GW - 355

PERMITS, RENEWALS, & MODS Application

ACKNOWLEDGEMENT OF RECEIPT
OF CHECK/CASH

I hereby acknowledge receipt of check No. _____ dated 8/17/10

or cash received on _____ in the amount of $ 3600 00

from Transwestern Pipeline Co.

for GW-355

Submitted by: Lawrence Zonelo Date: 8/23/10

Submitted to ASD by: Laurence Romero Date: 8/23/10

Received in ASD by: _____ Date: _____

Filing Fee _____ New Facility _____ Renewal _____

Modification _____ Other _____

Organization Code 521.07 Applicable FY 2010

To be deposited in the Water Quality Management Fund.

Full Payment _____ or Annual Increment _____

Attachments-1
xc: OCD District Office

ATTACHMENT

DISCHARGE PERMIT

APPROVAL CONDITIONS

1. **Payment of Discharge Plan Fees:** All discharge permits are subject to WQCC Regulations. Every billable facility that submits a discharge permit application will be assessed a filing fee of $100.00, plus a flat fee (*see* WQCC Regulation 20.6.2.3114 NMAC). The Oil Conservation Division ("OCD") has received the required $100.00 filing fee. The flat fee for an abatement of ground water and vadose zone contamination at oil and gas sites is $2,600.00. Please submit this amount with a signed copy of the permit and return to the OCD within 30 days. Checks should be made out to the New Mexico Water Quality Management Fund.

2. **Permit Expiration, Renewal Conditions and Penalties:** Pursuant to WQCC Regulation 20.6.2.3109.H.4 NMAC, this permit is valid for a period of five years. **The permit will expire on October 15, 2014** and an application for renewal should be submitted no later than 120 days before that expiration date. Pursuant to WQCC Regulation 20.6.2.3106.F NMAC, if a discharger submits a discharge permit renewal application at least 120 days before the discharge permit expires and is in compliance with the approved permit, then the existing discharge permit will not expire until the application for renewal has been approved or disapproved. ***Expired permits are a violation of the Water Quality Act {Chapter 74, Article 6, NMSA 1978} and civil penalties may be assessed accordingly.***

3. **Permit Terms and Conditions:** Pursuant to WQCC Regulation 20.6.2.3104 NMAC, when a permit has been issued, the owner/operator must ensure that all discharges shall be consistent with the terms and conditions of the permit. In addition, all facilities shall abide by the applicable rules and regulations administered by the OCD pursuant to the Oil and Gas Act, NMSA 1978, Sections 70-2-1 through 70-2-38.

4. **Owner/Operator Commitments:** The owner/operator shall abide by all commitments submitted in its June, 2009 discharge plan application, including attachments and subsequent amendments and these conditions for approval. Permit applications that reference previously approved plans on file with the division shall be incorporated in this permit and the owner/operator shall abide by all previous commitments of such plans and these conditions for approval.

5. **Modifications:** WQCC Regulation 20.6.2.3107.C and 20.6.2.3109 NMAC addresses possible future modifications of a permit. The owner/operator (discharger) shall notify the OCD of any facility expansion, production increase or process modification that would result in any significant modification in the discharge of water contaminants. The Division Director may require a permit modification if any water quality standard specified at 20.6.2.3103 NMAC is being or will be exceeded, or if a toxic pollutant as defined in WQCC Regulation 20.6.2.7 NMAC is present in ground water at any place of withdrawal for present or reasonably foreseeable future use, or that the Water Quality Standards for Interstate and Intrastate streams as specified in 20.6.4 NMAC are being or may be violated in surface water in New Mexico.

6. **Waste Disposal and Storage:** The owner/operator shall dispose of all wastes at an OCD-approved facility. Only oil field RCRA-exempt wastes may be disposed of by injection in a Class II well. RCRA non-hazardous, non-exempt oil field wastes may be disposed of at an OCD-approved facility upon proper waste determination pursuant to 40 CFR Part 261. Any waste stream that is not listed in the discharge permit application must be approved by the OCD on a case-by-case basis.

A. **OCD Part 35 Waste:** Pursuant to OCD Part 35 (19.15.35.8 NMAC) disposal of certain non-domestic waste without notification to the OCD is allowed at NMED permitted solid waste facilities if the waste stream has been identified in the discharge permit and existing process knowledge of the waste stream does not change.

B. **Waste Storage:** The owner/operator shall store all waste in an impermeable bermed area, except waste generated during emergency response operations for up to 72 hours. All waste storage areas shall be identified in the discharge permit application. Any waste storage area not identified in the permit shall be approved on a case-by-case basis only. The owner/operator shall not store oil field waste on-site for more than 180 days unless approved by the OCD.

7. **Drum Storage:** The owner/operator must store all drums, including empty drums, containing materials other than fresh water on an impermeable pad with curbing. The owner/operator must store empty drums on their sides with the bungs in place and lined up on a horizontal plane. The owner/operator must store chemicals in other containers, such as tote tanks, sacks, or buckets on an impermeable pad with curbing.

8. **Process, Maintenance and Yard Areas:** The owner/operator shall either pave and curb or have some type of spill collection device incorporated into the design at all process, maintenance, and yard areas which show evidence that water contaminants from releases, leaks and spills have reached the ground surface.

9. **Above Ground Tanks:** The owner/operator shall ensure that all aboveground tanks have impermeable secondary containment (e.g., liners and berms), which will contain a volume of at least one-third greater than the total volume of the largest tank or all interconnected tanks. The owner/operator shall retrofit all existing tanks before discharge permit renewal. Tanks that contain fresh water or fluids that are gases at atmospheric temperature and pressure are exempt from this condition.

10. **Labeling:** The owner/operator shall clearly label all tanks, drums, and containers to identify their contents and other emergency notification information. The owner/operator may use a tank code numbering system, which is incorporated into their emergency response plans.

11. **Below-Grade Tanks/Sumps and Pits/Ponds.**

A. All below-grade tanks and sumps must be approved by the OCD prior to installation and must incorporate secondary containment with leak detection into the design. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal. All existing below-grade tanks and sumps without secondary containment and leak detection must be tested annually or as specified herein. Systems that have

secondary containment with leak detection shall have a monthly inspection of the leak detection system to determine if the primary containment is leaking. Small sumps or depressions in secondary containment systems used to facilitate fluid removal are exempt from these requirements if fluids are removed within 72 hours.

B. All pits and ponds, including modifications and retrofits, shall be designed by a certified registered professional engineer and approved by the OCD prior to installation. In general, all pits or ponds shall have approved hydrologic and geologic reports, location, foundation, liners, and secondary containment with leak detection, monitoring and closure plans. All pits or ponds shall be designed, constructed and operated so as to contain liquids and solids in a manner that will protect fresh water, public health, safety and the environment for the foreseeable future. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal.

C. The owner/operator shall ensure that all exposed pits, including lined pits and open top tanks (8 feet in diameter or larger) shall be fenced, screened, netted, or otherwise rendered non-hazardous to wildlife, including migratory birds.

D. The owner/operator shall maintain the results of tests and inspections at the facility covered by this discharge permit and available for OCD inspection. The owner/operator shall report the discovery of any system which is found to be leaking or has lost integrity to the OCD within 15 days. The owner/operator may propose various methods for testing such as pressure testing to 3 pounds per square inch greater than normal operating pressure and/or visual inspection of cleaned tanks and/or sumps, or other OCD-approved methods. The owner/operator shall notify the OCD at least 72 hours prior to all testing.

12. Underground Process/Wastewater Lines:

A. The owner/operator shall test all underground process/wastewater pipelines at least once every five (5) years to demonstrate their mechanical integrity, except lines containing fresh water or fluids that are gases at atmospheric temperature and pressure. Pressure rated pipe shall be tested by pressuring up to one and one-half times the normal operating pressure, if possible, or for atmospheric drain systems, to 3 pounds per square inch greater than normal operating pressure, and pressure held for a minimum of 30 minutes with no more than a 1% loss/gain in pressure. The owner/operator may use other methods for testing if approved by the OCD.

B. The owner/operator shall maintain underground process and wastewater pipeline schematic diagrams or plans showing all drains, vents, risers, valves, underground piping, pipe type, rating, size, and approximate location. All new underground piping must be approved by the OCD prior to installation. The owner/operator shall report any leaks or loss of integrity to the OCD within 15 days of discovery. The owner/operator shall maintain the results of all tests at the facility covered by this discharge permit and they shall be available for OCD inspection. The owner/operator shall notify the OCD at least 72 hours prior to all testing.

13. Class V Wells: The owner/operator shall close all Class V wells (e.g., septic systems, leach fields, dry wells, etc.) that inject non-hazardous industrial wastes or a mixture of industrial wastes and domestic wastes unless it can be demonstrated that ground water will not be impacted in the reasonably foreseeable future. Leach fields and other wastewater disposal systems at OCD-

regulated facilities that inject non-hazardous fluid into or above an underground source of drinking water are considered Class V injection wells under the EPA UIC program. Class V wells that inject domestic waste only, must be permitted by the New Mexico Environment Department (NMED).

14. Housekeeping: The owner/operator shall inspect all systems designed for spill collection/prevention and leak detection at least monthly to ensure proper operation and to prevent over topping or system failure. All spill collection and/or secondary containment devices shall be emptied of fluids within 72 hours of discovery. The owner/operator shall maintain all records at the facility and available for OCD inspection.

15. Spill Reporting: The owner/operator shall report all unauthorized discharges, spills, leaks and releases and conduct corrective action pursuant to WQCC Regulation 20.6.2.1203 NMAC and OCD Part 29 (19.15.29 NMAC). The owner/operator shall notify both the OCD District Office and the Santa Fe Office within 24 hours and file a written report within 15 days. The OCD does not consider covering contaminated areas a remediation of the spill/release.

16. OCD Inspections: The OCD will perform an inspection of this facility. A separate report shall be submitted of any findings in reference to the discharge plan permit.

17. Storm Water: The owner/operator shall implement and maintain run-on and runoff plans and controls. The owner/operator shall not discharge any water contaminant that exceeds the WQCC standards specified in 20.6.2.3101 NMAC or 20.6.4 NMAC (Water Quality Standards for Interstate and Intrastate Streams) including any oil sheen in any stormwater run-off. The owner/operator shall notify the OCD within 24 hours of discovery of any releases and shall take immediate corrective action(s) to stop the discharge.

18. Unauthorized Discharges: The owner/operator shall not allow or cause water pollution, discharge or release of any water contaminant that exceeds the WQCC standards listed in 20.6.2.3101 NMAC or 20.6.4 NMAC (Water Quality Standards for Interstate and Intrastate Streams) unless specifically listed in the permit application and approved herein. ***An unauthorized discharge is a violation of this permit.***

19. Vadose Zone and Water Pollution: The owner/operator shall address any contamination through the discharge permit process or pursuant to WQCC 20.6.2.4000-.4116 NMAC (Prevention and Abatement of Water Pollution). The OCD may require the owner/operator to modify its permit for investigation, remediation, abatement, and monitoring requirements for any vadose zone or water pollution. Failure to perform any required investigation, remediation, abatement and submit subsequent reports will be a violation of the permit.

20. Additional Site Specific Conditions:

Sampling: Groundwater from the monitor wells currently existing at the site and any future monitor wells will be sampled semi-annually. The sampling will not be done on any monitor wells in which there is accumulated PSH in the casing. A lab will analyze these samples for BTEX (EPA Method 8021), inorganic constituents (EPA Method 6010), total dissolved solids (EPA Method 160.1) and chlorides (EPA Method 325.2)

Soil Vapor Extraction: The system described in the plan application will continue. Discontinuance of this activity will be done only upon the approval of the OCD.

Reporting: Annual reports on the progress of the remediation will be filed with the OCD for the duration of the remediation activities. These reports will follow the format of the annual report, dated August 10, 2004 already received by the OCD. Such reports are due within six months after the close of the previous reporting year.

Closure: The remediation activity at this site will be continued until it can be shown that the site poses no further threat to human health and the environment.

21. Transfer of Discharge Permit (WQCC 20.6.2.3111) Prior to any transfer of ownership, control, or possession (whether by lease, conveyance or otherwise) of a facility with a discharge permit, the transferor shall notify the transferee in writing of the existence of the discharge permit, and shall deliver or send by certified mail to the department a copy of such written notification, together with a certification or other proof that such notification has in fact been received by the transferee.

Upon receipt of such notification, the transferee shall have the duty to inquire into all of the provisions and requirements contained in such discharge permit, and the transferee shall be charged with notice of all such provisions and requirements as they appear of record in the department's file or files concerning such discharge permit. The transferee (new owner/operator) shall sign and return an original copy of these permit conditions and provide a written commitment to comply with the terms and conditions of the previously approved discharge permit.

22. Closure Plan and Financial Assurance: Pursuant to 20.6.2.3107 NMAC an owner/operator shall notify the OCD when any operations of the facility are to be discontinued for a period in excess of six months. Prior to closure, or as a condition of this permit, or request from the OCD, the operator will submit an approved closure plan, modified plan, and/or provide adequate financial assurance.

23. Certification: (Owner/Operator), by the officer whose signature appears below, accepts this permit and agrees to comply with all submitted commitments, including these terms and conditions contained here. **Owner/Operator** further acknowledges that the OCD may, for good cause shown, as necessary to protect fresh water, public health, safety, and the environment, change the conditions and requirements of this permit administratively

Conditions accepted by: "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment."

TRANSWESTERN PIPELINE COMPANY
Company Name-print name above

LARRY CAMPBELL
Company Representative- print name

Larry Campbell
Company Representative- Signature

Title Sr. Environ. Specialist

Date: 8-18-2010

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor
Jon Goldstein
Cabinet Secretary
Jim Noel
Deputy Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

June 30, 2010

Mr. Larry Campbell
Transwestern Pipeline Company
P.O. Box 1717
Roswell, N.M. 88202-1717

Re: Renewal Discharge Permit, GW-355
Bell Lake Remediation Site
SW/4 NE/4 Section 1, Township 24 South, Range 33 East, NMPM,
Lea County, New Mexico

Dear Mr. Campbell:

Pursuant to Water Quality Control Commission (WQCC) Regulations 20.6.2.3104 - 20.6.2.3114 NMAC, the Oil Conservation Division (OCD) hereby approves the **Transwestern Pipeline Company** discharge permit for the above referenced site contingent upon the conditions specified in the enclosed **Attachment to the Discharge Permit**. Enclosed are two copies of the conditions of approval. **Please sign and return one copy to the New Mexico Oil Conservation Division (OCD) Santa Fe Office within 30 days of receipt of this letter including permit fees.**

Please be advised that approval of this permit does not relieve the owner/operator of responsibility should operations result in pollution of surface water, ground water or the environment. Nor does approval of the permit relieve the owner/operator of its responsibility to comply with any other applicable governmental authority's rules and regulations.

If you have any questions, please contact Leonard Lowe of my staff at (505-476-3492) or E-mail leonard.lowe@state.nm.us. On behalf of the staff of the OCD, I wish to thank you and your staff for your cooperation during this discharge permit review.

Sincerely,

Glenn von Gonten
Acting Environmental Bureau Chief

Attachments-1
xc: OCD District Office

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21. Transfer of Discharge Permit (WQCC 20.6.2.3111) Prior to any transfer of ownership, control, or possession (whether by lease, conveyance or otherwise) of a facility with a discharge permit, the transferor shall notify the transferee in writing of the existence of the discharge permit, and shall deliver or send by certified mail to the department a copy of such written notification, together with a certification or other proof that such notification has in fact been received by the transferee.

Upon receipt of such notification, the transferee shall have the duty to inquire into all of the provisions and requirements contained in such discharge permit, and the transferee shall be charged with notice of all such provisions and requirements as they appear of record in the department's file or files concerning such discharge permit. The transferee (new owner/operator) shall sign and return an original copy of these permit conditions and provide a written commitment to comply with the terms and conditions of the previously approved discharge permit.

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23. Certification: (Owner/Operator), by the officer whose signature appears below, accepts this permit and agrees to comply with all submitted commitments, including these terms and conditions contained here. **Owner/Operator** further acknowledges that the OCD may, for good cause shown, as necessary to protect fresh water, public health, safety, and the environment, change the conditions and requirements of this permit administratively

Conditions accepted by: "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment."

_____
Company Name-print name above

_____
Company Representative- print name

_____
Company Representative- Signature

Title_____

Date:_____

Lowe, Leonard, EMNRD

From: Lowe, Leonard, EMNRD
Sent: Friday, July 31, 2009 11:25 AM
To: 'Campbell, Lawrence (Larry)'; VonGonten, Glenn, EMNRD
Cc: george.robinson@cypressinc.us; Spell, Richard
Subject: GW-355, TWP Bell Lake Remediation Site
Attachments: GW-355 Admin Complete Letter.pdf; GW-355 OCD PN.pdf; GW-355 Renewal Draft Permit.pdf

Mr. Campbell,

The OCD has determined your discharge permit application to be administratively complete.

Attached are documentation supporting this.

Your public notice is 99% complete. I would ask that you add Mr. Glenn von Gonten, Phone number 505-476-3488, next to my name in the last paragraph. Once added then you can publish.

Thank you,

llowe

Leonard Lowe
Environmental Engineer
Oil Conservation Division/EMNRD
1220 S. St. Francis Drive
Santa Fe, N.M. 87505
Office: 505-476-3492
Fax: 505-476-3462
E-mail: leonard.lowe@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor
Joanna Prukop
Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

July 31, 2009

Dear Mr. Campbell:

Re: Discharge Plan Renewal Permit GW-355
Transwestern Pipeline Company
Bell Lake Remediation site
Lea County, New Mexico

The New Mexico Oil Conservation Division (NMOCD) has received Transwestern Pipeline Company's request and initial fee, dated June 15, 2009, to renew GW-355 for their Bell Lake remediation project located in the SW/4 NE/4 of Section 1, Township 24 South, Range 33 East, NMPM, Lea County, New Mexico. The initial submittal provided the required information in order to deem the application "administratively" complete.

Therefore, the New Mexico Water Quality Control Commission regulations (WQCC) notice requirements of 20.6.2.3108 NMAC must be satisfied and demonstrated to the NMOCD. NMOCD will provide public notice pursuant to the WQCC notice requirements of 20.6.2.3108 NMAC to determine if there is any public interest.

If there are any questions regarding this matter, please do not hesitate to contact me at (505) 476-3492 or leonard.lowe@state.nm.us. On behalf of the staff of the NMOCD, I wish to thank you and your staff for your cooperation during this discharge permit review.

Sincerely,

Leonard Lowe
Environmental Engineer

LRL/lrl

xc: OCD District I Office, Hobbs

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor
Joanna Prukop
Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

July 31, 2009

Mr. Larry Campbell
Transwestern Pipeline Company
P.O. Box 1717
Roswell, N.M. 88202-1717

Re: Renewal Discharge Permit, GW-355
Bell Lake Remediation Site
SW/4 NE/4 Section 1, Township 24 South, Range 33 East, NMPM,
Lea County, New Mexico

Dear Mr. Campbell:

Pursuant to Water Quality Control Commission (WQCC) Regulations 20.6.2.3104 - 20.6.2.3114 NMAC, the Oil Conservation Division (OCD) hereby approves the **Transwestern Pipeline Company** discharge permit for the above referenced site contingent upon the conditions specified in the enclosed **Attachment to the Discharge Permit**. Enclosed are two copies of the conditions of approval. **Please sign and return one copy to the New Mexico Oil Conservation Division (OCD) Santa Fe Office within 30 days of receipt of this letter including permit fees.**

Please be advised that approval of this permit does not relieve the owner/operator of responsibility should operations result in pollution of surface water, ground water or the environment. Nor does approval of the permit relieve the owner/operator of its responsibility to comply with any other applicable governmental authority's rules and regulations.

If you have any questions, please contact Leonard Lowe of my staff at (505-476-3492) or E-mail leonard.lowe@state.nm.us. On behalf of the staff of the OCD, I wish to thank you and your staff for your cooperation during this discharge permit review.

Sincerely,

Glenn von Gonten
Acting Environmental Bureau Chief

Attachments-1
xc: OCD District Office

ATTACHMENT
DISCHARGE PERMIT
APPROVAL CONDITIONS

1. **Payment of Discharge Plan Fees:** All discharge permits are subject to WQCC Regulations. Every billable facility that submits a discharge permit application will be assessed a filing fee of $100.00, plus a flat fee (*see* WQCC Regulation 20.6.2.3114 NMAC). The Oil Conservation Division ("OCD") has received the required $100.00 filing fee. The flat fee for an abatement of ground water and vadose zone contamination at oil and gas sites is $2,600.00. Please submit this amount with a signed copy of the permit and return to the OCD within 30 days. Checks should be made out to the New Mexico Water Quality Management Fund.

2. **Permit Expiration, Renewal Conditions and Penalties:** Pursuant to WQCC Regulation 20.6.2.3109.H.4 NMAC, this permit is valid for a period of five years. **The permit will expire on October 15, 2014** and an application for renewal should be submitted no later than 120 days before that expiration date. Pursuant to WQCC Regulation 20.6.2.3106.F NMAC, if a discharger submits a discharge permit renewal application at least 120 days before the discharge permit expires and is in compliance with the approved permit, then the existing discharge permit will not expire until the application for renewal has been approved or disapproved. ***Expired permits are a violation of the Water Quality Act {Chapter 74, Article 6, NMSA 1978} and civil penalties may be assessed accordingly.***

3. **Permit Terms and Conditions:** Pursuant to WQCC Regulation 20.6.2.3104 NMAC, when a permit has been issued, the owner/operator must ensure that all discharges shall be consistent with the terms and conditions of the permit. In addition, all facilities shall abide by the applicable rules and regulations administered by the OCD pursuant to the Oil and Gas Act, NMSA 1978, Sections 70-2-1 through 70-2-38.

4. **Owner/Operator Commitments:** The owner/operator shall abide by all commitments submitted in its June, 2009 discharge plan application, including attachments and subsequent amendments and these conditions for approval. Permit applications that reference previously approved plans on file with the division shall be incorporated in this permit and the owner/operator shall abide by all previous commitments of such plans and these conditions for approval.

5. **Modifications:** WQCC Regulation 20.6.2.3107.C and 20.6.2.3109 NMAC addresses possible future modifications of a permit. The owner/operator (discharger) shall notify the OCD of any facility expansion, production increase or process modification that would result in any significant modification in the discharge of water contaminants. The Division Director may require a permit modification if any water quality standard specified at 20.6.2.3103 NMAC is being or will be exceeded, or if a toxic pollutant as defined in WQCC Regulation 20.6.2.7 NMAC is present in ground water at any place of withdrawal for present or reasonably foreseeable future use, or that the Water Quality Standards for Interstate and Intrastate streams as specified in 20.6.4 NMAC are being or may be violated in surface water in New Mexico.

6. **Waste Disposal and Storage:** The owner/operator shall dispose of all wastes at an OCD-approved facility. Only oil field RCRA-exempt wastes may be disposed of by injection in a Class

II well. RCRA non-hazardous, non-exempt oil field wastes may be disposed of at an OCD-approved facility upon proper waste determination pursuant to 40 CFR Part 261. Any waste stream that is not listed in the discharge permit application must be approved by the OCD on a case-by-case basis.

A. **OCD Part 35 Waste:** Pursuant to OCD Part 35 (19.15.35.8 NMAC) disposal of certain non-domestic waste without notification to the OCD is allowed at NMED permitted solid waste facilities if the waste stream has been identified in the discharge permit and existing process knowledge of the waste stream does not change.

B. **Waste Storage:** The owner/operator shall store all waste in an impermeable bermed area, except waste generated during emergency response operations for up to 72 hours. All waste storage areas shall be identified in the discharge permit application. Any waste storage area not identified in the permit shall be approved on a case-by-case basis only. The owner/operator shall not store oil field waste on-site for more than 180 days unless approved by the OCD.

7. **Drum Storage:** The owner/operator must store all drums, including empty drums, containing materials other than fresh water on an impermeable pad with curbing. The owner/operator must store empty drums on their sides with the bungs in place and lined up on a horizontal plane. The owner/operator must store chemicals in other containers, such as tote tanks, sacks, or buckets on an impermeable pad with curbing.

8. **Process, Maintenance and Yard Areas:** The owner/operator shall either pave and curb or have some type of spill collection device incorporated into the design at all process, maintenance, and yard areas which show evidence that water contaminants from releases, leaks and spills have reached the ground surface.

9. **Above Ground Tanks:** The owner/operator shall ensure that all aboveground tanks have impermeable secondary containment (e.g., liners and berms), which will contain a volume of at least one-third greater than the total volume of the largest tank or all interconnected tanks. The owner/operator shall retrofit all existing tanks before discharge permit renewal. Tanks that contain fresh water or fluids that are gases at atmospheric temperature and pressure are exempt from this condition.

10. **Labeling:** The owner/operator shall clearly label all tanks, drums, and containers to identify their contents and other emergency notification information. The owner/operator may use a tank code numbering system, which is incorporated into their emergency response plans.

11. **Below-Grade Tanks/Sumps and Pits/Ponds.**

A. All below-grade tanks and sumps must be approved by the OCD prior to installation and must incorporate secondary containment with leak detection into the design. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal. All existing below-grade tanks and sumps without secondary containment and leak detection must be tested annually or as specified herein. Systems that have secondary containment with leak detection shall have a monthly inspection of the leak detection system to determine if the primary containment is leaking. Small sumps or depressions in

secondary containment systems used to facilitate fluid removal are exempt from these requirements if fluids are removed within 72 hours.

B. All pits and ponds, including modifications and retrofits, shall be designed by a certified registered professional engineer and approved by the OCD prior to installation. In general, all pits or ponds shall have approved hydrologic and geologic reports, location, foundation, liners, and secondary containment with leak detection, monitoring and closure plans. All pits or ponds shall be designed, constructed and operated so as to contain liquids and solids in a manner that will protect fresh water, public health, safety and the environment for the foreseeable future. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal.

C. The owner/operator shall ensure that all exposed pits, including lined pits and open top tanks (8 feet in diameter or larger) shall be fenced, screened, netted, or otherwise rendered non-hazardous to wildlife, including migratory birds.

D. The owner/operator shall maintain the results of tests and inspections at the facility covered by this discharge permit and available for OCD inspection. The owner/operator shall report the discovery of any system which is found to be leaking or has lost integrity to the OCD within 15 days. The owner/operator may propose various methods for testing such as pressure testing to 3 pounds per square inch greater than normal operating pressure, and/or visual inspection of cleaned tanks and/or sumps, or other OCD-approved methods. The owner/operator shall notify the OCD at least 72 hours prior to all testing.

12. Underground Process/Wastewater Lines:

A. The owner/operator shall test all underground process/wastewater pipelines at least once every five (5) years to demonstrate their mechanical integrity, except lines containing fresh water or fluids that are gases at atmospheric temperature and pressure. Pressure rated pipe shall be tested by pressuring up to one and one-half times the normal operating pressure, if possible, or for atmospheric drain systems, to 3 pounds per square inch greater than normal operating pressure, and pressure held for a minimum of 30 minutes with no more than a 1% loss/gain in pressure. The owner/operator may use other methods for testing if approved by the OCD.

B. The owner/operator shall maintain underground process and wastewater pipeline schematic diagrams or plans showing all drains, vents, risers, valves, underground piping, pipe type, rating, size, and approximate location. All new underground piping must be approved by the OCD prior to installation. The owner/operator shall report any leaks or loss of integrity to the OCD within 15 days of discovery. The owner/operator shall maintain the results of all tests at the facility covered by this discharge permit and they shall be available for OCD inspection. The owner/operator shall notify the OCD at least 72 hours prior to all testing.

13. Class V Wells: The owner/operator shall close all Class V wells (e.g., septic systems, leach fields, dry wells, etc.) that inject non-hazardous industrial wastes or a mixture of industrial wastes and domestic wastes unless it can be demonstrated that ground water will not be impacted in the reasonably foreseeable future. Leach fields and other wastewater disposal systems at OCD-regulated facilities that inject non-hazardous fluid into or above an underground source of drinking water are considered Class V injection wells under the EPA UIC program. Class V wells that

inject domestic waste only, must be permitted by the New Mexico Environment Department (NMED).

14. Housekeeping: The owner/operator shall inspect all systems designed for spill collection/prevention and leak detection at least monthly to ensure proper operation and to prevent over topping or system failure. All spill collection and/or secondary containment devices shall be emptied of fluids within 72 hours of discovery. The owner/operator shall maintain all records at the facility and available for OCD inspection.

15. Spill Reporting: The owner/operator shall report all unauthorized discharges, spills, leaks and releases and conduct corrective action pursuant to WQCC Regulation 20.6.2.1203 NMAC and OCD Part 29 (19.15.29 NMAC). The owner/operator shall notify both the OCD District Office and the Santa Fe Office within 24 hours and file a written report within 15 days. The OCD does not consider covering contaminated areas a remediation of the spill/release.

16. OCD Inspections: The OCD performed an inspection of this facility on Month Day Year. Representative provided the inspection. All photographs referenced below are located in the attachment of this permit. The inspection concluded the following:

Knight Oil Tool shall resolve these concerns and report within **by Month day year**. The report shall be submitted, with photographs, to the Environmental Bureau Oil Conservation Division identifying the resolutions to the concerns.

17. Storm Water: The owner/operator shall implement and maintain run-on and runoff plans and controls. The owner/operator shall not discharge any water contaminant that exceeds the WQCC standards specified in 20.6.2.3101 NMAC or 20.6.4 NMAC (Water Quality Standards for Interstate and Intrastate Streams) including any oil sheen in any stormwater run-off. The owner/operator shall notify the OCD within 24 hours of discovery of any releases and shall take immediate corrective action(s) to stop the discharge.

18. Unauthorized Discharges: The owner/operator shall not allow or cause water pollution, discharge or release of any water contaminant that exceeds the WQCC standards listed in 20.6.2.3101 NMAC or 20.6.4 NMAC (Water Quality Standards for Interstate and Intrastate Streams) unless specifically listed in the permit application and approved herein. ***An unauthorized discharge is a violation of this permit.***

19. Vadose Zone and Water Pollution: The owner/operator shall address any contamination through the discharge permit process or pursuant to WQCC 20.6.2.4000-.4116 NMAC (Prevention and Abatement of Water Pollution). The OCD may require the owner/operator to modify its permit for investigation, remediation, abatement, and monitoring requirements for any vadose zone or water pollution. Failure to perform any required investigation, remediation, abatement and submit subsequent reports will be a violation of the permit.

20. Additional Site Specific Conditions:

Sampling: Groundwater from the monitor wells currently existing at the site and any future monitor wells will be sampled semi-annually. The sampling will not be done on any monitor wells in which there is accumulated PSH in the casing. A lab will analyze these samples for BTEX

(EPA Method 8021), inorganic constituents (EPA Method 6010), total dissolved solids (EPA Method 160.1) and chlorides (EPA Method 325.2)

Soil Vapor Extraction: The system described in the plan application will continue. Discontinuance of this activity will be done only upon the approval of the OCD.

Reporting: Annual reports on the progress of the remediation will be filed with the OCD for the duration of the remediation activities. These reports will follow the format of the annual report, dated August 10, 2004 already received by the OCD. Such reports are due within six months after the close of the previous reporting year.

Closure: The remediation activity at this site will be continued until it can be shown that the site poses no further threat to human health and the environment.

21. **Transfer of Discharge Permit (WQCC 20.6.2.3111)** Prior to any transfer of ownership, control, or possession (whether by lease, conveyance or otherwise) of a facility with a discharge permit, the transferor shall notify the transferee in writing of the existence of the discharge permit, and shall deliver or send by certified mail to the department a copy of such written notification, together with a certification or other proof that such notification has in fact been received by the transferee.

Upon receipt of such notification, the transferee shall have the duty to inquire into all of the provisions and requirements contained in such discharge permit, and the transferee shall be charged with notice of all such provisions and requirements as they appear of record in the department's file or files concerning such discharge permit. The transferee (new owner/operator) shall sign and return an original copy of these permit conditions and provide a written commitment to comply with the terms and conditions of the previously approved discharge permit.

22. **Closure Plan and Financial Assurance:** Pursuant to 20.6.2.3107 NMAC an owner/operator shall notify the OCD when any operations of the facility are to be discontinued for a period in excess of six months. Prior to closure, or as a condition of this permit, or request from the OCD, the operator will submit an approved closure plan, modified plan, and/or provide adequate financial assurance.

23. **Certification: (Owner/Operator)**, by the officer whose signature appears below, accepts this permit and agrees to comply with all submitted commitments, including these terms and conditions contained here. **Owner/Operator** further acknowledges that the OCD may, for good cause shown, as necessary to protect fresh water, public health, safety, and the environment, change the conditions and requirements of this permit administratively

Conditions accepted by: "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment."

_____
Company Name-print name above

_____

Company Representative- print name

_____

Company Representative- Signature

Title_____

Date:_____

NOTICE OF PUBLICATION

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission Regulations (20.6.2.3106 NMAC), the following discharge permit application(s) has been submitted to the Director of the New Mexico Oil Conservation Division ("NMOCD"), 1220 S. Saint Francis Drive, Santa Fe, New Mexico 87505, Telephone (505) 476-3440:

(GW-355) Transwestern Pipeline Company P.O. Box 1717, Roswell N.M. 88202-1717, has submitted a renewal application for the previously approved discharge plan for their Abatement of ground water and vadose zone contamination at oil and gas sites, identified at the non-operational Bell Lake Gas Plant located in the SW/4 NE/4 of Section 1, Township 24 South, Range 33 East, NMPM, Lea County. The remediation consists of pumping groundwater with elevated concentrations of Benzene in to yet to be approved ponds. Proposed effluents to be located on site will be stored in the ponds. Groundwater most likely to be affected by a spill, leak or accidental discharge is at a depth of approximately 90 - 95 feet, with a total dissolved solids concentration of approximately 800 mg/L. The discharge plan addresses how oilfield products and waste will be properly handled, stored, and disposed of, including how spills, leaks, and other accidental discharges to the surface will be managed in order to protect fresh water.

The NMOCD has determined that the application is administratively complete and has prepared a draft permit. The NMOCD will accept comments and statements of interest regarding this application and will create a facility-specific mailing list for persons who wish to receive future notices. Persons interested in obtaining further information, submitting comments or requesting to be on a facility-specific mailing list for future notices may contact the Environmental Bureau Chief of the Oil Conservation Division at the address given above. The administrative completeness determination and draft permit may be viewed at the above address between 8:00 a.m. and 4:00 p.m., Monday through Friday, or may also be viewed at the NMOCD web site http://www.emnrd.state.nm.us/ocd/. Persons interested in obtaining a copy of the application and draft permit may contact the NMOCD at the address given above. Prior to ruling on any proposed discharge permit or major modification, the Director shall allow a period of at least thirty (30) days after the date of publication of this notice, during which interested persons may submit comments or request that NMOCD hold a public hearing. Requests for a public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines that there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed permit based on information available, including all comments received. If a public hearing is held, the director will approve or disapprove the proposed permit based on information in the permit application and information submitted at the hearing.

Para obtener más información sobre esta solicitud en español, sirvase comunicarse por favor: New Mexico Energy, Minerals and Natural Resources Department (Depto. Del Energia, Minerals y Recursos Naturales de Nuevo México), Oil Conservation Division (Depto. Conservacio´n Del Petróleo), 1220 South St. Francis Drive, Santa Fe, New México (Contacto: Dorothy Phillips, 505-476-3461)

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 31st day of July 2009.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

S E A L

Mark Fesmire, Director

ACKNOWLEDGEMENT OF RECEIPT
OF CHECK/CASH

I hereby acknowledge receipt of check No _____ dated 6/16/09

or cash received on _____ in the amount of $ 100.00

from Cypress Engineering Inc

for GW-355

Submitted by: Lawrence Romero Date: 6/23/09

Submitted to ASD by: Lawrence Romero Date: 6/23/09

Received in ASD by: _____ Date: _____

Filing Fee ✓ New Facility _____ Renewal _____

Modification _____ Other _____

Transwestern Pipeline
Bell Lake Plant

Organization Code 521.07 Applicable FY 2004

To be deposited in the Water Quality Management Fund.

Full Payment _____ or Annual Increment _____

Cypress Engineering

7171 Highway 6 North, Suite 102
Houston, Texas 77095-2422
(281) 797-3420 office
(281) 859-1881 fax

RECEIVED
2009 JUN 16 PM 1 10

June 15, 2009

Mr. Leonard Lowe
Oil Conservation Division
1220 South St. Frances Dr.
Santa Fe, New Mexico 87505

Re: Renewal of Groundwater Discharge Plan GW-355
Transwestern Pipeline Company
Bell Lake Plant Remediation Site
Lea County, New Mexico

Dear Mr. Lowe:

On behalf of Transwestern Pipeline Company, Cypress Engineering submits the enclosed renewal application for Discharge Plan GW-355 originally issued by your office on October 25, 2004.

Be advised that there have been no new modification or alterations at this location which would subtantially differ from those covered under the original discharge plan application.

If you have any questions regarding this request, please contact me at (281) 797-3420.

Sincerely,

George C. Robinson, P.E.
President/Principal Engineer

cc: Richard Spell — Energy Transfer
Larry Campbell — Transwestern Pipeline Company

District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Avenue, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Revised June 10, 2003

Submit Original
Plus 1 Copy
to Santa Fe
1 Copy to Appropriate
District Office

DISCHARGE PLAN APPLICATION FOR SERVICE COMPANIES,GAS PLANTS, REFINERIES, COMPRESSOR, GEOTHERMAL FACILITES AND CRUDE OIL PUMP STATIONS

(Refer to the OCD Guidelines for assistance in completing the application)

☐ New ☒ Renewal ☐ Modification

1. Type: Bell Lake Plant Remediation Site
2. Operator: Transwestern Pipeline Company

   Address: P.O. Box 1717, Roswell, New Mexico 88202-1717

   Contact Person: Larry Campbell Phone: 575.625.8022
3. Location: SW /4 NE /4 Section 1 Township 24 South Range 33 East

   Submit large scale topographic map showing exact location.
4. Attach the name, telephone number and address of the landowner of the facility site.
5. Attach the description of the facility with a diagram indicating location of fences, pits, dikes and tanks on the facility.
6. Attach a description of all materials stored or used at the facility.
7. Attach a description of present sources of effluent and waste solids. Average quality and daily volume of waste water must be included.
8. Attach a description of current liquid and solid waste collection/treatment/disposal procedures.
9. Attach a description of proposed modifications to existing collection/treatment/disposal systems.
10. Attach a routine inspection and maintenance plan to ensure permit compliance.
11. Attach a contingency plan for reporting and clean-up of spills or releases.
12. Attach geological/hydrological information for the facility. Depth to and quality of ground water must be included.
13. Attach a facility closure plan, and other information as is necessary to demonstrate compliance with any other OCD rules, regulations and/or orders.
14. CERTIFICATIONI hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

Name: Richard Spell Title: Waste & Remediation Manager

Signature: Richard A Spell Date: 6-15-09

E-mail Address: richard.spell@energytransfer.com

SUPPORTING INFORMATION FOR DISCHARGE PLAN APPLICATION RENEWAL BELL LAKE PLANT REMEDIATION SITE, LEA COUNTY, NEW MEXICO JUNE 04, 2009

1. Type of Operation

The Bell Lake Plant began operation in 1961. During its operation, the facility performed three primary functions:

1. Dehydration – removal of water from natural gas by a regenerative triethylene glycol (TEG) process.
2. Sweetening – removal of hydrogen sulfide from natural gas by a regenerative amine process.
3. Mercaptan removal – removal of mercaptan from natural gas by a regenerative caustic process.

The sweetening plant was taken out of service in 1985. Currently, compression is the only active process occurring at the site. The facility is now owned and operated by Duke Energy. Transwestern Pipeline Company (TW) sold the Bell Lake Plant to Duke Energy in 1996. However, TW has retained responsibility for remedial activities at the site. This application pertains only to remediation activities at the facility.

2. Name of Operator or Legally Responsible Party and Local Representative

Questions and correspondence concerning remedial activity under the proposed discharge plan should be directed to:

Mr. Larry Campbell
Division Environmental Specialist
Transwestern Pipeline Company
P.O. Box 1717
Roswell, NM 88202-1717
(575) 625-8022

3. Location of the Discharge Plan Facility

The Bell Lake Plant Remediation Site is located on the west side of County Road 21, in Lea County, New Mexico, approximately 25 miles northwest of Jal, New Mexico within the SW ¼, NE ¼, Section 1, Township 24 South, Range 33 East. A site plan and topographic map are provided on Drawing G-1.

4. Landowners

The landowner of record for the facility is Duke Energy. The landowner of record for the surrounding area is the New Mexico State Land Office. The contact person and address is provided below:

New Mexico State Land Office
P.O. Box 1148
Santa Fe, NM 87504-1148
Phone: (505) 827-5760
Fax: (505) 827-4262

TW has obtained two Water Development Easements for monitoring wells from the New Mexico State Land Office, as follows:

WD-38
- Originally issued 11/28/94 for 3 wells and for a term of 5 years
- Renewed 11/24/99 for 5 wells and a term of 5 years
- Renewed 11/24/04 for 5 wells and a term of 3 years
- Currently includes 5 wells (MW-5, MW-6, MW-8, MW-9, & MW-10)
- An additional renewal is in process

WD-69
- Originally issued 11/24/97 for 3 wells and for a term of 5 years
- Renewed 11/24/02 for 3 wells and a term of 2 years
- Renewed 11/24/04 for 5 wells and a term of 3 years
- Currently includes 5 wells (MW-11, MW-12, MW-13, MW-15, & MW-16)
- An additional renewal is in process that will combine the two easements into one that will include all offsite monitoring wells.

5. Facility Description

The compressor station facility property boundary and the proposed layout of the remediation system, including the location of multi-phase extraction wells, equipment, conveyance lines, and the evaporation pond, are shown on the remediation system drawings provided in Appendix E.

The evaporation pond for the remediation system has not yet been constructed. TW is in the process of renewing the existing water development easements with the State Land Office. Once the water development easements have been renewed, TW will request an easement with the State Land Office for construction of the evaporation pond.

6. Materials Stored or Used at the Facility

The requested discharge plan is for the operation of the remedial system outlined in the Remedial Design. As such, there are no plans to store/dispose liquids or solids with the exception of the pumped groundwater which will be routed to the evaporation ponds for disposal. The pumped groundwater will contain petroleum hydrocarbons.

7. Sources and Quantities of Effluent and Waste Solids Generated at the Facility

Pumped groundwater will be the only source of effluent from the proposed remedial system. Based on short-term pumping tests conducted at the site, the anticipated combined process flow-rate from the recovery wells will be 2 gallons per minute (gpm).

Monitoring of groundwater quality at the site has been ongoing since the fall of 1993 on a semi-annual basis. The attached tables in each monitoring report (Cypress, 2009) provide information on the distribution of organic and inorganic constituents in groundwater. Elevated concentrations of benzene continue to be the primary concern at the site.

8. Description of Current Liquid and Solid Waste Collection/Storage/Disposal Procedures

Pumped groundwater from recovery wells will be routed to a manifold and then into a 210 bbl surge tank. The surge tank will be located within a secondary containment structure. From the tank, the water will be pumped through 2-inch diameter HDPE pipe, buried within a dedicated trench, to the evaporation ponds located south of the facility. The design and specifications for the evaporation pond were provided in the Remedial Design (Cypress, 2004). The evaporation ponds are designed to be zero-discharge facilities (total retention) from which contaminated groundwater will be disposed of through the process of evaporation.

9. Proposed Modifications

The remedial design is protective of underlying groundwater quality. The design and specifications require the installation of a double HDPE liner and leak detection system. In addition, provisions for diverting precipitation run-on to the ponds have been incorporated into the design.

10. Inspection, Maintenance and Reporting

The proposed routine inspection procedures outlined for the evaporation pond including frequency of inspection, maintenance of records, and OCD notification in the event of a leak are provided in the remedial design.

The ponds were sized to accommodate the introduction of direct precipitation into the evaporation ponds. No other water sources will be in contact with the pumped groundwater routed to the evaporation ponds.

11. Spill/Leak Prevention and Reporting Procedures (Contingency Plan)

As part of the routine system inspections, the OCD Director will be notified of any significant leaks and spills, and the OCD will be notified if more than 25 gallons of water accumulate in the sumps that collect potential leakage below the primary liner. Notification will include contact of the local OCD District field office within 24 hours of discovery of a significant spill or release as defined in OCD Rule 116 and WQCC Section 1203.

If water is detected in the sumps, the remedial system will be shut down and the water within the evaporation ponds will be allowed to evaporate so that the liner integrity can be inspected. Repairs to the liner will be made as necessary to ensure containment of future discharged water. Any water that collects in a sump will be directed back to the pond.

12. Site Characteristics

The site is situated in an area of recent Quaternary alluvial and terrace deposits. Surface materials consist of loosely consolidated sands and gravelly sands. The uppermost stratigraphic unit underlying the site is the Santa Rosa Formation.

The sediments encountered to approximately 35 feet below grade as determined from previous site investigations are loosely consolidated sands and gravelly sands. Between approximately 35 and 40 feet bgs, a well-cemented sandstone layer containing significant chert has been encountered across the site. Below the cherty zone, interbedded siltstones and sandstones are present to the maximum depth of exploration of 100 feet bgs. Records from nearby wells indicate the presence of shale, clay, and sandstones to depths of 650 ft bgs.

Groundwater is present at approximately 90 feet bgs within a relatively thin unconfined aquifer. Based on the monitoring well network, groundwater flow is toward the southeast with a hydraulic gradient of 0.002 feet per foot. There are no known uses of the shallow unconfined aquifer within a 2-mile radius of the site.

A supply well is located in the southeast part of the facility that has historically provided water for use at the facility. This well was completed in 1967 to a total depth of 659 ft, and is screened from 550 to 659 ft bgs. The well location is shown on drawing G-1. A past search of well records in the State Engineers Office in Roswell, NM identified two other wells completed in the deep aquifer within a 2-mile radius of the site. One of these wells is located 0.8 miles NE of the facility at a nearby Conoco facility, and the other was located approximately 1.3 miles southeast of the site but has been abandoned.

