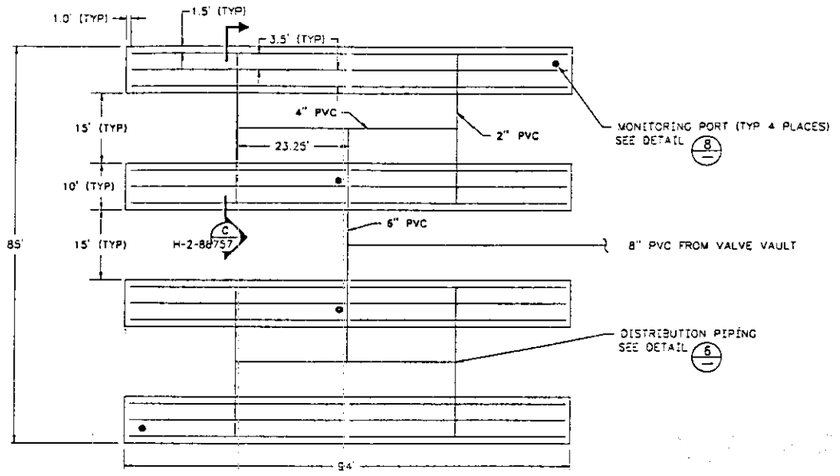

FIELD DISTRIBUTION DETAILS 1
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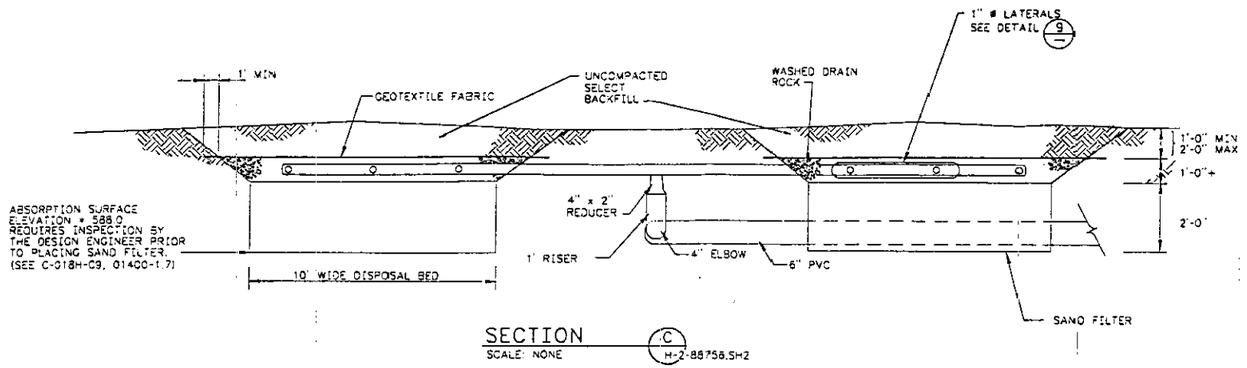
H-2-88756,SH2



SECTION C
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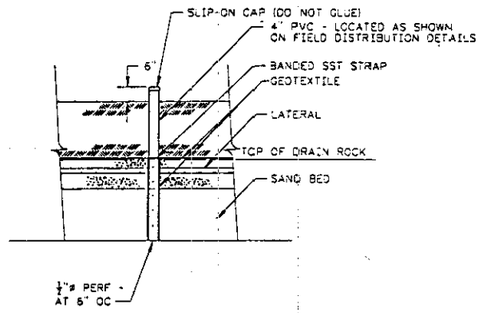
H-2-88758,SH2



MONITORING PORT 8
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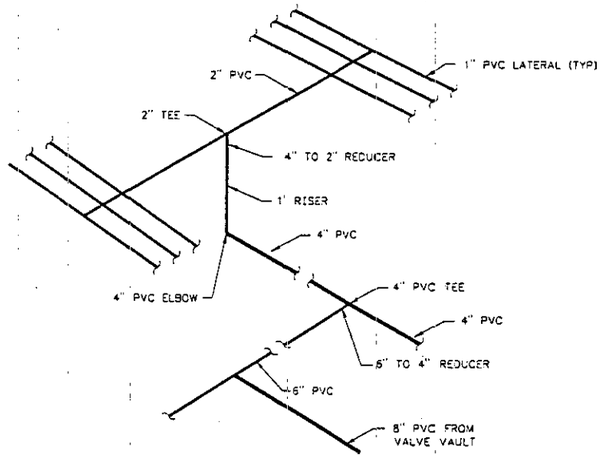