Laboratory analysis of water samples collected from the shallow aquifer indicates that background total dissolved solids concentrations are on the order of 800 milligrams-per-liter (mg/L). Hall Environmental Analysis Laboratory located in Albuquerque, New Mexico analyzed the water quality samples.

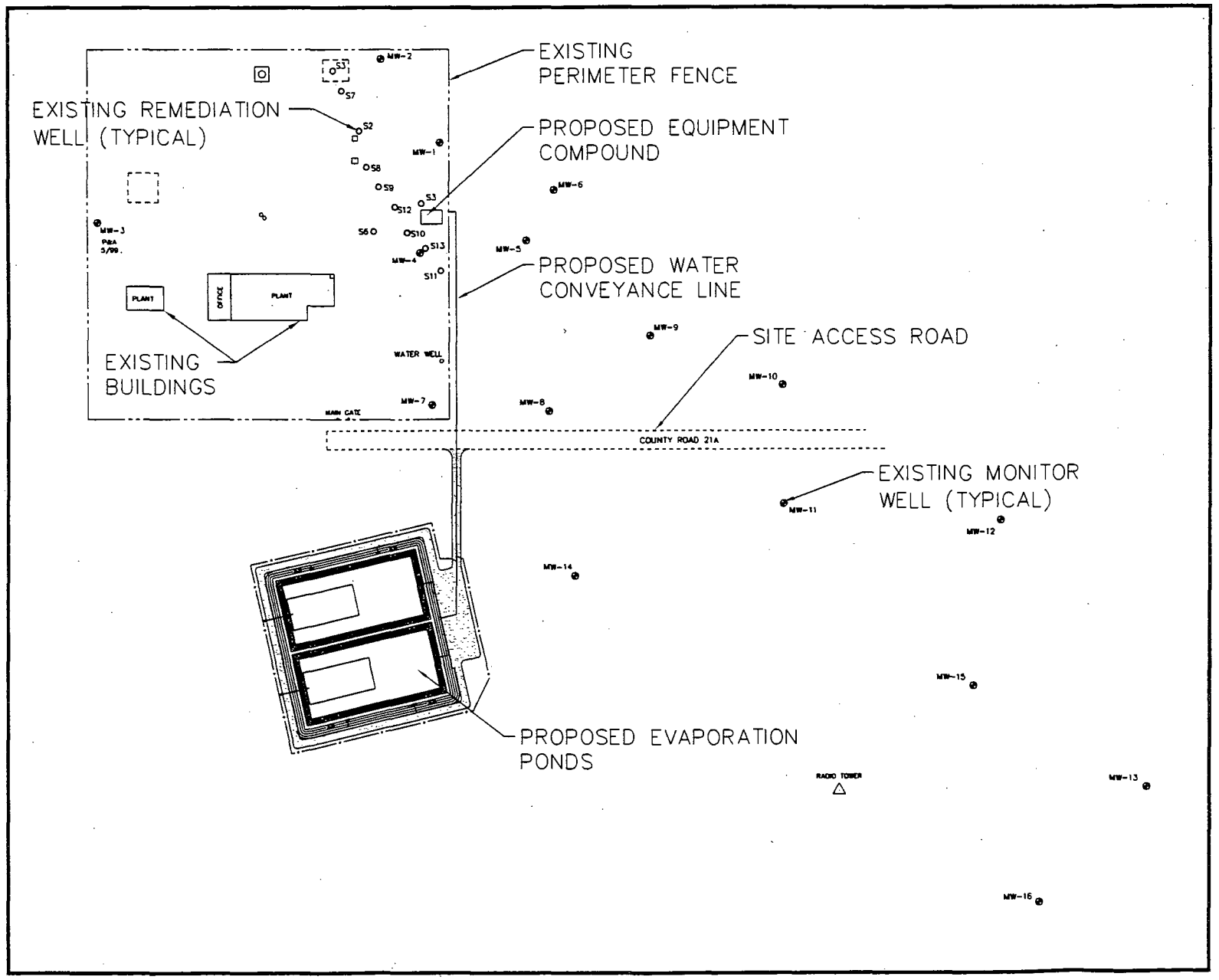
Flooding potential is quite low due to the limited watershed up gradient of the proposed evaporation ponds and the relatively flat topography of the area immediately surrounding the ponds (Drawing G-1). The remedial design has provisions for diverting run-on around the ponds and protection of the berms.

13. Other Compliance Information

TW is committed to NMOCD Rule 116 and WQCC Section 1203 spill/leak reporting. In accordance with OCD guidance, TW will notify OCD when operation of the facility is discontinued for a period in excess of six months or when the evaporation ponds are to be closed. At that time, TW will provide a closure plan pursuant to OCD requirements, and any other applicable local, state, and/or federal regulations.

INDEX OF DRAWINGS

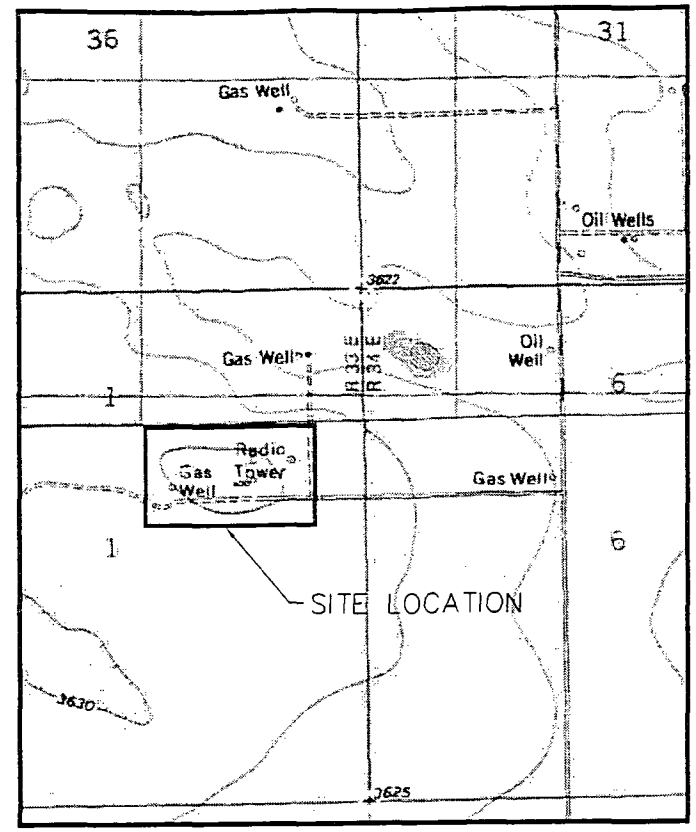
Dwg	Description
G-1	Index of Drawings, Vicinity Map, Site Location Map and Site Layout Map
G-2	Distribution of Groundwater Contamination–Benzene
C-1	Site Plan and Equipment Layout
C-2	SVE Wellhead, Valve Box and Trench Details
C-3	Manifold Details
C-4	Evaporation Pond Grading Plan
C-5	Evaporation Pond Grading Plan Details
P-1	Process Flow Diagram



SITE LAYOUT MAP

0 50 100 200 250 300 feet

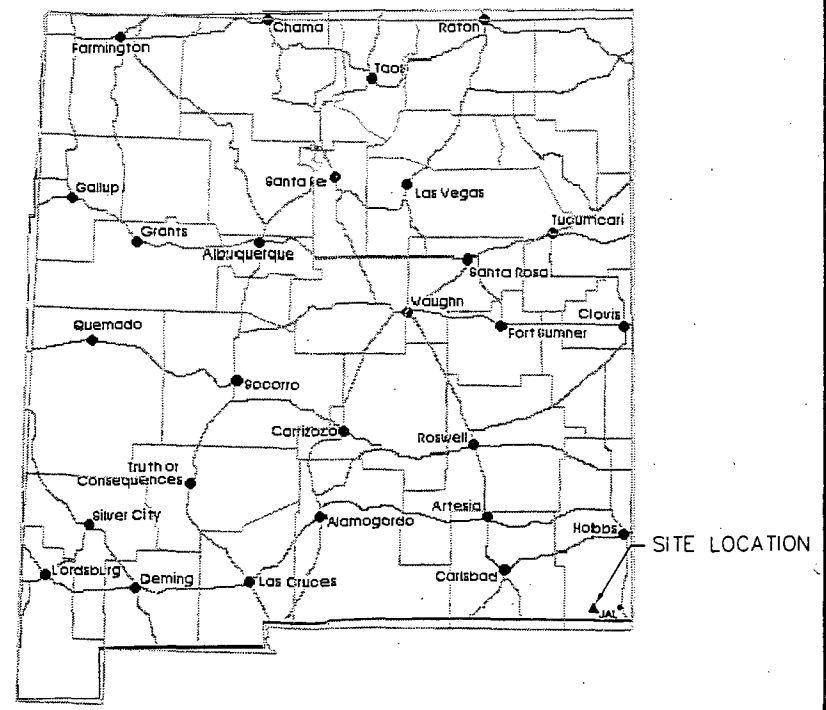
SCALE 1"=200'



SITE LOCATION MAP

500 0 500 1000 1500 2000 2500 3000 3500

SCALE 1"=2000'



VICINITY MAP

NOT TO SCALE

REV.	DATE	DRAWN	CHKD	REMARKS

REVISIONS

Tetra Tech EM Inc.

DESIGNED BY: RM
DRAWN BY: RM
CHECKED BY: RM

RE-CHECKED BY:
APPROVED BY:
DATE:

BELL LAKE PLANT
JAL, NEW MEXICO

INDEX OF DRAWINGS, VICINITY MAP, SITE LOCATION MAP AND SITE LAYOUT MAP

PROJECT NUMBER:
P-202204

DRAWING NO.:
G-1

:\DATASHAR\Cypress Engineering\Bell Lake\Figures\Sheets\G-1.dwg

PUBLIC NOTICE

Transwestern Pipeline Company, P.O. Box 1717, Roswell, New Mexico 88202-1717, has submitted a renewal application to the New Mexico Energy, Minerals and Natural Resources Department, Oil Conservation Division, for discharge plan permit GW-355 for their Bell Lake Plant Remediation Site located in the SW ¼, NE ¼ of Section 1, Township 24 South, Range 33 East, NMPM in Lea County, New Mexico. The physical address of the facility is 21 miles west of Jal, New Mexico on Hwy. 128, 2.5 miles north on County Road C21, and 0.5 miles west on County Road C21A.

The facility provides a remediation system; which is comprised of multi-phase extraction wells, equipment, conveyance lines, and a proposed evaporation pond. There are no plans to store or dispose of liquids or solids other than pumped groundwater which will be routed to the evaporation ponds for disposal. The pumped groundwater will contain petroleum hydrocarbons. Any liquids generated at the facility that are not disposed of in the evaporation pond will be stored in dedicated above ground storage tanks prior to offsite disposal or recycling at an OCD approved site. All storage tanks will be located within properly engineered secondary containment structures. The aquifer that potentially could be affected is 90 to 95 feet below ground surface; the total dissolved solids concentration of this aquifer is approximately 800 mg/l.

Any interested person may obtain information, submit comments, or request to be placed on a facility-specific mailing list for future notices by contacting Leonard Lowe at the New Mexico OCD, 1220 South St. Francis Drive, Santa Fe, New Mexico 87505, Telephone (505) 476-3492. The OCD will accept comments and statements of interest regarding the renewal and will create a facility-specific mailing list for persons who wish to receive future notices.

Cypress Engineering

7171 Highway 6 North, Suite 102
Houston, Texas 77095-2422
(281) 797-3420 office
(281) 859-1881 fax

November 30, 2004

Mr. Ed Martin
Environmental Bureau
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Transmittal of Signed Attachment to the Discharge Plan Renewal GW-355
Transwestern Pipeline Company
Bell Lake Plant Remediation Site
Lea County, New Mexico

Dear Ed,

Enclosed with this letter is the signed "Attachment to the Discharge Plan Renewal GW-355." The signed document is being returned per the OCD's instructions.

If you have any questions regarding this transmittal, please contact me at (713) 345-1537, or you may contact Bill Kendrick at (713) 646-7644.

Sincerely,

George Robinson

George C. Robinson, PE
President/Principal Engineer

xc w/enclosure: Bill Kendrick Transwestern Pipeline Company
Larry Campbell Transwestern Pipeline Company

ATTACHMENT TO THE DISCHARGE PLAN RENEWAL GW-355
Transwestern Pipeline Co.
Bell Lake Plant Remediation Site
Discharge Plan Approval Conditions
October 25, 2004

1. Payment of Discharge Plan Fees: The $100.00 filing fee and the $1,600.00 permit fee have not been received by the OCD as of the above date, and these are due and payable upon receipt of this approval.

2. Commitments: Transwestern Pipeline Co. will abide by all commitments submitted in the discharge plan application letter dated March 26, 2004 and these conditions for approval.

3. Drum Storage: All drums containing materials other than fresh water must be stored on an impermeable pad with curbing. All empty drums will be stored on their sides with the bungs in and lined up on a horizontal plane. Chemicals in other containers such as sacks or buckets will also be stored on an impermeable pad and curb type containment.

4. Labeling: All tanks, drums and containers will be clearly labeled to identify their contents and other emergency notification information.

5. Spill Reporting: All accidental spills/releases will be reported pursuant to OCD Rule 116 and WQCC 1203 to the OCD Hobbs District Office.

6. Transfer of Discharge Plan: The OCD will be notified prior to any transfer of ownership, control, or possession of a facility with an approved discharge plan. A written commitment to comply with the terms and conditions of the previously approved discharge plan must be submitted by the purchaser and approved by the OCD prior to transfer.

7. Sampling: Groundwater from the monitor wells currently existing at the site and any future monitor wells will be sampled semi-annually. This sampling will not be done on any monitor wells in which there is accumulated PSH in the casing. A lab will analyze these samples for BTEX (EPA Method 8021), inorganic constituents (EPA Method 6010), total dissolved solids (EPA Method 160.1) and chlorides (EPA Method 325.2).

8. Soil Vapor Extraction: The system described in the plan application will continue. Discontinuance of this activity will be done only upon the approval of the OCD.

9. Reporting: Annual reports on the progress of the remediation will be filed with the OCD for the duration of the remediation activities. These reports will follow the format of the annual report, dated August 10, 2004 already received by the OCD. Such reports are due within six months after the close of the previous reporting year.

10. Closure: The remediation activity at this site will be continued until it can be shown that the site poses no further threat to human health and the environment.

11. Conditions accepted by: Transwestern Pipeline Co., by the officer whose signature appears below, accepts this permit and agrees to comply with all terms and conditions contained herein. Transwestern Pipeline Co. further acknowledges that the Division, for good cause shown as necessary to protect fresh water, human health and the environment, may change these conditions and requirements of this permit administratively.

Transwestern Pipeline Co.

Print Name: WILLIAM A. KENDRICK

Signature: Wm. C. Kendrick

Title: SR. DIRECTOR ENVIRONMENTAL AFFAIRS

Date: 11/30/04

ACKNOWLEDGEMENT OF RECEIPT OF CHECK/CASH

I hereby acknowledge receipt of check No. [redacted] dated 10/20/04,

or cash received on 10/25/04 in the amount of $ 1700.00

from TRANSWESTERN PIPELINE Co.

for GW-355
(Facility Name)

Submitted by: Ed Martin Date: 10/25/04
(DP No.)

Submitted to ASD by: _____ Date: _____

Received in ASD by: _____ Date: _____

Filing Fee ✓ New Facility ✓ Renewal ____

Modification ____ Other _____
(specify)

Organization Code 521.07 Applicable FY 2001

To be deposited in the Water Quality Management Fund.

Full Payment ✓ or Annual Increment ____

☐ Florida Gas Transmission Company
☐ _____
☐ Northern Natural Gas Company
☒ Transwestern Pipeline Company

35-60 / 1130 No. [redacted]

PAY TO THE ORDER OF New Mexico Water Quality Fund

DATE 10-20-2004

WHOSE ADDRESS IS Attn: Ed Martin 1220 South St. Francis Dr, Santa Fe, NM 87505

$ 1,700.00

One thousand seven hundred & 00/100 DOLLARS

STATE Lea COUNTY NM LINE NO. ROW NO.

LEGAL DESCRIPTION TW Bell Lake Remediation Site

Description	GL Co. #	Tax Code	GL Account#	Cost Center	WBS Element	Material/ For Order	Amount
Right of Way (Easement)			~~50102000~~				
Damages, Services, Other	0060		~~50102100~~				
Real Property Purchase (Land Acquisition)			~~52102200~~ 52508000	X.002239.2649.85300060			
Remarks: Discharge Permit Fee					Sales Tax (if any)		
					Total		1,700.00

NOT VALID AFTER 180 DAYS

E.O.S.C.
P.O. Box 1188 Houston, Texas 77251-1188
Through JPMorgan Chase Bank
National Association
Houston, Texas

SSN or Tax ID# [redacted]

AUTHORIZED SIGNATURE

Cypress Engineering

7171 Highway 6 North, Suite 102
Houston, Texas 77095-2422
(281) 797-3420 office
(281) 859-1881 fax

October 20, 2004

Mr. Ed Martin
Environmental Bureau
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Discharge Plan Fees
Bell Lake Plant Remediation Site GW-355
Transwestern Pipeline Company
Lea County, New Mexico

Dear Ed,

Enclosed with this letter is a check in the amount of $1,700.00 to cover fees associated with the recently approved Discharge Plan application for the subject site.

If you have any questions regarding this fee payment, please contact me at (713) 345-1537, or you may contact Bill Kendrick at (713) 646-7644.

Sincerely,

George C. Robinson, PE
President/Principal Engineer

xc w/enclosure: Bill Kendrick Transwestern Pipeline Company
Larry Campbell Transwestern Pipeline Company

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary

October 25, 2004

Mark E. Fesmire, P.E.
Director
Oil Conservation Division

7001 1940 0004 3929 8461

CERTIFIED MAIL
RETURN RECEIPT NO. 7001 1940 0004 3929 8461

Mr. Bill Kendrick
Transwestern Pipeline Co.
P.O. Box 4657
Houston, TX 77210-4657

RE: Discharge Plan GW-355
Transwestern Pipeline Co.
Bell Lake Plant Remediation Site
Lea County, New Mexico

Dear Mr. Kendrick:

The ground water discharge plan renewal GW-355 for the Transwestern Pipeline Co. Bell Lake Remediation Site in the SW/4 NE/4 of Section 1, Township 24 South, Range 33 East, NMPM, Lea County, New Mexico, **is hereby approved** under the conditions contained in the enclosed attachment. Enclosed are two copies of the conditions of approval. **Please sign and return one copy to the New Mexico Oil Conservation Division (OCD) Santa Fe office within 10 working days of receipt of this letter.**

Please be advised that approval of this plan does not relieve Transwestern Pipeline Co. of liability should operations result in pollution of surface water, ground water or the environment.

All exposed pits, including lined pits and open tanks (exceeding 16 feet in diameter) shall be screened, netted or otherwise rendered nonhazardous to wildlife including migratory birds.

Note that Section 3104 of the regulations provides: "When a plan has been approved, discharges must be consistent with the terms and conditions of the plan." Pursuant to Section 3107.C, Transwestern Pipeline Co. is required to notify the Director of any facility expansion, production increase or process modification that would result in any change in the discharge of water quality or volume.

Pursuant to Section 3109.H.4, this plan is for a period of five years. This renewal will expire on October 15, 2009 and Transwestern Co. should submit an application for

renewal in ample time before this date. Note that under Section 3106.F of the regulations, if a discharger submits a discharge plan renewal application at least 120 days before the discharge plan expires and is in compliance with the approved plan, then the existing discharge plan will not expire until the application for renewal has been approved or disapproved.

The discharge plan application for the Transwestern Pipeline Co. Bell Lake Plant Remediation Site is subject to WQCC Regulation 3114. Every billable facility submitting a discharge plan application will be assessed a filing fee of $100.00. There is a flat fee assessed for discharge of remediation system effluent of $1,600. The OCD has not received these fees, and they are due and payable upon receipt of this approval.

On behalf of the staff of the OCD, I wish to thank you and your staff for your cooperation during this discharge plan review.

Sincerely,

Roger C. Anderson
Chief, Environmental Bureau
Oil Conservation Division

RCA/eem
Attachment

cc: OCD Hobbs Office
George Robinson, Cypress Engineering

ATTACHMENT TO THE DISCHARGE PLAN RENEWAL GW-355
Transwestern Pipeline Co.
Bell Lake Plant Remediation Site
Discharge Plan Approval Conditions
October 25, 2004

1. Payment of Discharge Plan Fees: The $100.00 filing fee and the $1,600.00 permit fee have not been received by the OCD as of the above date, and these are due and payable upon receipt of this approval.

2. Commitments: Transwestern Pipeline Co. will abide by all commitments submitted in the discharge plan application letter dated March 26, 2004 and these conditions for approval.

3. Drum Storage: All drums containing materials other than fresh water must be stored on an impermeable pad with curbing. All empty drums will be stored on their sides with the bungs in and lined up on a horizontal plane. Chemicals in other containers such as sacks or buckets will also be stored on an impermeable pad and curb type containment.

4. Labeling: All tanks, drums and containers will be clearly labeled to identify their contents and other emergency notification information.

5. Spill Reporting: All accidental spills/releases will be reported pursuant to OCD Rule 116 and WQCC 1203 to the OCD Hobbs District Office.

6. Transfer of Discharge Plan: The OCD will be notified prior to any transfer of ownership, control, or possession of a facility with an approved discharge plan. A written commitment to comply with the terms and conditions of the previously approved discharge plan must be submitted by the purchaser and approved by the OCD prior to transfer.

7. Sampling: Groundwater from the monitor wells currently existing at the site and any future monitor wells will be sampled semi-annually. This sampling will not be done on any monitor wells in which there is accumulated PSH in the casing. A lab will analyze these samples for BTEX (EPA Method 8021), inorganic constituents (EPA Method 6010), total dissolved solids (EPA Method 160.1) and chlorides (EPA Method 325.2).

8. Soil Vapor Extraction: The system described in the plan application will continue. Discontinuance of this activity will be done only upon the approval of the OCD.

9. Reporting: Annual reports on the progress of the remediation will be filed with the OCD for the duration of the remediation activities. These reports will follow the format of the annual report, dated August 10, 2004 already received by the OCD. Such reports are due within six months after the close of the previous reporting year.

10. Closure: The remediation activity at this site will be continued until it can be shown that the site poses no further threat to human health and the environment.

11. Conditions accepted by: Transwestern Pipeline Co., by the officer whose signature appears below, accepts this permit and agrees to comply with all terms and conditions contained herein. Transwestern Pipeline Co. further acknowledges that the Division, for good cause shown as necessary to protect fresh water, human health and the environment, may change these conditions and requirements of this permit administratively.

Transwestern Pipeline Co.

Print Name: _____

Signature: _____

Title: _____

Date: _____

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Total Postage & Fees $

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Sent To Mr. Jerry King
Street, Apt. No.; or PO Box No.
City, State, ZIP+4

See Reverse for Instructions

PS Form 3800, June 2002

7004 0750 0003 4772 1678

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Jerry King
NM State Land Office
Asst. Commissioner
- Surface Resources
PO Box 1148
Santa Fe, NM 87504-1148

2. Article Number (Transfer from service label) 7004 0750 0003 4772 1678

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) | C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

SANTA FE, NM
AUG 26 2004

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

U.S. Postal Service™
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OFFICIAL USE

Postage $
Certified Fee
Return Receipt Fee (Endorsement Required)
Restricted Delivery Fee (Endorsement Required)
Total Postage & Fees $

Postmark Here

Sent To Ms. Elizabeth Jones
Street, Apt. No.; or PO Box No.
City, State, ZIP+4

See Reverse for Instructions

PS Form 3800, June 2002

7004 0750 0003 4772 1685

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Ms. Elizabeth Jones
Duke Energy Fields Services
10 Desta Dr. Ste 400 West
Midland TX 79705-4515

2. Article Number (Transfer from service label) 7004 0750 0003 4772 1685

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) Sara Gastring | C. Date of Delivery 8-26-04

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

Transwestern Pipeline Company
1331 Lamar Street, Ste 650
Houston, TX 77010
713-646-7644

August 22, 2004

Ms. Elizabeth Jones
Duke Energy Field Services
10 Desta Drive, Suite 400 – West
Midland, TX 79705

via certified mail

RE: Notification of Proposed Discharge
Bell Lake Plant Remediation Site
Lea County, New Mexico

Dear Ms. Jones,

Transwestern Pipeline Company (Transwestern) is the responsible party for groundwater remediation activities at the Bell Lake Plant remediation site located in Lea County, New Mexico. Transwestern has recently submitted a Discharge Plan application to the New Mexico Oil Conservation Division (NMOCD) for a proposed expansion of the current remediation system to include the recovery and discharge of affected groundwater. The purpose of this letter is to provide written notice to property owners of record within ½ mile of the proposed discharge site as required under Section 20.6.2.3108 NMAC. The information specified under Subsection E of this Section is provided below.

1. *Name and address of proposed discharger*

   Transwestern Pipeline Company
   Attn: Bill Kendrick
   1331 Lamar Street, Suite 650
   Houston, TX 77010

2. *Location of the discharge*

   The discharge will be into an evaporation pond to be constructed at a location just south of Duke Energy's Bell Lake Plant. The facility is located on the west side of County Road 21 in Lea County, New Mexico, approximately 25 miles northwest of Jal, New Mexico in SW1/4, NE1/4, Section 1, Township 24 South, Range 33 East.

3. *Brief description of the activities that produce the discharge*

   Shallow groundwater beneath the Bell Lake Plant and adjacent property has been affected with petroleum hydrocarbons and other contaminants. In an ongoing effort, Transwestern installed and continues to operate a groundwater remediation system that consists of soil vapor extraction (SVE) and recovery of phase-

separated hydrocarbons (PSH). In an effort to more aggressively remove PSH still present at the shallow water table, Transwestern has submitted a proposal and Discharge Plan application to the New Mexico Oil Conservation Division (OCD) for an expansion to the groundwater remediation system that would include total fluid recovery pumps and an evaporation pond for management of recovered groundwater. A more detailed description is provided in a document titled "Remedial Design and Discharge Plan Application" dated February 23, 2004. A copy of the document is enclosed with this notification.

4. *Brief description of the expected quality and volume of the discharge*

   Pumped groundwater will be the only source of effluent from the proposed remedial system. Based on short-term pumping tests conducted at the site, the anticipated discharge rate of recovered groundwater will be 2 gallons per minute (gpm).

   Semiannual monitoring of groundwater quality at the site has been ongoing since the fall of 1993. The persistent presence of PSH at the shallow water table and elevated concentrations of benzene dissolved in groundwater are the primary concern at the site. A more detailed description of groundwater quality is provided in the most recent annual report titled "Report of Groundwater Remediation Activities" dated August 10, 2004. A copy of the document is enclosed with this notification.

5. *Depth to and total dissolved solids concentration of the ground water beneath the discharge site*

   Groundwater is present at approximately 90 feet bgs within a relatively thin unconfined aquifer perched upon a clay layer present at approximately 100 feet bgs. Water samples collected from the shallow aquifer indicates that background total dissolved solids (TDS) concentrations are on the order of 800 mg/L.

6. *Address and phone number within the NMOCD by which interested persons may obtain information, submit comments, and request to be placed on a facility-specific mailing list for future notices*

   Mr. William C. Olson
   Environmental Bureau
   New Mexico Oil Conservation Division
   1220 South St. Francis Drive
   Santa Fe, New Mexico 87505

   Telephone No. (505) 476-3491

7. *Required statement:*

The department (NMOCD) will accept comments and statements of interest regarding the application and will create a facility-specific mailing list for persons who wish to receive future notices.

If you have any questions or comments regarding this notification, please contact George Robinson at (713) 345-1537 or you can contact me at (713) 646-7644.

Sincerely,

Bill Kendrick
Senior Director, Environmental Affairs
Transwestern Pipeline Company

xc w/o enclosures:

Bill Olson	New Mexico Oil Conservation Division
Larry Campbell	Transwestern Pipeline Company
George Robinson	Cypress Engineering

NOTICE OF PUBLICATION

STATE OF NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to the New Mexico Water Quality Control Commission Regulations, the following discharge plan application has been submitted to the Director of the Oil Conservation Division, 1220 South Saint Francis Drive, Santa Fe, New Mexico 87505, Telephone (505) 476-3440:

(GW-355) – Transwestern Pipeline Co., William Kendrick, (713) 646-7644, P.O. Box 4657, Houston, Texas 77210-4657, has submitted a discharge permit application for the Bell Lake Plant remediation project located in the SW/4 NE/4 of Section 1, Township 24 South, Range 33 East, NMPM, Lea County, New Mexico. Approximately 1,000 gallons per day of groundwater will be discharged to an evaporation pond that is double-lined and has leak detection. Ground water most likely to be affected in the event of an accidental discharge at the surface is at a depth of approximately 90 feet. The discharge plan addresses how spills, leaks, and other accidental discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. The discharge plan application may be viewed at the above address between 8:00 a.m. and 4:00 p.m., Monday thru Friday.

Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and public hearing may be requested by any interested person. Request for public hearing shall set forth the reasons why a hearing shall be held. A hearing will be held if the director determines that there is significant public interest.

If no hearing is held, the Director will approve or disapprove the plan based on the information available. If a public hearing is held, the Director will approve the plan based on the information in the plan and information presented at the hearing.

GIVEN under the Seal of New Mexico Conservation Commission at Santa Fe, New Mexico, on this 17th day of May 2004.

STATE OF
NEW MEXICO
OIL CONSERVATION
DIVISION

JOANNA PRUKOP,
Acting Director

Legal #74436
Pub. June 9, 2004

THE SANTA FE
NEW MEXICAN
Founded 1849

RECEIVED
JUN 17 2004
OIL CONSERVATION
DIVISION

NM OIL CONSERVATION DV-EMNRDI
Attn: Ed Martin
1220 ST. FRANCIS DR

SANTA FE NM 87505

ALTERNATE ACCOUNT: 56689
AD NUMBER: 00069359 ACCOUNT: 00002212
LEGAL NO: 74436 P.O. #: 04-199-050340

200 LINES 1 TIME(S)	88.00
AFFIDAVIT:	5.50
TAX:	6.25
TOTAL:	99.75

AFFIDAVIT OF PUBLICATION

STATE OF NEW MEXICO
COUNTY OF SANTA FE

I, B. Perner, being first duly sworn declare and say that I am Legal Advertising Representative of THE SANTA FE NEW MEXICAN, a daily newspaper published in the English language, and having a general circulation in the Counties of Santa Fe and Los Alamos, State of New Mexico and being a newspaper duly qualified to publish legal notices and advertisements under the provisions of Chapter 167 on Session Laws of 1937; that the publication # 74436 a copy of which is hereto attached was published in said newspaper 1 day(s) between 06/09/2004 and 06/09/2004 and that the notice was published in the newspaper proper and not in any supplement; the first date of publication being on the 9th day of June, 2004 and that the undersigned has personal knowledge of the matter and things set forth in this affidavit.

/S/ B Perner
LEGAL ADVERTISEMENT REPRESENTATIVE

Subscribed and sworn to before me on this 9th day of June, 2004

Notary Laura L. Harding

Commission Expires: 11/23/07

AFFIDAVIT OF PUBLICATION

State of New Mexico,
County of Lea.

I, KATHI BEARDEN

Publisher

of the Hobbs News-Sun, a newspaper published at Hobbs, New Mexico, do solemnly swear that the clipping attached hereto was published once a week in the regular and entire issue of said paper, and not a supplement thereof for a period.

of 1

weeks.

Beginning with the issue dated

June 9 2004

and ending with the issue dated

June 9 2004

Kathi Bearden

Publisher

Sworn and subscribed to before

me this 9th day of

June 2004

Notary Public.

My Commission expires
November 27, 2004
(Seal)

This newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Laws of 1937, and payment of fees for said publication has been made.

01100060000 02570439

State of New Mexico Oil &
1220 S. St. Francis
Santa Fe, NM 87505

LEGAL NOTICE
June 9, 2004

NOTICE OF PUBLICATION

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to the New Mexico Water Quality Control Commission Regulations, the following discharge plan application has been submitted to the Director of the Oil Conservation Division, 1220 South Saint Francis Drive, Santa Fe, New Mexico 87505, Telephone (505) 476-3440:

(GW-355) – Transwestern Pipeline Co., William Kendrick, (713) 646-7644, P.O. Box 4657, Houston, Texas 77210-4657, has submitted a discharge permit application for the Bell Lake Plant remediation project located in the SW/4 NE/4 of Section 1, Township 24 South, Range 33 East, NMPM, Lea County, New Mexico. Approximately 1,000 gallons per day of groundwater will be discharged to an evaporation pond that is double-lined and has leak detection. Ground water most likely to be affected in the event of an accidental discharge at the surface is at a depth of approximately 90 feet. The discharge plan addresses how spills, leaks, and other accidental discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. The discharge plan application may be viewed at the above address between 8:00 a.m. and 4:00 p.m., Monday thru Friday.

Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and public hearing may be requested by any interested person. Request for public hearing shall set forth the reasons why a hearing shall be held. A hearing will be held if the director determines that there is significant public interest.

If no hearing is held, the Director will approve or disapprove the plan based on the information available. If a public hearing is held, the Director will approve the plan based on the information in the plan and information presented at the hearing.

GIVEN under the Seal of New Mexico Conservation Commission at Santa Fe, New Mexico, on this 17th day of May 2004.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
JOANNA PRUKOP, Acting Director
(SEAL)
#20713

Cypress Engineering

7[illegible] Highway 6 North, Suite 102
Houston, Texas 77095-2422
(281) 797-3420 office
(281) 859-1881 fax

April 12, 2004

Mr. William C. Olson
Environmental Bureau
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Remedial Design and Discharge Plan Application
Bell Lake Plant Remediation Site
Transwestern Pipeline Company
Lea County, New Mexico

Dear Bill,

The enclosed document contains a remedial system design for expansion of the existing remediation system at the Bell Lake Plant remediation site. The enclosed document also contains a discharge plan application for this activity. The purpose of the proposed system expansion is to more aggressively address phase-separated hydrocarbon (PSH) still present beneath the site. An electronic copy of the document has also been delivered to Ed Martin (NMOCD) for processing of the discharge plan application.

If you have any questions or comments regarding this document, please contact me at (713) 345-1537, or you may contact Bill Kendrick at (713) 646-7644.

Sincerely,

George C. Robinson, PE
President/Principal Engineer

xc w/enclosure:	Bill Kendrick	Transwestern Pipeline Company
	Larry Campbell	Transwestern Pipeline Company
	Ed Martin	NMOCD Santa Fe Office
	Paul Sheeley	NMOCD Hobbs District Office

GW-355

REMEDIAL DESIGN AND DISCHARGE PLAN APPLICATION BELL LAKE PLANT REMEDIATION SITE LEA COUNTY, NEW MEXICO

February 23, 2004

Prepared for

Transwestern Pipeline Company
6381 North Main Street
Roswell, New Mexico 88201

Prepared by

Tetra Tech EM Inc.
6121 Indian School Road, NE, Ste. 205
Albuquerque, New Mexico 87110

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LIST OF APPENDICES

1.0 INTRODUCTION

On behalf of Transwestern Pipeline Company (TPC), Tetra Tech EM Inc. (Tetra Tech) has prepared this remedial design (RD), plans and specifications, and manufacturer cut-sheets for specified equipment to address soil and groundwater contamination at the Bell Lake Plant Remediation Site located on the west side of County Road 21, in Lea County, New Mexico, approximately 25 miles northwest of Jal, New Mexico in SW ¼, NE ¼, Section 1, Township 24 South, Range 33 East. A site plan is provided on Drawing G-1.

This document is intended to support the discharge application submitted by TPC for the expansion of ongoing remediation activities at the site (Cypress, 1995 and 2002). The remediation systems described herein consists of multi-phase extraction (MPE), a combination of soil vapor extraction (SVE) and total fluids (groundwater and phase-separated hydrocarbon [PSH]) recovery. The goals of the MPE remedial phase are (1) removal of PSH from the subsurface and (2) reduction of soil and groundwater constituents to levels more amenable to passive bioremediation.

The passive phase of remediation will consist of monitored natural attenuation (MNA) to address residual soil and groundwater contamination. The goal of the MNA phase will be to reduce soil contamination so that leachate in the vadose zone shall not be capable of contaminating groundwater or surface water and groundwater constituent concentrations shall conform to New Mexico Water Quality Control Commission (NMWQCC) standards (or alternative abatement standards, if warranted).

This RD is divided into 6 Sections, of which this introduction is Section 1. A brief discussion of the site hydrogeology and contaminant distribution is provided in Section 2. Cleanup goals are described in Section 3. Section 4 provides a narrative of the remedy, including description of the remediation system, and basis of design. An operation, maintenance, monitoring, and reporting plan, including annual evaluation of remediation is provided in Section 5. Finally, Section 6 provides a list of references.

Appendix A contains a copy of the discharge plan application. Supporting design calculations are provided in Appendix B. Specifications and manufacturer cut sheets are provided in Appendices C and D, respectively. Finally, Appendix E contains design drawings for the system.

2.0 SITE HYDROGEOLOGY AND CONTAMINANT DISTRIBTUTION

The site is situated in an area of Quaternary alluvial and terrace deposits consisting primarily of loosely consolidated sands and gravelly sands to a depth of approximately 100 feet below ground surface (ft bgs). Records from nearby wells indicate the presence of shale, clay, and sandstones to depths of 650 ft bgs. These sediments are part of the underlying Triassic age Santa Rosa Formation (Nicholson, 1961).

At the site, groundwater is present at approximately 90 feet bgs within a relatively thin unconfined saturated zone perched upon the underlying Triassic age sediments. Based on the monitoring well network, groundwater flow is toward the southeast with a hydraulic gradient of 0.002 feet per foot. There are no known uses of the shallow unconfined zone within a 2-mile radius of the site.

A supply well, located in the southeast part of the facility, has historically provided water for use at the facility. This well was completed in 1967 to a total depth of 659 ft, and is screened from 550 to 659 ft bgs. The well location is shown on drawing G-1. Office of the State Engineer records indicates the presence of two wells completed in the deep aquifer within a 2-mile radius of the site. One of these wells is located 0.8 miles northeast of the facility at a nearby Conoco facility, and the other located approximately 1.3 miles southeast of the site has been abandoned.

The subsurface extent of phase-separated hydrocarbons and highly impacted groundwater to be addressed by the RD is depicted on Drawing G-2. Based on recent monitoring data (Cypress Engineering, 2002), measurable PSH thickness within monitor and SVE wells completed in this zone is currently less than 1-foot. As shown on drawing G-2, the PSH impacted zone is long and narrow, roughly 200 feet long by 50 feet wide encompassing an area of about 10,000 square feet (approximately 0.25 acres). In the vertical sense, the impacted soil zone extends from approximately 15 feet bgs (the depth of past contaminated soil removal efforts) to the water table near the former surface impoundments located near the upgradient edge of PSH. Away from these sources soil contamination occurs near the water table.

Recent monitoring data (Cypress Engineering, 2002) indicate that dissolved-phase petroleum hydrocarbons and total dissolved solids (TDS) extend downgradient toward the southeast a distance of approximately 1,000 and 1,500 feet respectively from on-site monitor well MW-4.

These impacts will be addressed through the MNA remedy. Of the dissolved-phase hydrocarbon constituents, elevated concentrations of benzene continue to be the primary concern at the site.

3.0 CLEANUP GOALS

Groundwater cleanup goals for the site are based on NMWQCC human health based standards stated in 20 NMAC 6.2 §3103.A. For benzene this standard is 10 micrograms-per-liter (µg/L). No other organic compounds currently exceed NMWQCC standards. The primary goal of the remedial action is to remove PSH from the water table and capillary fringe, so that, groundwater can be restored to the benzene standard.

It is not the intent to restore groundwater by active remediation (e.g., MPE system operation) alone. At such time as PSH is fully removed from the water table, active remediation may be suspended. The target concentrations for benzene at suspension of active remediation will be in the range of 10 times standards (EPA 1995) as the MNA phase of remediation commences. For benzene the target concentration will be about 100 µg/L.

Soil impacts will be cleaned up to OCD guidelines for TPH, benzene, and total benzene, toluene, ethyl benzene, and xylenes (BTEX). These standards are 10 milligrams-per-kilogram (mg/kg) for benzene, 50 mg/kg for total BTEX and 100 mg/kg for TPH (OCD 1993). If soil contaminant concentrations remain above OCD cleanup guidelines, Transwestern will likely complete a risk assessment to determine whether final contaminant concentrations pose a threat to workers and underlying groundwater quality.

4.0 REMEDIATION SYSTEM NARRATIVE

The proposed remedy for soil and groundwater contamination, and phase-separated hydrocarbon (PSH) recovery is multi-phase extraction (MPE). The remedy consists of a two-phase approach: a period of aggressive, active remediation employing MPE followed by passive MNA to restore residual groundwater contamination to standards. The following subsections provide an overview of the system design.

4.1 Description of Remediation System

Detailed elements of the remediation system are shown on Drawings C-1 through C-5, while a process flow diagram is provided as Drawing P-1 (Appendix E). The proposed system features include the following:

- Six existing SVE wells completed to total depths of approximately 100 feet bgs (S8, S9, S10, S11, S12, and S13).
- An equipment compound containing an existing 6-foot by 6-foot Morgan shed.
- A SVE blower with controls that will provide SVE and emission directly to the atmosphere through a 4-inch PVC exhaust stack.
- A pneumatic total fluids recovery system including pump controller, pumps, and air compressor.
- Conveyance piping consisting of high-density polyethylene (HDPE) of various diameters necessary to route compressed air, vapors, and water.
- Pumped groundwater will be routed to two evaporation ponds constructed with double liners and leak detection systems immediately south of the facility.

The SVE portion of the MPE well system will be designed to operate at maximum well output equal to 160 cubic foot per minute (cfm), the maximum flow rate of the blower. The system design accommodates flow variability by use of dedicated conveyance lines, valves, and manifolds to allow manipulation of SVE stresses.

Total fluids will pumped from the MPE wells with pneumatic pumps placed at the bottom of the MPE wells. The pneumatic pumps will be driven by a two-stage reciprocating air compressor. The pumps will discharge upon filling, thereby keeping the well bore evacuated of water and PSH. The pumps will be driven by dedicated airlines and recovered fluids conveyed by dedicated discharge lines. The total fluids will be routed to a storage tank prior to discharge to the lined evaporation ponds to be constructed south of the facility.

Transwestern has submitted a discharge plan application for the proposed evaporation ponds. A copy of the application is provided in Appendix A. The permit application is for the discharge of pumped groundwater containing total petroleum hydrocarbons and volatile organic compounds into the lined evaporation pond system.

4.2 Basis of Design

The design is based on several factors, including the following:

- The maximum airflow rate from a single MPE well is 20 CFM as indicated by past operation experience.
- The maximum sustainable total fluids flow rate from a single MPE well is 0.5 gallons per minute based on evaluation of aquifer permeability and thickness, and test pumping.
- A maximum combined groundwater effluent flow rate of 2 gallons-per-minute (gpm) to the double-lined evaporation ponds.

Discussions regarding the design factors are provided below.

Pneumatic Design - SVE Conveyance

On-site conveyance piping shall be layed on the ground surface to the extraction wells. The 1.25-inch conveyance pipe is designed to provide adequate pipe velocities (e.g., 2,500 to 4,000 feet per minute [ft/min]) to clear fluids and sediment while maintaining acceptable head losses (USCOE 1995, WDNR 1993). The three-inch manifold header is designed to experience minimal head loss.

Hydraulic Design – Groundwater Conveyance

Conveyance piping for the hydraulic system is based on anticipated flow rates and standard piping sizes. Conveyance lines from individual wells are 3/4-inch SDR 11 HDPE and are designed to carry 0.5 gpm. The header line is 1-inch in diameter and designed to carry a maximum of 5.5 gpm. The conveyance line from the storage tank to the evaporation pond is 2-inch in diameter and designed to convey 25 gpm. The conveyance line from the storage tank to the evaporation ponds will be buried within a dedicated trench that will be wheel rolled for compaction.

Evaporation Ponds

The evaporation ponds were designed in consideration of the guidelines set forth by the New Mexico Environment Department Ground Water Pollution Prevention Section (NMED, 1995) and the New Mexico Oil Conservation Division (NMOCD, 2002) for liner material and site preparation of synthetically-lined lagoons. The ponds will be constructed with a 60-mil high-density polyethylene (HDPE) primary liner overlying a 200-mil geotextile drainage layer, which in-turn is underlain by 40-mil secondary HDPE liner. The liner system is configured to direct any collected fluid between the double liners into a monitoring sump for leak detection. Drawings C-4 and C-5 show plan and cross sectional details of the proposed ponds.

The ponds are designed with a holding capacity of approximately 1 ac-ft each (~326,000 gallons) in order to accommodate pumped groundwater and precipitation while maintaining 2-feet of pond freeboard to the top of the berm. Potential run-on is diverted around the base of the pond through use of a drainage ditch. The ponds are designed with 3:1 (H:V) exterior sideslopes and 2:1 interior sideslopes, and have been oriented to minimize wave height in the prominent wind direction and associated earthwork requirements. The depth of the ponds from the top of the berm to the floor is 5-feet.

The ponds will be fenced to prevent livestock, wild animals, or humans from accidentally falling in and to protect the liner from damage. Sufficient room will be maintained around the pond perimeter to allow vehicles assess to the monitoring sumps and for pond maintenance.

5.0 OPERATION, MAINTENANCE, AND MONITORING PLAN

Operation, maintenance (O&M), and monitoring of the remediation system, troubleshooting, and system performance evaluation are presented in this section. O&M activities include the startup phase and the long-term O&M phase.

5.1 Operation and Maintenance.

One week of startup testing is scheduled to ensure the remediation system is operating as specified. Startup testing will include ensuring the system is properly constructed, that equipment and monitoring devices are working as specified, and that flow rates, vacuums, and vapor concentrations are within anticipated ranges.

Table 1 provides a checklist for final construction inspection of the remediation system, to be performed prior to operating the system. This checklist will be completed during final inspection. Table 2 provides a functional performance checklist to be competed each day during the startup phase to ensure all systems are working as designed. Tables 3 and 4 provide a summary of parameter measurements to be evaluated for system performance assessment during the startup phase and the long-term O&M phase. Finally, a routine monitoring data form is provided as Table 5.

5.2 Reporting and Performance Assessment

Routine reports on operation of the remediation system will be prepared. The reports will include:

- Groundwater quality and fluid gauging data.
- Evaluation of system performance, and system run-time.
- A summary of all O&M activities performed.
- Recommendations for improving system performance, if warranted.

5.3 Monitored Natural Attenuation Phase

Three lines of evidence (primary, secondary, and optional) are generally recommended to demonstrate the viability of MNA as an appropriate remedy (ASTM 1998). These lines of evidence include the following:

- Demonstration that the groundwater plume is stable or shrinking in areal extent (primary line of evidence)
- Groundwater monitoring data that indicate attenuation rates that will achieve remediation goals in a timely manner and geochemical indicators (secondary line of evidence)
- Demonstration or evidence that the microbiological mechanism exists in the subsurface to facilitate degradation of contaminants, estimation of the assimilative capacity of the aquifer to degrade COCs, and fate and transport modeling to evaluate natural attenuation rates (optional lines of evidence)

With regard to the primary line of evidence, data do not presently exist that indicate that the plume is stable or shrinking. It will not be until after the removal of PSH that hard evidence supporting the primary line of evidence can be established. The first year of monitoring following PSH removal will be critical in verifying the appropriateness of MNA as the remedy. Nonetheless, concentrations of benzene in monitor wells that do not contain PSH and have been sampled sufficiently to establish trends indicate that concentrations are stable to declining in most wells.

For the second and third line of evidence, attenuation rates will be estimated from groundwater monitoring data obtained during the first year after PSH removal. The focus of groundwater monitoring will be supporting the MNA remedy. COCs to be monitored include BTEX, and

inorganic constituents. Geochemical indicators to be monitored include ferrous iron, nitrate, sulfate, manganese, dissolved oxygen (DO), and oxidation-reduction potential (ORP).

6.0 REFERENCES

American Society for Testing and Materials (ASTM). 1998. "Standard Guide for Remediation of Ground Water by Natural Attenuation at Petroleum Release Sites." ASTM E 1943-98. August.

Cypress Engineering. 1995. Remedial Action Plan for Subsurface Soil and Groundwater, Bell Lake Plant, Lea County, New Mexico, Transwestern Pipeline Company. July 26.

Cypress Engineering. 2002. Annual Report of Groundwater Remediation Activities at the Bell Lake Gas Plant, Transwestern Pipeline Company. August 26.

Environmental Protection Agency (EPA). 1995. How to Evaluate Alternative Cleanup Technologies for Underground Storage Sites – A Guide for Corrective Action Plan Reviewers. EPA 510-B-95-007. May.

EPA. 1999. Multi-Phase Extraction: State of the Practice. EPA 542-R-99-004. June.

Hinchee,Robert E. 1994. Bioventing Petroleum Hydrocarbons *in* Handbook of Bioremediation, Robert D. Norris, Editor. Lewis Publishers. Pp. 39-59.

Nicholson and Clebsch. 1961. Geology and Ground-Water Conditions in Southern Lea County, New Mexico. Ground-Water Report 6.

New Mexico Environment Department. 1995. Guidelines for Liner Material and Site Preparation for Synthetically-Lined Lagoons. December.

New Mexico Oil Conservation Division. 1993. Unlined surface impoundment closure guidelines (February 1993). Tab 7b. In Environmental Regulations, State of New Mexico Energy and Minerals. March 13.

New Mexico Oil Conservation Division. 2002. Guidelines for Design, and Construction of Surface Pits. July.

United States Army Corps of Engineers. 1995. Soil Vapor Extraction and Bioventing. Engineer Manual 1110-1-4001. November 30.

TABLES

TABLE 1
PRECOMMISSIONING CHECKLIST
BELL LAKE PLANT REMEDIATION SITE, LEA COUNTY, NEW MEXICO

Checklist Item	*Responsible Person*	*Initials*	*Inspection Date*
Subsurface			
Trenches installed per specification			
Pneumatic pumps installed to specification			
Piping Installation			
Piping complete (including from wells/trenches)			
Valves installed and operation verified			
Pressure test complete			
Equipment and Evaporation Pond Compounds			
Evap. ponds and signs installed to specification			
Headers built to specification			
Blower connections installed/tested			
Air compressor installed to specification			
Transfer pumps installed to specification			
Monitoring points functional			
Valves, meters, and gauges installed and functional			
Electrical			
Grounding installed/checked			
Lighting functional			
Lockouts/covers/panels in place			
Blower rotation verified			
Disconnects in sight of unit being controlled			
Controls/alarms and interlocks functional			
Other			

Modified from USACE 1995

TABLE 2
FUNCTIONAL PERFORMANCE CHECKLIST FOR STARTUP TESTING
BELL LAKE PLANT REMEDIATION SITE, LEA COUNTY, NEW MEXICO

Checklist Item	*Responsible Person*	*Initials*	*Inspection Date*
Subsurface			
No piping/well pneumatic leaks			
Extraction well vacuums within expected ranges based on blower curves and anticipated head losses			
Remediation Equipment			
All switches and safety interlocks functioning			
Operating points match blower curve specification for flow rate vs. vacuum through start-up			
Pneumatic pumps operating within anticipated range for pressure, discharge, and well drawdown			
Current draw and voltage balance match manufacturers specifications			
No excessive vibration/noise/temperature rise			
Monitoring Systems			
Magnehelic and Capsuhelic gauges recording within specified range.			
Vacuum gauges recording within specified range			
Stack emission rates within limits of air quality permit			

Modified from USACE, 1995

TABLE 3
ROUTINE EQUIPMENT OPERATION AND MAINTANANCE TASKS
BELL LAKE PLANT REMEDIATION SITE, LEA COUNTY, NEW MEXICO

Activity	Activity Description	Frequency
1	Monitor system performance	Weekly
2	Inspect system for leaks	Weekly
3	Inspect apperance of pond waters (color, extent of bubbling, presense of floating matter, etc.)	Weekly
4	Inspect pond embankments for seepage/erosion	Weekly
5	Record operating parameters	Weekly
6	Re-torque terminal screws & tighten loose hardware	Monthly
7	Inspect, clean or replace filters, valves, equipment	Monthly
8	Site cleanup	Monthly
9	Inspect, clean or replace knock-out pot filter	Quarterly
10	Clean high-level switch & sight glass	Quarterly

Notes:

[a] The frequency of these activities is estimated; the actual frequency will be determined by actual conditions

[b] Bearing should be changed after 15,000 to 20,000 hours on average as per service and parts manual

TABLE 4
SYSTEM MONITORING REQUIREMENTS
BELL LAKE PLANT REMEDIATION SITE, LEA COUNTY, NEW MEXICO

SYSTEM OPERATIONAL TESTING		
Monitoring Parameter	**Monitoring Point**	**Method of Measurement**
Vapor and Water Flow Rates	Upstream of SVE Blowers	Capsuhelic Gauge/Blower Curve
	Pneumatic Pump Manifold (Individual Wells)	Bucket fill time
	Downstream of Storage Tank	Totalizing flow meter
Vapor Concentrations	Downstream of SVE Blowers	FID/Sample collection & analysis by EPA method 8015 for TPH
Groundwater Discharge Concentrations	Downstream of Storage Tank	Sample collection/analysis by EPA method 8015 for TPH

Notes:

EPA = U.S. Environmental Protection Agency
TPH = Total petroleum hydrocarbons
Monitoring frequency daily during system startup them monthly during long-term operation

TABLE 5
ROUTINE MONITORING DATA FORM
BELL LAKE PLANT REMEDIATION SITE

Date: _____ Time: _____ Operator: _____

	SVE Data Monitoring Point											
	Header	MPE/SVE Well Number										
Monitoring Parameter												
System Vacuum (pre-filter)												
System Vacuum (post-filter)												
	Total Fluids Data Monitoring Point											
	Header	MPE/SVE Wells										
Monitoring Parameter												
Flow Rate												

Other Notes:

Transwestern Pipeline Company
1331 Lamar Street, Ste 650
Houston, TX 77010
713-646-7644

August 22, 2004

Mr. Jerry King
Assistant Commissioner – Surface Resources
New Mexico State Land Office
PO Box 1148
Santa Fe, New Mexico 87504-1148

via certified mail

RE: Notification of Proposed Discharge
Bell Lake Plant Remediation Site
Lea County, New Mexico

Dear Mr. King,

Transwestern Pipeline Company (Transwestern) is the responsible party for groundwater remediation activities at the Bell Lake Plant remediation site located in Lea County, New Mexico. Transwestern has recently submitted a Discharge Plan application to the New Mexico Oil Conservation Division (NMOCD) for a proposed expansion of the current remediation system to include the recovery and discharge of affected groundwater. The purpose of this letter is to provide written notice to property owners of record within ½ mile of the proposed discharge site as required under Section 20.6.2.3108 NMAC. The information specified under Subsection E of this Section is provided below.

1. *Name and address of proposed discharger*

   Transwestern Pipeline Company
   Attn: Bill Kendrick
   1331 Lamar Street, Suite 650
   Houston, TX 77010

2. *Location of the discharge*

   The discharge will be into an evaporation pond to be constructed at a location just south of Duke Energy's Bell Lake Plant. The facility is located on the west side of County Road 21 in Lea County, New Mexico, approximately 25 miles northwest of Jal, New Mexico in SW1/4, NE1/4, Section 1, Township 24 South, Range 33 East.

3. *Brief description of the activities that produce the discharge*

   Shallow groundwater beneath the Bell Lake Plant and adjacent property has been affected with petroleum hydrocarbons and other contaminants. In an ongoing effort, Transwestern installed and continues to operate a groundwater remediation

system that consists of soil vapor extraction (SVE) and recovery of phase-separated hydrocarbons (PSH). In an effort to more aggressively remove PSH still present at the shallow water table, Transwestern has submitted a proposal and Discharge Plan application to the New Mexico Oil Conservation Division (OCD) for an expansion to the groundwater remediation system that would include total fluid recovery pumps and an evaporation pond for management of recovered groundwater. A more detailed description is provided in a document titled "Remedial Design and Discharge Plan Application" dated February 23, 2004. A copy of the document is enclosed with this notification.

4. *Brief description of the expected quality and volume of the discharge*

   Pumped groundwater will be the only source of effluent from the proposed remedial system. Based on short-term pumping tests conducted at the site, the anticipated discharge rate of recovered groundwater will be 2 gallons per minute (gpm).

   Semiannual monitoring of groundwater quality at the site has been ongoing since the fall of 1993. The persistent presence of PSH at the shallow water table and elevated concentrations of benzene dissolved in groundwater are the primary concern at the site. A more detailed description of groundwater quality is provided in the most recent annual report titled "Report of Groundwater Remediation Activities" dated August 10, 2004. A copy of the document is enclosed with this notification.

5. *Depth to and total dissolved solids concentration of the ground water beneath the discharge site*

   Groundwater is present at approximately 90 feet bgs within a relatively thin unconfined aquifer perched upon a clay layer present at approximately 100 feet bgs. Water samples collected from the shallow aquifer indicates that background total dissolved solids (TDS) concentrations are on the order of 800 mg/L.

6. *Address and phone number within the NMOCD by which interested persons may obtain information, submit comments, and request to be placed on a facility-specific mailing list for future notices*

   Mr. William C. Olson
   Environmental Bureau
   New Mexico Oil Conservation Division
   1220 South St. Francis Drive
   Santa Fe, New Mexico 87505

   Telephone No. (505) 476-3491

7. *Required statement:*

The department (NMOCD) will accept comments and statements of interest regarding the application and will create a facility-specific mailing list for persons who wish to receive future notices.

If you have any questions or comments regarding this notification, please contact George Robinson at (713) 345-1537 or you can contact me at (713) 646-7644.

Sincerely,

Bill Kendrick
Senior Director, Environmental Affairs
Transwestern Pipeline Company

xc w/o enclosures:

Bill Olson	New Mexico Oil Conservation Division
Larry Campbell	Transwestern Pipeline Company
George Robinson	Cypress Engineering

APPENDIX A
DISCHARGE PLAN APPLICATION

District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Avenue, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Revised June 10, 2003

Submit Original
Plus 1 Copy
to Santa Fe
1 Copy to Appropriate
District Office

DISCHARGE PLAN APPLICATION FOR SERVICE COMPANIES,GAS PLANTS, REFINERIES, COMPRESSOR, GEOTHERMAL FACILITES AND CRUDE OIL PUMP STATIONS

(Refer to the OCD Guidelines for assistance in completing the application)

☒ New ☐ Renewal ☐ Modification

1. Type: Bell Lake Plant Remediation Site
2. Operator: Transwestern Pipeline Company

   Address: P.O. Box 4657, Houston, TX 77210-4657

   Contact Person: Bill Kendrick Phone: (713) 646-7644
3. Location: SW1/4 NE1/4 Section 1 Township 24 South Range 33 East
   Submit large scale topographic map showing exact location.
4. Attach the name, telephone number and address of the landowner of the facility site.
5. Attach the description of the facility with a diagram indicating location of fences, pits, dikes and tanks on the facility.
6. Attach a description of all materials stored or used at the facility.
7. Attach a description of present sources of effluent and waste solids. Average quality and daily volume of waste water must be included.
8. Attach a description of current liquid and solid waste collection/treatment/disposal procedures.
9. Attach a description of proposed modifications to existing collection/treatment/disposal systems.
10. Attach a routine inspection and maintenance plan to ensure permit compliance.
11. Attach a contingency plan for reporting and clean-up of spills or releases.
12. Attach geological/hydrological information for the facility. Depth to and quality of ground water must be included.
13. Attach a facility closure plan, and other information as is necessary to demonstrate compliance with any other OCD rules, regulations and/or orders.
14. CERTIFICATION I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

Name: Bill Kendrick Title: Senior Director, Environmental Affairs

Signature: Bill Kendrick Date: 3/26/04

E-mail Address: William.kendrick@enron.com

SUPPORTING INFORMATION FOR DISCHARGE PLAN APPLICATION BELL LAKE PLANT REMEDIATION SITE, LEA COUNTY, NEW MEXICO February 23, 2004

1. Type of Operation

The Bell Lake Plant began operation in 1961. During its operation, the facility performed three primary functions:

1. Dehydration – removal of water from natural gas by a regenerative triethylene glycol (TEG) process.
2. Sweetening – removal of hydrogen sulfide from natural gas by a regenerative amine process
3. Mercaptan removal – removal of mercaptan from natural gas by a regenerative caustic process

The sweetening plant was taken out of service in 1985. Currently, dehydration and compression is the only active processes occurring at the site. These processes are owned and operated by Duke Energy. Transwestern Pipeline Company (TPC) sold the Bell Lake Plant to Duke Energy in 1996. However, TPC has retained responsibility for remedial activities at the site. This application pertains only to remediation activities at the facility.

2. Name of Operator or Legally Responsible Party and Local Representative

Questions and correspondence concerning remedial activity under the proposed discharge plan should be directed to:

Mr. Larry Campbell
Division Environmental Specialist
Roswell Technical Operations
Transwestern Pipeline Company
P.O Box 1717
Roswell, NM 88202-1717
(505) 625-8022

3. Location of the Discharge Plan Facility

The Bell Lake Plant Remediation Site is located on the west side of County Road 21, in Lea County, New Mexico, approximately 25 miles northwest of Jal, New Mexico within the SW ¼, NE ¼, Section 1, Township 24 South, Range 33 East. A site plan and topographic map are provided on Drawing G-1.

4. Landowners

The landowner of record for the facility is Duke Energy. The landowner of record for the surrounding area is the New Mexico State Land Office. The contact person and address is provided below:

Mr. Jerry King, Assistant Commissioner
Surface Resources Division
New Mexico State Land Office
P.O. Box 1148
Santa Fe, NM 87504-1148
Phone: (505) 827-5760
Fax: (505) 827-4262

TPC has obtained two Water Development Easements for monitoring wells from the New Mexico State Land Office, as follows:

WD-38
- Originally issued 11/28/94 for 3 wells and for a term of 5 years
- Renewed 11/24/99 for 5 wells and a term of 5 years
- Amended 4/14/03 for 3 additional wells
- Currently includes 8 wells (MW-5, MW-6, MW-8, MW-9, MW-13, MW-14, MW-15, & MW-16)
- Expires 11/24/04

WD-69
- Originally issued 11/24/97 for 3 wells and for a term of 5 years
- Renewed 11/24/02 for 3 wells and a term of 2 years
- Currently includes 3 wells (MW-10, MW-11, & MW-12)
- Expires 11/24/04

5. Facility Description

The facility property boundaries and the proposed layout of the remediation system including the location of multi-phase extraction wells, equipment, conveyance lines, and the evaporation pond are shown on the remediation system drawings provided in Appendix E.

6. Materials Stored or Used at the Facility

The requested discharge plan is for the operation of the remedial system outlined in the Remedial Design. As such, their are no plans to store/dispose liquids or solids with the exception of the pumped groundwater which will be routed to the evaporation ponds for disposal. The pumped groundwater will contain petroleum hydrocarbons.

7. Sources and Quantities of Effluent and Waste Solids Generated at the Facility

Pumped groundwater will be the only source of effluent from the proposed remedial system. Based on short-term pumping tests conducted at the site, the anticipated combined process flow-rate from the 6-MPE wells will be 2-gpm.

Monitoring of groundwater quality at the site has been ongoing since the fall of 1993 on a semi-annual basis. The attached tables in each monitoring report (Cypress, 2002) provide information on the distribution of organic and inorganic constituents in groundwater. Elevated concentrations of benzene continue to be the primary concern at the site.

8. Description of Current Liquid and Solid Waste Collection/Storage/Disposal Procedures

Pumped groundwater from each well will be routed to a manifold and then into a 210-bbl surge tank within a secondary containment structure. From the tank, the water will be pumped through 2-inch diameter HDPE buried within a dedicated trench to the evaporation ponds located south of the facility. The design and specifications for the evaporation pond are provided in the Remedial Design. The evaporation ponds are designed to be zero-discharge facilities (total retention) from which contaminated groundwater will be disposed of through the process of evaporation.

9. Proposed Modifications

The remedial design is protective of underlying groundwater quality. The design and specifications require the installation of a double HDPE liner and leak detection system. In addition, provisions for diverting precipitation run-on to the ponds have been incorporated into the design.

10. Inspection, Maintenance and Reporting

The proposed routine inspection procedures outlined for the evaporation pond including frequency of inspection, maintenance of records, and OCD notification in the event of a leak are provided in the remedial design.

The ponds were sized to accommodate the introduction of direct precipitation into the evaporation ponds. No other water sources will be in contact with the pumped groundwater routed to the evaporation ponds.

11. Spill/Leak Prevention and Reporting Procedures (Contingency Plan)

As part of the routine system inspections, TPC personnel will notify the OCD Director of any significant leaks and spills, and will notify the OCD if more than 25 gallons of water accumulate in the sumps that collect potential leakage below the primary liner. Notification will include contact of the local OCD District field office within 24 hours of discovery of a significant spill or release as defined in OCD Rule 116 and WQCC Section 1203.

If water is detected in the sumps, the remedial system will be shut down and the water within the evaporation ponds will be allowed to evaporate so that the liner integrity can be inspected. Repairs to the liner will be made as necessary to ensure containment of future discharged water. Any water that collects in a sump will be directed back to the pond.

12. Site Characteristics

The site is situated in an area of recent Quaternary alluvial and terrace deposits. Surface materials consist of loosely consolidated sands and gravelly sands. The uppermost stratigraphic unit underlying the site is the Santa Rosa Formation.

The sediments encountered to approximately 35 feet below grade as determined from previous site investigations are loosely consolidated sands and gravelly sands. Between approximately 35 and 40 feet bgs, a well-cemented sandstone layer containing significant chert has been encountered across the site. Below the cherty zone, interbedded siltstones and

sandstones are present to the maximum depth of exploration of 100 feet bgs. Records from nearby wells indicate the presence of shale, clay, and sandstones to depths of 650 ft bgs.

Groundwater is present at approximately 90 feet bgs within a relatively thin unconfined aquifer. Based on the monitoring well network, groundwater flow is toward the southeast with a hydraulic gradient of 0.002 feet per foot. There are no known uses of the shallow unconfined aquifer within a 2-mile radius of the site.

A supply well is located in the southeast part of the facility that has historically provided water for use at the facility. This well was completed in 1967 to a total depth of 659 ft, and is screened from 550 to 659 ft bgs. The well location is shown on drawing G-1. A past search of well records in the State Engineers Office in Roswell, NM identified two other wells completed in the deep aquifer within a 2-mile radius of the site. One of these wells is located 0.8 miles NE of the facility at a nearby Conoco facility, and the other was located approximately 1.3 miles southeast of the site but has been abandoned.

December 2002 analysis of water samples collected from the shallow aquifer indicates that background total dissolved solids concentrations are on the order of 800 milligrams-per-liter (mg/L). Heal Environmental Analysis Laboratory (HEAL) located in Albuquerque, New Mexico analyzed the water quality samples.

Flooding potential is quite low due to the limited watershed up gradient of the proposed evaporation ponds and the relatively flat topography of the area immediately surrounding the ponds (Drawing G-1). The remedial design has provisions for diverting run-on around the ponds and protection of the berms.

13. Other Compliance Information

TPC is committed to NMOCD Rule 116 and WQCC Section 1203 spill/leak reporting. In accordance with OCD guidance (OCD, 2002), TPC will notify OCD when operation of the facility is discontinued for a period in excess of six months or when the evaporation ponds are to be closed. At that time, TPC will provide a closure plan pursuant to OCD requirements, and any other applicable local, state, and/or federal regulations.

APPENDIX B
DESIGN CALCULATIONS

Evaporation Pond Design Spreadsheet

Site Name	Bell Lake Gas Plant	
Calcs by:	Jeffrey Forbes	
Date:	01/14/03	
Design Flow (gpm)	2	
Design Lifetime (yrs)	5	
Annual Influent Flow (gal)	1,051,200	
Annual Influent Flow (ft3)	140,535	
Lifetime Influent Flow (gal)	5,256,000	
Lifetime Influent Flow (ft3)	702,674	
Pond Evap Rate (in/yr)	80	Jal area, Williams,1986, p. 48
Pond Evap Rate (mm/yr)	2032	Jal area
Mean Annual Precip (in)	12.53	Jal, NM data from WRCC website
Mean Annual Precip (mm)	318.3	Jal, NM
Pan Evap Rate (in/yr)	112.93	Lake Avalon, Roswell, NM from WRCC website
Pan Coefficient (Ep/Eo)	1.5	Linacre, 2002, www-das.uwyo.edu
Est Pond Evap Rate (in/yr)	75	Lake Avalon, Roswell

Influent Water Quality (mg/L):

(based on 12/13/95 MW-4 results, normalized to 10,000 mg/L TDS)

Calcium	112
Magnesium	6
Sodium	2,850
Potassium	9
Chloride	2,880
Sulfate	140
Bicarbonate	4030 (est)
TDS	10,000

Lifetime Mass Salts (kg)	198,940	(based on TDS)
Lifetime Mass NaCl (kg)	113,992	(based on sum of Na+Cl)
Lifetime Volume Salts (m3)	99	(assuming salt density = 2000 kg/m3)
Lifetime Volume NaCl (m3)	57	(assuming salt density = 2000 kg/m3)
Lifetime Salt Thickness (m)	0.04	
Lifetime Salt Thickness (ft)	0.12	

Evap Pond Dimensions:

Avg. Width (ft)	170
Avg. Length (ft)	170
Area (ft2)	28,900
Area (m2)	2,686
Area (acre)	0.66
Berm Height (ft)	5
Storage Volume (ft3)	144,500
Storage Volume (m3)	4,092
Storage Volume (gal)	1,080,860

Water Balance Calculations:

Month	Inflow (gal)	Direct Precip (gal)	Total Inflow (gal)	Evap (gal)	Vol Chg (gal)	Pond Volume (gal)	Water Depth (ft)
Jan	87,552	7,566	95,118	53,923	41,195	41,195	0.2
Feb	87,552	7,926	95,478	64,011	31,467	72,662	0.3
Mar	87,552	6,485	94,037	113,130	-19,093	53,570	0.2
Apr	87,552	10,448	98,000	148,438	-50,438	3,132	0.0
May	87,552	26,841	114,393	171,857	-57,463	0	0.0
Jun	87,552	25,580	113,132	182,065	-68,933	0	0.0
Jul	87,552	30,444	117,996	169,815	-51,819	0	0.0
Aug	87,552	34,407	121,959	148,078	-26,118	0	0.0
Sep	87,552	34,948	122,500	111,088	11,411	11,411	0.1
Oct	87,552	23,959	111,511	87,189	24,322	35,733	0.2
Nov	87,552	8,106	95,658	56,205	39,454	75,187	0.3
Dec	87,552	9,007	96,559	50,440	46,119	121,306	0.6
Annual	**1,050,624**	**225,720**	**1,276,344**	**1,356,239**			

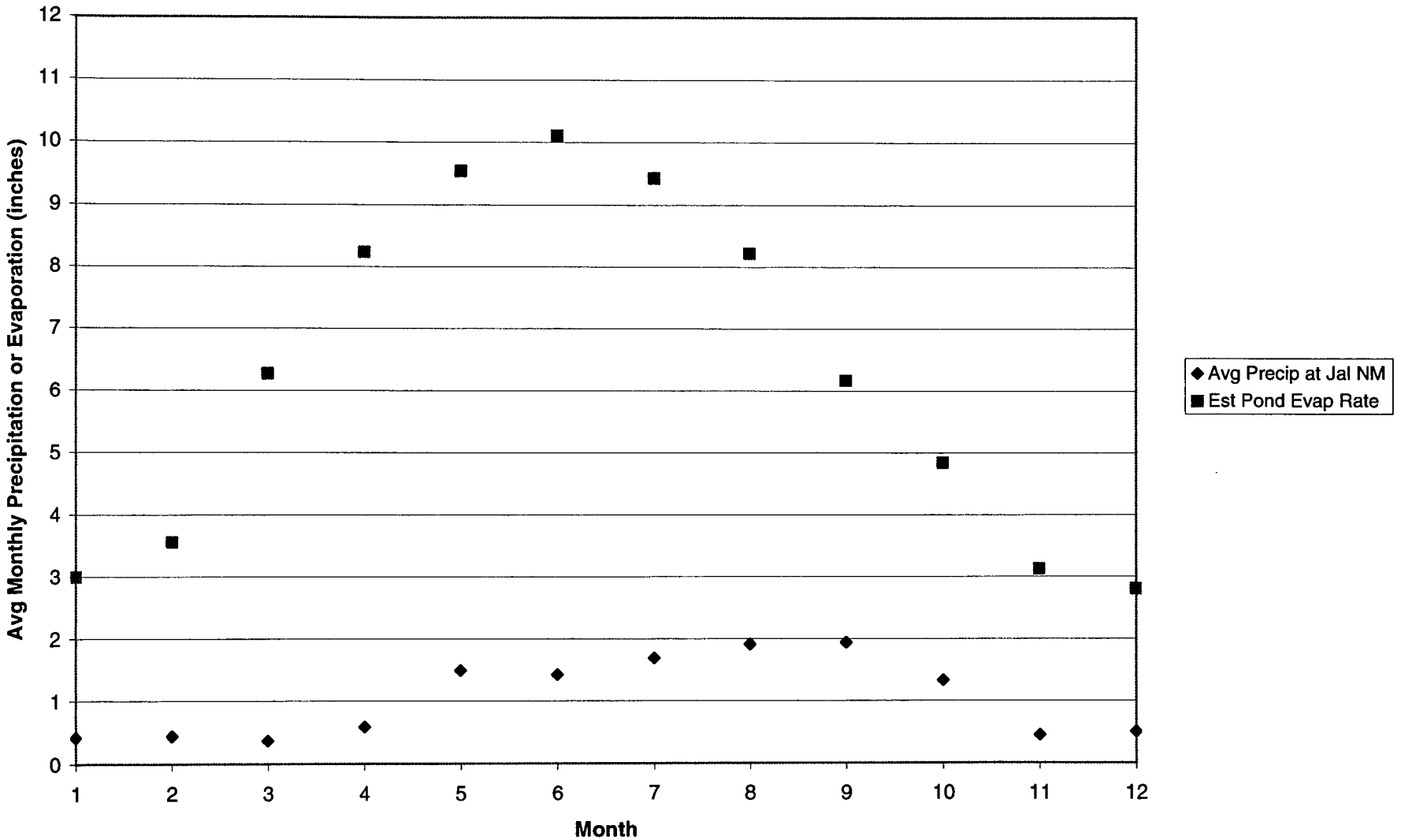
Info Sources:

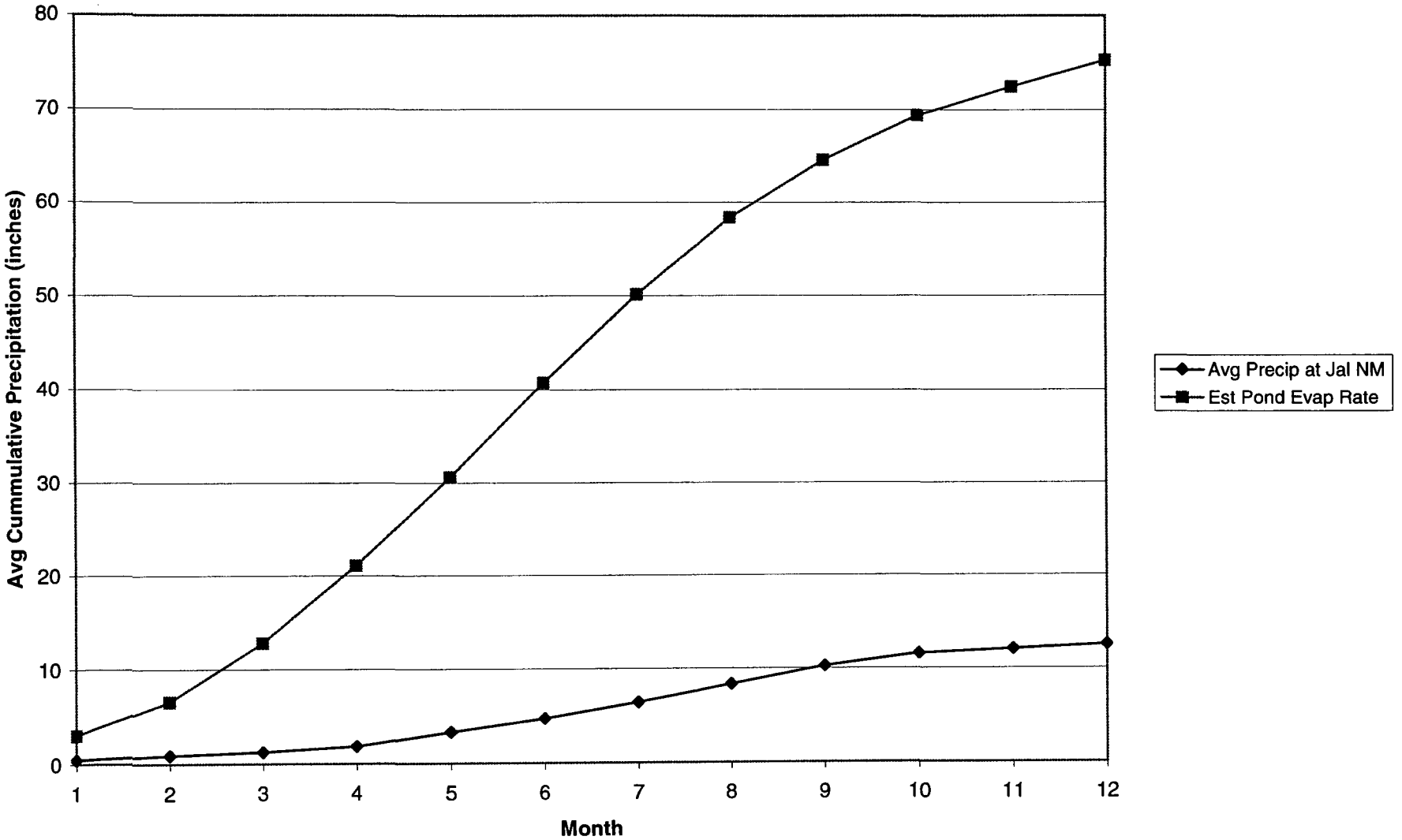
WRCC website: www.wrcc.dri.edu
Williams, J.L., 1986, New Mexico in Maps, 2nd Ed.

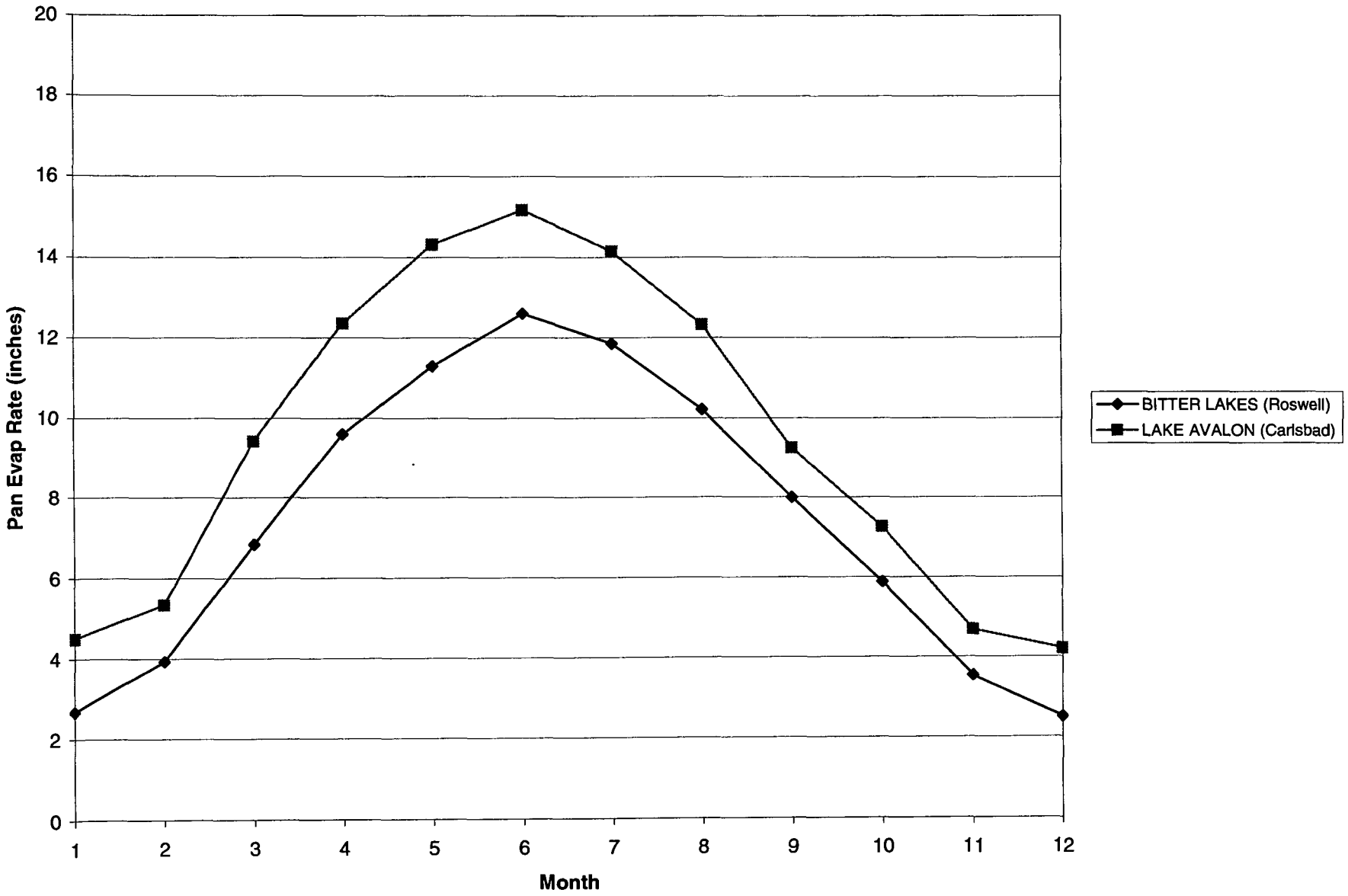
Station	Jal (294346)				
Period	1919-2001		Lake Avalon	Estimated	Est Cumm
Month	Avg Precip (in)	Cumm. Precip (in)	Pan Evap (in)	Pond Evap (in)	Pond Evap (in)
Jan	0.42	0.42	4.49	2.99	2.99
Feb	0.44	0.86	5.33	3.55	6.55
Mar	0.36	1.22	9.42	6.28	12.83
Apr	0.58	1.80	12.36	8.24	21.07
May	1.49	3.29	14.31	9.54	30.61
Jun	1.42	4.71	15.16	10.11	40.71
Jul	1.69	6.40	14.14	9.43	50.14
Aug	1.91	8.31	12.33	8.22	58.36
Sep	1.94	10.25	9.25	6.17	64.53
Oct	1.33	11.58	7.26	4.84	69.37
Nov	0.45	12.03	4.68	3.12	72.49
Dec	0.50	12.53	4.20	2.80	75.29
Annual	12.53		112.93	75.29	

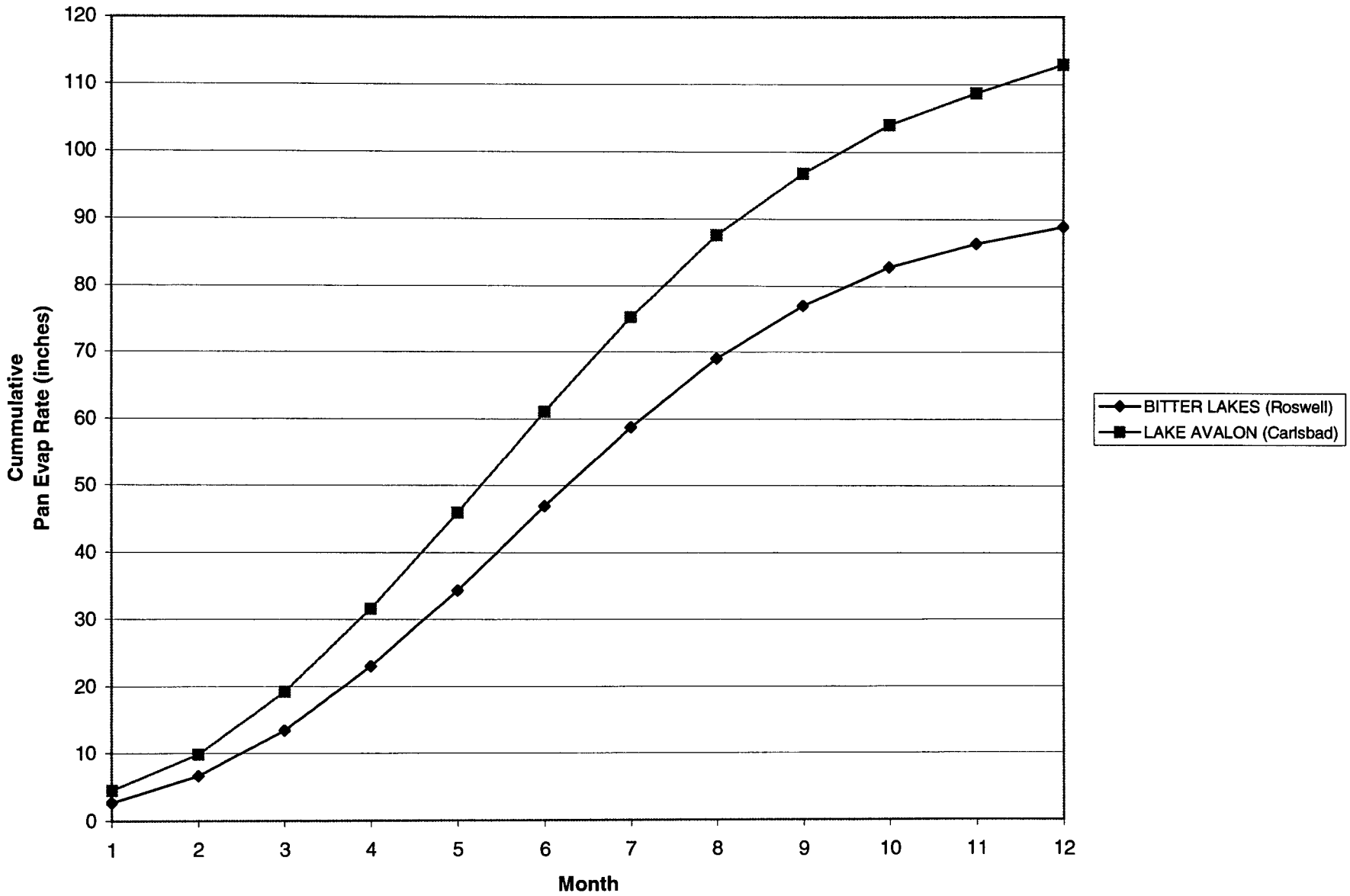
Pan Evaporation (inches)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period
BITTER LAKES (Roswell)	2.67	3.93	6.83	9.60	11.29	12.6	11.85	10.21	7.99	5.88	3.53	2.5	88.88	1950-2000
LAKE AVALON (Carlsbad)	4.49	5.33	9.42	12.36	14.31	15.16	14.14	12.33	9.25	7.26	4.68	4.2	112.93	1914-1979
Cummulative Pan Evaporation (inches)														
BITTER LAKES (Roswell)	2.67	6.6	13.43	23.03	34.32	46.92	58.77	68.98	76.97	82.85	86.4	88.9		
LAKE AVALON (Carlsbad)	4.49	9.82	19.24	31.60	45.91	61.07	75.21	87.54	96.79	104.05	109	113		

Source: www.wrcc.dri.edu


Avg Monthly Precipitation or Evaporation (inches)
0
1
2
3
4
5
6
7
8
9
10
11
12
1
2
3
4
5
6
7
8
9
10
11
12
Month
Avg Precip at Jal NM
Est Pond Evap Rate


80
70
60
50
40
30
20
10
0
Avg Cummulative Precipitation (inches)
1
2
3
4
5
6
7
8
9
10
11
12
Month
Avg Precip at Jal NM
Est Pond Evap Rate


20
18
16
14
12
10
8
6
4
2
0
Pan Evap Rate (inches)
1
2
3
4
5
6
7
8
9
10
11
12
Month
BITTER LAKES (Roswell)
LAKE AVALON (Carlsbad)


Cummulative
Pan Evap Rate (inches)
120
110
100
90
80
70
60
50
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30
20
10
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11
12
Month
BITTER LAKES (Roswell)
LAKE AVALON (Carlsbad)

APPENDIX C
SPECIFICATIONS

SPECIFICATION 1

SUMMARY OF WORK

PART 1—GENERAL

1.1 SUMMARY

This section includes basic identification of the work and other related activities.

1.2 PROJECT DESCRIPTION

The project includes, but is not limited to, the following:

A. Installation and startup testing of a multiphase extraction (MPE) system at the Transwestern Pipeline Company remediation system at the Bell Lake Gas Plant located approximately 25 miles west of Jal, Lea County, New Mexico. The construction will take place on- and off-site at the gas plant – therefore, adherence with all plant protocols and procedures specific to on-site contractors must be strictly adhered to throughout the course of the project.

B. Much of the earthwork for installing conveyance lines and the evaporation ponds for the system will take place on open grazing land. As such, trenching will be performed with a trenching machine, pipes laid, and the trenches backfilled and compacted by wheel rolling. The surface of the evaporation pond to be lined must be free of irregularities, protrusions, vegetation, excessive water, loose soil or abrupt changes in grade. The goal is to expedite installation but ensure the installation of a quality system.

C. Manifolds and conveyance piping connections shall be constructed on pipe supports (e.g., UniStrut) set to elevation and place in shallow post-holes.

D. Electrical service will be provided by the Engineer via a separate subcontract.

E. Remediation equipment to a large extent will be supplied by the Engineer. This is called out clearly throughout the specifications where applicable.

F. The work shall include the following as shown on the plans and as specified herein:

1. Procure and install conveyance systems to each of 6 multi-phase extraction (MPE) wells.
2. Procure and construct SVE, total fluids, and pneumatic manifolds as specified within Engineer provided aluminum equipment boxes.
3. Procure and install piping from manifold to the remediation equipment as indicated.
4. Retrofit an existing day tank and equipment shed to become integral components of the remedial system as indicated.
5. Install a 210 bbl surge tank and containment structure.
6. Restore all impacted site surfaces, as specified, whether directly or indirectly related to the Contractors completion of the work.
7. Construct evaporation ponds, as specified.

8. Perform five (5) days of system startup testing in accordance with Operation and Maintenance requirements stated in the Remedial Design.

1.3 CONTRACTOR'S USE OF PREMISES

A. LIMITED USE

1. Limit use of the Owner's property to that required for execution of the work. Limit storage of materials and equipment to the Owner's property only. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
2. Conduct operations to ensure the least inconvenience to adjoining property owners and to the general public.

1.4 OWNER'S USE OF PREMISES

The Owner and the Company will require access to the site during the entire construction period. The Contractor shall cooperate with the Company and the Owner during construction operations to minimize conflicts and to ensure access to the Remediation Site.

1.5 WORK SEQUENCE

A. GENERAL: Construction sequence shall be determined by the Contractor, subject to the Company's approval.

B. SCHEDULED EVENTS: Schedule the work to conform to the following events and dates:

1. All construction work shall be completed by September 30, 2004.
2. Placement of remediation equipment and start up testing shall be performed in fall 2003.

1.6 PRECONDITION PHOTOGRAPHIC SURVEY

Prior to the start of construction, the site and all structures which may be affected by the construction may be photographed by the Company in the presence of the Contractor. Attention will be paid to existing defects. Photographs will indicate date, time, weather conditions, and all the Contractor's and the Company's staff present. Original photographs will remain with the Company. Copies can be provided to the Contractor upon request.