DISTRIBUTION PIPING DETAIL 6
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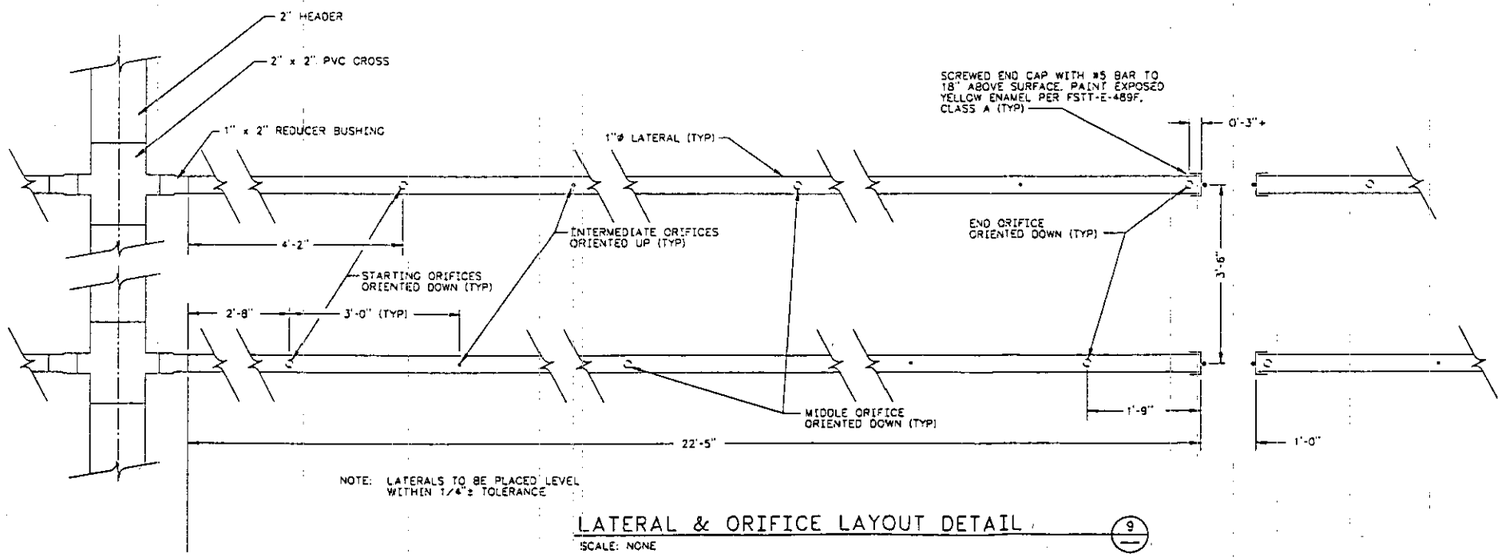

NOTE: LATERALS TO BE PLACED LEVEL WITHIN 1/4"± TOLERANCE

LATERAL & ORIFICE LAYOUT DETAIL 9
SCALE: NONE

DATE 2-7-94
STATION 37 SHEET 69

CHARLES S. MORTIMER
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER
2-3-94

DESIGNED JO AXFORD	SAFETY CLASS 3	DEPARTMENT OF ENERGY RICHLAND FIELD OFFICE KAISER ENGINEERS HANFORD COMPANY	
CIVIL SEWAGE DISPOSAL SYSTEM SECTIONS & DETAILS			
PROJECT C-018H 242A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY			
F 2000	0400	H-2-88757	0
SCALE SHOWN	JOB NO. CR1208	SHEET 1 OF 1	

DESIGN TRACEABILITY LIST | REFERENCES | REVISIONS

2 PLOT SCALE: 1=50 | KEHCAD | D-3

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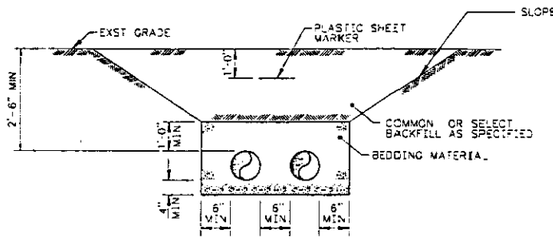