1.7 COORDINATION WITH UTILITIES

The Contractor shall coordinate all work involving either public or private utilities and shall satisfy himself as to the existing conditions for the areas in which he is to perform his work. The Contractor shall also be responsible for coordinating any and all work performed by his Subcontractors on or adjacent to either public or private utilities.

1.8 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

During all construction activities, the Contractor shall be solely responsible for the protection of all private or public buildings, structures, and utilities whether or not shown on the plans and should be responsible for their support as necessary. Any damage resulting from the Contractor's operations shall be repaired immediately by him at his expense.

1.9 COPIES OF DOCUMENTS

A. FURNISHED COPIES: The Contractor will be provided (at no cost) three (3) sets of full-size drawings, including revised drawings, and one (1) set of the Remedial Design Report following issuance of the Company's written contract.
B. ADDITIONAL COPIES: Additional copies of above documents will be supplied at printing and delivery cost upon request.

PART 2—PRODUCTS

NOT APPLICABLE

PART 3—EXECUTION

NOT APPLICABLE

END OF SPECIFICATION 1

SPECIFICATION 3

SITE PREPARATION AND EARTHWORK

PART 1—GENERAL

1.1 SUMMARY

A. DEFINITION: This section includes all trenching, excavating, construction, backfilling, compacting, grading, and all related items necessary to complete the work indicated or specified.

B. RELATED WORK SPECIFIED ELSEWHERE

1. Specification for Piping and Accessories
2. Specification for Geomembrane Liner Installation

1.2 REFERENCES

A. APPLICABLE STANDARDS

1. American Society for Testing and Materials (ASTM)

a. C88—Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
b. D698—Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 Pound (2.49 kg) Rammer and 12 Inch (304.8 mm) Drop
c. D1241—Materials for Soil-Aggregate Subbase, Base and Surface Courses
d. D4253—Maximum Index Density of Soils Using a Vibratory Table
e. D4254—Minimum Index Density of Soils and Calculation of Relative Density

PART 2—MATERIALS

2.1 MATERIALS ENCOUNTERED

A. SUITABLE BACKFILL MATERIAL: Excavated materials suitable for use as compacted backfill include cohesive and cohesionless material, as defined below, that are free of debris, roots, organic matter, frozen matter, and stones or solid rubble (brick and/or concrete or asphalt pavement) having any dimension greater than 4 inches and which have not been placed in the soils stockpile.

1. Cohesionless materials include gravel, gravel-sand mixture, sands, and gravelly sands generally exclusive of clayey and silty materials; materials which are free-draining and for which impact compaction will not produce a well-defined moisture-density relationship curve, and materials for which the maximum density by impact methods will generally be less than by vibrating methods.
2. Cohesive materials include silts and clays generally exclusive of sands and gravel, and materials for which impact compaction will produce a well-defined moisture-density relationship curve.

B. UNSUITABLE BACKFILL MATERIAL: Materials unsuitable for use as compacted backfill include all Material that contains debris, roots, organic matter, frozen matter, stones (with any dimension greater than 4-inch diameter), materials which have been placed in the contaminated

soils stockpile, or other materials that are determined by the Company as too wet or otherwise unsuitable for providing a stable subgrade.

C. CONCRETE OR ASPHALT: In general, concrete or asphalt pavement removed during construction will not be allowed for use as trench backfill. Final disposal and/or recycling of concrete or asphalt pavement rubble will be the responsibility of the Contractor. The Contractor must obtain the Company's approval of his intended disposal and/or recycling plan for these materials before hauling any of the material off-site.

2.2 BORROW MATERIALS

A. BORROW MATERIALS INCLUDE THE FOLLOWING:

1. Acceptable backfill materials and granular material obtained from locations arranged for by the Contractor (off the job site), required to the extent that sufficient suitable materials is not encountered and available from on-site excavations.

2.3 GRANULAR MATERIAL

A. Crushed stone or gravel indicating a loss of not more than 15 percent after 5 cycles when tested for soundness with sodium sulfate, as described in ASTM C33 Graduation 67, as follows:

Percent Passing	Sieve Size
100	0.75-inch
60B100	0.5-inch
0B5	Number 4

B. Granular material shall not contain vegetation, root masses, organic matter, fine or harmful substances.

PART 3—EXECUTION

3.1 SITE CLEARING

A. TREES AND VEGETATION: The Contractor shall not cut or injure any trees or other vegetation outside the limits of the area on which work is to be done without permission to do so, and he shall guard against like action by his employees.

B. GROUND SURFACE: All stumps, roots, foreign matter, topsoil, loam, sludge piles, and unsuitable earth shall be stripped from the ground surface. The topsoil and loam shall be used insofar as possible, for finished surfacing. Loam shall not be removed from the site.

3.2 EXCAVATION

A. GENERAL

1. Open trenches and excavations shall be kept to a minimum to allow access to site facilities at all times. No open trenches or excavations will be allowed at the end of each day or over weekends, unless thoroughly barricaded and protected.
2. Steel plates, fences, barricades and other measures necessary shall be used to maintain access to the site and to protect all site occupants and visitors.
3. If required due to soil type, classification, depth of excavation, or other criteria, sheeting and bracing shall be designed, installed, and maintained in full compliance with applicable laws and regulations including, but not limited to, 20 CFR, Part 1926. Excavation support shall be solely the Contractor's responsibility and shall be installed at no additional cost to the Company.
4. Remove sheeting and bracing as backfill progresses. Fill voids left after withdrawal with sand or other approved material.

B. EXPLOSIVES

1. Blasting will not be permitted.

C. TRENCHING

1. Trenching shall be dug to the depths shown on the drawings or as directed by the Company. Trench depth shall be increased as necessary to remove unsuitable supporting materials.
2. Trenching will be performed with a trenching machine (e.g., "Ditch Witch" to the extent possible.
3. Trenching in segments containing a high density of conveyance pipe shall be performed with a backhoe equipped with a 2-foot bucket.
4. The Contractor shall excavate the trench to a minimum of 4 inches below the pipe barrel for placement of embedded material.

3.3 EARTHWORK

A. COMPACTION

1. General.

    a. Excavate or backfill as required to construct subgrades to the elevations and grades indicated.
    b. Remove all unsuitable material and replace with acceptable fill material and perform all wetting, drying, shaping, and compacting required to prepare subgrade.
    c. Trenches in un-trafficked areas will be compacted by wheel rolling only
    d. Trenches in trafficked areas and around and under concrete slabs and foundations shall be compacted to 95% standard proctor.

2. Subgrades for Trench and Evaporation Pond Areas

    a. Emplace dry, cohesionless granular materials (e.g., coarse sand or pea gravel) in trench subgrades to set slope for piping. This material shall not be compacted.
    b. Conveyance piping shall be covered with 4-inches of dry, cohesionless granular materials prior to backfilling and compacting.
    c. The bed of the pond and inside grade of the levee shall be smooth and compacted, free of holes, rocks, stumps, clods, or any other debris with may rupture the liner. In extremely rocky areas, it will be necessary to cover the pond bed with a compacted layer of sand or other suitable material.

B. BACKFILLING

1. Construct backfill to the contours and elevations indicated, using suitable approved material.

    a. Place fill material in 0.5- to 1.0-foot layers
    b. Place backfill only on subgrades approved by the Engineer
    c. Do not place snow, ice, or frozen earth in fill and do not place fill on a frozen surface

2. Obtain compaction by the controlled movement of equipment or as required during the placing and grading of layers and to the minimum density specified for indicated locations.
3. Remove all debris from excavation prior to placement of material.
4. Exercise extreme care in the use of heavy equipment in areas adjacent to structures. Equipment operated within 9 feet of any wall shall not exceed 17,000 pounds gross.

C. SITE GRADING

1. Excavate, fill, compact fill, and rough grade to bring project area to subgrades as follows:

    a. For areas to be paved, to underside of respective surfacing or base course
    b. When rock is encountered in grading areas, overexcavate to depth specified and backfill to grade with earth compacted in place
        i. Under areas to be paved, to 6 inches below top of respective subgrades for such areas.
    c. Finish all ditches, swales, and gutters to drain readily
    d. Unless otherwise indicated, slope the subgrade evenly to provide drainage as indicated in all directions at a grade not less than 0.25 inch per foot

3.4 MAINTENANCE

A. Protect newly graded areas from actions of the elements.

B. Fill and repair settling or erosion and reestablish grades to the required elevations and slopes.

3.5 CARE AND RESTORATION OF PROPERTY

A. TREES: The Contractor shall enclose the trunks of trees adjacent to his work and not to be cut as needed to protect them from injury by piled material, equipment, work operations or otherwise.
B. PAVED SURFACES: If wheel treads will cut or otherwise injure paved surfaces, the Contractor shall not use or operate tractors, bulldozers, or other powered equipment on these surfaces.
C. RESTORATION: All surfaces which have been injured by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately before work was begun. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

END OF SPECIFICATION 3

SPECIFICATION 4

PIPING AND ACCESSORIES

PART 1—GENERAL

1.1 SUMMARY

A. This Section includes pipe and fittings, strainers, piping specialties, hangers and supports, valves, steam traps, vibration isolators, meters and gauges, and other basic materials.

B. General

1. All special valves, controllers, fittings, and equipment shall meet the following requirements:

    a. Furnished, installed, tested, and put into successful operation.
    b. Be complete with all necessary miscellaneous pipe, valves, unions, fittings, and auxiliaries whether indicated or not, but required.
    c. Be insulated and covered in accordance with the pipe system to which they attach.

2. Furnish and install piping connected to accessories which must vary from the drawings because of requirements peculiar to the particular equipment furnished, as required to make a complete and workable installation at no additional cost to the Owner. This requirement shall include changes required in the piping systems because of design changes made by the manufacturer between the time of design and the time of installation or because of equipment furnished by a different manufacturer than that specified.

3. Furnish control valves complete, including pilot lines, solenoid valves, shutoff valves, and operators whether or not specific mention was made of these items. All control valves shall be by the same manufacturer.

4. Furnish the necessary pipe and fittings required to install all safety and relief valves vertically. Furnish and route tail pipes to a place where the discharge will not injure personnel, or as indicated.

5. Where spare, replacement, or additional parts are required for the equipment specified herein, deliver these items to the Owner immediately upon receipt at the job site. Parts shall be packaged and sealed for long storage, securely and visibly labeled as to part, function, and name of equipment to which they apply.

6. Equip all Y-type strainers, 4 inches and larger, with blowdown valves and piping.

C. Related Work Specified Elsewhere

1. Excavation and Backfill Specification

1.2 REFERENCES

A. Applicable Standards

1. American National Standards Institute (ANSI)

    a. B2.1—Pipe Threads (Except Dry Seal)
    b. B16.12—Cast-Iron Threaded Drainage Fittings
    c. B16.22—Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
    d. B16.29—Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV
    e. B31.1—Power Piping
    f. B36.10—Welded and Seamless Wrought Steel Pipe

2. American Petroleum Institute (API)

    a. 5L—Plastic-Coated Steel Pipe

3. American Society of Mechanical Engineers (ASME)

    a. B361—Code for Pressure Piping

4. American Society for Testing and Materials (ASTM)

    a. A53—Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
    b. A74—Cast-Iron Soil Pipe and Fittings
    c. A105—Forgings, Carbon Steel, for Piping Components
    d. A120—Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses
    e. A307—Carbon Steel Externally Threaded Standard Fasteners
    f. B32—Solder Metal
    g. B88—Seamless Copper Water Tube
    h. B306—Copper Drainage Tube (DWV)
    i. D1248—Polyethylene Plastic Molding and Extrusion Materials
    j. D1330—Rubber, Sheet Gaskets
    k. D1693—Environmental Stress-Cracking of Ethylene Plastic
    l. D1784—Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
    m. D1785—Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120
    n. D2146—Propylene Plastic Molding and Extrusion Materials
    o. D2241—Poly(Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
    p. D2464—Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
    q. D2466—Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
    r. D2564—Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
    s. D2657—Heat Joining of Polyolefin Pipe and Fittings

t. D2665—Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
u. D2846—Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
v. D2855—Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
w. D3350—Polyethylene Plastic Pipe and Fittings Material
x. F104—Nonmetallic Gasket Materials
y. F493—Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings

5. American Water Works Association (AWWA)

    a. C203—Coal-Tar Protective Coatings and Linings for Steel Water Pipelines—Enamel and Tape—Hot-Applied

6. Cast Iron Soil Pipe Institute (CISPI)

    a. 301—Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary System
    b. 310—Cast Iron Soil Pipe Institute's Patented Joint for Use in Connection with Hubless Cast Iron Sanitary System
    c. HSN—Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

7. Federal Specification (FS)

    a. QQ-L-201—Lead Sheet

8. Military Specification (MIL)

    a. F-1183G—Fitting, Tube, Cast Bronze, Silver-Brazing

9. Manufacturers Standardization Society (MSS)

    a. SP-58—Pipe Hangers and Supports—Materials, Design and Manufacture
    b. SP-69—Pipe Hangers and Supports—Selection and Application

10. National Sanitary Foundation (NSF):

    a. 14—Plastic Piping System Components and Related Materials

11. Pipe Fabrication Institute (PFI)

    a. ES5—Cleaning of Fabricated Piping

12. Society of Automotive Engineers (SAE)

    a. J514—Hydraulic Tube Fittings

13. Steel Tank Institute (STI):

    a. Sti-P3—3-way Corrosion Protection

14. Underwriters Laboratories (UL)

    a. 58—Steel Underground Tanks for Flammable and Combustible Liquids

1.3 PRODUCT STORAGE AND HANDLING

A. Except for hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps in place through shipping, storage, and handling to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe, valves, fittings, and equipment inside and protected from weather. Where necessary to store outside, elevate well above grade and enclose with durable waterproof wrapping.

PART 2—EQUIPMENT AND MATERIALS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturers and model numbers specified herein are to establish quality and performance only. Products of manufacturers regularly engaged in their manufacture are acceptable if proven to the Engineer as equal or better quality and performance and as stated in the General Conditions.

2.2 PIPE AND FITTINGS

A. Pipe furnished under this contract shall conform to ASTM material specifications herein referenced. All wrought-steel pipe shall meet the standards set forth in ANSI B36.10.

B. Drainage System Soil, Waste, Sparge, and Vent Piping Materials:

1. Polyvinyl Chloride (PVC) Pressure Pipe:

    a. PVC pipe for pressure applications for underground installation shall be of the type and size designated on the drawings, minimum Schedule 40 with solvent-weld joints. Provide threaded joints with Teflon tape or flange joints with nitrile or urethane gaskets as indicated on the drawings.
    b. All fittings shall be of the same manufacturer, material, class, and schedule as the pipe.
    c. Solvent cement joints for the pipe shall be made in accordance with the manufacturer's recommendations and ASTM D2855.
    d. Stop valves shall be 150-pound, true-union PVC ball valves with TFE O–rings, 150-pound PVC butterfly valves, or 150-pound non-rising stem bronze gate valves with screw-in bonnets as indicated.
    e. Applicable System Piping:

i. All below-grade, non-exposed, compressed air piping up to within 20 feet of riser or outside of manholes as indicated.

2. Polyvinyl Chloride (PVC) Pressure Pipe With Pressure Fittings:

   a. PVC fittings shall be Schedule 40 or Schedule 80 as indicated and conform to ASTM D2466. Joints shall be made with solvent cement in accordance with the manufacturer's recommendations. Stop valves and piping between fittings shall be Schedule 40, PVC pressure pipe as specified above.
   b. Applicable System Piping: All soil vapor extraction (SVE) and groundwater recovery (GW) containment system piping.

3. Galvanized Carbon Steel Pipe:

   a. All exposed pipe and fittings for the compressed air piping within 20 feet of and including piping riser and within manholes and all piping for the natural gas service line shall be Schedule 40, hot-dipped galvanized carbon steel pipe.
   b. Stop valves shall be 150-pound, non-rising stem bronze gate valves.
   c. Piping joints to be screwed with Teflon tape or flange with nitrile or urethane gaskets as indicated.
   d. Applicable System Piping:
      i. Compressed air piping as indicated and specified.

4. High Density Polyethylene (HDPE) Thermoplastic Pipe:

   a. Pipe shall conform to ASTM D3350, PE3406 Type III, Grade P34, SDR11.
   b. Applicable System Piping
      i. Below-grade natural gas piping.
      ii. Soil vapor extraction conveyance piping, groundwater extraction and injection conveyance piping, and air sparging conveyance piping.
      iii. The natural gas pipe within five (5) feet of the gas meter and within five (5) feet of the equipment compound will be plastic-coated steel or an approved gas line adapter.

C. Natural Gas System Materials (2 inches and smaller):

1. Pipe:

   a. Schedule 40, seamless or electric-resistance welded carbon steel ASTM A53, Grade A.
   b. Pipe underground: Factory-applied plastic-coated pipe, X-TRU-COAT plastic-coated API-5L, welded carbon steel, Schedule 40, line pipe by Republic Steel. All field joints and damaged areas shall be protected by X-TRU-COAT primer and pressure-sensitive tape.
   c. Pipe underground: Where not prohibited by local codes or utilities or by pressure limitations, black polyethylene thermoplastic piping may be

used. Pipe shall conform to ASTM D3350, PE3406, Type III, Grade P34.

2. Joints: Screwed or butt-welded for steel pipe. Socket-fusion type as outlined in ASTM D2657 for polyethylene pipe.
3. Fittings: 150-pound, malleable iron screwed fittings and unions or butt-weld carbon-steel fittings for steel pipe. Polyethylene fittings shall be of the same material as the pipe.
4. Stop Valves:

    a. Cocks — 125-pound, bronze, threaded ends, square head, Crane No. 254 or equal by Stockham, Jenkins, Walworth, or Lunkenheimer.

2.3 PIPING SPECIALTIES

A. Gaskets:

1. Rubber gaskets for flanged joints, ASTM D1330:

    a. 1/16-inch-thick, full-faced red rubber for all pipe sizes 10 inches and smaller in diameter.
    b. 1/8-inch-thick, full-faced red rubber for all pipe sizes 12 inches and larger in diameter.
    c. 1/16-inch-thick, full-faced neoprene or equal for fuel oil and natural gas service.
    d. Furnish with bolt holes and pipe openings punched.

2. Synthetic fiber gaskets for flanged joints, ASTM F104 (F712400-A9B4E44K5M9):

    a. Garlock 3200 or 3400 synthetic fiber gaskets with SBR binder, manufactured by Chicago Wilcox Mfg. Co.
    b. 1/16-inch-thick, full-faced for flat faced flanges.
    c. 1/16-inch-thick, ring for raised-faced flanges.
    d. Furnish with bolt holes and pipe openings punched.

3. Grooved-End Mechanical Joint Gaskets:

    a. Victaulic "Triple Seal" Grade H synthetic, or Gustin-Bacon Style "C" Type II butyl.
    b. Lubricate gaskets with a lubricant compatible with gasket material and service conditions.
    c. Flange Bolt Thread Lubricant: An antiseize compound and thread lubricant designed for 1,000 °F.

B. Insulating Flanges and Unions:

1. Insulating Flanges: Maloney-flanged insulating set, or approved equal, consisting of Type "E" neoprene laminated phenolic gaskets, integral sleeves, washers, and flat washers.

2. Unions: Insulating type, Epco or approved equal, installed in a position to take pipe line expansion as an axial thrust.

C. Instrument Needle Valves:

1. 3,000-pound, bronze, globe or angle needle or Kel-F, stainless-steel stem, "O" ring or Teflon seal, and screwed ends. Hoke Series 300 or Whitey. Install an instrument needle valve with each pressure gauge.

2.4 PIPE HANGERS AND SUPPORTS

A. Pipe hangers and supports shall meet the requirements of Section 5, ChapterII of ANSIB31.1 and shall be types as given for MSS Standard Practice SP-58 and SP-69.

B. Constant Support, Spring, and Rigid Hangers: Bergen, Blaw Knox, Fee and Mason, Grinnell or NAVCO.

C. Pipe hanger and supports shall be of the types listed in Table 1 "Hanger and Support Selection," MSS Standard Practice SP-69 except that the following figure types given in Fig. 1 will not be acceptable: Types 5, 6, 11, 12, 7, 9, 10, and 25.

D. Hangers supporting bare copper pipe shall be copper plated.

E. All hangers shall have electrogalvanized finish unless copper plated.

F. All hanger rods shall be galvanized or cadmium plated.

G. Concrete Inserts and Expansion Shields:

1. Type A:

a. Unistrut Corporation, Series P-3200 inserts or Brinkley Company.
b. Inserts shall be galvanized and have a recommended load capacity of 2,000 pounds per foot of length in average good concrete with a safety factor of 3.
c. Inserts shall be continuous and located as required.
d. Provide end caps at each end. End caps shall have attached anchor if spacing from end of insert to next anchor is greater than 2 inches.
e. Inserts shall be 5⅝ inches wide outside by 1⅜ inches deep outside and constructed of minimum 12-gauge galvanized steel, adequate for a ⅞-inch rod and nut.
f. The Contractor shall furnish Unistrut galvanized nuts with or without springs required for work under this contract.

2. Type B: Concrete inserts shall be malleable iron Type 18 listed in MSS Standard Practice SP-69, Grinell, Fig. 282 or Fee and Mason.

3. Type C: Concrete inserts shall be malleable iron, Grinell Fig. 152, Fee and Mason or approved equal.

2.5 METERS AND GAUGES

A. General:

1. Provide all instruments, meters, gauges, and thermometers, complete with interconnecting tubing, piping, valves, as specified and as indicated.
2. Provide gauge cock (shutoff/isolation valve) in the instrument piping connection for all gauges. Gauge cock shall be of the same design requirements as the lines they serve. Quarter-turn brass plug or ball valves are acceptable.

B. Indicating Pressure Gauges and Flow Meters:

1. Vacuum gauges:

   a. Ashcroft 2.5-inch size Model 1490, low-pressure diaphragm gauge or Company-approved equal.
   b. Polysulfone case with ¼-inch NPT lower connection.
   c. Gauges shall be installed as specified on the drawings with a brass threaded bushing, ½ NPT O.D. by ¼" NPT ID.
   d. Range:0" to 100" W.C. in 1" W.C. increments

2. SVE flow meter:

   a. Each SVE riser pipe shall be fitted with a Dwyer A160 Thredolet, forged steel, 3,000 psi with 3/8-inch NPT brass plug.
   b. Flow measurements shall be made with a Dwyer DS-200-1.5" Flow Sensor pitot tubes installed into the thread-o-let fitting. Measurements shall be made with Dwyer Capsuhelic differential pressure gauges, Model 4000 and Model 4002.
   c. Range:Model 4000 - 0"-0.5" W.C. vacuum, 0-20 SCFM Model 4002 - 0.1" - 2" W.C. vacuum, 10-70 SCFM

3. SVE Manifold Sample Ports:

   a. Each SVE riser pipe shall be fitted with a vapor sample port.
   b. Sample ports shall consist of ¼" threaded brass nipples, ¼" brass ball valve, and a ¼" brass hose barb fitting.
   c. Samples shall be collected with a peristaltic pump and dedicated silicon surgical tubing.

4. Total Fluids Manifold Sample Ports:

   a. Each Total Fluids riser pipe shall be fitted with a fluid sample port.
   b. Sample ports shall consist of 3/4" slip by 3/4" slip by FNPT tee cut into riser, connected to a 3/4-inch bronze ball valve connected in turn to a 3/8-inch brass hose barb fitting.

5. Total fluids flow metering:

    a. Individual multiphase extraction wells will be metered by bucket gauging flow at the sample tap on individual well risers
    b. Cumulative total flow measurements will be made under pressure immediately downstream of the storage tank using a Hayes 2-inch totalizing flow meter

2.5 VALVES

A. PVC Valves Specified

1. Ball Valves:
    a. 1.5 Inch, George Fischer MIP type 350 or approved equivalent, FNPT x FNPT

B. Brass Valves

1. Pneumatic ball valve, 3/4-inch, DynaQuip VMH2.A9 3/4 or equivalent, FNPT x FNPT
2. Pneumatic ball valve, 1.5-inch, DynaQuip VMH2.A9 1 1/2 or equivalent, FNPT x FNPT
3. Pneumatic ball valve, -inch, DynaQuip VMH2.A9 2 or equivalent, FNPT x FNPT

C. Bronze Valves

1. Bronze ball valve, 3/4-inch, Conbraco Apollo 7010401 or equivalent, FNPT x FNPT

PART 3—PERFORMANCE

3.1 INSTALLATION

A. General:

1. Furnish all labor, materials, and equipment necessary to make a complete installation as indicated and specified.

    a. Provide all necessary supports, brackets, or foundations for properly installing all equipment.
    b. Coordinate with the other trades before installation of materials.
    c. Properly align, adjust, and lubricate all equipment before final acceptance.
    d. Provide vents and drains at high and low points of water systems.
    e. All connections to equipment shall be made with unions or flanges.
    f. Provide dielectric-type unions where copper piping is connected to ferrous material.

g. Piping indicated on the plans is diagrammatic and not necessarily the exact routing. Provide all necessary bends that may be required to avoid conflicts.
h. Provide sleeves and flashings for all piping penetrating walls or the roof. Provide all required openings in walls and floors.
i. Test, flush, and balance all systems. Install all vents, test tees, test connections and other items required by local practice, codes, and regulations.

B. Piping Installation:

1. General:

a. Install pipe and fittings in accordance with recognized industry practice which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure.
b. Install each run with a minimum of joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment.
c. Reduce sizes (where indicated) by use of reducing fittings.
d. Align pipe accurately at connections within 1/16-inch misalignment tolerance.
e. Comply with ASME — Code for Pressure Piping.
f. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible.
g. Orient horizontal runs parallel with walls and column lines.
h. Locate runs as indicated or described by diagrams, details, and notations or, if not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.
i. Hold piping close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of the building.
    i. Limit clearance to 0.5-inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any.
j. Where possible, locate insulated piping for 1.0-inch clearance outside insulation.
k. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings.
    i. Do not encase horizontal runs in solid partitions except as indicated.

C. Electrical Equipment Spaces:

1. Do not run piping through transformer vaults or other electrical or electronic equipment spaces and enclosures.

D. Piping System Joints:

1. Threaded joints:

    a. Thread pipe in accordance with ANSI B2.1.
    b. Cut threads full and clean using sharp dies.
    c. Ream threaded ends to remove burrs and restore full inside diameter.
    d. Apply pipe joint compound or pipe joint tape (Teflon) on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

2. Flanged joints:

    a. Match flanges within piping system and at connections with valves and equipment.
    b. Clean flange faces and install gaskets.
    c. Tighten bolts to provide uniform compression of gaskets.

3. Glued PVC joints:

    a. Screen, pipe and fittings will be joined with PVC glue (solvent cement) that meets ASTM D2564 specifications. Interior and exterior surfaces shall clean and free of dirt, grease, oil, and other foreign materials. Surfaces to be glued will be further cleaned with PVC primer and allowed to dry to touch.
    b. Pipe gluing will take place at temperatures above 40 degrees Farenheit. A thin surface of glue will be applied to interior and exterior surfaces. The pipe will then be immediately joined with a ¼-turn twisting motion until the pipe seats completely in the fitting.
    c. Joined pipe will be held a minimum of 1 minute. Joined pipe will rest a minimum of 15 minutes before placement in the trenches.

4. HDPE joints:

    a. Sections of polyethylene pipe shall be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturers recommendations. Butt fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures.
    b. HDPE to galvanized steel or PVC transition fittings shall be male nipple by male NPT carbon steel. HDPE shall be heat shrinked onto the nipple end of the fitting.

E. Cleaning and Protection:

1. Cleaning: Clean all fabricated assemblies, according to the provisions of the Pipe Fabrication Institute Standard ES5 prior to shipping to the job site.
2. Protection: Protect all pipe ends of fabricated sections with heavy metal pipe end-protectors, tack welded to the pipe, and do not remove until pipe is in position for final welding. The removal or damaging of these protectors to assist in moving the pipe in the field will not be tolerated.

3. Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings, if any.
4. Unless otherwise specified, flush out piping systems with clean water for a minimum of 10 minutes before proceeding with required tests.
5. Inspect each run of each system for completion of joints, supports, and accessory items.

F. Hangers, Supports, and Anchors:

1. General:

a. The design, selection, spacing, and application of pipe hangers, supports, and anchors shall be in accordance with the codes and standards specified except that ANSI B31.1 — Code for Power Piping shall take precedence over the MSS SP-69 standard.
b. Hanger class and selection of components shall be in accordance with those specified.
c. Furnish and install all rigid and spring supports, whether or not they are shown and detailed, but are required to adequately support the piping system.
d. Furnish and install for all pipe installed under this contract.
e. Include all necessary structural steel, brackets, and concrete inserts which are not a part of the building, or specified, but required to properly support the piping systems.
f. Include necessary temporary supports, and pins for the hydrostatic testing of steam lines and other lines that are spring supported.
g. Install piping and provide necessary supports and anchors to prevent the forces and mounting imposed on equipment from exceeding the limits specified by the equipment manufacturer.
h. The Contractor shall note that a maximum rod size of 7/8-inch can be used with Type A concrete insets. Maximum horizontal pipe hangers and support spacing shall be reduced for 14-inch and larger lines supported from new and existing Unistrut P-3200 type concrete inserts.

3.2 ADJUSTMENT:

A. Prior to putting the piping systems into service, adjust all spring hangers to the correct cold load, adjust all solid hangers to correct position and remove all temporary hangers used in erection and testing.

B. After and during the time the piping systems are being put into service, adjust all spring hangers for the current hot load and align all hanger rods to the vertical position.

C. Hanger Assemblies, Anchors, and Sway Braces Not on Drawings: Pipe hanger assemblies, anchors, and sway braces other than those indicated on the drawings shall be designed, selected, and located by the Contractor or hanger manufacturer in accordance with the following:

1. Make accurate weight balance calculations to determine the required supporting force on each hanger and to show the reaction and forces on equipment on the shop drawings. Calculate expansion and movement of all pipe installed under

this contract and select hanger type and components to allow for pipe expansion and movement.

D. Submit detail shop drawings of each hanger assembly for review and comments.

PART 4—EXECUTION

4.1 TRANSPORTATION AND DELIVERY

A. Every precaution shall be taken to prevent injury to the pipe during transportation and delivery to the site and handling prior to and during installation. Extreme care must be taken in loading and unloading the pipe and fittings. Under no conditions shall the pipe be dropped, bumped, dragged, pushed, or moved in any way which will cause damage to the pipe.

B. If in the process of transportation, handling, or laying, any pipe is damaged, such pipe or pipes shall be replaced or repaired by the Contractor at his own expense.

4.2 PIPE LAYING—GENERAL

A. Laying and jointing pipelines shall include the installation of all pipelines. Pipeline materials shall be as specified or shown. Piping shall be installed where shown or specified.

B. Proper and suitable tools and appliances for the safe and convenient cutting, handling, and laying of the pipe and fitting shall be used.

C. Before being laid, all pipe, fittings, and specials shall be examined for defects, and no piece shall be installed which is known to be defective.

D. Any defective pieces discovered after having been installed shall be removed and replaced.

E. The pipe and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until final acceptance. Care shall be exercised to avoid leaving bits of wood, dirt, and other foreign particles in the pipe. All lines shall be kept clean during construction and shall be capped off with appropriate caps, tape, or wooden bulkheads at the end of each day's work. Exposed ends of uncompleted lines shall be capped or otherwise temporarily sealed at all times when the pipe laying is not in progress. Pipelines shall be laid accurately to line and grade shown in the drawings.

F. Contractor shall provide all necessary joint gaskets, lubricants, solvents, cements, and all special tools and accessories that may be required to assemble the pipe or fittings. Pipe jointing materials shall be stored in a cool place and protected from light, sunlight, heat, oil, or grease until installed.

4.2 PIPE LAYING

A. Pipeline layed on the ground surface shall be budled (air, water, and SVE lines) when routed to individual well heads and properly secured against movement at the locations shown, specified, or directed by the Company

B. Pipeline in trench excavation shall be properly secured against movement and pipe joints shall be made in the excavation as shown, specified, or directed by the Company.

C. Pipe laying will be permitted only in dry trenches having a stable bottom. Where groundwater is encountered, the Contractor shall undertake the necessary dewatering operations as specified.

D. Where concrete encasement of a pipeline is specified, the pipe shall be encased with a minimum of 6 inches of concrete.

E. As soon as the excavation is completed to normal grade of the bottom of the trench, the Contractor shall immediately place screened gravel bedding conforming to the requirements specified under Specification 3. Bell holes or female couplings shall be excavated so that only the barrel of the pipe shall bear upon the bedding over the trench bottom. Blocking under the pipe will not be permitted. Bedding material shall be placed to mid-diameter and thoroughly compacted to give firm support to the pipe. The spigot or male end shall be pushed home into the adjacent bell or female couplings to form a closed joint. The interior of each pipe shall be inspected while joined to see that the alignment is preserved. Once the pipe has been joined and tested, bedding material shall be placed to a level of 6 inches above the top of the pipe. Then backfilling shall begin and shall be carried out as specified in Specification 3.

F. No pipe shall be laid in water or when weather and trench conditions are unsuitable for pipe laying.

G. Before lowering, and while suspended, the pipe shall be inspected for defects. Any defective, damaged, or unsound pipe shall be rejected. All foreign matter, such as dirt, shall be removed from the inside and outside of the pipe before it is lowered into position in the trench.

H. The cutting of pipe for inserting fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe. In general, pipe shall be laid with bell ends, if applicable, facing in the direction of laying. Whenever necessary to deflect pipe from a straight line, either in the vertical or horizontal plane to avoid obstructions or for other purposes, the maximum degree of deflection shall be as recommended by the manufacturer. Pipes shall be furnished in standard laying lengths. Random short lengths shall be used only as required to connect manholes and cleanouts.

I. Joining shall be accomplished in strict accordance with manufacturers' recommendations. When solvent-weld joints are required, solvent for pipe jointing shall be as recommended by the manufacturer of the pipe.

4.3 ERECTION AND INSTALLATION OF ABOVE-GRADE PIPING

A. General

1. Erect and install all above-grade piping and accessories required to complete the piping systems as indicated on the drawings, as specified, and as required for a proper installation.
2. Above-grade piping erection and installation includes the following:

    a. Connections to the remediation equipment building.
    b. Connections to existing soil vapor extraction wells.
    c. Testing of piping systems.

B. Installation of above-grade piping

1. Contractor shall fabricate and erect the above-grade portions of the piping in accordance with the following:

    a. The specific arrangements shown on the mechanical and piping detail drawings for the piping shall not be appreciably varied.
    b. Field-route piping in a manner to avoid interference with work by this purchase order and to provide a neat and accessible installation.
    c. Piping shall be installed in a rectangular form either perpendicular to, or parallel to the building structure, the floor, or to the major equipment except in cases required or approved by the Company.
    d. Pipe shall be routed to avoid aisleways, and equipment maintenance access areas, and shall satisfy the Company's operation and maintenance requirements which include locating valves, specials, and instruments at a point where they are easily accessible. Improperly located piping shall be removed and rerouted as directed and approved by the Company with all labor and material furnished by the Contractor.
    e. Pipe routing shall avoid interference with required electrical conduit. The Contractor shall preplan his electrical conduit routing schedule to avoid such interferences before routing the piping.
    f. Access shall not be blocked around equipment, particularly access to motors.
    g. Piping shall not interfere with maintenance access for removal of valves, flow indicators, motors, motor rotors, process instrumentation, or any other device which may be required to be removed from piping or equipment for maintenance.
    h. Provide offsets, fittings, unions, drip pockets, vents, drains, hangers, and supports to make a complete installation.
    i. Furnish and install unions in piping systems using screwed joints as follows:

        i. Install so lines may be broken for maintenance, valves or piping may be removed and equipment disconnected.
        ii. Install in lines which are erected without unions and which, in the opinion of the Company, cannot be properly maintained.

4.5 TESTING

A. All vapor extraction piping shall be pressure tested by the Contractor prior to acceptance. All below grade pipe must be tested prior to backfill.

1. Vacuum Testing: requires that all Soil Vapor Extraction (SVE) process piping and hose be isolated as necessary and a minimum vacuum of 100 inches water be applied and the vacuum source disconnected from the piping. The test vacuum is to be monitored for one hour with an appropriate gauge on the piping system. The piping and hose must remain at the test vacuum (±2%) to pass the test procedure.
2. Pipe systems or sections thereof shall be repaired or replaced by the Contractor at no cost to the Company until they pass the required test.

B. All pressure piping (e.g, total fluids and pneumatic lines) shall be pressure tested by the Contractor prior to acceptance. All below grade pipe must be tested prior to backfill.

1. Pressure Testing: requires that all pressure process piping and hose be isolated as necessary and a minimum pressure of 100 PSI be applied and the pressure source disconnected from the piping. The test pressure is to be monitored for one hour with an appropriate gauge on the piping system. The piping and hose must remain within 2 % of the test pressure to pass the test procedure.
2. The integrity of continuous HDPE piping (e.g., no welded joints) may be determined prior to its use. HDPE that passes may be used without further testing so long as no welded joints will be placed below grade. All strands of pipe with welded joints shall be tested prior to backfilling as described above.

END OF SPECIFICATION 4

SPECIFICATION 5

SOIL VAPOR EXTRACTION SYSTEM

A. PART 1—GENERAL

1.1 DESCRIPTION OF WORK

This specification prescribes the requirements for the installation of the soil vapor extraction and treatment system. The General Contractor shall provide labor, supervision, materials, equipment, tools, permits, and services that are required to install, startup, and test the soil vapor extraction and treatment system as shown on the drawings and as covered in this specification including, but not limited to, the following:

A. Pipe, pipe fittings, and appurtenances necessary for connecting the SVE well to conveyance piping.

B. Pipe, pipe fittings, valves, flow meters, and appurtenances necessary to construct the SVE manifold.

C. Underground and aboveground electrical conduit (as appropriate) and wire from the service panel to the SVE blower.

D. Piping from the SVE wells to the SVE manifold.

E. Piping from the SVE manifold to the SVE blower.

F. Moisture separators, automatic transfer pumps, piping, pipe fittings, and appurtenances necessary to install the vapor extraction unit.

G. Piping from the moisture separator to the water treatment system.

H. Piping downstream of the SVE blower, including an erected exhaust stack to be provided by the Engineer.

1.2 DEFINITIONS

A. CFR—Code of Federal Regulations
B. SVE—Soil Vapor Extraction
C. OSHA—Occupational Health and Safety Administration

1.4 SUBMITTALS

A. The General Contractor shall submit product specifications for alternate piping, pipe fittings, airflow meters, vacuum gauges, etc. Products must be approved by the Engineer prior to installation.

B. PART 2—PRODUCTS

2.1 QUALITY ASSURANCE

A. All electrical work and material shall be in compliance with the ordinances of the city, state, federal, or other political subdivision having jurisdiction. In the absence of other more stringent authority, the work shall conform to the requirements of the National Electric Code (NEC).

B. The General Contractor shall arrange and pay for all necessary official inspections and permits and shall install or change work as required by official inspection. All such indicated drawings shall be documented by the General Contractor and reported to the Engineer to allow for construction options to be exercised.

2.2 PIPING

All piping that will be used in the SVE system shall be in accordance with design drawings and Specification 4.

2.3 FLOW CONTROL AND MEASUREMENT DEVICES

The SVE system shall be provided with flow control valves, vacuum gauges, flow meters, and other pipe fittings as shown on design drawings and in accordance with all related specifications.

A. Vacuum shall be gauged using Ashcroft Model 1490 vacuum gauges. Gauges shall be capable of measuring vacuums from 0 to 100 inches water column. Each riser shall be equipped with a vacuum gauge upstream of the header. The gauges shall be 2.5 inches in diameter with a 0.25 inch lower mount NPT connection. Contractor may substitute an Engineer-approved equivalent.

B. Flow rates at the SVE blower shall be measured by controls provided by Transwestern Pipeline Company. Contractor is not responsible for performance flow control and measurement devices associated with the SVE blower.

2.4 MECHANICAL DEVICES

A. SVE blower — The blower assembly will consist of a sealed ring pump, a flow meter, a moisture separator fitted with an automatic transfer pump, and logic controls. The blower assembly is presently located on-site.

B. Transfer Pumps — The transfer pump shall provide automatic transfer of collected liquid in the moisture separator to the water holding tank with the aluminium equipment box housing the water collection manifold. The transfer pump shall be driven by a logic controller to enable automatic startup and shutdown, but shall also be fitted with a manual override. The pump shall be capable of producing suction heads high enough to drain the liquid from the moisture separator during operation against a vacuum between 17 and 29.5

inches Hg. The pump will be capable of transferring the liquid against a delivery head of approximately 20 psig. The transfer pump will also be fitted with a check valve to prevent airflow into the moisture separator.

C. Sensiphone Data Transmitters

C. PART 3—EXECUTION

3.1 INSTALLATION

A. The installation of the SVE blower shall be in strict compliance with the manufacturer's technical data and printed instructions. Installation shall include furnishing the required manufacturer's recommended lubricants for initial operation. Inspection and calibration of all supplied metering and measurement devices necessary for proper performance shall be performed by contractor. Devices include but are not limited to:
   1. Temperature sensors
   2. Flow meters
   3. Remote data transmission devices

B. Contractor shall not be responsible for replacing malfunctioning devices on the SVE blower unit. Contractor shall identify faulty or potentially faulty devices and advice Engineer of necessary or recommended repairs and replacements. Engineer shall develop a separate scope of work and budget with Contractor to effect repairs and replacements to the SVE blower as necessary.

C. All pipe, pipe fittings, flow control and measurement devices, and appurtenances shall be installed in accordance with design drawings and Specification 4.

D. All electrical work shall be performed in accordance with Specification 7.

3.2 TESTING

A. Following blower, header and piping installations, the General Contractor shall demonstrate the system performance and shall certify that the system has been installed to conform with the design drawings and specifications and subsequent revisions and approvals. The period for startup testing shall be 5 days.

B. Leak Testing

   1. Leak testing shall be performed for all exposed and buried pipe. All buried and exposed pipe shall withstand a pressure of 5 psig for a period of not less than 2 hours without a drop in pressure greater than 0.25 psig. Pressure shall be measured with a pressure gauge (ANSI Grade B, 2% of full scale accuracy, or better) or equivalent device, calibrated to read in increments not greater than 0.1 psig. The source of pressure shall be isolated before the pressure tests are made. All joints shall be sprayed with a soap water solution and visually inspected for leaks. If the joint leaks, testing shall be discontinued, the joint shall be repaired, and the pipe retested. Testing shall be conducted with compressed air or inert gas.

C. Startup and performance testing shall be of sufficient complexity and duration to fully demonstrate the operability of all equipment and systems with respect to functionality, rate, and capacity over the specified operating ranges of the equipment provided.

END OF SPECIFICATION 5

SPECIFICATION 6

MULTI-PHASE EXTRACTION SYSTEM

PART 1—GENERAL

1.1 DESCRIPTION OF WORK

A. The General Contractor shall provide labor, supervision, materials, equipment, tools, permits, and services that are required to install, startup, and test the ground water recovery system as shown on the drawings and as covered in this specification including, but not limited to, the following:

a. Pneumatic pumps (6), down-hole pneumatic lines, exhaust lines, and fluid return lines for each dual-phase extraction well.
b. Wellhead penetrations for lines as noted on drawings.
c. Pipe, pipe fittings, and appurtenances necessary for connecting the pneumatic and fluid return lines to the conveyance piping.
d. Pipe, pipe fittings, valves, and appurtenances necessary to construct the total fluids recovery and pneumatic manifolds.
e. Conveyance piping from wellheads to the manifolds.
f. Piping, valves, and appurtenances from the total fluids recovery manifolds to the storage tank.
g. Piping, valving, and appurtenances from the pneumatic manifolds to the air compressor.
h. Transfer pump, conveyance piping, vavles to the evaporation ponds
i. High and low level switches and auto-shutoff interlocks to connect the day tank transfer pump to the main control panel
j. Heat tracing and insulation on all exterior exposed total fluids lines
k. Electrical service to the service panel.
l. Underground and aboveground electrical conduit (as appropriate) and wire from the service panel to each piece of remediation equipment (transfer pumps, controllers, heat tracing, etc.).

1.2 DEFINITIONS

A. CFR—Code of Federal Regulations

B. OSHA—Occupational Health and Safety Administration

1.3 REFERENCES

A. Regulations

1. 29 CFR 1910.120, OSHA Regulations, Hazardous Waste Operations and Emergency Response

B. Guidance

1. ASTM D3299, Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
2. ASTM D5421, Standard Specification for Contact Molded AFiberglass@ (Glass-Fiber-Reinforced Thermosetting Resin) Flanges
3. ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Material
4. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
5. ASTM F441/F441M, Standard Specification for Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe, Schedules 40 and 80
6. ASTM F493, Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
7. ASTM F438, Standard Specification for Socket-Type Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
8. ASTM D3915, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Chlorinated Polyvinyl Chloride (CPVC) Compounds for Plastic Pipe and Fittings Used in Pressure Applications

1.4 SUBMITTALS

A. Copy of New Mexico General Contractors license (GB-98) or New Mexico Remediation Contractors license (GS-29).

B. Copies of all subcontractor licenses as applicable (e.g., electrical, plumbing).

PART 2—PRODUCTS

2.1 QUALITY ASSURANCE

A. All electrical work and material shall be in compliance with the ordinances of the city, state, federal, or other political subdivision having jurisdiction. In the absence of other more stringent authority, the work shall conform to the requirements of the NEC.

B. The General Contractor shall arrange and pay for all necessary official inspections and shall install or change work as required by official inspection. All such indicated drawings shall be documented by the General Contractor and reported to the Engineer to allow for construction options to be exercised.

2.2 EXISTING SITE CONDITIONS

A. Not applicable

2.3 GENERAL

A. The total fluids pumps and controllers shall be supplied by Engineer.
B. The air compressor shall be supplied by Engineer.
C. The manufacturer supplied transfer pumps shall be supplied by Engineer as shown on manufacturer supplied cut-sheets.
D. The 6' x 6' Morgan shed shall be supplied by Engineer.
E. The electrical supply and service panels shall be provided by a separate contractor.
F. All valve boxes, pipe supports, valves, sample ports, meters and other equipment specified and shown on drawings shall be supplied by Remediation Contractor.
G. The General Contractor shall comply with all laws, ordinances, codes, rules, and regulations of the local, state, and federal authorities having jurisdiction over any of the work specified in this section.

2.4 TOTAL FLUIDS PUMP SYSTEMS

A. The total fluids recovery system shall consist of 6 top-loading Clean Environment Engineers model AP-4/TL pneumatic pumps, rated from 0 to 4 gpm, with controllerless operation and stainless steel outer casing, or an Engineer approved equivalent.

B. The pneumatic pump system shall have the following major components.

1. 100-feet of ½-inch discharge tubing
2. 100-feet of ½-inch air supply tubing
3. 100-feet of ½-inch air exhaust tubing
4. 100-feet of suspension cable
5. 4-inch well cap with appropriate couplings for tubing
6. Wellhead piping, fittings, and appurtenances as indicated on the drawings.
7. Pneumatic and total fluids recovery manifolds as indicated on the drawings.
8. Installation of the air compressor provided by Engineer as shown on drawings.
9. Electrical conduit, control wiring, and service to the control panel.

2.5 CONTROL PANEL

A. The control panel shall have the following major components.

1. NEMA 4 enclosure
2. Inner door with disconnect switch
3. HOA switches with lights
4. IEC motor started with overloads
5. Alarm interlocks with red lights
6. Alarm reset button
7. Intrinsic safety barriers
8. UL listing
9. GFI receptacle
10. System interlocks and automatic control logic
11. System interface contacts
12. Remote HH switch

2.6 SURGE TANK

A. The surge tank is to be a 210 bbl welded steel above ground storage tank in secondary containment to be located near the water collection point as shown on drawings. The surge tank shall be used for water storage prior to discharge by transfer pump to the evaporation ponds.

B. The day tank will be fitted with high-level and low-level switches. When the high level switch is contacted, the transfer pump shall start discharging water to the evaporation ponds. When the low level switch is contacted, pumping shall cease. A second high-level switch shall be installed above the first. This switch shall be connected to the control panel and shall shut down the total fluids recovery system in the event discharge of the tank fails.

C. The day tank and irrigation system shall have the following major components.

1. Fiberglass secondary containment.
2. Two high level switches and one low-level switch.
3. Effluent conveyance line outfall.
4. StaRite, high head (DHG), 2-HP transfer pumps.
5. Two inch HDPE discharge line to evaporation ponds.
6. Heat tracing and insulation on all exposed piping.
7. Electrical conduit, control wiring, and service to the service panel and control panel as required.

2.7 DELIVERY AND STORAGE

A. The equipment shall be shipped with suitable in-transit protection and shall be outfitted with lifting lugs, cleats, or other suitable means for unloading and erecting.

B. Finished surfaces, which may be damaged during installation, shall be protected by removable tape or suitable alternate.

C. Care shall be taken to prevent the introduction of water or dirt during shipment and handling.

2.8 ELECTRICAL EQUIPMENT

A. All electrical equipment and controls shall conform to the requirements of Specification 7.

2.9 MECHANICAL EQUIPMENT

A. All piping, fittings, valves, level instruments, pressure instruments, and other appurtenances required for the total fluids recovery, storage tank, and evaporation pond shall conform to Specification 4 and all applicable codes.

PART 3—EXECUTION

3.1 INSTALLATION

A. The installation of the total fluids recovery system and storage tank system components shall be in strict compliance with the manufacturer's technical data and printed instructions. Installation shall include furnishing the required, manufacturer's recommended lubricants for initial operation.

B. Pumps and ancillary equipment shall be installed in accordance with the design drawings and as covered in this specification.

3.2 TESTING

A. Following completion of the total fluids recovery system, storage tank retrofit, and evaporationpond system installations, the General Contractor shall demonstrate the system performance and shall certify that the system has been installed to conform with the design drawings and specifications and subsequent revisions and approvals.

B. Startup and performance testing shall be of sufficient complexity and duration to fully demonstrate the operability of all equipment and systems with respect to functionality, rate, and capacity over the specified operating ranges of the equipment provided. The period of startup testing shall be not less than 5 days.

C. All piping shall be leak tested per Specification 4.

END OF SPECIFICATION 6

SPECIFICATION 7

ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

Provide all labor and material for installation of the following:

A. Move 460 volt, three-phase service to new equipment compound located approximately 100 feet south of current location

B. Feeder circuit and NEMA 3R load center.

C. Branch circuits to receptacles, lights, and equipment as indicated.

D. Grounding.

1.2 REFERENCES

A. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. C80.1 — Rigid Steel Conduit, Zinc-Coated.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. B3 - Soft or Annealed Copper Wire.
2. B8 - Concentric Lay Stranded Copper Conductors, Hard, Medium - Hard, or Soft.

C. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

1. AB1 - Molded Case Circuit Breakers.
2. FB1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. FU1 - Low Voltage Cartridge Fuses.
4. ICS6 - Enclosures for Industrial Control and Systems.
5. KS1 - Enclosed Switches.
6 .PB1 - Panelboards.
7. RN1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
8. ST20 - Dry-type Transformers for General Applications.

D. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1. 70 - National Electrical Code (NEC).

E. UNDERWRITERS LABORATORIES (UL)

1. 6 - Rigid Metal Electrical Conduit.
2. 50 - Cabinets and Boxes.
3. 67 - Panelboards.
4. 360 - Liquid-tight Flexible Steel Conduit, Electrical.
5. 467 - Electrical Grounding and Bonding Equipment.
6. 489 - Molded-case Circuit Breakers and Circuit-Breaker Enclosures.
7. 514A - Metallic Outlet Boxes, Electrical.
8. 514B - Fittings for Conduit and Outlet Boxes.
9. 651 - Schedule 40 and 80 Rigid PVC Conduit.
10. 844 - Electric Lighting Fixtures for use in Hazardous (Classified) Locations.
11. 1010 - Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.
12. 1561 - Dry-Type General Purpose and Power Transformers.

1.3 SUBMITTALS

A. SUBMIT CATALOG CUT SHEETS FOR THE FOLLOWING EQUIPMENT:

1. Wiring devices.
2. Wire and cable.
3. Safety switches (disconnects).

B. DRAWINGS AND DATA SHEETS: Submit drawings and data sheets with equipment outline dimensions, weight, electrical ratings, and wiring diagrams for the following equipment:

1. Load centers and panelboards.
2. Motor starters.
3. Control devices, including level and pressure switches.

1.4. SITE CONDITIONS

Unless indicated otherwise, the site is classified Class I, Division 1 below grade and Class I, Division 2 from grade elevation to 18 inches above grade. Areas above grade near well heads are classified as indicated. Equipments shall be located outside the hazardous areas whenever possible.

PART 2 - PRODUCTS

2.1 CONDUIT AND FITTINGS

A. CONDUIT: Conduit shall be rigid galvanized steel conforming to ANSI C80.1 and UL 6. Minimum size shall be ¾ inch unless indicated otherwise.

B. FITTINGS: Fittings and outlet bodies shall be cast gray iron alloy or cast malleable iron bodies and covers with a cadmium plated finish. Units in damp or wet areas or outdoors shall be gasketed and watertight. Fittings and outlet bodies shall conform to NEMA FB1 and UL514B.

2.2 WIRE AND CABLE

A. All conductors shall be copper conforming to ASTM B3 and B8. Minimum insulation rating for power and control wiring shall be 600 volts. Conductors No.10 AWG and smaller shall be solid, No.8 AWG and larger shall be stranded, and instrumentation and control cable shall be stranded regardless of size.

B. Wire and cable No.4 AWG and larger shall be NEC Type XHHW. No.6 AWG and smaller shall be NEC Type THHN/THWN.

C. Wire and cable for grounding shall be bare copper, Type BC. Equipment ground conductors shall be either bare copper or an identified "green" conductor.

2.3 WIRING DEVICES

A. RECEPTACLES FOR NON-HAZARDOUS AREAS

1. Specification grade, rated 20 amperes, 125 volts, NEMA configuration 5-20R.
2. Back and side wired with heavy duty, triple wipe "T" contacts.
3. Cover plates shall be galvanized steel for indoor and dry locations and Crouse-Hinds Type WLRS for outdoor and wet locations.

B. RECEPTACLES FOR HAZARDOUS AREAS

1. Dead front, delayed action circuit breaking type, rated for Class I, Group D locations.
2. Receptacle shall be deenergized until the plug is fully inserted and rotated.
3. With the receptacle switch closed, the plug shall be locked in the receptacle to prevent disengagement while under load.
4. Receptacle shall be rated 20 amperes, 125 volts, NEMA configuration 5-20R.

C. SWITCHES

1. Specification grade, quiet type, rated 20-amperes at 277 volts. Switch shall be mounted in FS or FD boxes with galvanized metal cover plate. Switches located outdoors or in damp and wet locations shall be furnished with a Crouse-Hinds Catalog No.DS128 or DS185 raintight cover.

D. BOXES

1. Cast gray iron alloy or cast malleable iron, with a cadmium finish.
2. Type FS or FD.

2.4 DISTRIBUTION

A. PANELBOARDS

1. Shall conform to NEMA PB1, UL 50 and UL 67. Arrangement shall be as indicated.
2. Provide with copper bas bars, solid neutral bar.
3. Enclosure shall be NEMA 3R. Provide with door lock.

4. Circuit breakers shall be molded case, thermal magnetic type, with the trip ratings and number of poles as indicated. Breakers shall be manufactured by the same manufacturer as the panelboard and conform to NEMA AB1.
5. The branch circuit interrupting capacity shall be 10,000 amperes symmetrical unless indicated otherwise.

B. MANUAL MOTOR STARTERS

1. Provide integral horsepower, full voltage, non-reversing manual motor starters.
2. The contactors shall be horsepower rated, NEMA sizes M-O, M-1, and M-1P. The contact mechanism shall be quick-make, quick-break.
3. Provide with manually reset thermal overload relays. The overload mechanism shall be trip-free from the operating handle.
4. Provide with low voltage protection where indicated.
5. Enclosure shall be NEMA 4 stainless steel or NEMA 7 for Class 1, Group D areas as indicated.
6. Acceptable manufacturers:

    a. Allen-Bradley, Bulletin 609
    b. Cutler-Hammer, 9115 Series
    c. Furnas, Class II
    d. General Electric, CR1062 Series
    e. Siemens
    f. Square D, Class 2510
    g. Westinghouse, Type B100

C. MAGNETIC MOTOR STARTERS

1. Provide combination magnetic motor starters as indicated.
2. NEMA rated starters. Minimum starter size shall be size O.
3. Disconnecting handle shall be lockable in the OFF position. Enclosure door shall be interlocked with the disconnecting means to prevent opening the door with the disconnect on. Provide a defeat mechanism for the interlock to allow authorized personnel access while the starter is energized.
4. Provide three overloads in three-phase starters. Overloads shall be manually reset from the outside of the enclosure.
5. Control voltage shall be 120 volts maximum. Provide control power transformers as required.
6. Provide auxiliary contacts required for the control indicated. As a minimum provide 1N.O. and 1 N.C. contact.

D. CONTACTORS

1. Provide as indicated.
2. NEMA rated. Minimum size shall be size O.
3. Control voltage shall be 120 volts maximum.
4. Provide contacts required for the control indicated.
5. Control voltage shall be 120 volts maximum.
6. Provide auxiliary contacts required for the control indicated. As a minimum provide 1N.O. and 1 N.C. contact.

2.5 DISCONNECT SWITCHES

A. Provide horsepower rated, heavy duty, single throw switches with visible blades.

B. Switches shall be nonfused or fused as indicated.

C. Number of poles shall be as indicated.

D. Conform to NEMA KS 1.

E. Enclosures shall be NEMA 12 for dry indoor locations and NEMA 4X for outdoor and damp or wet indoor locations.

F. Provide where indicated and where required by the NEC.

2.6 LIGHTING

A. LAMPS

1. Fluorescent lamps shall be rapid-start, 48 inch, cool white, F40CW.
2. High pressure sodium lamps shall have a mogul base and a diffuse coating. Wattage shall be as specified for specific luminaires.
3. Incandescent lamps shall be as specified for specific luminaires.

B .BALLASTS

1. Fluorescent: High power factor, thermally protected Class P. Power factor shall be 0.9 or higher. Units installed in unheated areas shall have a minimum starting temperature of 0°F.

C. LIGHTING FIXTURES

1. Type L - 1:

   a. 1X4 ft. industrial fluorescent luminaire for dry indoor locations.
   b. Shall be constructed of 20-gauge (minimum) steel, formed to provide a rigid wiring channel. Finish shall be white, baked-in enamel.
   c. Reflector shall be 20-gauge (minimum) steel with a porcelain enamel finish that provides a minimum reflectance of 85 percent. Reflector shall provide 10 percent uplight.
   d. Designed for pendant or chain mounting.
   e. Provide with 2 lamps.
   f. Operate from 120 volts.

2. Type L - 2:

   a. 1X4 ft. industrial fluorescent luminaire for wet locations.

3. Type L - 3:

   a. HID, enclosed and gasketed rated for Class I, Division 2 locations.

4. Type L - 4:

a. Incandescent, emergency lighting unit.

5. Type L - 5:

a. Incandescent exit light.

6. Type L - 6:

a. Wall mounted, vandal resistant, HPS outdoor luminaire
b. Die-cast aluminum housing with bronze finish
c. Polycarbonate prismatic lens
d. Full front access
e. Provide with 70 watt, HPS lamp
f. Integral photocontrol
g. UL listed, suitable for wet locations
h. Acceptable manufacturers:

(1) Day-brite, Cat. No.WL70HS-DT-PEC.
(2) Hubbel, Cat. No.PVL-0070S-118 with accessories PBT-1 and PVL-PK.

2.7 GROUNDING

A. Equipment and materials for grounding shall conform to UL 467.

B. Ground rods shall be copperclad steel, ¾-inch-diameter, 10-feet-long.

C. Connectors shall be copper-alloy, compression-type, specifically designed for the connection to be made.

2.8 SUPPORT SYSTEM

A. Fabricated from manufactured framing members equal to Unistrut P-3000 series as manufactured by Unistrut Corporation.

B. Construct as required to rigidly support all conduit runs and boxes.

C. Hot-dip galvanized steel or cast-aluminum conduit clamps, sized for the specific conduit size, to support all exposed metallic conduit.

D. Nonmagnetic clamps to support nonmetallic conduits.

E. Provide stainless steel rods, anchors, inserts, bolts, washer and nuts with all other support hardware electrogalvanized steel.

F. Channel hot-dipped galvanized after all manufacturing operations are completed.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION

A. GENERAL REQUIREMENTS

1. Shift locations as required to avoid interference with other equipment and piping being installed.
2. Where routing of conduit is not indicated, route conduit as specified subject to approval by Engineer.
3. Do not use conduit in sizes smaller than ¾ inch, except ½inch may be used for connections to control devices and thermocouples (where necessary).
4. Holes and Sleeves:

    a. Provide through floors, walls and roofs as necessary for conduit runs, including approved flashing and weather proofing at outside walls and on roofs.
    b. Install sleeves or forms for all openings in new work.
    c. Provide the required inserts and holes, completely sleeved, bonded, curbed, flashed and finished off in an approved manner, whether in concrete, steel grating, metal panels or roofs.
    d. Core-drill all holes required in existing building work using a dustless method.
    e. Place nonshrinking grout or Dow Corning 3-6548 Silicone RTV or equivalent General Electric RTV 851 foam as specified in all holes in concrete, walls, floor and roof slabs after installation of conduit.
    f. Install wall entrance seals where conduit enters the building or vaults from exterior underground.
    g. Install fire and smoke stop fittings at all conduit penetration of fire rated walls, ceilings and floors.

5. Make connections to boxes, panels and other equipment as follows:

    a .Double locknuts, one inside and one outside.
    b. Bushings:

        1. Threaded malleable iron or steel.
        2. Insulated with Bakelite, molded and bonded into the bushing.
        3. Placed on end of conduit in addition to locknuts.
        4. Install with integral grounding connector and conductor where all conduits pass through multiple concentric panel knockouts and where the conduit must be bonded to equipment to which it is not attached.
        6. Running threads will not be permitted.
        7. Coat all field cut threads in galvanized conduit with aluminum paint.
        8. Place drainage fittings or weep holes at unavoidable low points where moisture can collect.

9. Install an entire conduit system that is electrically continuous with bonding jumpers provided as necessary to conform to NEC.
10. Provide suitable protection for conduit risers against damage during construction.
11. Cap ends of all conduits before concrete is poured.
12. Cap all conduits after cleaning where conduits are to be left empty by this contract.
13. Carefully ream ends of all conduit lengths after cutting to eliminate sharp burrs.
14. Clean out all conduit before pulling wire.
15. Clean out all conduits immediately after concrete work is finished.

B. EXPOSED INSTALLATION

1. Install horizontal runs as high above floor as possible, and in no case lower than 7 feet above floor, walkway, or platform in passage area.
2. Run conduit parallel or perpendicular to walls, ceiling, beams and columns unless indicated otherwise.
3. Route to clear all doors, windows, access wells and openings.
4. Group parallel runs in neatly aligned banks where possible with minimum of 1-inch clearance between conduits.
5. Maintain 6-inch clearance between conduit and coverings on all hot lines; steam and hot water.
6. Do not exceed a distance of 8 feet between supports on horizontal or vertical runs.

C. CONCEALED INSTALLATION

1. Do not install conduit in concrete where conduit outside diameter exceeds one-third of concrete thickness.
2. Install parallel runs with a minimum spacing of three conduit diameters between conduits.
3. Use expansion and deflection fitting with bonding jumpers at all concrete expansion joints.
4. Tie securely in place to prevent movement when concrete is poured.
5. Install in floor slabs in as straight a run as possible. Conduit crossovers are not permitted unless conduit total outside diameter is one-third of the concrete thickness or less.
6. Use long radius elbows except on risers where curved portion or elbow would extend above the finished floor or foundation.
7. Make all joints watertight after installation by coating all finished joints with coal tar solution applied at 15 mils minimum dry film.

    a. Koppers — No. 50
    b. Tnemec — 46-449

D. BURIED INSTALLATION

1. Use PVC conduit.
2. Make all joints watertight with cement furnished by the conduit manufacturer.
3. Bury conduits a minimum of 24-inches below finish grade unless indicated otherwise.
4. Slope conduit away from conduit risers where possible.
5. Maintain 6-inch separation from underground piping.
6. Use long radius bends at all risers where possible.
7. After trench bottom has been finished to grade, lay conduit. Cap the ends of all conduit risers before backfilling. Backfilling shall be as specified in Division 2.

3.2 WIRE AND CABLE INSTALLATION

A. Use insulating types of pulling compounds containing no mineral oil. Pulling tension shall be within the limits recommended by the wire and cable manufacturer. Use a dynamometer where mechanical means are used. Cut off section subject to mechanical means.

B. Bending radius shall be limited to 8 times cable overall diameter.

C. Provide maximum slack at all terminal points. Support cables so that strain on cable will not be transmitted to the termination.

D. Use solderless-type connectors. For wire sizes up to No.6 AWG, use compression type, and B Sta-Kon, Burndy Hylug, or equal. For sizes No.4 and above, use either compression-type or bolted-type with silver-plated contact faces. For sizes No.250 MCM and larger, use connectors with at least 2 cable clamping elements or compression indents and provision for at least 2 bolts for joining to apparatus terminals.

E. Install cable continuous, without splice from termination to termination. Where required, splice in junction box using terminal boards for all control wiring and approved connectors as specified for all power wiring. Splices in conduits not allowed. All splices must be approved by the Engineer in advance of making said splice.

F. Identify all conductors at each end by circuit number or terminal number at each terminal in control center, panelboard, device box, junction box, pull box, manhole and terminal panel. Use pressure-sensitive labels. Record the identification of each wire and cable on drawings.

G. Install color code power cable insulation as follows:

1. 120/208 volt phase legs:
   a. Black
   b. Red
   c. Blue
2. 120/208 volt neutrals - White
3. 277/480 volt phase legs
   a. Yellow
   b. Brown
   c. Orange
4. 277/480 volt neutrals - Gray
5. Ground conductors - Green

Where conductor insulation cannot be furnished, color impregnated conductors shall be color coded at all accessible locations with colored plastic adhesive tapes suitable for the application. In all cases, color-coding shall be as indicated in the schedule above.

H. Shielded cable shall be installed in conduit separate from power cables. Ground shield at one end only or as recommended by instrument manufacturer. Terminate stranded conductors with preinsulated crimp type spade or ring tongue terminals.

I. Minimum wire sizes shall be No.12 AWG for power and lighting, No.14 AWG for control and No.18 AWG for instrumentation.

3.3 GROUNDING INSTALLATION

A. Ground all electrical equipment as indicated and to comply with the NEC.

B. Provide separate stranded copper green insulated ground conductors with all branch circuit and feeder wiring installed in conduit. Connect to ground bus where service originates and to equipment being served. Size ground conductors in accordance with the National Electrical Code if not indicated.

C. Connect ground conductors to conduit with copper clamps, straps or with grounding bushings.

D. Connect to metal piping by welding or brazing. Use copper bonding jumpers on all gasketed joints.

E. Connect to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not use anchor bolts. Where grounding provisions are not included, drill suitable holes in locations designated by the Engineer.

F. Connect to service water piping by means of copper clamps.

G. Ground instruments and conductor shields and drain wires in accordance with the recommendations of the instrument manufacturer.

H. Scrape bolted surfaces clean and coat with oxide-resistance compound.

3.4 LIGHTING AND DEVICES INSTALLATION

A. Fixture mounting heights and locations indicated are approximate and are subject to revision in the field where necessary to clear conflicts and obstructions.

B. Suspended fixtures shall be pendant mounted using ½-inch conduit stems. Ground to outlet box. Attach mounting to building structure with anchors of the type required for the construction surface.

C. Surface mounted fixtures shall be attached to appropriate outlet boxes.

D. Boxes and Fixtures

1. For units mounted against steel, masonry or concrete walls, provide suitable 1.5-inch spacers to prevent mounting back of box directly against wall.
2. Bolt units rigidly to building with expansion anchors, toggle bolts, hangers or Unistrut.
3. No boxes to be installed with open conduit holes.
4. Label each circuit and identify with tag.

E. Mounting heights or elevations are to bottom of fixture or to centerline of device.

1. Fixtures: As indicated.
2. Wall Switches: 4 feet, 6 inches above finished floor.
3. Outlets: 1 foot, 6 inches above finished floor in nonhazardous areas, or as indicated.

3.5 FIELD TESTING

A. WIRE AND CABLE TESTS (FEEDER, BRANCH AND CONTROL CIRCUITS ONLY)

1. Megger all 600V insulated wire with a 500V megger for one minute, and record the values. Determine the values with all panelboards, fuse holders, switches, and overcurrent devices in place. Do not connect motors and transformers during meggering. Megger wire and cable after installation, not on the cable reel.
2. Check all control cable by megger tests similar to those described for 600V insulated wire. Check all control wiring for tightness of terminal contacts and continuity through each run of control circuiting. Thoroughly verify all wiring. Provide all phasing tests and make all changes necessary to assure proper rotation of all motors, the correct phasing and phase sequence of all circuits susceptible to being paralleled, the proper polarity on all instrument transformer wiring, and such other phasing tests as may be required for the equipment being connected.

B. GROUNDING TESTS

1. Measure resistance of ground system at each ground riser.
2. Record results and notify Engineer if any reading exceeds 5 ohms.
3. Test by one of the following methods for resistance measurement:

   a. 3-point method, using an ammeter and voltmeter with AC or DC power supply
   b. Commercial instrument method

END OF SECTION 7

SPECIFICATION 8A

POLYETHYLENE GEOMEMBRANE LINER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specifications and guidelines for MANUFACTURING and INSTALLING geomembrane.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. D 638 Standard Test Method for Tensile Properties of Plastics
   2. D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
   3. D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
   4. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
   5. D 1603 Test Method for Carbon Black in Olefin Plastics
   6. D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
   7. D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
   8. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
   9. D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
   10. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
   11. D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
   12. D 6392 Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

1.03 DEFINITIONS

A. Lot- A quantity if resin (usually the capacity of one rail car) used in the manufacture of polyethylene geomembrane rolls. The finished roll will be identified by a roll number traceable to the resin lot used.

B. Construction Quality Assurance Consultant (CONSULTANT)- Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.

C. ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

D. Geomembrane Manufacturer (MANUFACTURER)- The party responsible for manufacturing the geomembrane rolls.

E. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY)- Party, independent from the OWNER, MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.

F. INSTALLER- Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.

G. Panel- Unit area of a geomembrane that will be seamed in the field that is larger than 100 square feet.

H. Patch- Unit area of a geomembrane that will be seamed in the field that is less than 100 square feet.

I. Subgrade Surface- Soil layer surface which immediately underlies the geosynthetic material(s).

1.04 SUBMITTALS POST-AWARD

A. Furnish the following product data, in writing, to ENGINEER prior to installation of the geomembrane material:
   1. Resin Data shall include the following.
      a. Certification stating that the resin meets the specification requirements (see Section 1.09).
   2. Geomembrane Roll
      a. Statement certifying no reclaimed polymer is added to the resin (product run may be recycled).

B. The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation:
   1. Installation layout drawings
      a. Must show proposed panel layout including field seams and details
      b. Must be approved prior to installing the geomembrane
         1) Approved drawings will be for concept only and actual panel placement will be determined by site conditions.
   2. Installer's Geosynthetic Field Installation Quality Assurance Plan

C. The INSTALLER will submit the following to the ENGINEER upon completion of installation:
   1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents
   2. Material and installation warranties
   3. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

1.05 QUALITY ASSURANCE

A. The OWNER will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

1.06 QUALIFICATIONS

A. MANUFACTURER
   1. Geomembrane shall be manufactured by the following:
      a. GSE Lining Technology, Inc.
      b. approved equal
   2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. INSTALLER
   1. Installation shall be performed by one of the following installation companies (or approved equal)
      a. GSE Lining Technology, Inc.
      b. GSE Approved Dealer/Installers
   2. INSTALLER shall have installed a minimum of [ ] square feet of HDPE geomembrane during the last [ ] years.
   3. INSTALLER shall have worked in a similar capacity on at least [ ] projects similar in complexity to the project described in the contract documents, and with at least [ ] square feet of HDPE geomembrane installation on each project.
   4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
   5. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
      a. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.07 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

1. Labeling - Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:
   a. manufacturer's name
   b. product identification
   c. thickness
   d. length
   e. width
   f. roll number
2. Delivery- Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
3. Storage- The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:
   a. level (no wooden pallets)
   b. smooth
   c. dry
   d. protected from theft and vandalism
   e. adjacent to the area being lined
4. Handling- Materials are to be handled so as to prevent damage.

1.08 WARRANTY

A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.

B. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion.

1.09 GEOMEMBRANE

A. Material shall be smooth/textured polyethylene geomembrane as shown on the drawings.

B. Resin
1. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
2. Natural resin (without carbon black) shall meet the following additional minimum requirements:

Property	Test Method	HDPE	LLDPE
Density [g/cm^3]	ASTM D 1505	0.932	0.915
Melt Flow Index [g/10 min.]	ASTM D 1238 (190/2.16)	≤ 1.0	≤ 1.0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100	100

C. Geomembrane Rolls

1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
2. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
3. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating both number, thickness, length, width and MANUFACTURER.
4. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in

Section 1.09, B, and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

D. Smooth surfaced geomembrane shall meet the requirements shown in the following table(s) for the following material(s):
   1. Table 1.1 for black HDPE
   2. Table 1.2 for white-surfaced HDPE
      a) The geomembrane shall be a white-surfaced, coextruded geomembrane.
      b) The white surface shall be installed upwards.
   3. Table 1.3 for smooth conductive HDPE
      a) The geomembrane shall have a coextruded, electrically conductive layer.
      b) The conductive layer is installed downward.
      c) Electrical testing shall be performed after liner installation by the INSTALLER.
   4. Table 1.4 for black LLDPE
   5. Table 1.5 for white-surfaced LLDPE
      a) The geomembrane shall be a white-surfaced, coextruded geomembrane.
      b) The white surface shall be installed upwards.

E. Textured surfaced geomembrane shall meet the requirements shown in the following table(s) for the following material(s).
   1. Table 2.1 for black coextruded textured HDPE
   2. Table 2.2 for black coextruded textured LLDPE
   3. Table 2.3 for white-surfaced coextruded textured LLDPE
      a) The white surface shall be installed upwards.

F. Extrudate Rod or Bead
   1. Extrudate material shall be made from same type resin as the geomembrane.
   2. Additives shall be thoroughly dispersed.
   3. Materials shall be free of contamination by moisture or foreign matter.

1.10 EQUIPMENT

A. Welding equipment and accessories shall meet the following requirements:
   1. Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.
   2. An adequate number of welding apparati shall be available to avoid delaying work.
   3. Power source capable of providing constant voltage under combined line load shall be used.

1.11 DEPLOYMENT

A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.

B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

C. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
   1. Unroll geomembrane panels using methods that will not damage geomembrane and will protect underlying surface from damage (i.e., spreader bar, protected equipment bucket).
   2. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.
   3. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane. Smoking will not be permitted on the geomembrane.

4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 6 psi.
5. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

D. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

1.12 FIELD SEAMING

A. Seams shall meet the following requirements:
1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.
2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
3. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.
4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CONSULTANT and INSTALLER.
5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-inch overlap is commonly suggested.

B. During Welding Operations
1. Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

C. Extrusion Welding
1. Hot-air tack adjacent pieces together using procedures that do not damage geomembrane.
2. Clean geomembrane surfaces by disc grinder or equivalent.
3. Purge welding apparatus of heat-degraded extrudate before welding.

D. Hot Wedge Welding
1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
2. Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.
3. Protect against moisture build-up between sheets.

E. Trial Welds
1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
4. Cut four, one-inch wide by six-inch long test strips from the trial weld.
5. Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear).
6. Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.
   a. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
   b. The break is ductile.
7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

G. Defects and Repairs
1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

1.13 FIELD QUALITY ASSURANCE

A. MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.

B. Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.

C. Field Testing
1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
   a. Vacuum Testing
      1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
   b. Air Pressure Testing
      1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
   c. Other approved methods.
2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
   a. Location and Frequency of Testing
      1) Collect destructive test samples at a frequency of one per every 1500 lineal feet of seam length.
      2) Test locations will be determined after seaming.
      3) Exercise Method of Attributes as described by GRI GM-14 (Geosynthetics Institute, http://www.geosynthetic-institute.org) to minimize test samples taken.
   b. Sampling Procedures are performed as follows:
      1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
      2) CONSULTANT will number each sample, and the location will be noted on the installation as-built.
      3) Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.
      4) Cut a 2-inch wide strip from each end of the sample for field-testing.
      5) Cut the remaining sample into two parts for distribution as follows:
         a) One portion for INSTALLER, 12-inches by 12 inches
         b) One portion for the Third Party laboratory, 12-inches by 18-inches
         c) Additional samples may be archived if required.
      6) Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determing the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
      7) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
      8) Repair and test the continuity of the repair in accordance with these Specifications.
3. Failed Seam Procedures
   1) If the seam fails, INSTALLER shall follow one of two options:

a) Reconstruct the seam between any two passed test locations.
b) Trace the weld to an intermediate location at least 10 feet minimum or to where the seam ends in both directions from the location of the failed test.

2) The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.
3) If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
4) If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

1.14 REPAIR PROCEDURES

A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

C. INSTALLER shall be responsible for repair of defective areas.

D. Agreement upon the appropriate repair method shall be decided between CONSULTANT and INSTALLER by using one of the following repair methods:
1. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
2. Abrading and Re-welding- Used to repair short section of a seam.
3. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
4. Capping- Used to repair long lengths of failed seams.
5. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
6. Remove the unacceptable seam and replace with new material.

E. The following procedures shall be observed when a repair method is used:
1. All geomembrane surfaces shall be clean and dry at the time of repair.
2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

F. Repair Verification
1. Number and log each patch repair (performed by CONSULTANT).
2. Non-destructively test each repair using methods specified in this Specification.

1.15 MEASUREMENT AND PAYMENT

A. Payment for geomembrane installation will be as per contract unit price per square foot, as measured parallel to liner surface, including designed anchor trench material and is based upon net lined area.

B. Net lined area is defined to be the true area of all surfaces to be lined plus designed burial in all anchor trenches, rubsheets, and sacrificial layers.

C. Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals.

D. Prices also include doing all the work involved in performing geomembrane installation completely as shown on the drawing, as specified herein, and as directed by the ENGINEER.

Table 1.1: Minimum Values for Smooth Black-Surfaced HDPE Geomembranes

Property	Test Method[1]						
Thickness, mil (mm)	ASTM D 5199						
Minimum Average		30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)	120 (3.0)
Lowest Individual Reading		27 (0.69)	36 (0.91)	54 (1.4)	72 (1.8)	90 (2.3)	108 (2.7)
Density, g/cm^3	ASTM D 1505	0.94	0.94	0.94	0.94	0.94	0.94
Carbon Black Content, %	ASTM D 1603, mod.	2.0	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 2*
Tensile Properties:	ASTM D 638						
(each direction)	Type IV, 2 ipm						
Strength at Yield, lb/in (kN/m)		63 (11)	84 (15)	130 (23)	173 (30)	216 (38)	259 (45)
Strength at Break, lb/in (kN/m)		122 (21)	162 (28)	243 (43)	324 (57)	405 (71)	486 (85)
Elongation at Yield, %	(1.3" gauge length)	13	13	13	13	13	13
Elongation at Break, %	(2.0" gauge length)	700	700	700	700	700	700
Tear Resistance, lb (N)	ASTM D 1004	21 (93)	28 (124)	42 (187)	56 (249)	70 (311)	84 (373)
Puncture Resistance, lb (N)	ASTM D 4833	59 (263)	79 (352)	119 (530)	158 (703)	198 (881)	238 (1059)
Notched Constant Tensile Load, hours	ASTM D 5397, app.	400	400	400	400	400	400
Oxidative Induction Time, min.	ASTM D 3895	100	100	100	100	100	100

1 Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.
2 Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

Table 1.2: Minimum Values for Smooth White-Surfaced HDPE Geomembranes

Property	Test Method[1]					
Thickness, mil (mm)	ASTM D 5199					
Minimum Average		30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)
Lowest Individual Reading		27 (0.69)	36 (0.91)	54 (1.4)	72 (1.8)	90 (2.3)
Density, g/cm^3	ASTM D 1505	0.94	0.94	0.94	0.94	0.94
Carbon Black Content[2], %	ASTM D 1603	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 4*	*Note 4*	*Note 4*	*Note 4*	*Note 4*
Tensile Properties:	ASTM D 638					
(each direction)	Type IV, 2 ipm					
Strength at Yield, lb/in (kN/m)		63 (11)	84 (15)	130 (23)	173 (30)	216 (38)
Strength at Break, lb/in (kN/m)		122 (21)	162 (28)	243 (43)	324 (57)	405 (71)
Elongation at Yield, %	(1.3" gauge length)	13	13	13	13	13
Elongation at Break, %	(2.0" gauge length)	700	700	700	700	700
Tear Resistance, lb (N)	ASTM D 1004	21 (93)	28 (124)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	59 (263)	79 (352)	119 (530)	158 (703)	198 (881)
Notched Constant Tensile Load, hours	ASTM D 5397, app.	400	400	400	400	400
Oxidative Induction Time[3], min.	ASTM D 3895	100	100	100	100	100

1 GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.
2 GSE White may have an overall ash content greater than 3.0% due to the white layer.
3 The OIT values apply to the black layer only.
4 Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

Table 1.3: Minimum Values for Smooth Conductive HDPE Geomembranes

Property	Test Method[1]				
Thickness, mil (mm)	ASTM D 5199				
Minimum Average		40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)
Lowest Individual Reading		36 (0.91)	54 (1.4)	72 (1.8)	90 (2.3)
Density, g/cm^3	ASTM D 1505	0.94	0.94	0.94	0.94
Carbon Black Content[2], %	ASTM D 1603, modified	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 5*	*Note 5*	*Note 5*	*Note 5*
Tensile Properties[3]:	ASTM D 638				
(each direction)	Type IV, 2 ipm				
Strength at Yield, lb/in (kN/m)		84 (15)	130 (23)	173 (30)	216 (38)
Strength at Break, lb/in (kN/m)		162 (28)	243 (43)	324 (57)	405 (71)
Elongation at Yield, %	(1.3" gauge length)	13	13	13	13
Elongation at Break, %	(2.0" gauge length)	700	700	700	700
Tear Resistance, lb (N)	ASTM D 1004	28 (124)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	79 (352)	119 (530)	158 (703)	198 (881)
Notched Constant Tensile Load, hours	ASTM D 5397, appendix	400	400	400	400
Oxidative Induction Time[3], min.	ASTM D 3895	100	100	100	100

[1] GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.
[2] GSE Conductive and GSE Conductive White may have an overall ash content of greater than 3.0% due to the conductive and/or white layers.
[3] Due to surface effects caused by the conductive layer, these tensile properties are minimum average values.
[4] The OIT values apply to the non-conductive black layer only.
[5] Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3

Table 1.4: Minimum Values for Smooth LLDPE Geomembranes

Property	Test Method[1]					
Thickness, mil (mm)	ASTM D 5199					
Minimum Average		30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)
Lowest Individual Reading		27 (0.69)	36 (0.91)	54 (1.4)	72 (1.8)	90 (2.3)
Density, g/cm^3	ASTM D 1505	0.92	0.92	0.92	0.92	0.92
Carbon Black Content, %	ASTM D 1603, modified	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 2*
Tensile Properties:	ASTM D 638					
(each direction)	Type IV, 2 ipm					
Strength at Break, lb/in (kN/m)		114 (20)	152 (27)	228 (40)	304 (53)	380 (66)
Elongation at Break, %	(2.0" gauge length)	850	850	850	850	850
Tear Resistance, lb (N)	ASTM D 1004	16 (71)	22 (100)	33 (150)	44 (200)	55 (250)
Puncture Resistance, lb (N)	ASTM D 4833	46 (205)	62 (276)	92 (409)	123 (547)	154 (685)
Oxidative Induction Time, min.	ASTM D 3895	100	100	100	100	100

[1] GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics.
[2] Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3

Table 1.5: Minimum Values for Smooth White-Surfaced LLDPE Geomembranes

Property	Test Method[1]		
Thickness, mil (mm)	ASTM D 5199		
Minimum Average		40 (1.0)	60 (1.5)
Lowest Individual Reading		36 (0.91)	54 (1.4)
Density, g/cm^3	ASTM D 1505	0.92	0.92
Carbon Black Content[2], %	ASTM D 1603, modified	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 4*	*Note 4*
Tensile Properties:	ASTM D 638		
(each direction)	Type IV, 2 ipm		
Strength at Break, lb/in (kN/m)		152 (27)	228 (40)
Elongation at Break, %	(2.0" gauge length)	850	850
Tear Resistance, lb (N)	ASTM D 1004	22 (100)	33 (150)
Puncture Resistance, lb (N)	ASTM D 4833	62 (276)	92 (409)
Oxidative Induction Time[3], min.	ASTM D 3895	100	100

[1] GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures.
[2] GSE UltraFlex White may have an overall ash content greater than 3.0% due to the white layer.
[3] The OIT values apply to the black layer only.
[4] Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

Table 2.1: Minimum Values for Coextruded Textured HDPE Geomembranes

Property	Test Method[1]					
Thickness, mil (mm)	ASTM D 5994					
Minimum Average		30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)
Lowest Individual Reading		27 (0.69)	36 (0.91)	54 (1.4)	72 (1.8)	90 (2.3)
Density, g/cm^3	ASTM D 1505	0.94	0.94	0.94	0.94	0.94
Carbon Black Content[2], %	ASTM D 1603, modified	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 4*	*Note 4*	*Note 4*	*Note 4*	*Note 4*
Tensile Properties[2]:	ASTM D 638					
(each direction)	Type IV, 2 ipm					
Strength at Yield, lb/in (kN/m)		63 (11)	84 (15)	130 (23)	173 (30)	216 (38)
Strength at Break, lb/in (kN/m)		45 (8)	60 (11)	90 (16)	120 (21)	150 (27)
Elongation at Yield, %	(1.3" gauge length)	13	13	13	13	13
Elongation at Break, %	(2.0" gauge length)	150	150	150	150	150
Tear Resistance, lb (N)	ASTM D 1004	21 (93)	28 (124)	40 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	54 (240)	72 (320)	108 (480)	144 (641)	180 (801)
Notched Constant Tensile Load [3], hours	ASTM D 5397, appendix	400	400	400	400	400
Oxidative Induction Time, min.	ASTM D 3895	100	100	100	100	100

[1] Some test procedures have been modified for application to geosynthetics.
[2] The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variations of test results. Therefore, these tensile properties are minimum average roll values.
[3] NCTL on coextruded textured product is conducted on representative smooth membrane samples.
[4] Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3

Table 2.2: Minimum Values for Coextruded Textured LLDPE Geomembranes

Property	Test Method[1]		
Thickness, mil (mm)	ASTM D 5994		
Minimum Average		40 (1.0)	60 (1.5)
Lowest Individual Reading		36 (0.91)	54 (1.4)
Density, g/cm^3	ASTM D 1505	0.92	0.92
Carbon Black Content, %	ASTM D 1603, modified	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 3*	*Note 3*
Tensile Properties[3]:	ASTM D 638		
(each direction)	Type IV, 2 ipm		
Strength at Break, lb/in (kN/m)		100 (18)	132 (23)
Elongation at Break, %	(2.0" gauge length)	500	500
Tear Resistance, lb (N)	ASTM D 1004	22 (100)	33 (150)
Puncture Resistance, lb (N)	ASTM D 4833	48 (214)	73 (325)
Oxidative Induction Time, min.	ASTM D 3895	100	100

[1] GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics.
[2] The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variations of test results. Therefore, these tensile properties are average roll values.
[3] Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

Table 2.3: Minimum Values for White-Surfaced Coextruded Textured LLDPE Geomembranes

Property	Test Method[1]		
Thickness, mil (mm)	ASTM D 5994		
Minimum Average		40 (1.0)	60 (1.5)
Lowest Individual Reading		36 (0.91)	54 (1.4)
Carbon Black Content[2], %	ASTM D 1603, modified	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 5*	*Note 5*
Tensile Properties[3]:	ASTM D 638		
(each direction)	Type IV, 2 ipm		
Strength at Break, lb/in (kN/m)		100 (18)	132 (23)
Elongation at Break, %	(2.0" gauge length)	500	500
Tear Resistance, lb (N)	ASTM D 1004	22 (100)	33 (150)
Puncture Resistance, lb (N)	ASTM D 4833	48 (214)	73 (325)
Oxidative Induction Time[4], min.	ASTM D 3895	100	100

[1] GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics.
[2] GSE UltraFlex White Textured may have an overall ash content greater than 3.0% due to the white layer.
[3] The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variations of test results. Therefore, these tensile properties are average roll values.
[4] The OIT values apply to the black layer only.
[5] Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

Table 3.1: Minimum Weld Values for HDPE Geomembranes

Property	Test Method	30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)	120 (3.0)
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	49 (8.6)	65 (12)	98 (17)	130 (23)	162 (29)	196 (35)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	39 (6.9)	52 (9)	78 (14)	104 (18)	130 (23)	157 (28)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	61 (11)	81 (14)	121 (21)	162 (29)	203 (36)	242 (43)

Table 4.1: Minimum Weld Values for LLDPE Geomembranes

Property	Test Method	30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)
Peel Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	36 (6.3)	48 (8.4)	72 (13)	96 (17)	120 (21)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	40 (7.0)	56 (9.8)	84 (15)	112 (20)	140 (25)

These values apply to both coextruded and flat cast produced geomembranes to include white-surfaced products.

SPECIFICATION 8B

GEONET DRAINAGE LAYER

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Specifications and guidelines for MANUFACTURING and INSTALLING geonet.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. D 1238-01 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
   2. D 1505-98 Standard Test Method for Density of Plastics by the Density-Gradient Technique
   3. D 1603-94 Standard Test Method for Carbon Black in Olefin Plastics
   4. D 4716-00 Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
   5. D 5035-95 Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
   6. D 5199-99 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

B. Relevant publications from the Environmental Protection Agency (EPA):
   1. Daniel, D.E. and R.M. Koerner, (1993), *Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities,* EPA/600/R-93/182.

1.03 DEFINITIONS

A. Construction Quality Assurance Consultant (CONSULTANT) - Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.

B. ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

C. Geonet Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geonet rolls.

D. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY)- Party, independent from the MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.

E. INSTALLER- Party responsible for field handling, transporting, storing and deploying the geonet.

F. Lot- A quantity of resin (usually the capacity of one rail car) used to manufacture polyethylene geonet rolls. The finished rolls will be identified by a roll number traceable to the resin lot.

1.04 QUALIFICATIONS

A. MANUFACTURER

1. Geonet shall be manufactured by the following:
   a. GSE Lining Technology, Inc.
   b. approved equal
2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geonet material during the last year.

B. INSTALLER

1. Installation shall be performed by one of the following installation companies (or approved equal):
   a. GSE Lining Technology, Inc.
   b. GSE Approved Dealer/ Installer
2. INSTALLER shall have installed a minimum of [ ] square feet of geonet in the last [ ] years.
3. INSTALLER shall have worked in a similar capacity on at least [ ] projects similar in complexity to the project described in the contract documents, and with in at least [ ] square feet of geonet installation on each project.
4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

1.05 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

A. Labeling- Each roll of geonet delivered to the site shall be labeled by the MANUFACTURER. The label will identify:

1. manufacturer's name
2. product identification
3. length
4. width
5. roll number

B. Delivery- Rolls of geonet will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

C. Storage- The on-site storage location for the geonet, provided by the CONTRACTOR to protect the geonet from abrasions, excessive dirt and moisture shall have the following characteristics:

1. level (no wooden pallets)
2. smooth
3. protected from theft and vandalism
4. adjacent to the area being lined.

D. Handling
   1. The CONTRACTOR and INSTALLER shall handle all geonet in such a manner as to ensure it is not damaged in any way.
   2. The INSTALLER shall take any necessary precautions to prevent damage to underlying layers during placement of the geonet.