TYP MULTIPLE PIPE TRENCH SECT

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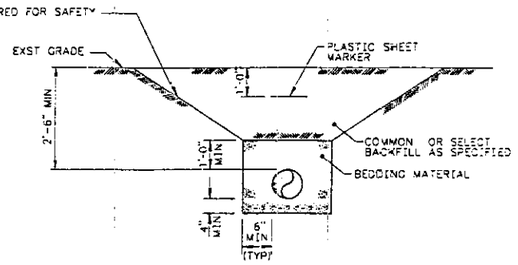

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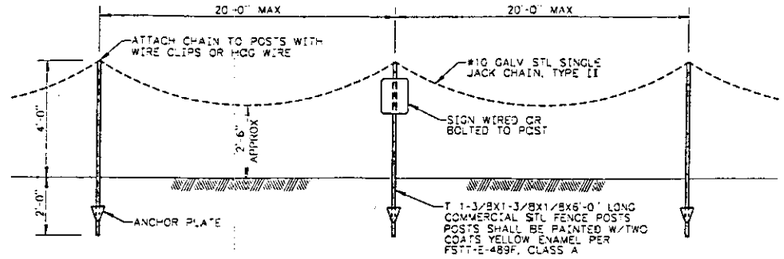

BARRICADE MARKER FENCE

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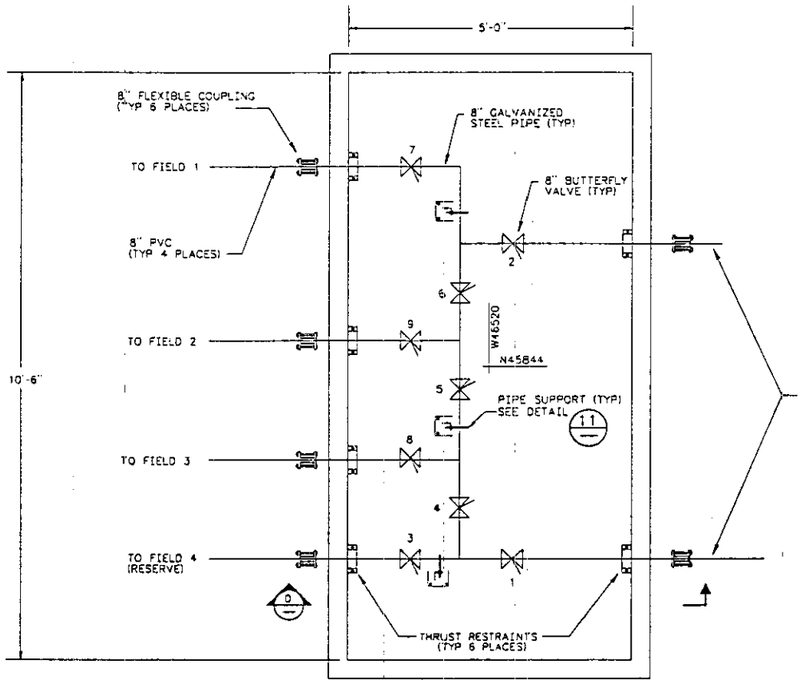
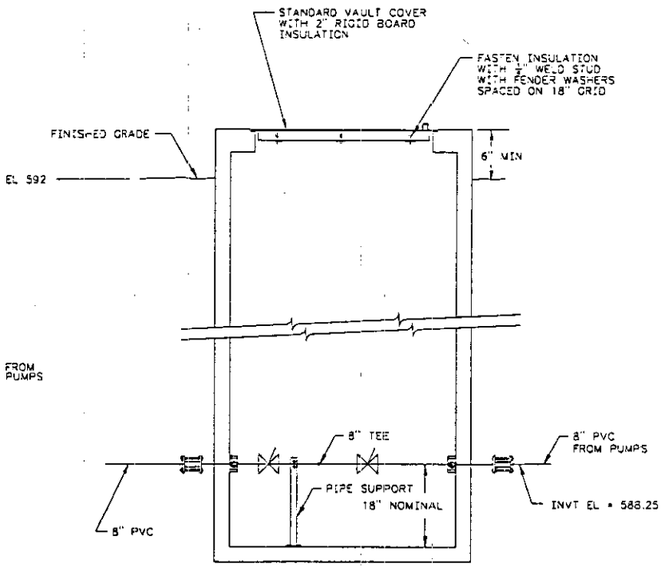


VALVE VAULT SCHEMATIC (5)

SCALE: NONE

H-2-88756,SH2



SECTION (D1)

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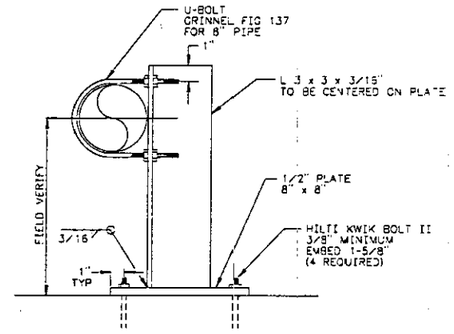

PIPE SUPPORT (11)

SCALE: NONE

NOTES:

1. PHYSICAL ARRANGEMENT WITHIN THE VAULT MAY BE MODIFIED TO ACHIEVE IMPROVED CONSTRUCTIBILITY AND/OR ACCESS, INCLUDING THE SIZE OF THE VAULT.
2. LAYOUT IS BASED ON THE USE OF A PRECAST VAULT BY PIPE,INC. #510620 WITH A #510633 COVER.
3. FLEXIBLE COUPLINGS SHALL BE INSTALLED AS SHOWN WITHIN 1'-6" OF THE VAULT WALL.
4. FASTEN METAL TAGS TO EACH VALVE WITH THE VALVE NUMBER ENGRAVED ON THE TAG.