1.06 WARRANTY

A. Material shall be warranted, on a pro-rata basis against defects for a period of 1-year from the date of the geonet installation.

B. Installation shall be warranted against defects in workmanship for a period of 1-year from the date of geonet completion.

PART 2: PRODUCTS

2.01 GEONET PROPERTIES

A. A geonet shall be manufactured by extruding two crossing strands to form a bi-planar drainage net structure.

B. The geonet specified shall have properties that meet or exceed the values listed in Tables 02621-1and 02621-2.

Table 02621-1

Standard Property Drainage Sheet GSE Bi-Planar Geonet			
Tested Property	**Test Method**	**MINIMUM AVERAGE VALUES[d]**	
		HyperNet	**HyperNet HF**
Transmissivity, m^2/sec	ASTM D4716-00	$2x10^{-3}$[a]	$3x10^{-3}$[b]
Thickness, mil (mm)	ASTM D 5199	200 (5)	250 (6.3)
Density, g/cm^3	ASTM D 1505	0.94	0.94
Tensile Strength (MD), lb/in (N/mm)	ASTM D 5035	45 (7.9)	55 (9.6)
Carbon Black Content, %	ASTM D 1603, modified	2.0	2.0
Roll Width, ft (m)		15 (4.6)	15 (4.6)
Roll Length [c], ft (m)		300 (90)	250 (76)
Roll Area, ft^2 (m^2)		4,500 (418)	3,750 (348)

(a) Gradient of 0.1, normal load of 10,000 psf, water at 70° between stainless steel plates for 15 minutes.
(b) Gradient of 0.1, normal load of 10,000 psf, water at 70° between stainless steel plates for 15 minutes.
(c) Other roll lengths may be available upon request.
(d) These are MARV values that are based on the cumulative results of specimens tested and determined by GSE.

C. Resin

1. Resin shall be first quality, compounded polyethylene resin.
2. Natural resin (without carbon black) shall meet the following additional minimum requirements:

Table 02621-2

Property	Test Method [1]	Testing Frequencies	Value
Density (g/cm3)	ASTM D 1505	Once Per Resin Lot	>0.94
Melt Flow Index (g/10 min)	ASTM D 1238	Once Per Resin Lot	≤1.0

[1]GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.

2.02 MANUFACTURING QUALITY CONTROL

A. The geonet shall be manufactured in accordance with the Manufacturer's Quality Control Plan submitted to and approved by the ENGINEER.

B. The geonet shall be tested according to the test methods and frequencies listed below:

Table 02621-3

Manufacturing Quality Control Test Frequencies			
Characteristics	**Test Method**	**Units**	**FREQUENCY**
			Bi-Planar
Resin			
Polymer Density	ASTM D 1505	g/cm^3	Once Per Lot
Melt Flow Index	ASTM D 1238	g/10 min	Once Per Lot
Geonet Test			
Thickness	ASTM D 5199	mil	1/50,000 ft^2
Carbon Black	ASTM D 4218	%	1/50,000 ft^2
Tensile Strength, MD	ASTM D 4595	lbs/ ft	1/50,000 ft^2
Transmissivity	ASTM D 4716-00	m^2/sec	1/540,000 ft^2

PART 3: EXECUTION

3.01 FAMILIARIZATION

A. Inspection

1. Prior to implementing any of the work in the Section to be lined, the INSTALLER shall carefully inspect the installed work of all other Sections and verify that all work is complete to the point where the installation of the Section may properly commence without adverse impact.

2. If the INSTALLER has any concerns regarding the installed work of other Sections, he shall notify the Project ENGINEER.

3.02 MATERIAL PLACEMENT

A. The geonet roll should be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the ENGINEER.

B. If the project contains long, steep slopes, special care should be taken so that only full-length rolls are used at the top of the slope.

C. In the presence of wind, all geonets shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until replaced with cover material.

D. If the project includes an anchor trench at the top of the slopes, the geonet shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geonet.

E. In applying fill material, no equipment can drive directly across the geonet. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure.

F. The cover soil shall be placed in the geonet in a manner that prevents damage to the geonet. Placement of the cover soil shall proceed immediately following the placement and inspection of the geonet.

3.03 SEAMS AND OVERLAPS

A. Each component of the geonet will be secured to the like component at overlaps.

B. Geonet Components
   1. Adjacent edges of the geonet along the length of the geonet roll shall be placed with the edges of each geonet butted against each other.
   2. The butted edges shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every 5 feet along the roll length.
   3. Adjoining net rolls (end to end) across the roll width should be shingled down in the direction of the slope and joined together with cable ties spaced every foot along the roll width.
   4. Geonet should be tied every 6 inches in the anchor trench or as specified by the ENGINEER.

3.04 REPAIR

A. Prior to covering the deployed geonet, each roll shall be inspected for damage resulting from construction.

B. Any rips, tears or damaged areas on the deployed geonet shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be cut out and the two portions of the geonet shall be joined in accordance with Subsection 3.03.

END OF SECTION

FALCON'S INSTALLATION QUALITY ASSURANCE PLAN

1.0 INTRODUCTION

1.1 Overview of Construction Quality Assurance Plan

The Falcon's Installation Quality Assurance Plan was developed based on the company's long-tem policy and tradition of quality being the single most significant determining factor. Some projects have specifications which may require project specific modifications to this manual. Such documents, when required, will become an appendix to the construction contract or this manual.

Commonly used geosynthetic components of a lining system are discussed in this manual This includes polyethylene geomembranes, geotextiles, geonets and geocomposites. This manual can be a useful guide in delineating the quality assurance procedures and minimum requirements for the installation of all the above geosynthetic products.

This manual does not address design guidelines, installation specifications, or selection of geomembranes, bentonite blankets, and other geosynthetics.

1.2 Project Duties and Qualifications of the Geosynthetic Installer Personnel

1.2.1 Project Manager

The Falcon Project Manager is charged, at a minimum, with the following responsibilities.

- Primary customer contact for all aspects of the project
- Coordinate projects with clients with regard to submittals, documentation, material delivery, crew mobilization, job progress, invoicing and project close- out
- Develop and implement staffing, equipment and operational plans prior to job start
- Continuously monitor job progress and make necessary adjustments to ensure successful completion; maintain revised schedules and schedule coordination with other project activities to reflect current status subsequent to any significant change
- Attend pre-construction meetings
- Available for site visits and meetings as job progresses to ensure client satisfaction

1.2.2 Site Supervisor

The Site Supervisor shall have installed a minimum of 5,000,000 square feet of geomembrane. The Falcon Site Supervisor is charged, at a minimum, with the following responsibilities.

- Accept surface conditions as satisfactory for deployment or advise customers and project manager if not satisfactory
- The deployment, seaming, testing, repair and detailing of the geosynthetic components installation for which Falcon is contracted to install
- The Welding Technicians and other field staff
- Repair and maintenance of all equipment and vehicles used on jobsite
- Communication with the customer on all matters of scheduling and the installer's role in project
- Develop time and scope estimates for any applicable change orders with assistance from project manager
- Act as the primary on-site contact for the customer and Independent construction quality assurance (CQA) personnel
- Supervise the completion of all lining installation work including clean up of the jobsite

1.2.3 Quality Assurance Technician

The Quality Assurance (QA) Technician is charged, at a minimum, with the following responsibilities.

- Removal of all conformance and destructive samples from the liner
- Monitor all trial welds
- Performance of all non-destructive and destructive testing
- Maintain records of testing performed
- Measurement of deployed materials
- Inspections (walkdown) of completed areas of installation
- Other tasks required

1.2.4 Welding Technician

The Welding Technician is charged, at a minimum, with the following responsibilities.

- Perform deployment, seaming, and repairs as required for project
- Equipment maintenance as required
- Perform trial welds
- Perform other functions for the scope of work as directed by the Site Supervisor
- Assist QA Technician as required by the Site Manager

The Master Seamer shall be a welding technician with a minimum of 1,000,000 square feet of geomembrane seaming work and can also be the Site Supervisor or QA Technician

1.3 Construction Meeting

1.3. 1 Pre-Construction Meeting

Following the award of contract, a Pre-Construction Meeting should be held. This meeting should include all involved parties

The purpose of this meeting is to begin planning coordination of task, addressing problems which might cause difficulties and delays in construction, and present the relevant quality assurance guidelines to all the parties involved. It is very important that the specifications regarding testing, repair, etc. be known and accepted by all.

This meeting should include, but not limited to, the following activities:

- Communicate to all parties any relevant documents
- Review critical design details of the project
- Review the relevant quality assurance guidelines and specifications and agree on any appropriate modifications
- Make appropriate site-specific modifications to the design criteria, plans and specifications through the implementation of a documented, site specific addendum
- Reach an agreement on quality control procedures, especially on methods of determining acceptability of the lining system
- Establish lines of authority and communication
- Review safety plans and procedures
- Prepare a time schedule for all operations and any other site specific items pertinent to the lining installation

The meeting should be documented and minutes transmitted to all parties within one week of the meeting

1.3.2 Progress Meetings

It is recommended an informal daily installation Progress Meeting be held among appropriate parties to discuss current progress.

2.0 GEOMEMBRANE INSTALLATION

2.1 Earthwork

2 .1. 1 Surface Preparation

The Earthwork Contractor shall be responsible for preparing the subgrade according to the project Specifications

The Site Supervisor shall verify that:

a) The surface to be lined has been prepared so as to be free of irregularities, protrusions, vegetation, excessive water, loose soil or abrupt changes in grade.

b) The supporting surface does not contain stones or other matter of such composition, shape or size which may be damaging to the geomembrane and

c) There are no excessively soft surface areas. Smooth drum rolled surface.

Under no circumstances shall the installer deploy any geomembrane in areas not acceptable within these guidelines. A completed surface acceptance form shall be provided to the customer specifically indicating the areas accepted for geomembrane installation during each day's activities. This form shall be provided after the installation activities within that area. If at any time during the installation of the geosynthetic lining system the prepared subgrade deteriorates, becomes damaged, or in any way is determined unacceptable by the Site Supervisor, all liner installation work shall stop in those areas and the condition of those areas brought to the attention of the appropriate party.

2.1.2 Anchor Trench

The Earthwork Contractor shall construct the anchor trenches (unless otherwise specified in the contract) to the lines, widths and depths as shown on the drawings and specifications. This task should be performed prior to the geomembrane deployment.

The edges where the geosynthetics enter the trench should be free of irregularities, protrusions, etc. to avoid potential damage to the material. Backfilling of the anchor trench shall be the responsibility of the Earthwork Contractor in accordance with specifications. Backfilling should occur when the geosynthetic material is at its most contracted state to avoid potential bridging problems. Care must be taken to avoid damaging the geosynthetics during backfilling

2.2 Geomembrane Deployment

The site supervisor, in conjunction with the customer shall agree upon the following issues. If any adverse situation or disagreement exists, the site supervisor shall cease deployment until issues are resolved.

2.2.1 Installation

The Site Supervisor shall proceed with deployment provided that:

- Deployment equipment does not damage the subgrade.
- Personnel who are in contact with the liner do not smoke, wear damaging shoes or engage in other activities which risk damage to the liner.
- Use of a low ground pressure, rubber-tired all terrain vehicle (i.e. ATV) is allowed on the geosynthetic surface, provided proper care is taken to avoid damage and excessive traffic.

Field panel placement installation sequence should take into account site drainage, wind direction, subgrade surface, access to the site, and production schedule of the project. Geomembrane panel deployment shall not proceed when adverse weather conditions exist which may jeopardize the integrity of the liner installation. Field panels should be seamed as soon as possible after deployment and all deployed material shall be marked with appropriate identification.

2.2.2 Visual Inspection

The Site Supervisor and/or the QA Technician and the designated Independent Inspector shall visually inspect each panel, as soon as possible after deployment, for damage or areas needing repair. Areas shall be marked for repair.

2.3 Field Seaming

Field seaming involves the bonding of adjacent panels using thermal methods.

2.3.1 Seam Layout

In general, seams shall be oriented parallel to the direction of maximum slope, i.e. oriented along, not across, the slope. In corners and odd-shaped geometric locations, the number of seams should be minimized No horizontal seams should occur on a panel less than five lineal feet from the toe of the slope. On slopes of less than 10% (6L:1H), this rule shall not apply. A cross slope seam may be utilized provided the panel ends are cut at an angle of approximately 45°
A seam is considered a separate entity if it is the principal attachment that joins two or more panels. Repairs are not considered seams in this context.

A numbering system using adjacent panel numbers shall identify each seam.

2.3.2 Seaming Equipment and Products

Approved processes for field seaming and repairing are extrusion welding and fusion welding. All welding equipment shall have accurate temperature monitoring devices to insure proper measurement of the welder temperatures.

a) Fusion Process

This process shall be used for seaming panels together and is not generally used for patching or detail work. The apparatus shall be of a hot wedge type and is commonly equipped with a "split wedge" to allow air pressure seam testing.

Fusion welding equipment shall be self-propelled devices and shall be equipped with functioning wedge temperature and seaming speed controllers to assure proper control by the Welding Technician.

b) Extrusion Process

This process shall be used primarily for repairs, patching, and special detail fabrication. This method is also useful to connect new panels to previously installed liner that does not have an exposed edge capable of being fusion welded.

The extrusion welding apparatus (handwelder) shall be equipped with temperature monitoring devices.

2.3.3 Seam Preparation

The Welding Technician shall verify that prior to seaming, the seam area is free of moisture, dust, dirt, sand, or debris of any nature; the seam is properly overlapped for welding; the seam is properly heat tacked and abraded when extrusion welding, and seams are performed to minimize "fishmouths."

2.3.4 Trial Seams (Trial Welds)

Prior to production seaming, trial seams shall be made and accepted using specified criteria. Trial seams shall be made on appropriate sized pieces of identical or equivalent geomembrane material to verify that seaming conditions and procedures are adequate. Each trial seam sample shall be assigned a number and the test results recorded in the appropriate log.

- Trial seams shall be performed for each welder to be used and by each operator of extrusion welders, and by the primary operator of each fusion welder.
- A passing trial seam shall be made prior to the beginning of each seaming period. Typically this is at the start of the day and after lunch break.
- Fusion welded trial seam samples shall be approximately six feet long by one foot wide with the seam centered lengthwise. For extrusion welding, the trial seam sample size shall be approximately three feet long, by one foot wide with the seam centered lengthwise.
- Four specimens, each one inch wide and six inches long shall be cut from the trial seam using a coupon cutter. Two of the specimens shall be tested in shear and two specimens tested for peel on a field tensiometer. When testing a fusion welded seam, both inside and outside seams shall be tested. All shear and peel test specimens shall meet or exceed the project requirements.

2.3.5 Panel Seams (Production Seaming)

Upon acceptance of the trial seams, work may begin on deployed panels. All seams shall be non-destructively and destructively tested. Each completed seam shall be labeled with pertinent information.

2.3.6 Non-Destructive Seam Testing

Falcon shall non-destructive test field seams for their full length using an air pressure test or a vacuum test. The purpose of non-destructive tests is to demonstrate the leak resistance of the seam.

On seams that cannot be non-destructively tested by vacuum or air-pressure methods due to physical constraints, i.e. a boot detail, the seam shall be tested using other approved methods.

The Site Supervisor shall schedule all non-destructive testing operations in order to ensure prompt demonstration of weld quality and the orderly progress of the project.

The QA Technician shall instruct the testing personnel regarding marking of repairs needed, leaks and sign-off marks on seam and repairs

a) Vacuum Testing

Vacuum testing is routinely performed on extrusion welds and can be performed on fusion welds. The equipment shall consist of a vacuum box assembly with a vacuum gauge, a pumping device, and a soap solution.

The following procedure shall be followed:

- Wet a section of the seam with the soap solution. The seam section must be longer than the vacuum box.
- Place the vacuum box over the wetted area and apply body weight to form a seal between the gasket and the liner.
- Evacuate air to create a negative pressure of approximately 5 psig.
- Observe the seam through the viewing window for presence of soap bubbles emitting from the seam.
- If no bubbles are observed, reposition the box on the next wetted area for testing with a slight overlap.
- If bubbles are detected, which indicates a leak in the seam, mark the area of the leak for repair and retest.

b) Air Pressure Testing

Air pressure testing is performed on seams made by a double-seam fusion welding apparatus.

The equipment shall be comprised of the following:

- An air pump, or air tank capable of producing a minimum air pressure of 25 psig in the seam channel.
- A sharp hollow needle to insert air into the air channel of the seam.
- A hot air gun or other heating device to seal the ends of the air channel.

The following procedures shall be followed:

- Seal both ends of the air channel of the seam to be tested.
- Insert the needle into the air chamber at either end of the seam to be tested.
- Pressurize the air channel to a minimum of 25 psig. Allow the pressure to stabilize, and if necessary, re-pressurize to 25 psig and note the pressure.
- With a minimum pressure of 25 psig stabilized in the air channel, the time of day shall be noted.
- After approximately 5 minutes, the air pressure should be read again.
- If the difference between the two readings is more than 4 psig, the seam needs to be retested.
- Upon completion of the test and recording all information required, open the opposite end of the seam from the needle. Escaping air will confirm that the entire length of the seam was pressurized and therefore tested. If air does not escape, the channel is blocked. The blockage must be located and the test redone from that point.
- Upon completion of the air pressure test the seam shall be marked and points requiring repair identified.

c) Procedures for Air Pressure Test Failure

Should the seam fail the air pressure test, the following procedure shall be followed:

- Reposition the apparatus and retest the same section.
- While the seam air-channel is under pressure, traverse the length of the seam and listen for the leak.
- While the seam air-channel is under pressure, apply a soapy solution to the seam edge (do not trim excess material from edge of seam) and observe for bubbles formed by escaping air.
- Re-test the seam in progressively smaller increments, until the area of leakage is identified.
- Repair the identified leak area by extrusion welding the excess material at the edge of the seam and then vacuum test.
- In areas where the air channel is closed and integrity of the weld is not suspect, vacuum testing is acceptable.

2.3.7 Destructive Seam Testing

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate bonded seam strength. Seam strength testing shall be performed as work progresses.

a) Location and Frequency

The frequency of sample removal is commonly no more than one sample per 500 lineal feet of seam.

b) Size of Samples

A sample segment twelve inches by twelve inches shall be cut with the seam centered lengthwise. Additional segments may be cut for independent lab testing, archival retain or other uses.

c) Sample Identification

The sample shall be marked with the appropriate destructive sample (D/S) number.

d) Field Testing

Sample shall be tested in peel and in shear using the following procedure:

- Ten specimens of one inch width shall be cut with a coupon cutter from the segment a machine press and die.
- Five specimens shall be tested for peel. Fusion welds shall be tested from both sides.
- Five specimens shall be tested for shear.
- If specified, a field tesiometer will be supplied. Testing will occur at a rate of two inches per minute.

e) Pass/Fail Criteria

Seams shall exhibit a film tear bond (FTB). For projects which utilize a tensiometer, the following table provides minimum acceptable values.

ASTMD 4437		Seam Strength			
		Shear		Peel	
Product Name	Thickness ASTMD 5199 mm(mils)	Extrusion kN/m (lb/in)	Fusion kN/m (lb/in)	Extrusion kN/m (lb/in)	Fusion kN/m (lb/in)
HDPE Smooth	1.0(40)	14.1(81)	14.1(81)	9.1(52)	11.4(65)
HDPE Smooth	1.5(60)	21.2(121)	21.2(121)	13.7(78)	17.2(98)
HDPE Smooth	2.0(80)	28.4(162)	28.4(112)	18.2(104)	22.8(130)
ASTMD 4437		Seam Strength			

		Shear		Peel	
Product Name	Thickness ASTMD 5199 mm(mils)	Extrusion kN/m (lb/in)	Fusion kN/m (lb/in)	Extrusion kN/m (lb/in)	Fusion kN/m (lb/in)
HDPE Textured	1.0(40)	14.1(81)	14.1(81)	9.1(52)	11.4(65)
HDPE Textured	1.5(60)	21.2(121)	21.2(121)	13.7(78)	17.2(98)
HDPE Textured	2.0(80)	28.4(162)	28.4(162)	18.2(104)	22.8(130)

In addition to these values, the sample shall not fail within the seam area. Four out of five specimens meeting the above criteria will constitute a passing test.

If the seam fails the test, the following procedure shall be followed. Additional sample segments of the same size shall be removed approximately 10 lineal feet in each direction from the failed seam. Both of these sample segments shall be tested accordance with the criteria listed above and each segment must pass. This procedure is repeated until a passing result is obtained. In lieu of taking an excessive number of samples, the entire seam may be repaired as outlined in Section 2.3.8 a.

2.3.8 Defects and Repairs

All seams and non-sewn areas of the polyethylene lining system shall be examined for identification of defects. Identification of the defect or repair may be made by marking on the sheet/seam with an appropriate marking device.

a) Repair Procedures

Any portion of the polyethylene lining system exhibiting a defect, which has been marked for repair, shall be repaired with any one or combination of the following methods:

- Patching: used to repair holes, tears.
- Grind and reweld: used to repair small sections of extruded seams.
- Spot welding: used to repair small minor, localized flaws.
- Flap welding: used to extrusion weld the flap of a fusion weld in lieu of a full cap.
- Capping: used to repair failed seams.
- Topping: application of extrudate bead directly to existing Seams.

The suspected defect shall be demonstratable as out of specification and detrimental to the performance of the liner.

The following conditions shall apply to all the above methods:

- Surfaces of the polyethylene, which are to be repaired, shall be lightly abraded to assure cleanliness.
- All surfaces intended to receive extrudate must be clean and dry at the time of the repair.
- All patches and caps shall extend at least four inches beyond the edge of the defect, and all patches shall have rounded corners.

b) Verification of Repairs

Repairs shall be non-destructively tested according to the criteria established in Section 2.3.6 e.

Repairs which pass the non-destructive test will be taken as an indication of an adequate repair. Failed tests indicate that the repair must be re-done and re-tested until a passing test result is obtained.

2.4 Lining System Acceptance

After work is complete, the Site Supervisor and/or QA Technician shall conduct a final inspection (walk-down) of the area for confirmation that all repairs have been appropriately performed, all test results are acceptable and the area has all scrap, trash and debris removed. Only after careful evaluation by the Site Supervisor and acceptance by the Customer shall any material be placed upon the lining system.

The geosynthetic lining system will be accepted by the customer when:

- Installation of materials is complete
- Verification of the adequacy of all seams and repairs, including associated testing and documentation is complete

Acceptance will be indicated by all parties involved by signing a Certificate of Acceptance (see Section 4) Partial areas of the installation may be accepted in order to allow further construction of the project.

3.0 ANCILLARY GEOSYNTHETICS INSTALLATION (Geonets, Geocomposites, GCL's, Geotextiles, and Geogrids)

3.1 Handling

Falcon shall handle all geotextile, geonets, geogrids and geocomposites, in such a manner as to ensure they are not damaged.

- On slopes, the geosynthetics shall be securely anchored in the anchor trench and then rolled down the slope in such a manner as to keep the material in tension.
- Sandbags shall be used to secure the edges of the material when the potential for wind damage is significant.

- Cutting of the material shall be done in such a manner as to prevent damage to any underlying or adjacent geomembrane.
- Care should be taken when deploying geosynthetic materials that stones, debris or other material is not trapped by the geonet, geocomposites, geotextile, geogrids, or GCL and which might damage the geosynthhetic or geomembrane.

3.2 Deployment

3.2.1 Geonet (GSE HyperNet®)
Geonets shall be overlapped approximately four inches and fastened together with plastic cable ties,

3.2.2 Geotextile/Geonet Geocomposite (GSE FabriNet®)
The geonet component shall be butted or overlapped and fastened together with plastic cable ties. The unbonded edges of the geotextile component shall remain overlapped. Bonded edges of the geocomposite shall be overlapped approximately four inches and fastened with plastic cable ties.

3.2.3 Geotextile
Geotextiles may be installed by overlapping, by heat bonding (spot or continual basis) or by sewing as specifications dictate.

3.2.4 Geogrid
Geogrids should be installed per manufacturer's recommendations and/or project specifications.

3.2.5 Geosynthetic Clay Liner (GCL)
Seaming of GCLs is achieved by overlapping the GCL panels approximately six inches. When installing GSE GundSeal® GCL with the geomembrane backing up and the bentonite side down, it is necessary to place tape over the seam to prevent intrusion of overlying cover soils into the overlap during soil placement. Alternately, the geomembrane backing may be welded in accordance with GSE GundSeal installation specification.

3.3 Geosynthetic Repairs

Repairs shall be made on geosynthetic products as necessary.

3.3.1 Geonet

Any tears larger than twelve inches shall be repaired. Patches shall extend at least six inches from all sides of the tear and shall be fastened with plastic cable ties.

3.3.2 Geotextile/Geonet Geocomposite
Holes or tears in the geocomposite material shall be repaired with a patch of identical or similar material extending at least 6" from all sides of the hole or tear and fastened with plastic cable ties.

3.3.3 Geotextile

Holes in geotextile material shall be repaired using a patch of identical or similar material extending approximately six inches on all sides from the hole and heat bonded to the parent material

3.3.4 Geogrid

Repair of geogrid shall only be made according to the geogrid manufacturer's instructions

3.3.5 Geosynthetic Clay Liner (GCL)

The area to be repaired (patched) must be free of contamination by foreign matter. Patches should have approximately twelve inches overlaps around the damaged area. For fabric-encased GCLs, the patch is to be tucked into place with excess bentonite poured over the overlap. Simple overlapping of the patch is sufficient for geomembrane backed GCLs. However, temporary attachment of patches is required to ensure that the patch is not dislodged by covering with geomembrane or soil.

4.0 DOCUMENTATION (see attached)

Various aspects of the liner system installation shall be recorded and approved. Attached are Falcon's standard Field Installation forms.

4.1 Subgrade Surface Acceptance

4.2 Daily Progress Report/Panel Log

4.3 4.3 Certificate of Acceptance

Falcon Environmental Lining Systems, Inc.
P.O. Box 4306, Odessa Texas, 79760
5200 Johnson Rd. 79764
Phone 915/366-2611 1-800-842-0945 Fax 915-266-2999

PANEL DEPLOYMENT LOG

Project Name	**Job Number**
Field Supervisor	**Page of**

Panel Number	Roll Number	Mil	Deployment Date	Gross Width (ft.)	Gross Length (ft.)	Gross Square Feet

FALCON ENVIRONMENTAL LINING SYSTEM'S INC.
P.O. BOX 4306 ODESSA, TEXAS 79760
5200 JOHNSON RD. ODESSA, TEXAS 79764
Ph. 915/366-2611 1/800/842-0945 Fax 915/366-2999

Project Name:	**Job Number**
Field Supervisor:	**Page of**
Location:	**Sheet Thickness and Type**

SEAM Number	TESTED BY	TEST DATE	AIR TEST PSI Before / After		Time Begin	End	No. of Repairs	TEST Results	ACCEPTED DATE

FALCON ENVIRONMENTAL LINING SYSTEM'S INC.
P.O. BOX 4306 ODESSA, TEXAS 79760
5200 JOHNSON RD. ODESSA, TEXAS 79764
Ph. 915/366-2611 1/800/842-0945 Fax 915/366-2999

JOB NAME________________________ MATERIAL TYPE__________

GEOMENBRANE SEAMING LOG

Seam #	TECH	WELDER #	DATE	Start Time	Finish Time

Falcon Environmental Lining Systems, Inc.
P.O. Box 4306 Odessa, Texas 79760
5200 Johnson Rd. 79764
Phone 015-366-2611 Fax 915-366-2999

Sub-grade Surface Acceptance

Project Name: _____

Location: _____

Date: _____

Partial: _____ **Final:** _____

This document only applies to the acceptability of surface conditions for installation of Geosynthetic liner. Falcon does not accept responsibility for compaction, elevation or moisture content, nor for the surface condition maintenance during deployment. Structural integrity of the sub grade and maintenance of these conditions are the responsibility of the Owner or Earthwork Contractor.

_____

_____

_____

_____

For Falcon Environmental Lining
Accepted by: _____

For Contractor/Owner
Accepted by: _____

_____ _____

Acceptance Number: Area Accepted: Total Area accepted to date:

_____ _____/SF _____/SF

Pre-Weld Test

Job Name:_____ Machine #_____

Date:_____ Type weld: wedge_____ extruder_____

Weld Tech:_____ Speed Setting:_____

Liner Matl._____ Temp Setting:_____

AM Test Results

Peel in-side	Peel out-side	Shear test	pass	fail
1. _____	_____	1. _____	P_____	F_____
2. _____	_____	2. _____	P_____	F_____
3. _____	_____	3. _____	P_____	F_____

Comments on repairs: _____

_____

_____

PM Test Results

Peel in-side	Peel out-side	Shear test	pass	fail
1. _____	_____	1. _____	P_____	F_____
2. _____	_____	2. _____	P_____	F_____
3. _____	_____	3. _____	P_____	F_____

Comments on repairs: _____

_____

_____

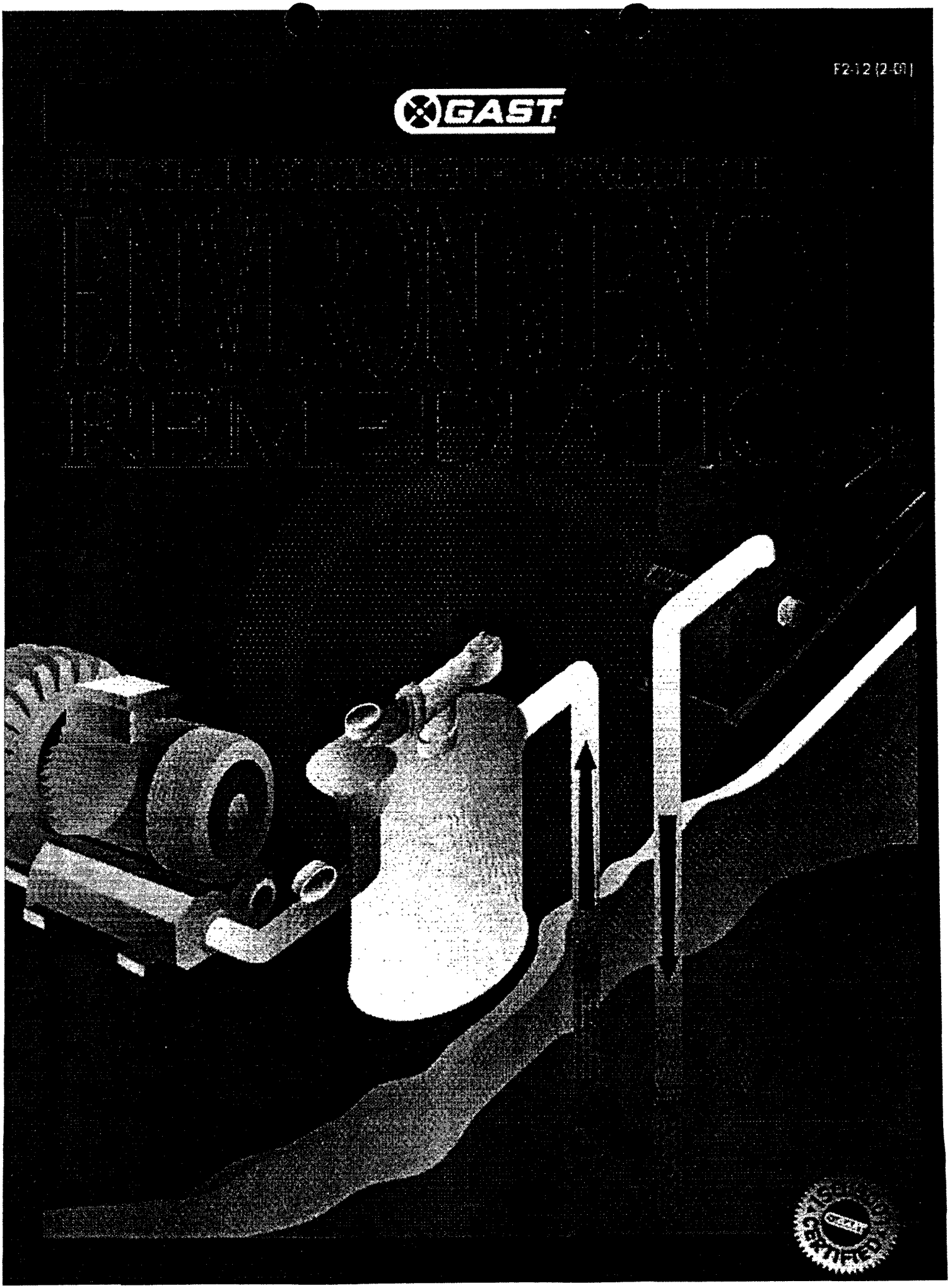
Supervisor:_____

APPENDIX D
MANUFACTURER CUT SHEETS AND MISCELLANEOUS EVAPORATION POND DETAILS

SVE BLOWER AND MOISTURE SEPARATOR

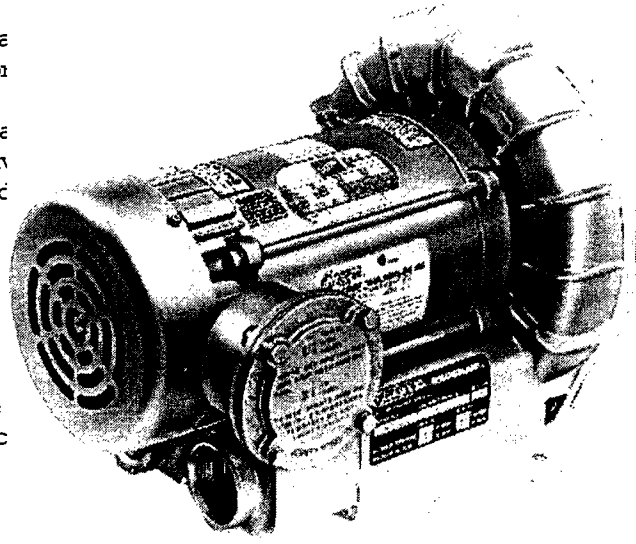
F2-1.2 (2-09)

GAST



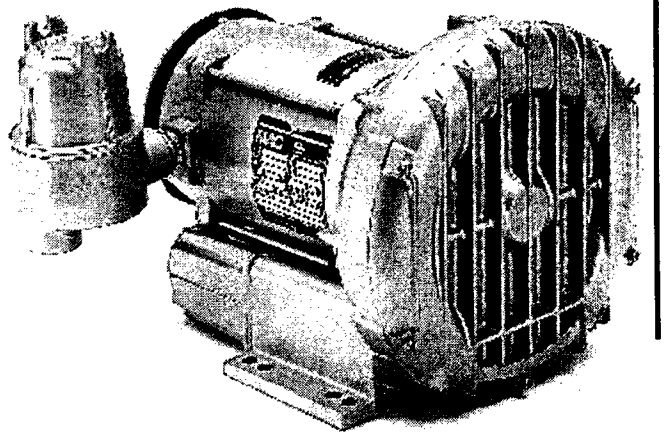
SOIL VAPOR EXTRACTION PUMPS - REGENERATIVE BLOWERS

Gast Manufacturing has a worldwide reputation for quality and customer satisfaction. We supply a moving products that hav set the industry standard for excellence since 1921. Among these are quiet-operating, maintenance-free Regenair® regenerative blowers for soil vapor extraction in a complete range of sizes from 1/3 to 10 HP.



style

R3105N-50



Gast Regenair® SVE Blower Specifications

Practical Design

Gast Regenair® regenerative blowers for soil vapor extraction are rugged industrial grade blowers, engineered for continuous long-life operation. Maintenance free, their only contacting moving parts are the shaft seal and motor ball bearings. Sealed air streams mean air and vapors passing through the blower do not become contaminated.

Rugged Construction

Blower impeller, housing and cover are made of cast aluminum which is inherently ductile and spark- and corrosion-resistant. Exterior castings are vacuum impregnated with a process conforming to Mil Spec. 17563B to eliminate porosity. The fluorocarbon blower shaft seal is lubricated with chemical resistant non-hydrocarbon grease for long life. The rotating mechanism of the blower and motor is dynamically balanced to prevent vibration. Every Gast Regenair® blower is performance tested as well as pressurized and leak-tested to less than 5 cc/minute.

Dependable Electric Motors

UL and CSA approved motors are multi voltage; most are dual frequency. Conforming to NEMA frame sizes, Gast motors on these SVE blowers are classified as EXPLOSION PROOF Division 1 and 2, Class 1, for Group hazardous atmospheres. They are rated for continuous duty and carry full rated load at temperatures below class B motor insulation limits. Class F motor insulatic is used in motors larger than 1 HP even though they operate at temperatures below class B insulation limits. All motors incorporate UL and CSA approved thermal protection.

Motor ball bearings are double sealed, with a B10 life exceeding 20,000 hours of continuous operation at the maximum rated continuous blower load. This extended bearing life is achieved by designing the blower and motor so bearings run cool, avoiding problems associate with high temperature bearing operation. Shell Dolium R, a long-life grease with a wide operating- temperatur capacity and superior resistance to both contaminants and moisture, is the specified lubricant.

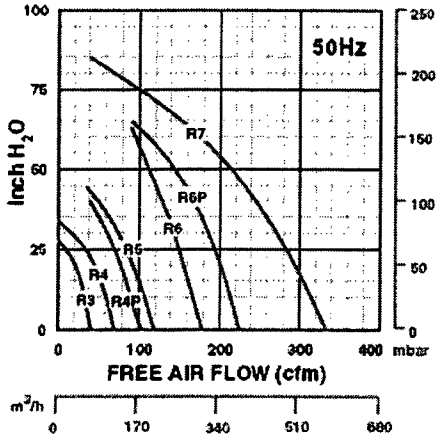
Pilot duty thermal overload protection is standard on all 1 HP and larger explosion proof motors. To conform to the National Electric Code, motor starters suitable for protecting motors with pilot duty thermal overloads must be used on these motors.

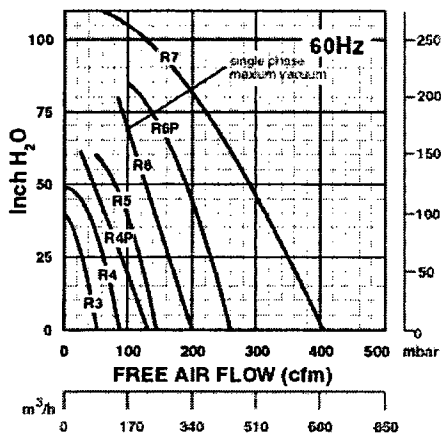
Product Specifications

Model Number	Phase	Hz	Motor Specifications Voltages	HP	Full Load Amps	Max Vac "H_2O	Max Vac mbar	Max Pressure "H_2O	Max Pressure mbar	Max Flow cfm	Max Flow m^3h	Net. Wt. lbs	Net. Wt. kg
R3105N-50	Single	50	110/220-240	.33	4.8/2.4-2.2	28	70	31	77	43	73	52	24
		60	115/208-230	0.5	5.2/2.9-2.6	40	100	43	107	53	90		
R4110N-50	Single	50	110/220-240	0.6	9.2/5.2-4.6	35	87	38	95	74	126	60	28
		60	115/208-230	1.0	11.4/6.2-5.6	48	120	51	127	92	156		
R4310P-50	Three	50	220/380	0.6	3.2/1.6	35	87	38	95	74	126	58	27
		60	208-230/460	1.0	3.4-3.3/1.6	48	120	51	127	92	156		
R4P115N-50	Single	50	110/220-240	1.0	15.2/7.6-8	40	100	45	112	112	190	79	36
		60	115/208-230	1.5	20.3/11.2-10.6	60	149	65	162	133	226		
R5125Q-50	Single	60	115/230	2.0	25/12.5	60	149	55	137	160	272	77	35
R5325R-50	Three	50	190-220/380-415	1.5	5.0-4.4/2.5-2.6	47	117	50	125	133	226	75	34
		60	208-230/460	2.0	6.6-6.1/3.05	60	149	65	162	160	272		
R6130Q-50	Single	50	220-240	2.5	14.7-13.5	65	162	75	187	182	309	129	59
		60	230	3.0	16.3	70	174	60	149	215	365		
R6340R-50	Three	50	190-220/380-415	3.0	14.4-13.4/7.2-6.8	65	162	75	187	180	306	112	51
		60	208-230/460	4.0	13-12/6	80	199	100	249	215	365		
R6P155Q-50	Single	50	220-240	4.0	20.8-19.1	65	162	80	199	235	399	243	110
		60	230	5.5	29.9	85	212	95	237	280	476		
R6P355R-50	Three	50	190-220/380-415	4.5	14.9-11/7.45-5.8	65	162	80	199	232	394	233	105
		60	208-230/460	6.0	20-18/9	85	212	100	249	280	476		
R7100R-50	Three	50	190-220/380-415	8.0	23.2-21.0/11.6-10.9	85	212	90	224	350	595	297	134
		60	208-230/460	10.0	26.5-24/12	110	274	100	249	420	714		

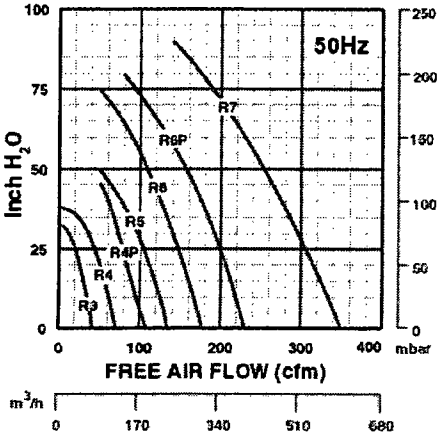
NOTICE: Performance specifications subject to change without notice.

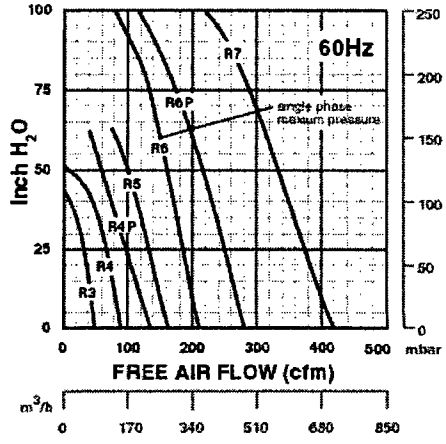
VACUUM



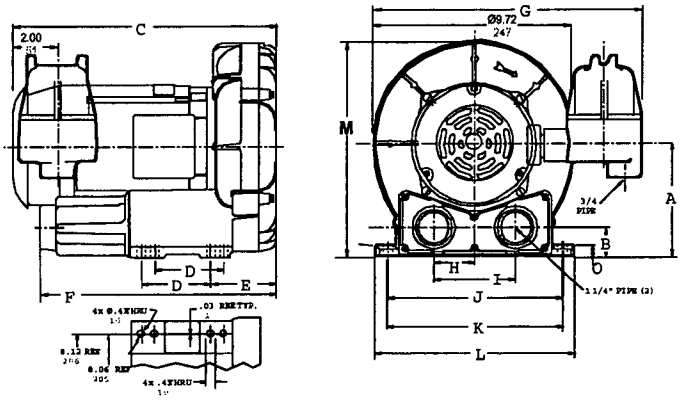


PRESSURE

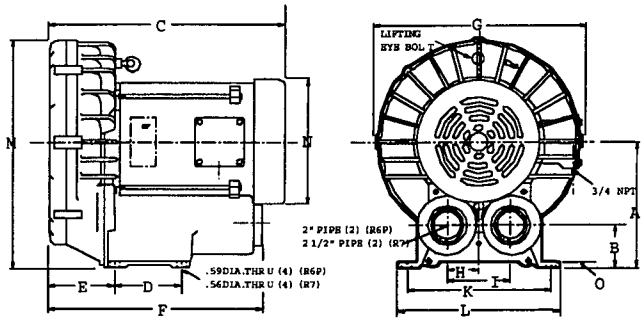




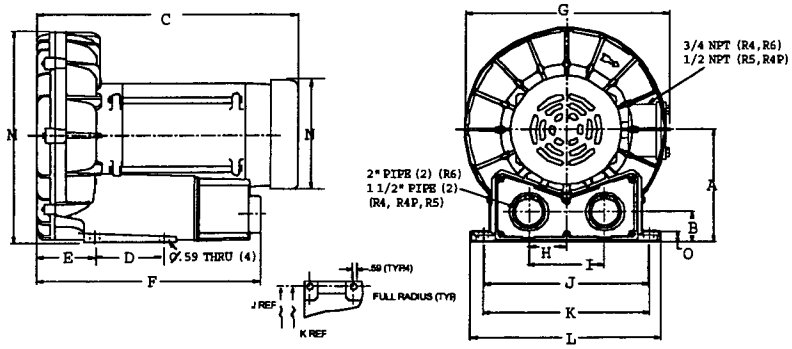
Model R3



Models R6P, R7



Models R4, R4P, R5, R6



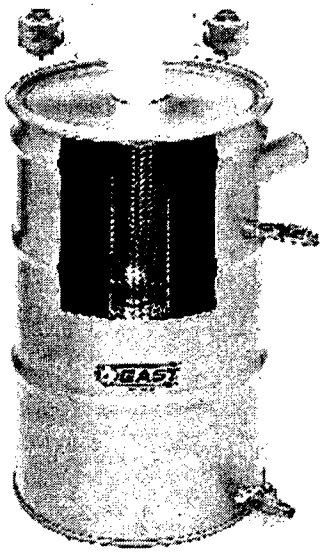
Product Dimensions (mm) (inches)

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
R3105N-50	131	35	310	83	80	281	324	49	99	205	206	238	258	-	13
	5.17	1.37	12.20	3.25	3.03	11.06	12.75	1.94	3.88	8.06	8.12	9.38	10.15	-	.53
R4110N-50	157	43	389	95	72	316	313	50	101	225	227	254	293	175	11
	6.18	1.68	15.30	3.75	2.85	12.44	12.31	1.98	3.96	8.86	8.93	10.00	11.73	6.88	.44
R4310P-50	157	43	356	95	72	316	313	50	101	225	227	254	293	175	11
	6.18	1.68	14.03	3.75	2.84	12.44	12.31	1.98	3.96	8.86	8.93	10.00	11.73	6.88	.44
R4P115N-50	177	47	442	114	83	354	338	60	121	260	262	298	346	175	15
	6.98	1.84	17.41	4.50	3.25	13.93	13.31	2.38	4.75	10.25	10.31	11.75	13.6	6.88	.60
R5125Q-50	178	46	445	114	91	361	344	60	121	260	262	298	350	173	15
	7.00	1.82	17.50	4.50	3.58	14.22	13.56	2.38	4.75	10.25	10.31	11.75	13.78	6.81	.59
R5325R-50	178	46	423	114	91	361	344	60	121	260	262	298	350	183	15
	7.00	1.82	16.66	4.50	3.58	14.22	13.56	2.38	4.75	10.25	10.31	11.75	13.78	7.19	.59
R6130Q-50	197	49	511	140	98	404	389	62	125	289	290	329	391	217	13
	7.75	1.94	20.13	5.50	3.85	15.89	15.30	2.46	4.92	11.38	11.42	12.96	15.38	8.56	.52
R6340R-50	197	49	478	140	98	404	385	62	125	289	290	329	390	217	13
	7.75	1.94	18.82	5.50	3.85	15.89	15.17	2.46	4.92	11.38	11.42	12.96	15.34	8.56	.52
R6P155Q-50	248	80	602	140	137	438	428	64	127	-	290	325	463	257	13
	9.77	3.15	23.7	5.51	5.39	17.25	16.87	2.50	5.00	-	11.42	12.80	18.21	10.12	.50
R6P355R-50	248	80	554	140	137	438	428	64	127	-	290	325	463	257	13
	9.77	3.15	21.80	5.51	5.39	17.25	16.87	2.50	5.00	-	11.42	12.80	18.21	10.12	.50
R7100R-50	274	92	577	216	212	545	457	100	200	-	375	410	509	257	14
	10.79	3.64	22.72	8.50	8.33	21.46	18.00	3.94	7.88	-	14.76	16.14	20.02	10.12	.56

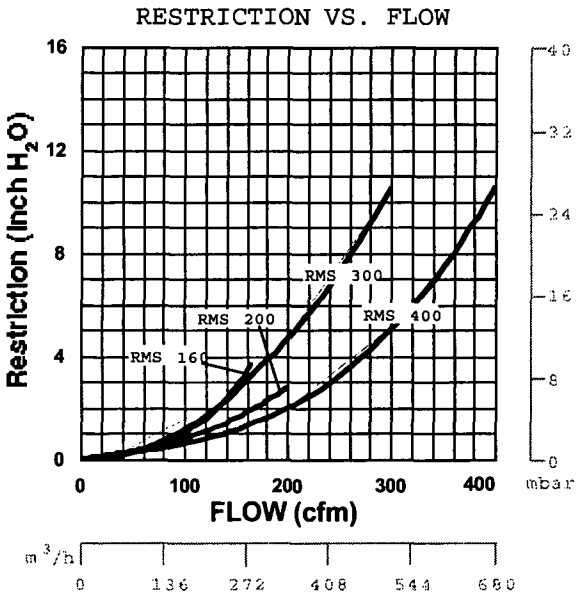
Notice: Specifications subject to change without notice.