REGISTERED PROFESSIONAL ENGINEER
DATE 2-7-94
STATE OF WASHINGTON 37 CHARLES E. MORTIMER 69

CHARLES E. MORTIMER STATE OF WASHINGTON 21966 REGISTERED PROFESSIONAL ENGINEER

DESIGNED	JD AXFORD	SAFETY CLASS	3
DRAWN			
CHECKED			
SAFETY			
APPROVED			
RELEASED			
FOR	WHC		

U.S. DEPARTMENT OF ENERGY
RICHLAND FIELD OFFICE
KAISER ENGINEERS HANFORD COMPANY

CIVIL
SEWAGE DISPOSAL SYSTEM
SECTIONS & DETAILS

PROJECT C-018H 242A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY

SIZE	DRAWING NO.	REV NO.
F	H-2-88758	0

SCALE: SHOWN | LAST CHANGED: ER 1208 | SHEET 1 OF 2

2 PLOT SCALE: 1=50 | KEHCAD

D-4

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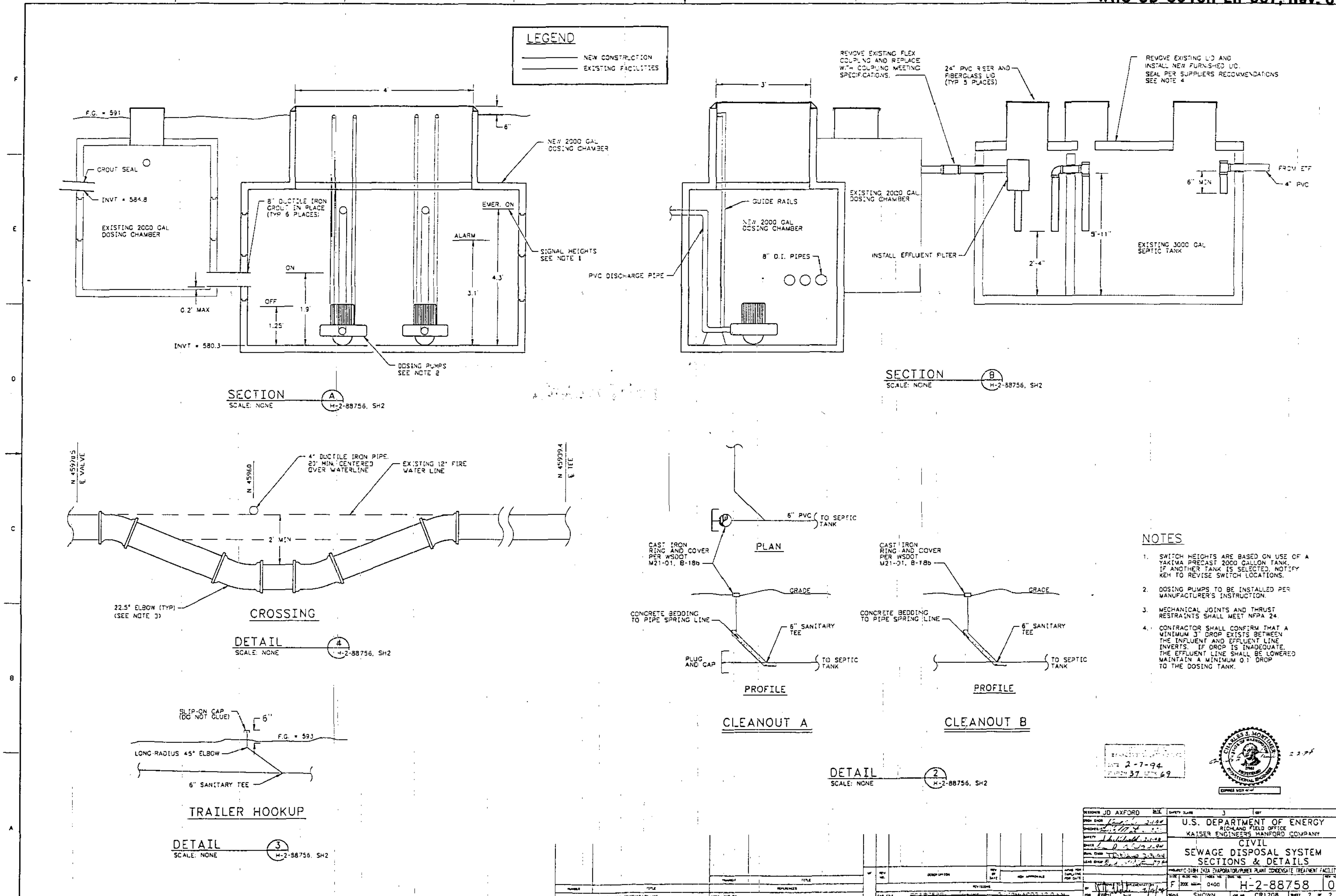

LEGEND
NEW CONSTRUCTION
EXISTING FACILITIES
F.G. = 591
GROUT SEAL
INVT = 584.8
EXISTING 2000 GAL DOSING CHAMBER
0.2' MAX
INVT = 580.3
4'
6"
NEW 2000 GAL DOSING CHAMBER
8" DUCTILE IRON GROUT IN PLACE (TYP 6 PLACES)
EMER. ON
ALARM
ON
OFF
1.25'
1.9'
3.1'
4.3'
SIGNAL HEIGHTS SEE NOTE 1
DOSING PUMPS SEE NOTE 2
SECTION A
SCALE: NONE
H-2-88756, SH2
3'
GUIDE RAILS
NEW 2000 GAL DOSING CHAMBER
8" D.I. PIPES
PVC DISCHARGE PIPE
EXISTING 2000 GAL DOSING CHAMBER
REMOVE EXISTING FLEX COUPLING AND REPLACE WITH COUPLING MEETING SPECIFICATIONS.
24" PVC RISER AND FIBERGLASS LID (TYP 5 PLACES)
REMOVE EXISTING LID AND INSTALL NEW FURNISHED LID. SEAL PER SUPPLIERS RECOMMENDATIONS SEE NOTE 4
INSTALL EFFLUENT FILTER
EXISTING 3000 GAL SEPTIC TANK
FROM ETF
4" PVC
6" MIN
5'-11"
2'-4"
SECTION B
SCALE: NONE
H-2-88756, SH2
N 459785 ℄ VALVE
N 45960
N 459934
4" DUCTILE IRON PIPE. 20' MIN. CENTERED OVER WATERLINE
EXISTING 12" FIRE WATER LINE
2' MIN
22.5° ELBOW (TYP) (SEE NOTE 3)
CROSSING
DETAIL 4
SCALE: NONE
H-2-88756, SH2
6" PVC TO SEPTIC TANK
PLAN
CAST IRON RING AND COVER PER WSDOT M21-01, B-18b
GRADE
CONCRETE BEDDING TO PIPE SPRING LINE
6" SANITARY TEE
PLUG AND CAP
TO SEPTIC TANK
PROFILE
CLEANOUT A
CLEANOUT B
DETAIL 2
SCALE: NONE
H-2-88756, SH2
SLIP-ON CAP (DO NOT GLUE)
6"
F.G. = 593
LONG-RADIUS 45° ELBOW
6" SANITARY TEE
TRAILER HOOKUP
DETAIL 3
SCALE: NONE
H-2-88756, SH2
NOTES
1. SWITCH HEIGHTS ARE BASED ON USE OF A YAKIMA PRECAST 2000 GALLON TANK. IF ANOTHER TANK IS SELECTED, NOTIFY KEH TO REVISE SWITCH LOCATIONS.
2. DOSING PUMPS TO BE INSTALLED PER MANUFACTURER'S INSTRUCTION.
3. MECHANICAL JOINTS AND THRUST RESTRAINTS SHALL MEET NFPA 24.
4. CONTRACTOR SHALL CONFIRM THAT A MINIMUM 3" DROP EXISTS BETWEEN THE INFLUENT AND EFFLUENT LINE INVERTS. IF DROP IS INADEQUATE, THE EFFLUENT LINE SHALL BE LOWERED MAINTAIN A MINIMUM 0.1' DROP TO THE DOSING TANK.
2-7-94
JD AXFORD
U.S. DEPARTMENT OF ENERGY
RICHLAND FIELD OFFICE
KAISER ENGINEERS HANFORD COMPANY
CIVIL
SEWAGE DISPOSAL SYSTEM
SECTIONS & DETAILS
C-018H 242A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY
F
H-2-88758
0
SHOWN
CR1208
2 OF 2
PLOT SCALE: 1=1
KEHCAD

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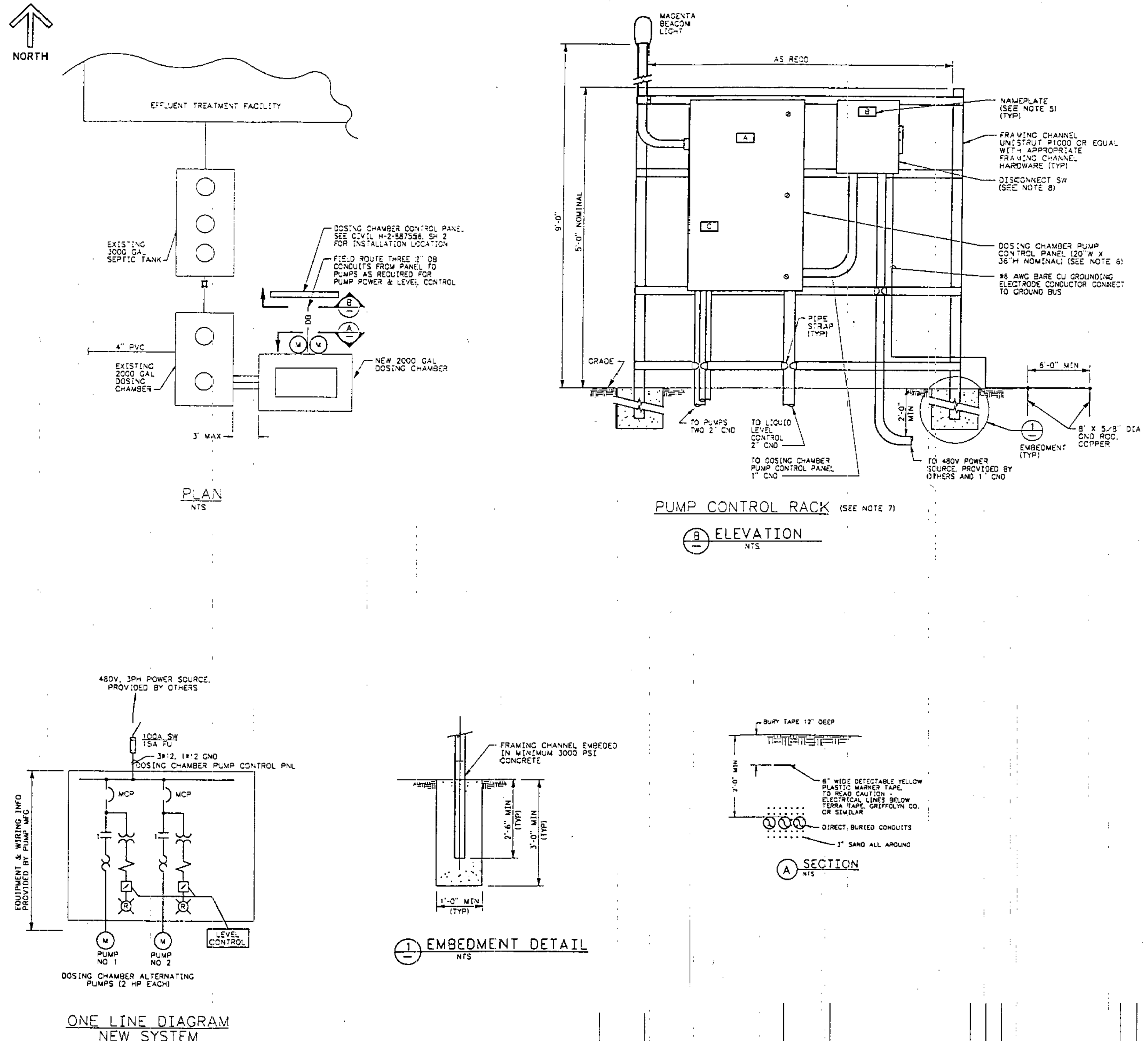