LIQUID SEPARATOR

The separator removes liquids from the gas stream in a soil vapor extraction process, to help protect both blower and vapor treatment system from corrosion and mineral deposit buildup. The separator is located between the extraction wells and the blower. An in-line filter is installed between separator and blower.



Cut away to show ball float. Above model shows optional explosion proof float switch AJ213

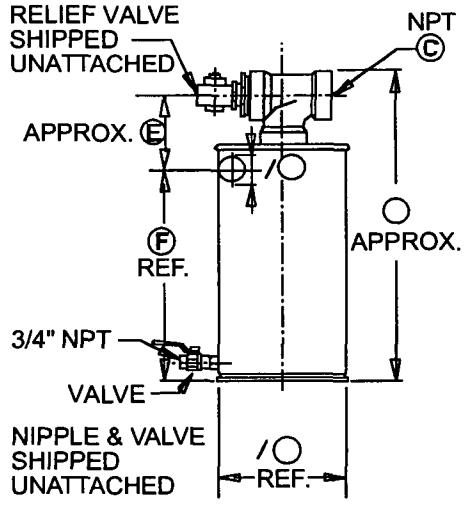


Regenair® Liquid Separator Specifications

Practical Design Engineered to remove and contain moisture ranging from a fine mist to slugs of water from blower inlet air streams, Gast separators incorporate a cyclonic action which results in a very high degree of efficiency.
A floating ball valve which closes when the liquid level becomes too high prevents collected liquid from overflowing back into the air stream. When the float valve closes an integral vacuum relief valve opens, admitting air to cool the blower and prevent overheating.

Rugged Construction Gast separator drums are made from ribbed heavy gauge cold-rolled steel, with heavy steel inlet, drain and float switch ports welded to the drum wall. Drum interiors are epoxy coated to resist abrasion, corrosion and chemicals, while the drum exterior is coated with durable urethane. For ease of connection, the outlet port is female pipe threaded. The heavy-duty 304 stainless steel ball float resists chemicals; maximum rated vacuum is 22 inches Hg (299 inches H_2O).

Included is a pilot operated precision relief valve capable of functioning over a wide duty range. This vacuum relief valve is designed and built to proven reliability and durability standards. Moving parts are nickelplated for corrosion resistance and smooth operation. Explosion proof AJ213 float switch is optional; single pole double throw switch; electrical rating 5 amps at 125/250 VAC.

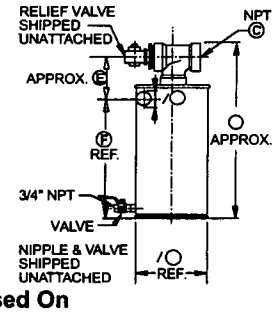


Part No.	Liq. Cap. (gal.)	A(dia.)	Dim. B	C(NPT)	D(dia.)	Dim. E	Dim. F
RMS160	10	14.8"	37.5"	2"	2"	7.5"	26.6"
RMS200	19	19.7"	35"	2"	2"	7.5"	26.6"
RMS300	19	19.7"	35"	2.5"	2.5"	7.5"	26.6"
RMS400	40	24"	44"	3"	3"	9.7"	29"

ACCESSORIES

Liquid Separators

Separators remove liquids from the gas stream in a vacuum process, helping protect the blower from corrosion and a buildup of mineral deposits.

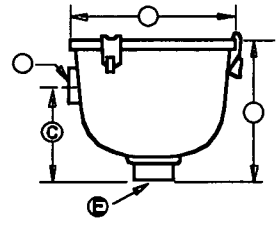


Part No.	Liq. Cap. (gal.)	A(dia.)	Dim. B	C(NPT)	D(dia.)	Dim. E	Dim. F
RMS160	10	14.8"	37.5"	2"	2"	7.5"	26.6"
RMS200	19	19.7"	35"	2"	2"	7.5"	26.6"
RMS300	19	19.7"	35"	2.5"	2.5"	7.5"	26.6"
RMS400	40	24"	44"	3"	3"	9.7"	29"

Part No.	Product Type	Description	Used On
RMS160	Liquid separator	10 gallon liquid carrying capacity	R3, R4, R4P, R5 Blowers
RMS200	Liquid separator	19 gallon liquid carrying capacity	R4, R4P, R5, R6 Blowers
RMS300	Liquid separator	19 gallon liquid carrying capacity	R5, R6, R6P Blowers
RMS400	Liquid separator	40 gallon liquid carrying capacity	R6P, R7 Blowers
AJ213	Float switch	SPDT switch, 5 amp 125/250 VAC, 1" NPT mounting	RMS Series-Separators

Filters

Since the blower impeller passes very close to the housing, it is always wise to have an in-line or inlet filter to ensure trouble free life.



In-line (for vacuum)

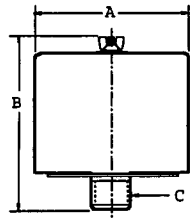
Part No.	Dim. A	Dim. B	Dim. C	Dim. D	Dim. E
AJ151C	7.38"	6.81"	4.62"	1-1/4" FPT	1-1/4" FPT
AJ151D	7.38"	6.81"	4.62"	1-1/2" FPT	1-1/2" FPT
AJ151E	8.75"	10.25"	5.00"	2" FPT	2" FPT
AJ151G	8.00"	10.25"	5.50"	2-1/2" FPT	2-1/2" FPT
AJ151H	14.00"	26.50"	18.13"	3" MPT	3" MPT
AJ151L	14.00"	27.13"	18.50"	4" MPT	4" MPT

MPT = Male Pipe Thread FPT = Female Pipe Thread All are heavy-duty for high amounts of particulates.
Inlet filters for REGENAIR® blowers are drip-proof when mounted as shown.

For Vacuum Service

AJ151C	In-line filter	10 micron filter (replacement element AJ135E)	R3 Blower
AJ151D	In-line filter	10 micron filter (replacement element AJ135E)	R4, R4P
AJ151E	In-line filter	10 micron filter (replacement element AJ135F)	R5, R4H Blowers
AJ151G	In-line filter	10 micron filter (replacement element AJ135G)	R6, R6P, R4M Blowers
AJ151H	In-line filter	10 micron filter (replacement element AJ135C)	R7 Blower

Inlet (for pressure units only)



Part No.	Dim. A	Dim. B	Dim. C
AJ126C	6.00"	7.12"	1-1/4" MPT
AJ126D	7.70"	7.25"	1-1/2" MPT
AJ126F	10.63"	4.81"	2" FPT
AJ126G	10.00"	13.12"	2-1/2" MPT
AJ126L	10.00"	14.62"	4" MPT

MPT = Male Pipe Thread FPT = Female Pipe Thread All are heavy-duty for high amounts of particulates.
Inlet filters for REGENAIR® blowers are drip-proof when mounted as shown.

For Compressor Inlet

AJ126C	Inlet filter	10 micron filter (replacement element AJ134C)	R3 Blower, 2067, 2567
AJ126D	Inlet filter	10 micron filter (replacement element AJ134E)	80 Series, 6066, 1290, R4, R4H R4P, R5 Blowers
AJ126F	Inlet filter	25 micron filter (replacement element AG340)	R6, R6P, R4M Blowers
AJ126G	Inlet filter	10 micron filter (replacement element AJ135A)	R7 Blower
AL355	Inlet filter	10 micron filter	0823

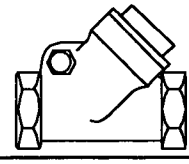
Pressure-Vacuum Gauge

To monitor the system performance so maximum duties are not exceeded. Using two gauges (one on each side of the filter) is a great way to know when the filter needs servicing.

AJ497	Vacuum gauge	0-60" H_2O, 1/4" NPT connection	Blowers
AE134	Vacuum gauge	0-160" H_2O, 1/4" NPT connection	Blowers
AE134F	Vacuum gauge	0-15" HG, 1/4" NPT connection	R4H Blower
AA644B	Pressure gauge	0-30 psi, 1/4" NPT	80 Series, 2567, 2067, 6066, 0823
AE133	Pressure gauge	0-160" H_2O, 1/4" NPT connection	Blowers
AE133A	Pressure gauge	0-200" H_2O, 1/4" NPT connection	Blowers
AE133F	Pressure gauge	0-15 psi, 1/4" NPT connection	R4H Blower
AJ496	Pressure gauge	0-60" H_2O, 1/4" NPT connection	SVE Blowers

Check Valve

Designed to prevent back-wash of fluids that would enter the blower. Also prevents air back-streaming if needed. Can be mounted with discharge either vertical or horizontal. Valve will open with 3" of water pressure.

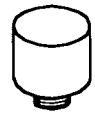


AH326D	Check valve	1-1/2" NPT (3" H_2O cracking pressure)	Blowers
AH326F	Check valve	2" NPT (3" H_2O cracking pressure)	Blowers
AH326G	Check valve	2-1/2" NPT (3" H_2O cracking pressure)	R7 Blower

Relief Valve

By setting a relief valve at a given pressure/vacuum you can ensure excessive duties will not harm the blower or products in your application.

AN225

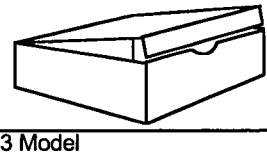


PV Series

AA307	Relief valve	For pressure, 3/4" NPT, adjustable 2-25 psi	6066, 2567 Series
AA600	Relief valve	For pressure, 3/8" NPT, adjustable 2-30 psi	0823
AG258	Relief valve	1-1/2" NPT adjustable 30-170" H_2O, vac. or press., 200 CFM max.	Blowers
AG258F	Relief valve	2-1/2" NPT adjustable for higher flows, vacuum or pressure	Blowers
PV072	Relief valve	For pressure, pre-set for 7.2 psi, 1-1/4" NPT connection (60Hz)	Consult Factory
PV098	Relief valve	For pressure, pre-set for 9.8 psi, 1-1/4" NPT connection (50Hz)	R4H Blower
PV102	Relief valve	For pressure, pre-set for 10.2 psi, 1-1/4" NPT connection (60Hz)	R4H Blower
AN225	Relief valve	15-45 cfm, 3/4" NPT connection, adjustable 0-20 psi	2080, 3080, 4080 Series

Service Kit

If pump performance on rotary vane models diminishes, installation of the Service Kit replacement parts will have it performing like new again.



K479A	Service Kit	Includes items for unit repair	0823 Model
K504	Service Kit	Includes items for unit repair	6066, 1290 (uses 2)
K583	Service Kit	Includes items for unit repair	2567 Models
K584	Service Kit	Includes items for unit repair	2080, 3080, 4080 Models
K585	Service Kit	Filter/Muffler Kit only	2080, 3080, 4080 Models

AIR COMPRESSOR, PNEUMATIC PUMPS, AND CONTROLS

CARBONAIR®
ENVIRONMENTAL SYSTEMS

1322 Space Park Drive, Suite #A200
Houston, Texas 77058
800 526.4999 *Toll Free*
281 333.5271 *General*
281 333-4782 *Fax*
sales@carbonair.com
Visit our web site: *http://www.carbonair.com*

Service Office
4105 Hunter Road #10
San Marcos, TX 78666
800 893 5937
512 392 0066

Tuesday, February 11, 2003

Tetra Tech EMI
6121 Indian School Road, NE
Suite #205
Albuquerque, NM 87110
Attn: Bob Marley

Phone: 505-881-3188
Fax: 505-881-3283

Re: Bell Lake NM Project

Dear Mr. Marley,

Thank you for the opportunity to provide pricing information for the above referenced application. Please review the following and feel free to call with questions or comments.

Groundwater Pumps

(6) Clean Environment Engineers model AP-2/TL pneumatic pump
- 0-2 gpm
- Controllerless operation
- Top loading
- SS outer casing
- 95' of 1/2" discharge tubing
- 95' of 3/8" air supply tubing
- 95' of 3/8" air exhaust tubing
- 95' of suspension cable
- 5 micron filter regulator
- 4" well cap with appropriate couplings for tubing
- Maximum design pressure 100 psi

(1) Compressor, Gardener Denver model VR7F-8 two stage reciprocating compressor
5 hp, 230/460 VAC, 3Ø, EXP motor
25.8 icfm capacity at 175 psi
NEMA 1 pressure switch
80 gallon vertical ASME reservoir tank
Low oil level switch
Air cooled aftercooler
Automatic condensate drain
5 micron coalescing filter with gage
Regulator
ASCO 1/2" 3-way solenoid valve, NEMA 7, to shut down pneumatic pumps upon alarm

(1) 500 Gallon Poly holding tank with:
- Level Controls
- (1) Myers CT centrifugal transfer pump
  - 25 gpm @ 78' TDH

- 2 hp, 230V, 3 phase, TEFC motor
- Steel base

Control System $ 3,154.00

(1) Control panel
- NEMA 4 enclosure
- Inner door with disconnect switch
- H.O.A. switches w/ lights
- IEC Motor starters w/overloads
- Alarm interlocks w/ red lights
- Alarm reset button
- Intrinsic safety barriers
- UL Listing
- GFI receptacle
- System interlocks and automatic control logic
- System interface contacts
- Remote HH switch

(1) Estimated freight to Bell Lake, NM
- Assumes non-expedited, double-drop trucking

(1) Start-up supervision and training
- One technician on site for 2 days (8 hours per day)
- Includes travel, labor, mileage, and per diem expenses
- Additional over time hours (>8 hrs. per day) to be billed at $75/hr.
- Additional regular time hours (<8 hrs. per day) to be billed at $55/hr. plus expenses

Terms
All sales subject to the Terms & Conditions attached.
Terms of payment are 30% with order, 30% with submittal approval, and balance (40%) due Net 30 days from date of shipment.
Proposal and pricing valid for 30 days.
This proposal and pricing are based on our interpretation of the sections of the RFQ or specification that have been made available to us. Exceptions have been noted where ever possible. In the event of a conflict between the language in the specification and the proposal, the language in the proposal takes precedence and is the basis of the proposed pricing. Carbonair reserves the right to reject any order based on differences in pricing, interpretation of the specification, or for any reason at the time that an order is tendered.
The predicted performance of the STAT low profile air stripper proposed is based upon the data provided. The presence of other compounds in the liquid stream may effect the performance of the air stripper. Detergents, foaming agents, oil and greases, proteins, and fatty acid (surfactants) can cause frothing/foaming that may significantly effect the removal efficiency of the unit. If these types of compounds are suspected to be present, we recommend that a pilot test be performed to determine is foam protection measures should be taken. Carbonair is available to perform these tests, for a nominal fee, and can aide in the design of the foam prevention system.
Carbonair will not guarantee the performance of any air stripper without an accurate measurement of the air flow to the stripper.
Carbonair will not initiate work without an executed Contract or Purchase Order. Fabrication will not begin until receipt of approved submittals.
Submittals will be supplied within 2 weeks after execution of Contract or Purchase Order.
The typical shipping time for this equipment is 6 - 8 weeks. The actual delivery schedule will be provided after receipt of approved submittals.
Shipping charges are not included. Actual shipping and handling charges will be invoiced on a pre-pay

DD-B-1626	QUOTE NO._____	DATE:_____	MODEL NO.:_____

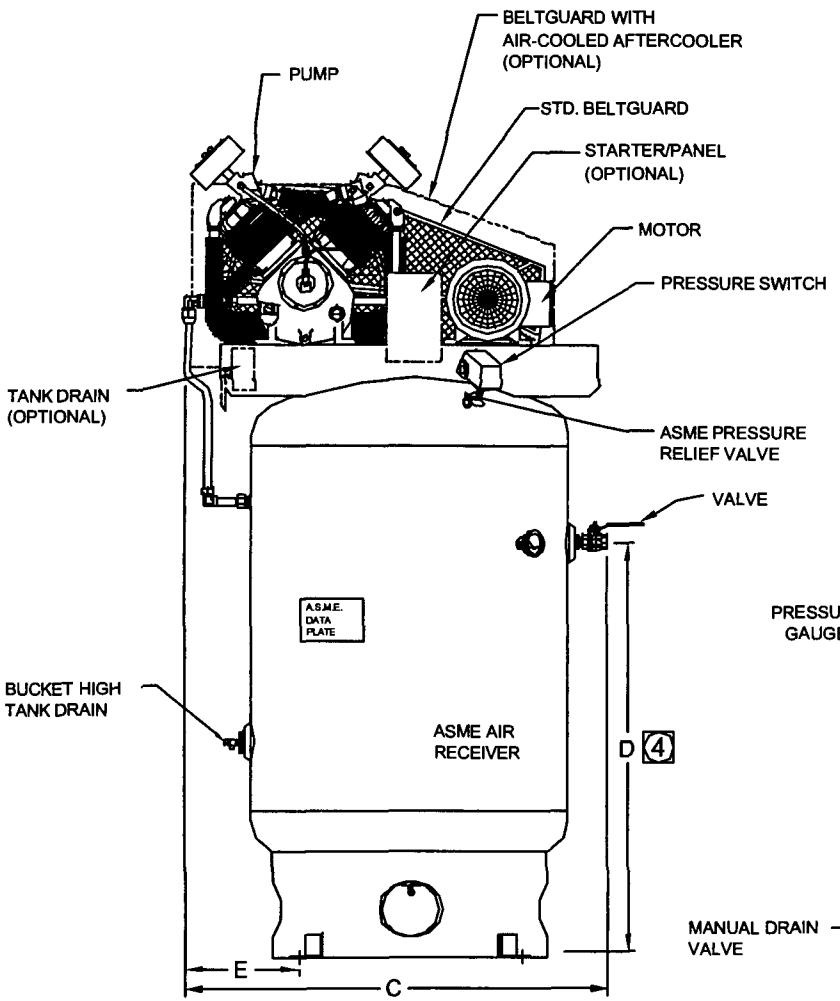
RECVR (Gallons)	VALVE (N.P.T. Size)	DIMENSIONS A (Dia)	B (Dia)	C	D	W	H	E
80	3/4"	30.00	28.00	42.50	24.50	30.00	66.81	11.00
120	3/4"	30.00	28.00	42.50	38.50	30.00	80.81	11.00

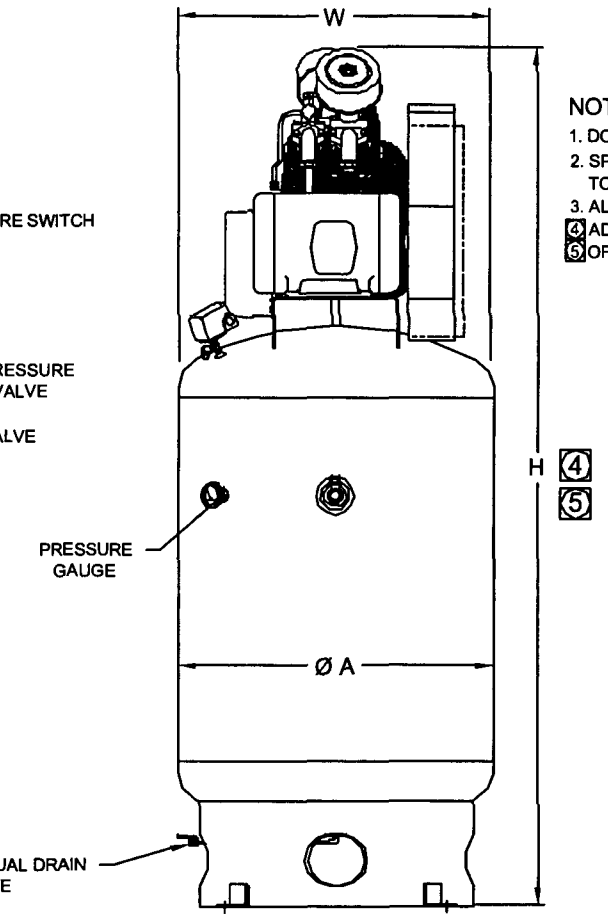
PUMP CONFIGURATION:
- ☐ STD
- ☐ HEAD UNLOADERS/DUAL CONTROL

MOTOR:_____HP/VOLTS/PH/HZ
- ☐ ODP(STD) ☐ TEFC [5] ☐ HIEFF [5]

RECEIVER SIZE(Gal.)
- ☐ 80 ☐ 120 ☐ VINYL ☐ GALVANIZED

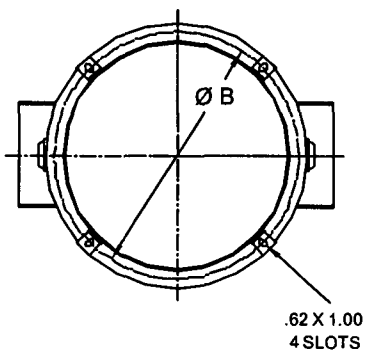
OPTIONAL EQUIPMENT
- ☐ STARTER
- ☐ SIMPLEX CONTROL PANEL [5]
- ☐ FUSED DISCONNECT [5]
- ☐ LOSC
- ☐ AIR-COOLED AFTERCOOLER
- ☐ TIMED TANK DRAIN
- ☐ AUTO TANK DRAIN
- ☐ VIBRATION ISOLATORS [4]
- ☐ OTHER





NOTES:
1. DO NOT SCALE PRINT, TYPICAL DIMENSIONS ONLY.
2. SPECIFICATIONS AND DIMENSIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE OR OBLIGATION.
3. ALL DIMENSIONS IN INCHES.

[4] ADD 1.00" TO HEIGHT FOR VIBRATION ISOLATION OPTION.
[5] OPTIONAL EQUIPMENT MAY EFFECT DIMENSION.



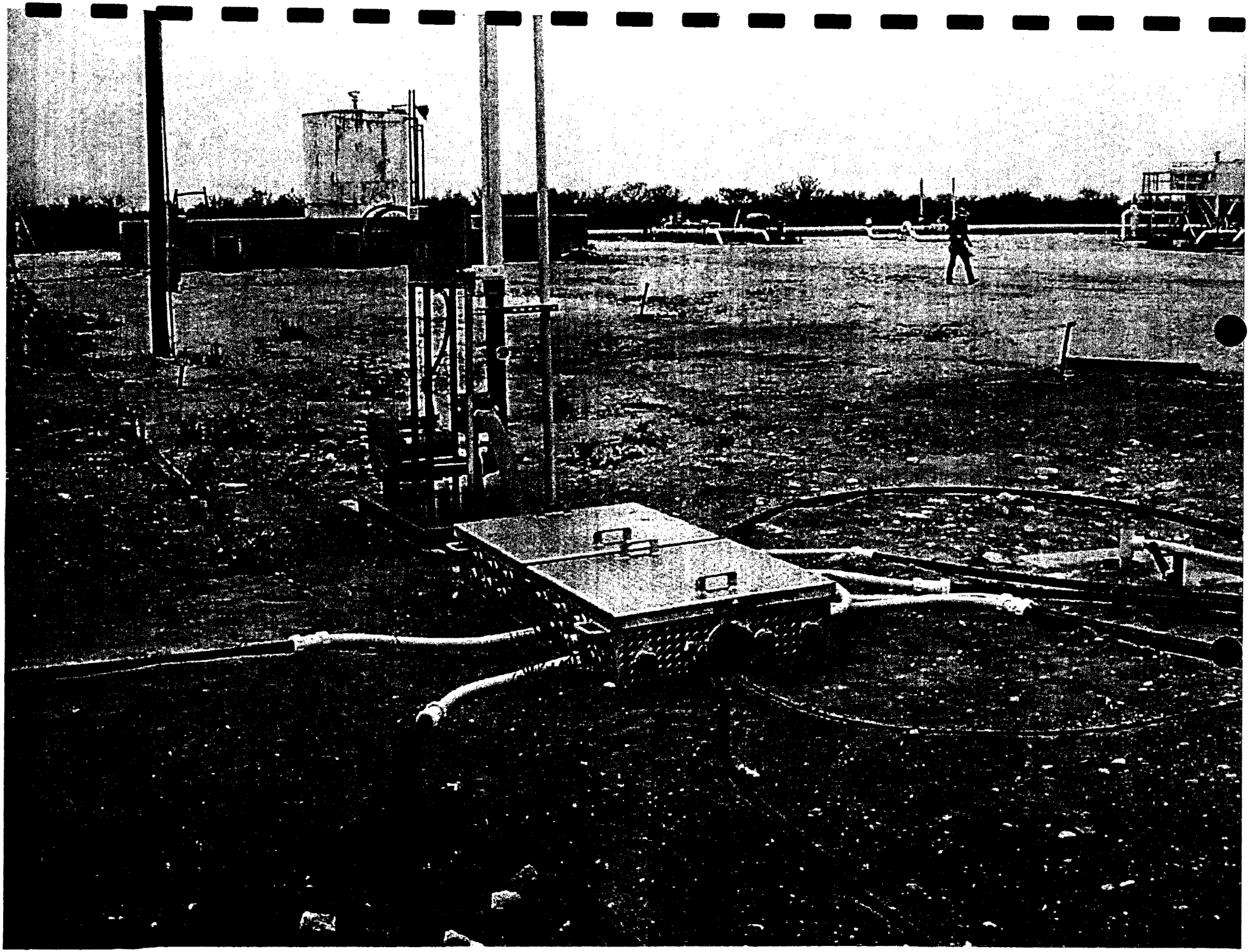
NOTICE:

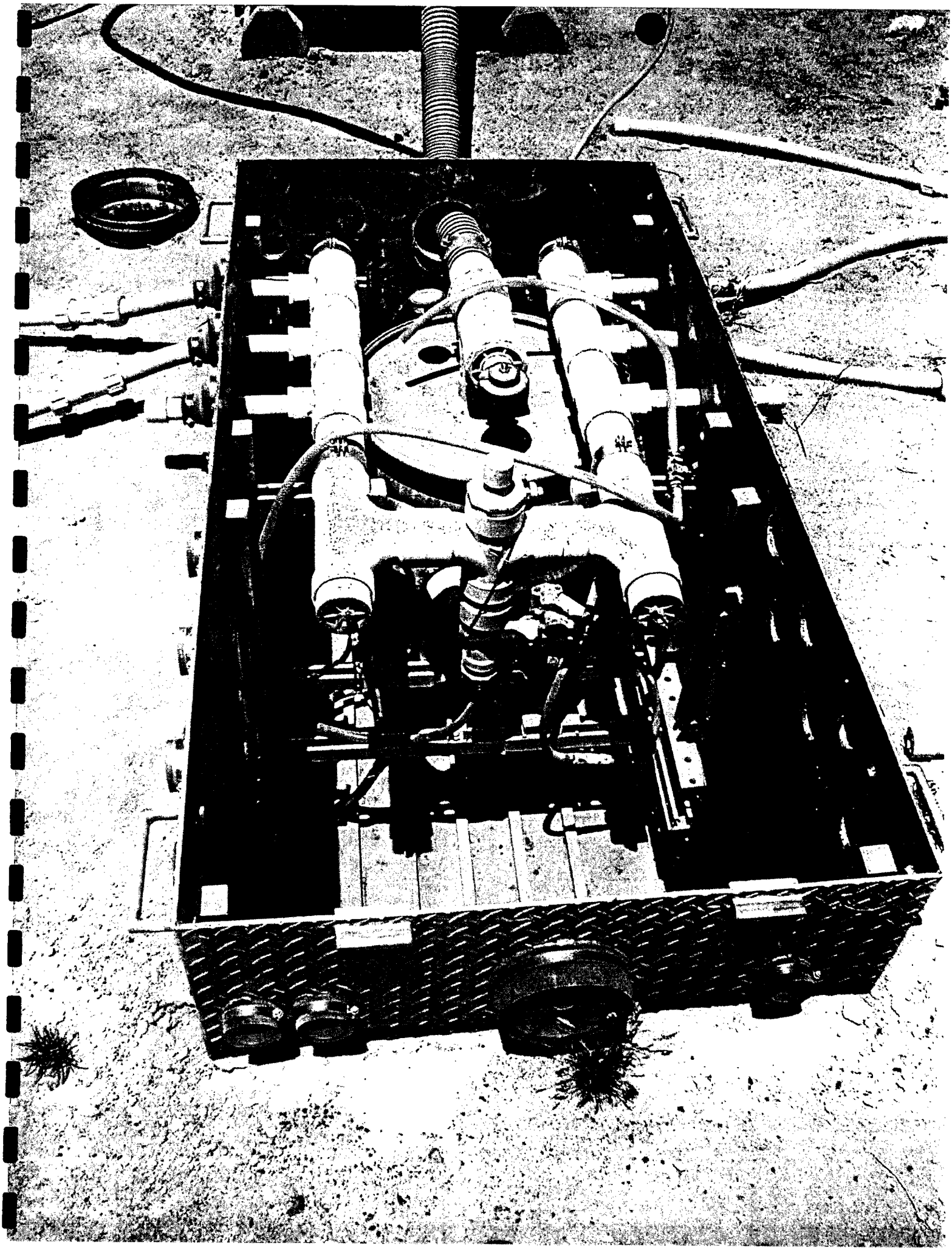
REFERENCE DRAWING ONLY MAY NOT INCLUDE SPECIFIC ACCESSORY ITEMS FOR ANY PARTICULAR ORDER.

CHAMPION- A GARDNER DENVER COMPANY

GENERAL ARRANGEMENT	PRINT NO.: DD-B-1626
	REV. DATE:
R30, VERTICAL TANKMOUNT	DRAWN BY: G.L.
	DATE: 04-27-2000
	CHK'D BY:
	DATE:

ALUMINUM EQUIPMENT BOXES

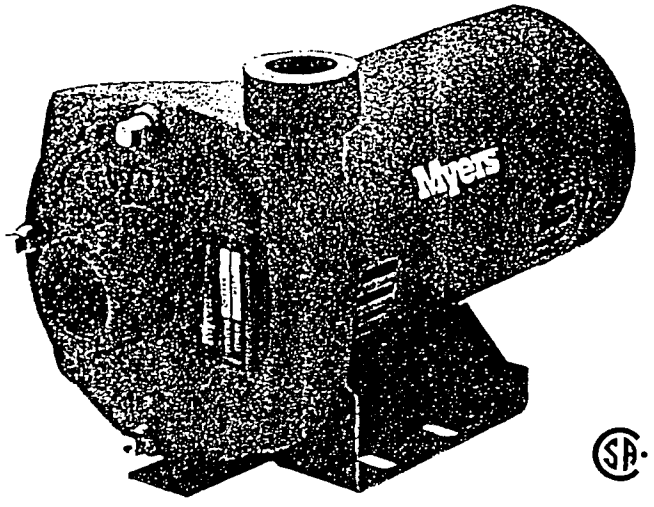




TRANSFER PUMPS

CT Series

High Pressure Centrifugal Pumps
½ - 2½ HP
Heads to 140 Feet
Capacities to 95 GPM



MYERS CT SERIES LINE OF HIGH PRESSURE CENTRIFUGAL PUMPS PROVIDES QUALITY AT A COMPETITIVE PRICE. The complete line of ½ to 2½ HP units provide strong pressures up to 140 feet and flows up to 95 gpm.

The rugged cast iron body construction is available with either a corrosion resistant composite or brass impeller. The brass impeller unit is equipped with a high temperature, viton seal for more demanding applications. The heavy duty motor features a double ball bearing, 50° C ambient, dual voltage design for dependable service. The compact, back pullout design provides easy installation and serviceability.

The quality features of the CT series will provide dependable service for a wide variety of applications.

SPECIFICATIONS

HP	Catalog No. Composite Impeller	Catalog No. Brass Impeller	Pipe Tapping Sizes Suction (NPT)	Pipe Tapping Sizes Discharge (NPT)	Motor Voltage	Phase	Approx. Wt. Lbs.
½	CT05	CT05B	1¼"	1"	115/230	1	30
	CT053	CT05B3	1¼"	1"	208/230/460	3	30
¾	CT07	CT07B	1¼"	1"	115/230	1	32
	CT073	CT07B3	1¼"	1"	208/230/460	3	32
1	CT10	CT10B	1¼"	1"	115/230	1	35
	CT103	CT10B3	1¼"	1"	208/230/460	3	35
1½	CT15	CT15B	1¼"	1"	115/230	1	40
	CT153	CT15B3	1¼"	1"	208/230/460	3	40
2	CT20	CT20B	1½"	1¼"	115/230	1	57
	CT203	CT20B3	1½"	1¼"	208/230/460	3	57
2½	CT25	CT25B	2"	1½"	115/230	1	62
	CT253	CT25B3	2"	1½"	208/230/460	3	62

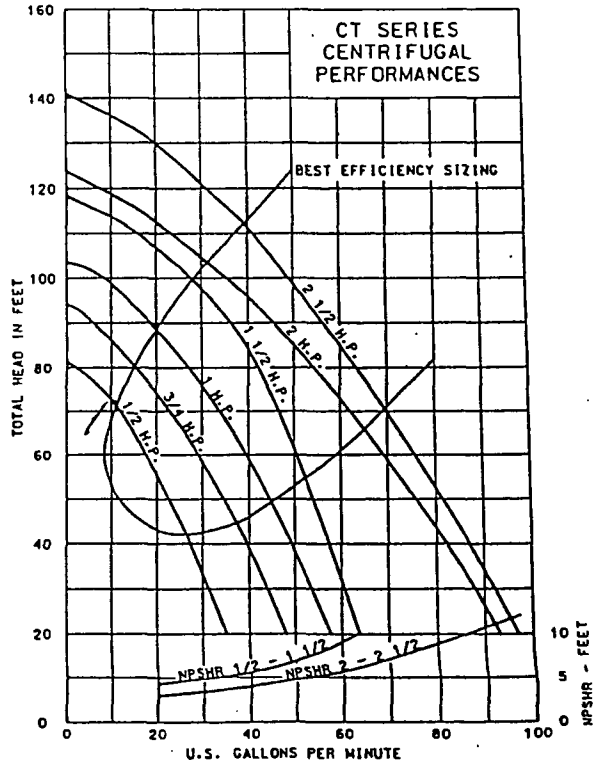
ADVANTAGES BY DESIGN

- Heavy duty cast iron construction.
- Back pull-out design.
- Dependable double ball bearing motor
- Continuous duty rating motor.
- Choice of brass or composite impeller.
- Brass impeller pumps rated 212° F.
- Composite impeller pumps rated 140° F.
- Maximum working pressure of 125 psi.
- CSA listed.

Applications

- Booster service
- Irrigation
- Circulating
- Cooling towers
- Air conditioning
- Liquid transfer
- Sprinkling systems
- General industrial service

PUMP PERFORMANCE



WHERE INNOVATION MEETS TRADITION

Myers®

Wil-Flo™ TECHNOLOGY

The Wil-Flo™ patent-pending air distribution system greatly improves the performance characteristics of air-operated, double-diaphragm pumps. This innovative design incorporates an instantaneous shift mechanism and an enhanced exhaust configuration. Pressurized air is alternately routed by the air valve piston to one of the power ports, through the spring-energized sliding check valve and directly behind one of the diaphragms. The air valve piston movement is initiated by inner piston contact with one of the pressure relief valves located on each side of the center block. This causes the valve piston to shift vertically. Upon the shifting of the air valve piston, compressed air in the air chamber moves the sliding check assembly into its recess within the center block, thus exposing the exhaust channel. This vents exhaust air directly to atmosphere, bypassing the air valve and eliminating a major cause of freezing while maximizing flow rates and efficiency.

WIL-FLO™

Market Position
- Superior anti-freezing
- ON/OFF reliability
- Most efficient (SCFM/GPM)
- Superior Flow rate
- Lube-free operation

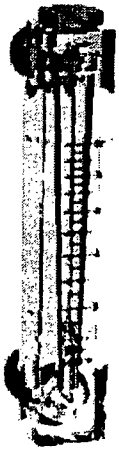
Application Traits
- Maximum reliability
- Very wet air supply
- NFPA/UV stabilized
- Priority consideration =

Features
- Aluminum C-block brass air
- Plastic air valve piston (ringed)
- Pressure relief valves
- Quick air exhaust
- Dbl. Muffler configuration

Availability
- 1½" pumps
- 2" pumps
- 3" pumps

DWYER METERS

VFC Series Visi-Float® Flowmeter Installation and Operating Instructions



Back Connections

End Connections

SPECIFICATIONS

Meter Body	Acrylic Plastic Metering tube machined into body
Wetted Metal Parts	Stainless Steel
Floats	Stainless Steel
Fittings	PVC
Guide Rod Holder	Mineral reinforced nylon bonded in fitting with epoxy (EC models only)
Pipe Connections	1" N P T female, horizontal or vertical
"O" Rings	Buna-N
Mounting Inserts	10-32 x ⅜" deep
Scale	Hot pressed into acrylic body
Pressure Rating	100 P S I maximum
Temperature Rating	120°F maximum
Accuracy	± 2% of full scale

Dwyer Series VFC Visi-Float® flowmeters are available in two basic styles, either back or end connected with direct reading scales for air or water. Installation, operation, and maintenance are simple and require only a few common sense precautions to assure long, accurate, trouble-free service.

CALIBRATION

All Dwyer flowmeters are calibrated at the factory and normally will remain within their accuracy tolerance for the life of the device. If at any time you wish to re-check its calibration, do so only with instruments or equipment of certified accuracy. Do not attempt to check the Dwyer Visi-Float® flowmeter with a similar flowmeter as even minor variations in piping and back pressure can cause significant differences between the indicated and actual readings. If in doubt, your Dwyer flowmeter may be returned to the factory and checked for calibration at no charge.

LOCATION

Select a location where the flowmeter can be easily read and where the temperature will not exceed 120°F (49°C). The mounting surface and piping to the flowmeter should be free from vibration which could cause fatigue of fittings or mounting inserts. Piping must be carefully arranged and installed to avoid placing stress on fittings and/or flowmeter body. Avoid locations or applications with strong chlorine atmospheres or solvents such as benzene, acetone, carbon tetrachloride, etc. Damage due to contact with incompatible gases or liquids is not covered by warranty. Compatability should be carefully determined before placing in service.

PIPING

INLET PIPING

It is good practice to approach the flowmeter inlet with as few elbows, restrictions and size changes as possible. Inlet piping should be as close to the flowmeter connection size as practical to avoid turbulence which can occur with drastic size changes. The length of inlet piping has little effect on normal pressure fed flowmeters.

For vacuum service, the inlet piping should be as short and open as possible to allow operation at or near atmospheric pressure and maintain the accuracy of the device. Note that for vacuum service, any flow control valve used must be installed on the discharge side of the flowmeter.

DISCHARGE PIPING

Piping on the discharge side should be at least as large as the flowmeter connection. For pressure fed flowmeters on air or gas service, the piping should be as short and open as possible. This allows operation at or near atmospheric pressure and assures the accuracy of the device. This is less important on water or liquid flowmeters since the flowing medium is generally incompressible and back pressure will not affect the calibration of the instrument.

DWYER INSTRUMENTS, INC.
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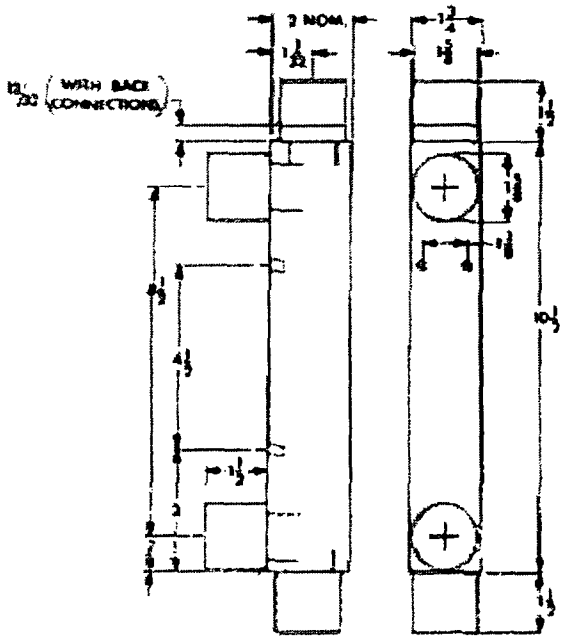
SERIES VFC
Visi-Float® Flowmeters



DIMENSIONS

POSITION AND MOUNTING

All Visi-Float® flowmeters must be installed in a vertical position with the inlet connection at the bottom and outlet at the top.

SURFACE MOUNTING:
Drill three holes in panel using dimensions shown in drawing. Holes should be large enough to accommodate #10-32 machine screws. If back connected model, drill two additional holes for clearance of fittings. Install mounting screws of appropriate length from rear. Attach piping using RTV silicone sealant or Teflon® tape on threads to prevent leakage.

CAUTION: Do not overtighten fittings or piping into fittings. Maximum recommended torque is 10 ft/lbs. Hand tighten only.

IN LINE MOUNTING:
Both end connected and back connected models may be installed in-line supported only by the piping. Be sure that flowmeter is in a vertical position and that piping does not create excess stress or loading on the flowmeter fittings.

OPERATION

Once all connections are complete, introduce flow as slowly as possible to avoid possible damage. With liquids, make sure all air has been purged before taking readings. Once the float has stabilized, read flow rate by sighting across the largest diameter of the float to the scale graduations on the face of the device.

MAINTENANCE

The only maintenance normally required is occasional cleaning to assure proper operation and good float visibility.

DISASSEMBLY:
The flowmeter can be completely disassembled by removing the connection fittings and top plug. When lifting out the float guide assembly, be careful not to lose the short pieces of plastic tubing on each end of the guide rod which serve as float stops.

CLEANING:
The flowmeter body and all other parts can be cleaned by washing in a mild soap and water solution. A soft bristle bottle brush will simplify cleaning of the flow tube. Avoid benzene, acetone, carbon tetrachloride, gasoline, alkaline detergents, caustic soda, liquid soaps, (which may contain chlorinated solvents), etc., and avoid prolonged immersion.

RE-ASSEMBLY:
Install the lower fitting and then the float and float guide. Finally install the upper fitting and plug being certain that both ends of the float guide are properly engaged and the float is correctly oriented. A light coating of silicone stopcock grease or petroleum jelly on the "O" rings will help maintain a good seal as well as ease assembly.

ADDITIONAL INFORMATION

For additional flowmeter application information, conversion curves, correction factors and other data covering the entire line of Dwyer flowmeters, write for bulletin F-41.