SYMBOL LIST

SYMBOL	DESCRIPTION
—DB—	DIRECT BURIED CONDUIT (PVC COATED RIGID STEEL)
(M)	PUMP MOTOR

NAMEPLATE LEGEND

NAMEPLATE	ENGRAVING
A	DOSING CHAMBER PUMP CONTROL PANEL
B	DOSING CHAMBER PUMP CONTROL SERVICE DISCONNECT
C	IF BEACON IS FLASHING AND AUDIBLE WARING DEVICE IS SOUNDING, CALL MAINTENANCE ENGINEERING

NOTES:

1. WORK AND MATERIAL SHALL CONFORM WITH THE CONSTRUCTION SPECIFICATION UNLESS OTHERWISE NOTED.
2. ABRREVIATIONS AS PER ASME Y1.1-1989.
3. FOR SYMBOLS NOT SHOWN SEE DWG H-7-1275.
4. ALL CONDUITS SHALL CONTAIN A GREEN INSULATED EQUIPMENT GROUNDING CONDUCTOR SIZED PER NATIONAL ELECTRIC CODE.
5. PROVIDE AND INSTALL NAMEPLATES, SIZE AS REQUIRED, ENGRAVED WITH 1/4" MIN HIGH LETTERS AS SHOWN ON NAMEPLATE LEGEND.
6. THE DOSING CHAMBER PUMP CONTROL PANEL, INCLUDING CONTROLS AND LOCAL ALARM COMPONENTS AND NEW PUMPS, INCLUDING POWER AND CONTROL CABLE, AND SYSTEM WIRING DIAGRAMS ARE PROVIDED BY PUMP EQUIPMENT SUPPLIER.
7. THE FINAL LOCATION OF CONTROLS, SWITCHES, ALARM, INDICATOR LIGHTS, RECEPTACLES, ETC, SHALL BE FIELD DETERMINED.
8. PROVIDE AND INSTALL (1) 480 VA, 3 POLE, 3 WIRE, 100A SWITCH, 15A FUSES, FUSIBLE, LOCKABLE, NEMA TYPE 3R SAFETY SWITCH, SUITABLE FOR USE AS SERVICE EQUIPMENT.

DATE 2-7-94
STATION 37 CLERK 69

DESIGNER H TRAN/G MCKEE

U.S. DEPARTMENT OF ENERGY
RICHLAND FIELD OFFICE
KAISER ENGINEERS HANFORD COMPANY

ELECTRICAL
SEWAGE DISPOSAL SYSTEM
ONE LINE DIAG, PLAN & DETAIL

PROJECT C-018H 242A EVAPORATOR/PUREX PLANT CONDENSATE TREATMENT FACILITY

SIZE	BLDG NO.	INDEX NO.	DWG NO.	REV NO.
F	200E	7301	H-2-88759	0

SCALE NONE | JOB NO. CR1208 | SHEET 1 OF 1

CAD FILE 8088759A | 2J-DEC-AC02:11:0:NN

2 PLOT SCALE: 1=1 | KEHCAD

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