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DWYER INSTRUMENTS, INC.
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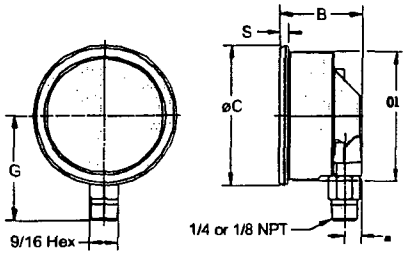
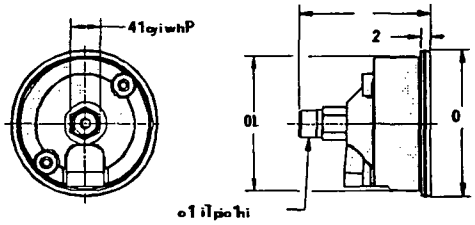
ASHCROFT

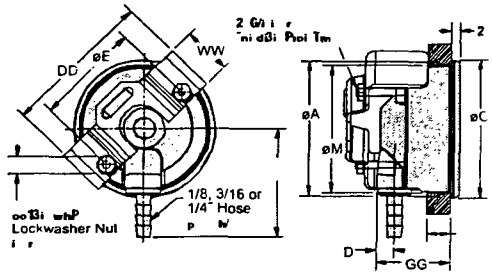
Diaphragm Gauges
Type 1490 Low Pressure
2½" and 3½"



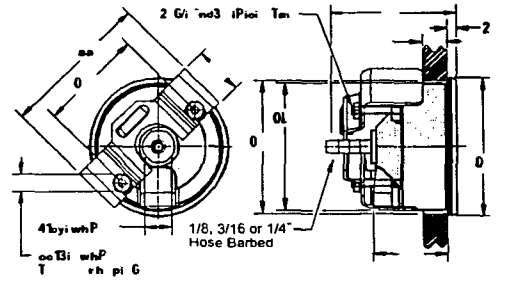
Size	øA	B	øC	D	G	S
2½"	2 19/32 (66)	1 23/32 (44)	2 1/8 (73)	3/8 (10)	2 1/16 (55)	1/32 (5)
3½"	3 19/32 (93)	1 11/16 (43)	3 19/32 (101)	3/8 (10)	2 39/64 (69)	1/32 (5)



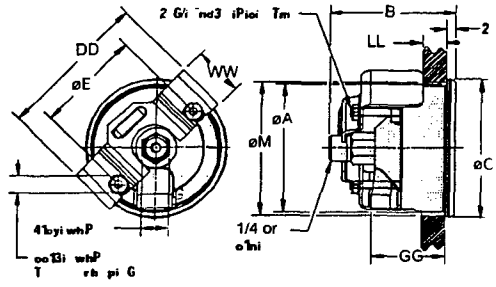
Size	øA	B	øC	S
2½"	2 19/32 (66)	2 19/32 (66)	2 1/8 (73)	1/32 (5)
3½"	3 21/32 (93)	2 9/16 (65)	3 31/32 (101)	1/32 (5)



Size	øA	øC	D	øE	G 1/8	G 3/16	G 1/4	øM	S	DD	GG	LL MAX	WW
2½"	2 19/32 (66)	2 1/8 (73)	3/8 (10)	2 1/8 (54)	1 3/4 (44)	2 1/8 (54)	2 37/64 (54)	2 21/32 (67)	1/32 (5)	3 1/16 (78)	1 19/32 (40)	1/2 (13)	1 (25)
3½"	3 21/32 (93)	3 31/32 (101)	3/8 (10)	3 1/16 (67)	2 9/16 (59)	2 21/32 (81)	2 13/16 (54)	3 3/4 (95)	1/32 (5)	4 1/8 (105)	1 17/32 (39)	1/2 (13)	1 (25)



Size	øA	B 1/8	B 3/16	B 1/4	øC	øE	øM	S	DD	GG	LL MAX	WW
2½"	2 19/32 (66)	2 3/16 (55)	2 17/32 (64)	2 11/16 (68)	2 1/8 (73)	2 1/8 (54)	2 21/32 (67)	1/32 (5)	3 1/16 (78)	1 19/32 (40)	1/2 (13)	1 (25)
3½"	3 21/32 (93)	2 1/8 (54)	2 1/2 (63)	2 27/32 (67)	3 31/32 (101)	3 3/16 (81)	3 3/4 (95)	1/32 (5)	4 1/8 (105)	1 17/32 (39)	1/2 (13)	1 (25)

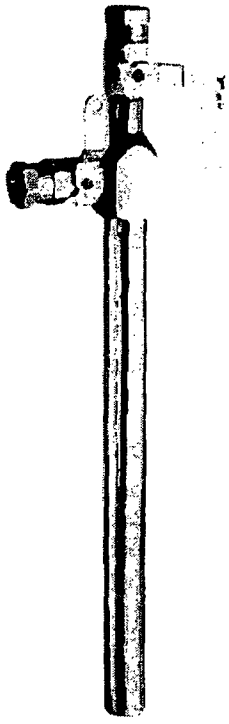


dui eTm

Size	øA	B	øC	øE	øM	S	DD	GG	LL MAX	WW
2½"	2 19/32 (66)	2 19/32 (66)	2 1/8 (73)	2 1/8 (54)	2 21/32 (67)	1/32 (5)	3 1/16 (78)	1 19/32 (40)	1/2 (13)	1 (25)
3½"	3 21/32 (93)	2 9/16 (65)	3 31/32 (101)	3 3/16 (81)	3 3/4 (95)	1/32 (5)	4 1/8 (105)	1 17/32 (39)	1/2 (13)	1 (25)

SERIES DS-400 FLOW SENSORS

Installation and Operating Instructions, Flow Calculations



INSPECTION

Inspect the sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General – The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location – The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. This will provide a flow profile as ideal as possible. A rule of thumb is to allow 10-15 pipe diameters upstream and 5 down. The table below lists recommended up and down piping:

PRESSURE AND TEMPERATURE

Maximum 200 psig at 200°F.

UPSTREAM AND DOWNSTREAM DIMENSIONS IN TERMS OF INTERNAL DIAMETER OF PIPE

*SEE NOTE #1

UPSTREAM CONDITION	MINIMUM DIAMETER OF STRAIGHT PIPE		
	UPSTREAM		DOWNSTREAM
	IN-PLANE	OUT-OF-PLANE	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	6	8	5
All Valves *See Note 2	24	24	5

*Note #1: Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

*Note #2: Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.

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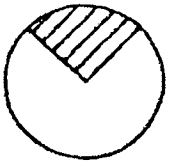
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

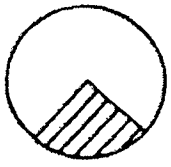
Flow Sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For air or gas flow:
Install in upper quadrant of pipe



Condensate drains back to pipe

For liquid or steam flow:
Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

1. Attach a ¾" NPT female fitting, such as a thred-o-let or saddle clamp, to the piping in which flow will be measured. Note the required upstream and downstream conditions on page one which should be observed.

2. Drill a hole through the center of the attached fitting into the pipe with a bit that is slightly larger than the flow sensor diameter.

3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes inside the fitting body.

4. Insert the sensor until it contacts the opposite wall of the pipe and then withdraw it 1/16" for models -6 through -12 or ⅛" for models -14 through -24. This is to allow for thermal expansion.

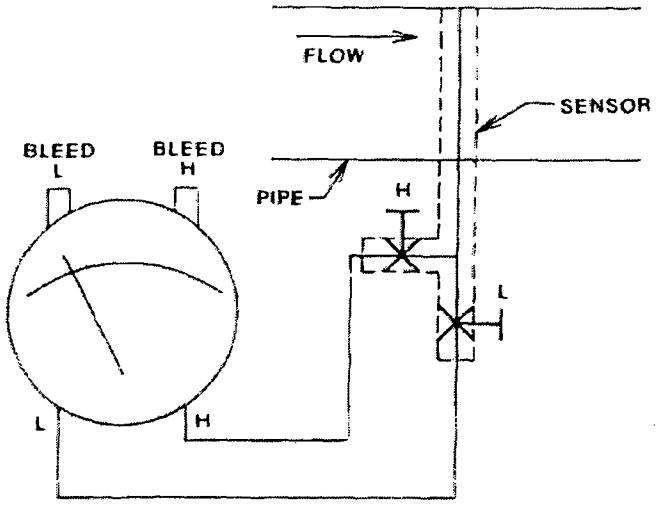
5. Tighten packing gland nut finger tight. Then tighten the nut with a wrench an additional 1¼ turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

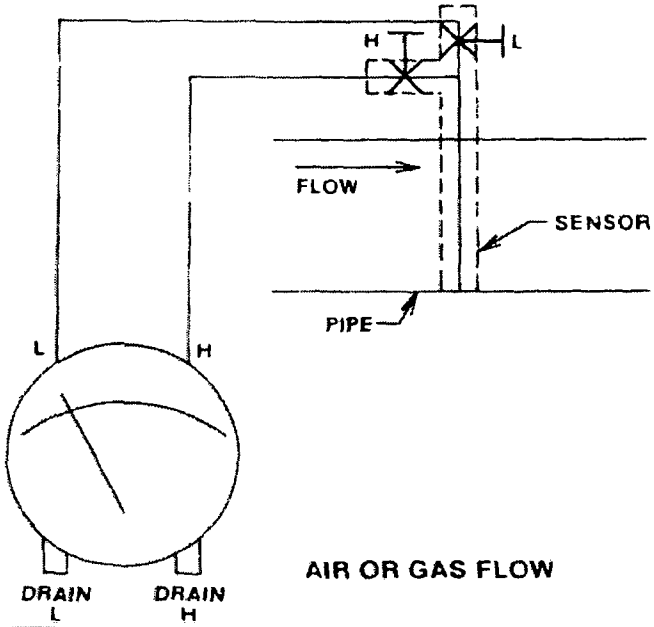
Connect the side pressure tap to the high pressure port of the Magnehelic (air only) or Capsuhelic gage or transmitting instrument and the top connection to the low pressure port. See the connection schematics below.

Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

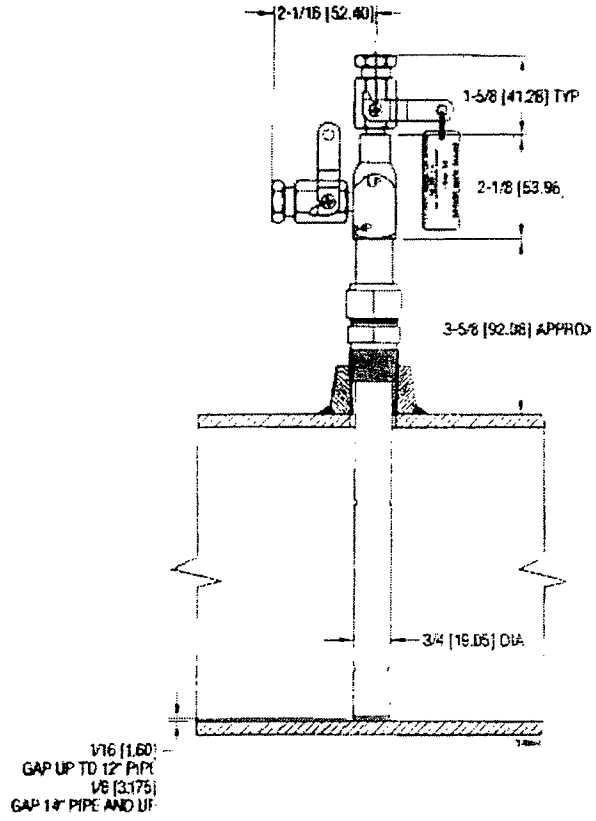


WATER FLOW



AIR OR GAS FLOW

SERIES DS-400 FLOW SENSORS



FLOW CALCULATIONS AND CHARTS

The following information contains tables and equations for determining the differential pressure developed by the DS-400 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. Where direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic or Capsuhelic gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletin A-30 for additional information on Magnehelic and Capsuhelic gages.

For additional useful information on making flow calculations, the following reference is recommended: Crane Valve Co. Technical Paper No. 410 "Flow of Fluids Through Valves, Fittings and Pipe." It is available from Crane Valve Co., 104 N. Chicago St., Joliet, IL 60431. Phone 815/727-2600. Price including shipping is $20.00

Using the appropriate differential pressure equation from page 4, calculate the differential pressure generated by by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges for other gases, liquids and/or operating conditions, consult the factory.

Note the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40 up to 20". Std. wt. for 24")	Flow Coefficient "K"	Operating Ranges Air @ 60°F & 14.7 psia (D/P Inches W.C.)	Operating Ranges Water @ 70°F (D/P Inches W.C.)	Velocity Ranges Not Recommended (Feet per Second)
6	.706	0.70 to 51	2.54 to 187	83 to 124
8	.675	0.64 to 28	2.31 to 102	53 to 79
10	.676	1.12 to 37	4.05 to 136	36 to 54
12	.683	0.19 to 20	0.70 to 72	26 to 40
14	.698	0.17 to 13	0.60 to 46	22 to 33
16	.688	3.78 to 56	13 to 203	17 to 26
18	.689	0.04 to 5.48	0.14 to 19	14 to 21
20	.686	0.39 to 4.93	1.40 to 17	11 to 17
24	.789	0.05 to 11	0.20 to 40	8 to 12

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\triangle P / S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \triangle P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \triangle P}{(T+460) \times S_S}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\triangle P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\triangle P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\triangle P\ (in.\ WC) = \frac{Q^2 \times S_S \times (T+460)}{K^2 \times D^4 \times P \times 16{,}590}$$

TECHNICAL NOTATIONS

The following notations apply:

$\triangle P$ = Differential pressure expressed in inches of water column.
Q = Flow expressed in GPM, SCFM or PPH as shown in equation.
K = Flow coefficient — See Values Tabulated on page 3.
D = Inside diameter of line size expressed in inches. For square & rectangular ducts use $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460=°Rankin)
p = Density of medium in pounds per cubic foot
S_f = Sp Gr at flowing conditions
S_S = Sp Gr at 60°F

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right)\left(\frac{520^\circ}{460 + {}^\circ F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right)\left(\frac{460 + {}^\circ F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right)\left(\frac{460 + {}^\circ F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right)\left(\frac{520}{460 + {}^\circ F}\right)$$

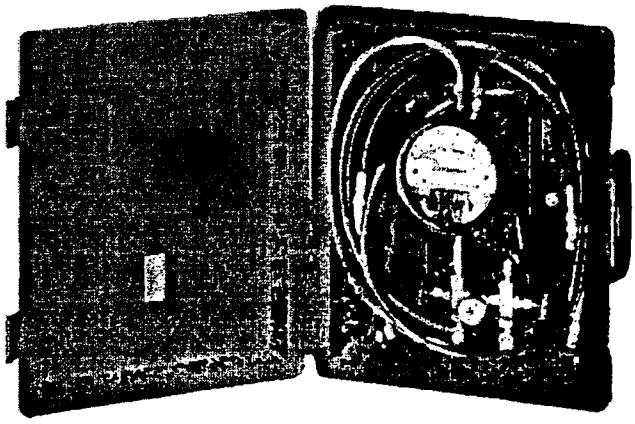
1 CUBIC FOOT OF AIR = 0.076 POUNDS PER CUBIC FOOT AT 60°F AND 14.7 PSIA

*(520 = 460 + 60°) Std. Temp. Rankine

Printed in U.S.A. 1/97 FR 72-440451-00

A-471 CAPSUHELIC PORTABLE KIT

This kit has been carefully engineered to include everything needed to adapt the 4000 series Capsuhelic gage for portable use. Once assembled, you can quickly, conveniently, and accurately measure positive, negative, or differential pressures of air and compatable gases and fluids. The Capsuhelic gage is not included in the kit. You should order it separately in the range best suited to your needs. It is available in many ranges from 0—0.50 in. W.C. up to 0-300 PSI.



Operating Instructions

(See reverse side for kit assembly instructions)

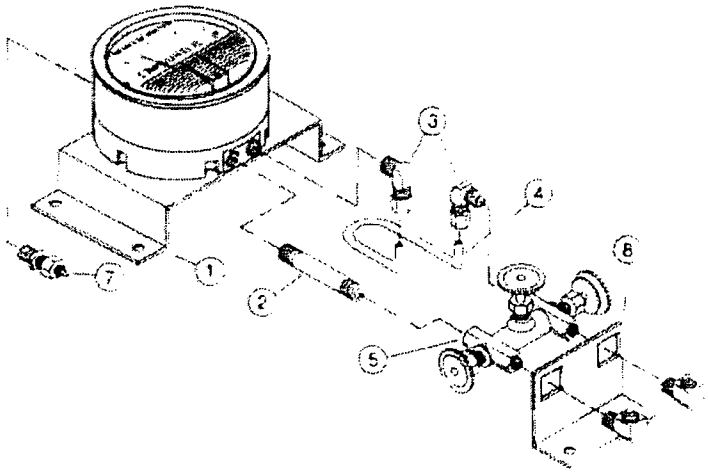
1. As noted in the assembly instructions, the equalizer and shutoff manifold must be installed in the upper pressure ports for air or gases and in the lower ports for fluids. This allows you to use the bleed fittings in the opposite ports to either drain condensate, (air or gas service) or purge air from the gage (fluid service).
2. Open case and place on a horizontal surface with the gage vertical as shown in photo above.
3. Close all three valves and attach the five foot high pressure hoses to the elbow connectors marked PROC. Connect the other ends to the pressure sources. When measuring differential pressures, the right high pressure line is run to the higher of two pressures and the left, low pressure line to the lower. You may also measure a single pressure, positive or negative, relative to atmosphere. Positive pressures are applied to the high pressure port and negative pressures to the low pressure port. Be sure the center equalizer valve is closed and the opposite port is vented.
4. If measuring liquid pressure the following procedure is necessary. Open both bleed fittings using a 9/16" open end wrench. Attach the clear vinyl tubes to these fittings and position the other ends in a suitable container to collect the bled fluid. Slowly open all three valves until fluid leaves both bleed fittings thus indicating the gage is filled. Close both bleed fittings and drain remaining fluid.

   On air or gas service, slowly open all three equalizer valves. Next open both bottom bleed fittings to expel any condensate. Finally, close the bleed fittings before placing gage in service.
5. Close the left, low pressure valve. This will apply the higher pressure equally to both sides of the diaphragm. Turn the zero adjust screw at bottom of gage cover until the pointer is exactly on zero.
6. Close the center equalizer valve and open the left, low pressure valve. The gage will now be indicating differential pressure.
7. When all measurements are completed, disconnect pressure lines. If used on fluid, open bleed fittings and equalizer valve to drain entire assembly before storing.

Litho in U.S.A. 2/89

FR NO. 15-440360-00

A-471 PORTABLE KIT



NO.	PARTS LIST DESCRIPTION	QUANTITY REQ'D.
1.	Gage Mounting Bracket	1
2.	Nipple ¼" NPT x 3"	1
3.	Elbow, ¼" Compression x ¼" NPT Male	2
4.	Formed Copper Tube	1
5.	3 Way Manifold Valve	1
6.	Street El, ¼" NPT Male x ¼" NPT Female	2
7.	Bleed fitting ¼" NPT Male	2
8	Manifold Mounting Bracket	1
FOLLOWING ITEMS NOT SHOWN:		
9.	Carrying Case	1
10.	5 Ft. High Pressure Hose	2
11.	6-32 x 3/16" Machine Screw	4
12	10-32 x 1¼" Machine Screw	2
13.	10-32 Hex Nut	2
14.	3/16" x 3/8" Washer	2
15	¼"-20 x ½" Truss Head Machine Screw	6
16.	¼"-20 Hex Nuts	6
17.	Plastic Feet	2
18.	¾" Plastic Hole Plugs	6
19.	3/16" Plastic Hole Plugs	2
20.	Vinyl Tube 3 Ft. Long	2
21.	Adapter Elbow, 3/16"-20 x ¼" NPT Male	2
22.	Straight Adapter, 3/16"-20 x ¼" NPT Male	2

To Assemble Kit

NOTE: Before beginning assembly you must determine whether the gage will be measuring pressures of gases or fluids. Installation is reversed for the two types of media. Seal all pipe threads with Teflon tape or pipe joint compound.

1. Attach two plastic feet to case through holes provided. First insert #12 screw through #17 plastic foot and case. Secure to case from inside with #14 washer and #13 nut. Tighten nut only until foot is snug. Overtightening can collapse case wall. With case handle facing you, left hand pair of holes are used if for fluid service and right hand holes for air or gas service. Plug unused holes with #19 plastic hole plugs. Insert from outside, and press to lock.
2. Install one #3 elbow in the left "INST" port of the 3-way manifold valve. Install the second elbow in the bottom high pressure gage port for fluid service or the top low pressure gage port for air or gas service. Both fittings must face back when tight.
3. Install #2 nipple in remaining "INST" port of manifold and both #6 elbows in the two "PROC" ports. These elbows should face front when tight.
4. The manifold assembly is now attached to the gage by installing the other end of the nipple in the gage port next to the #3 elbow.
5. Installed #4 formed copper tube in #3 compression elbows.
6. Attach gage to #1 gage mounting bracket with #11 machine screws. Orient the bracket so the two 3/16" vent clearance holes are toward the top of the gage. Install both #7 bleed fittings in remaining gage ports.
7. The #8 manifold bracket is now fastened to the case with #15 machine screws and #16 hex nuts Insert machine screws from back of case.
8. Lower completed gage/manifold assembly into case making sure that both "PROC" ports of manifold are positioned in the manifold bracket.
9. Align four holes in gage mounting bracket with matching holes in case and secure with #15 machine screws and #16 hex nuts. Screws must be inserted from back of case.
10. Make sure all fittings and fasteners are secure. Press #18 plastic plugs into holes in back of case.
11. Hoses are connected to completed assembly with #22 adapters installed in #6 elbows. If danger of dirt or other foreign matter entering gage exists, we recommend use of optional A-391 in line filter between these fittings. The two #21 adapters are for connecting opposite ends of hoses to pressure source. Loosely coil the hoses around the gage assembly for storage.

FOR REPLACEMENT PARTS OR REPAIR, WRITE:

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360 U.S.A.
Telephone 219/879-8000
Fax 219/872-9057

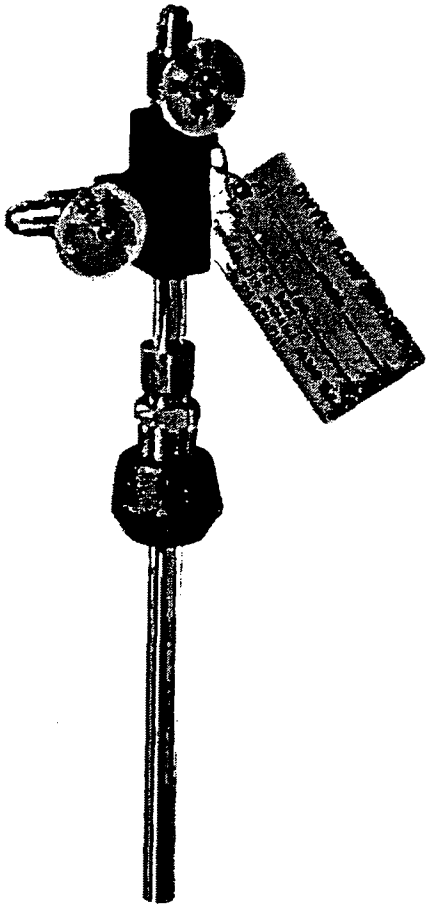
Series DS-200 Flow Sensor

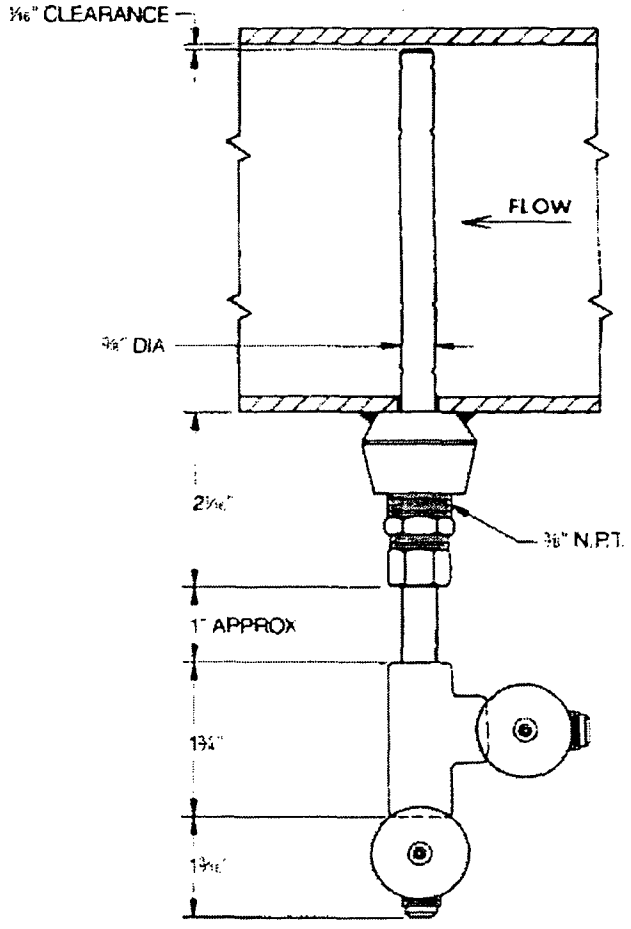
Flow Calculation and Data Bulletin

This bulletin contains equations, charts, and data for determining the differential pressure developed by the Dwyer Series DS 200 Flow Sensor for various flow rates of water, air, steam, or gases in various pipe sizes.

The contents of this bulletin can be utilized to prepare conversion charts to translate the differential pressure readings in a given flow sensor installation to the equivalent flow rate. Where direct readout of flow is required, use the bulletin to calculate the full flow differential pressure in order to specify the exact Dwyer Capsuhelic gage range needed. Special ranges and scale calibrations for the Capsuhelic gage are available at minimal extra cost. Consult Bulletin A-30 in the Dwyer catalog or contact the factory for additional information. Bulletin F-50 covers installation.

For additional useful information in working up flow calculations, the following reference is recommended: Crane Co. Technical Paper No. 400 "Flow of Fluids Through Valves, fittings and pipe" available from Crane Company, 300 Park Avenue, New York, New York 10022, Attn: Advertising Dept. Price $8.00.





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Fax 219/872-9057 Telex 25-1131

FLOW EQUATIONS

1. Any Liquid
   $Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$
2. Steam or Any Gas
   $Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$
3. Any Gas
   $Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T+460) \times S_S}}$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid
   $\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$
2. Steam or Any Gas
   $\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$
3. Any Gas
   $\Delta P\ (in.\ WC) = \frac{Q^2 \times S_S \times (T+460)}{K^2 \times D^4 \times P \times 16{,}590}$

TECHNICAL NOTATIONS

The following notations apply:

ΔP = Differential pressure expressed in inches of water column.
Q = Flow expressed in GPM, SCFM or PPH as shown in equation.
K = Flow coefficient — See Values Tabulated on page 3.
D = Inside diameter of line size expressed in inches. For square & rectangular ducts use $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankin)
p = Density of medium in pounds per cubic foot
S_f = Sp Gr at flowing conditions
S_S = Sp Gr at 60°F

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right)\left(\frac{520°}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right)\left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right)\left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right)\left(\frac{520}{460 + °F}\right)$$

1 CUBIC FOOT OF AIR = 0.076 POUNDS PER CUBIC FOOT AT 60°F AND 14.7 PSIA

*(520 = 460 + 60°) Std. Temp. Rankine

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Phone: 219/879-8000 • Telex: 25515 • Fax: 219/872-9057

TABLE 1

FLOW COEFFICIENTS (K)

FPS = Average Velocity Ft./Sec. (Water)

PIPE SIZE (SCH. 40)	VELOCITY* FPS	K	
1	13.0	.521	(use .558 above 7 FPS)
1-1/4	13.3	.536	(use .572 above 7 FPS)
1-1/2	13.0	.556	
2	15.0	.586	
2-1/2	15.1	.625	
3	15.2	.645	
4	15.6	.670	
5	16.0	.681	
6	16.6	.652	
8	16.0	.669	
10	17.1	.677	(use .726 above 6 FPS)

NOTE: If only one K factor is listed, it applies to all flow rates for the size of pipe and velocity limits listed.

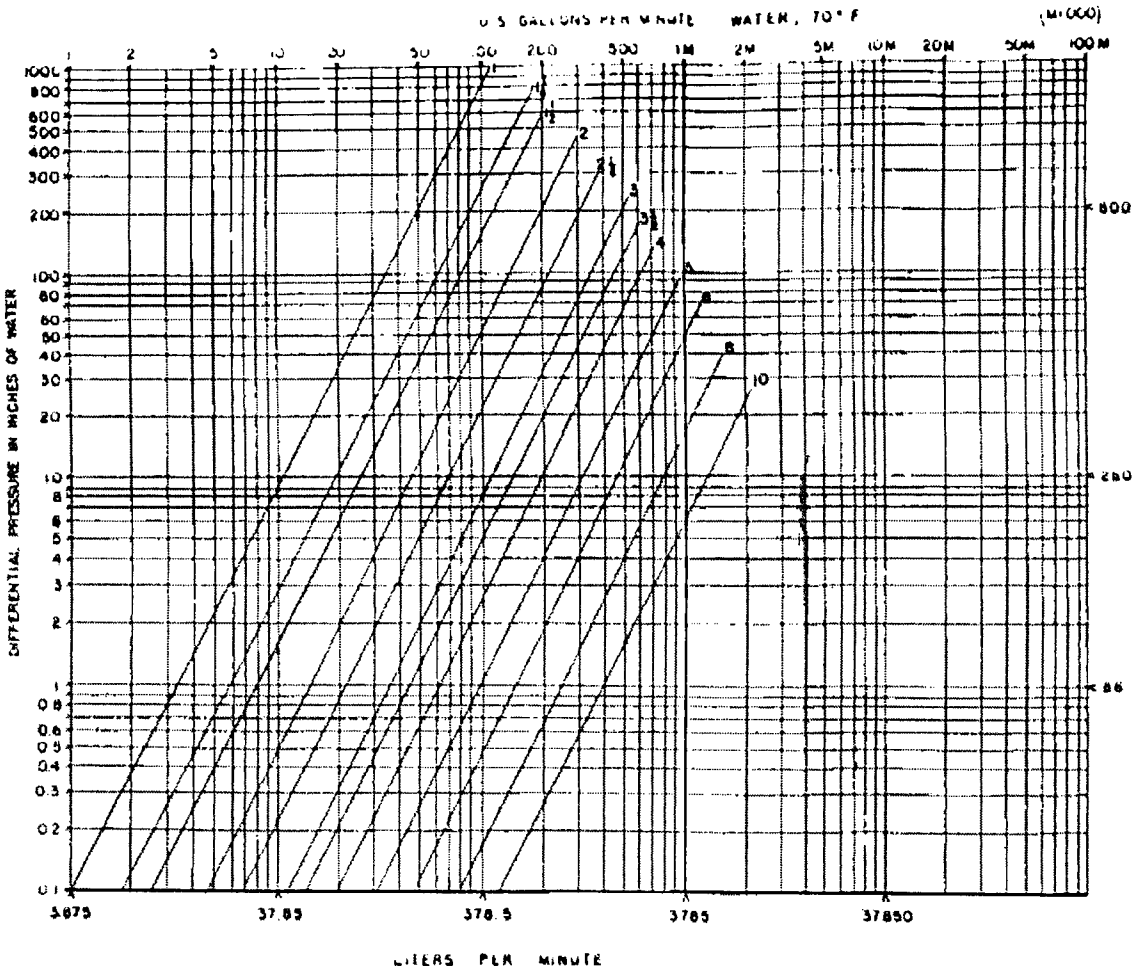
*Represents velocity at 100" H_20 differential pressure. Consult factory for velocities above those listed.

TABLE 2

ALTITUDE/PRESSURE TABLE

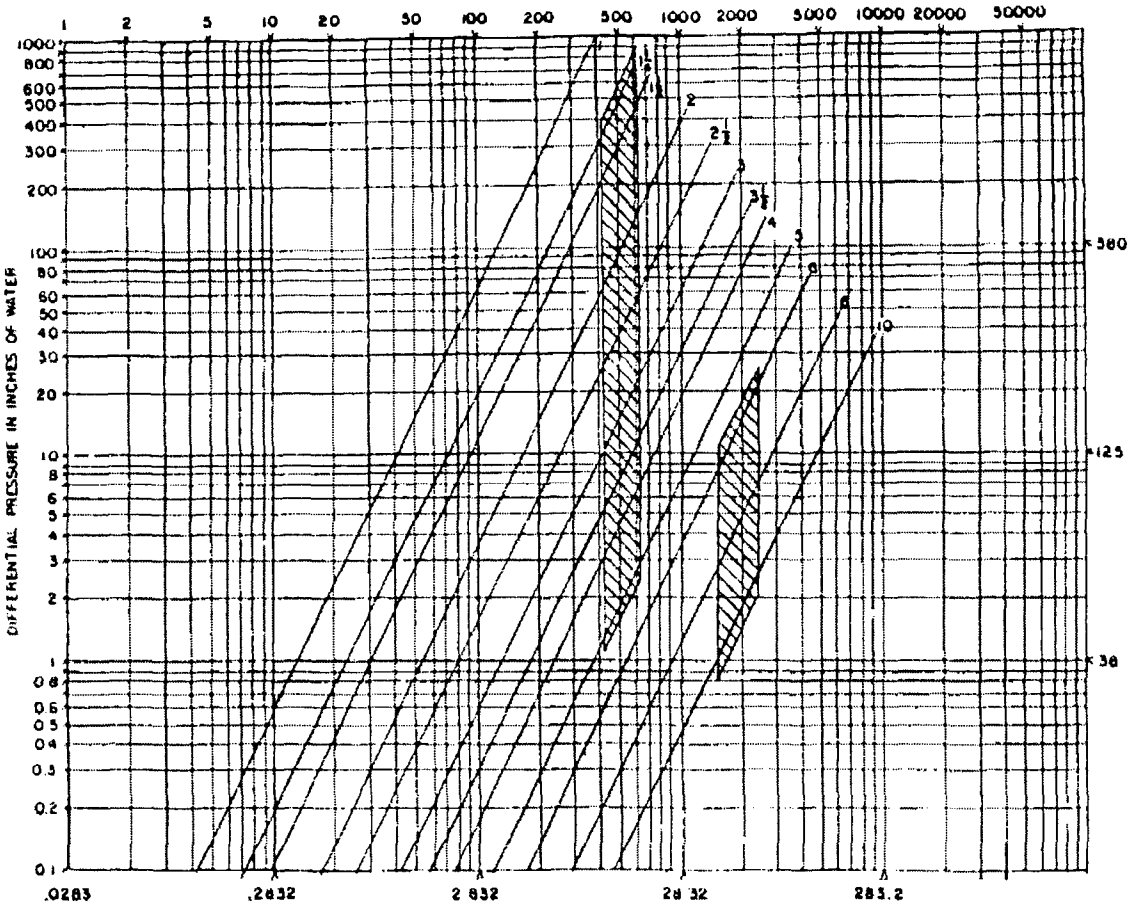
The following table gives the U.S. standard atmosphere (1962) for various altitudes above sea level.

Altitude Feet	Atmospheric Pressure PSIA
0	14.696
500	14.433
1,000	14.173
1,500	13.917
2,000	13.664
2,500	13.416
3,000	13.171
3,500	12.930
4,000	12.692
4,500	12.458
5,000	12.227
6,000	11.777
7,000	11.340
8,000	10.916
9,000	10.505
10,000	10.106
15,000	8.293



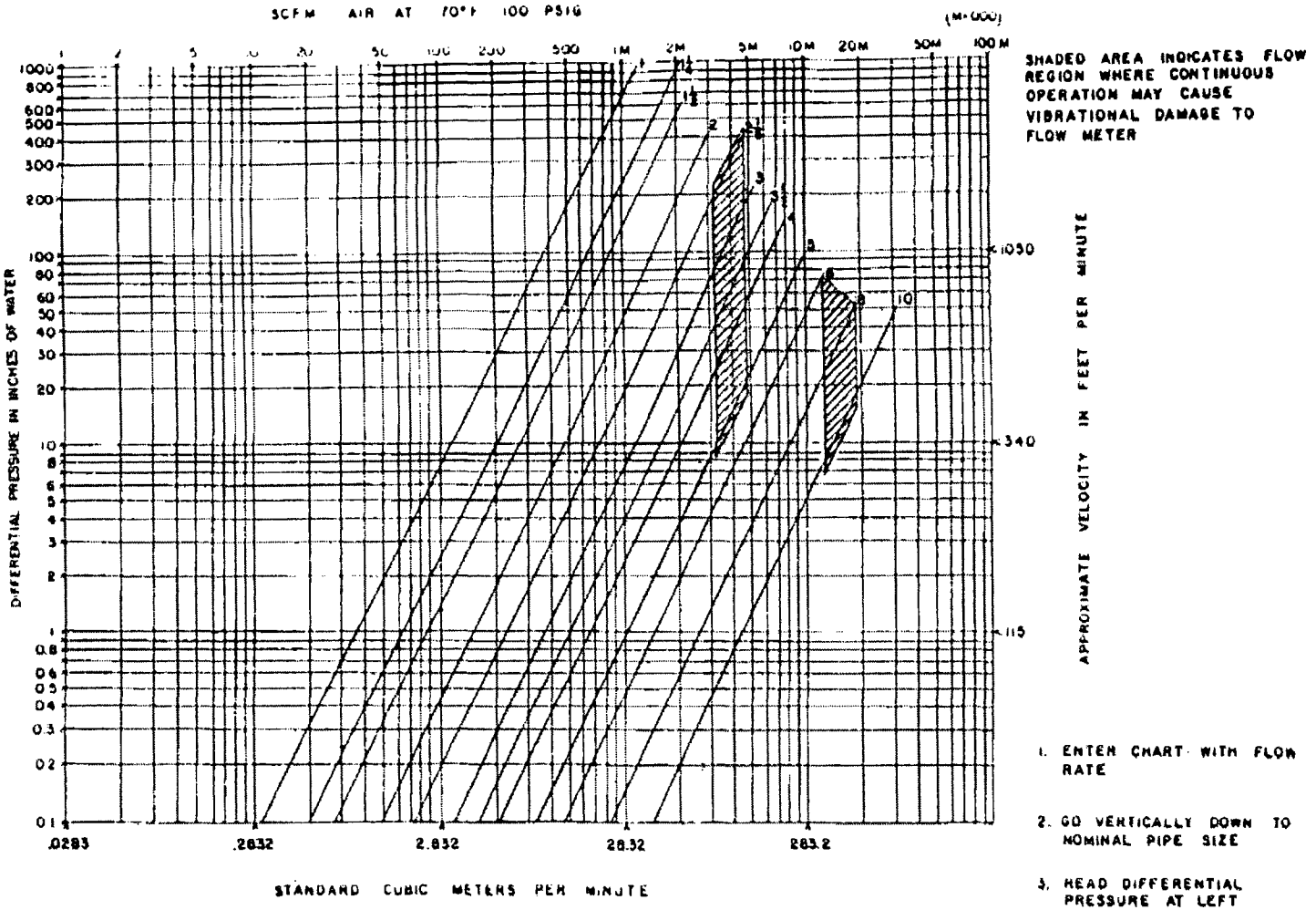
1. ENTER CHART with FLOW RATE
2. GO VERTICALLY DOWN TO NOMINAL PIPE SIZE
3. READ DIFFERENTIAL PRESSURE AT LEFT

SCFM AIR AT 70°F 14.696 PSIA



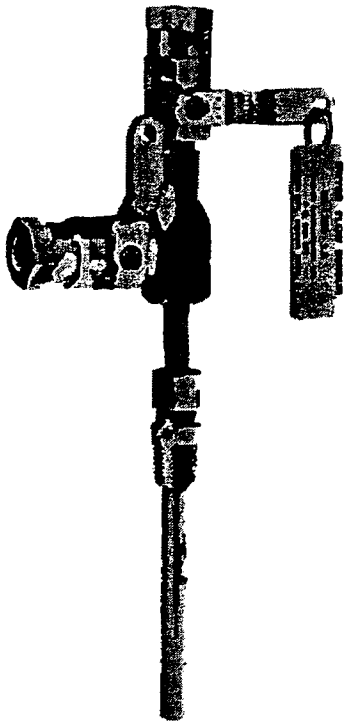
SHADED AREA INDICATES FLOW REGION WHERE CONTINUOUS OPERATION MAY CAUSE VIBRATIONAL DAMAGE TO FLOW METER

1. ENTER CHART WITH FLOW RATE
2. GO VERTICALLY DOWN TO NOMINAL PIPE SIZE
3. READ DIFFERENTIAL PRESSURE AT LEFT



SERIES DS-300 FLOW SENSORS

Installation and Operating Instructions, Flow Calculations



INSPECTION

Inspect the sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General – The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location – The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. This will provide a flow profile as ideal as possible. A rule of thumb is to allow 10-15 pipe diameters upstream and 5 down. The table below lists recommended up and down piping:

PRESSURE AND TEMPERATURE

Maximum 200 psig at 200°F.

UPSTREAM AND DOWNSTREAM DIMENSIONS IN TERMS OF INTERNAL DIAMETER OF PIPE

*SEE NOTE #1

UPSTREAM CONDITION	MINIMUM DIAMETER OF STRAIGHT PIPE		
	UPSTREAM		DOWNSTREAM
	IN-PLANE	OUT OF PLANE	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves *See Note 2	24	24	5

*Note #1: Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values

*Note #2: Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.

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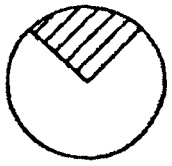
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

Flow Sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For air or gas flow:
Install in upper quadrant of pipe



Condensate drains back to pipe

For liquid or steam flow:
Install in lower quadrant of pipe

Air bleeds back to pipe.

INSTALLATION

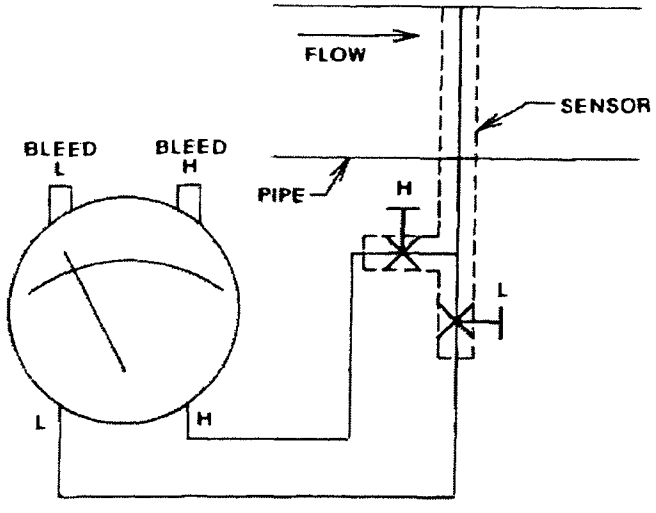
1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4"×3/8") will be needed.
2. Drill through the center of the thred-o-let into the pipe, with a drill that is slightly larger than the flow sensor diameter.
3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.
4. Insert the sensor until it bottoms against the opposite wall of the pipe, then withdraw 1/16" to allow for thermal expansion.
5. Tighten packing gland nut finger tight. Then tighten the nut with a wrench an additional 1 1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

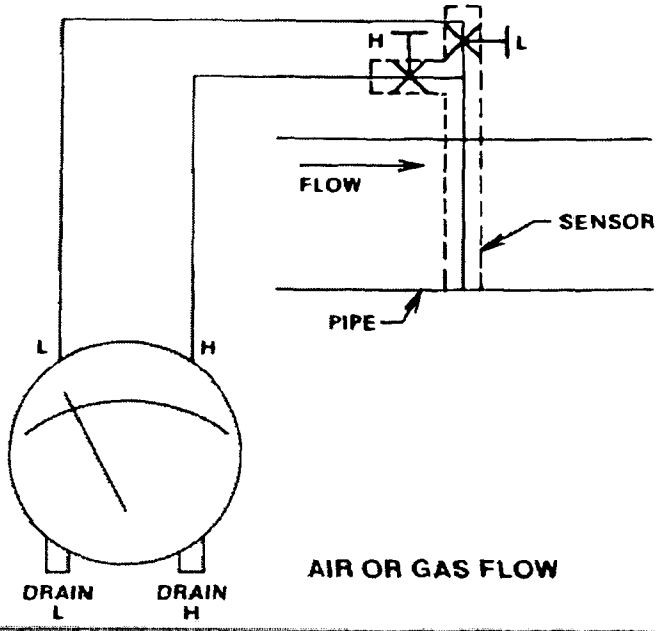
Connect the side pressure tap to the high pressure port of the Magnehelic (air only) or Capsuhelic gage or transmitting instrument and the top connection to the low pressure port. See the connection schematics below.

Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

Open valves to instrument to place flow meter into service For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

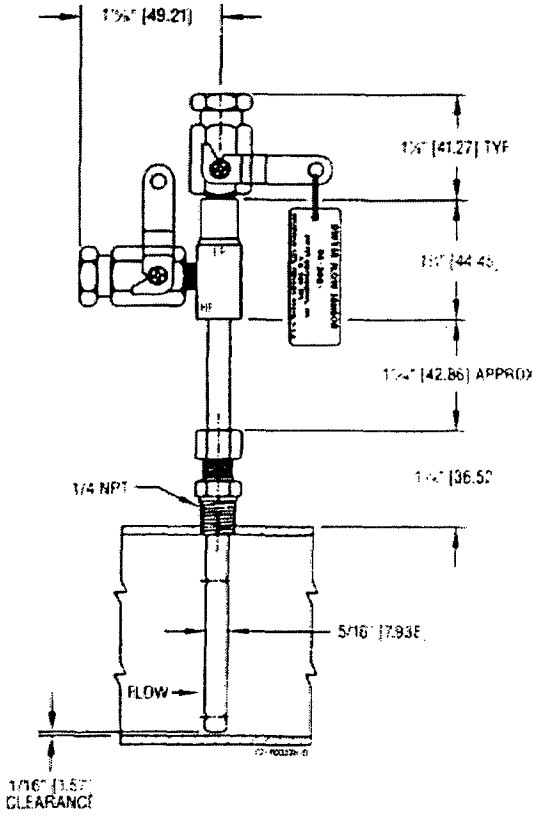


WATER FLOW



AIR OR GAS FLOW

SERIES DS-300 FLOW SENSORS



FLOW CALCULATIONS AND CHARTS

The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. Where direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic or Capsuhelic gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletins A-30 and F-41 for additional information on Magnehelic and Capsuhelic gages and DS-300 flow sensors.

For additional useful information on making flow calculations, the following reference is recommended: Crane Valve Co. Technical Paper No. 410 "Flow of Fluids Through Valves, Fittings and Pipe." It is available from Crane Valve Co., 104 N. Chicago St., Joliet, IL 60431. Phone 815/727-2600. Price including shipping is $20.00

Using the appropriate differential pressure equation from page 4, calculate the differential pressure generated by the sensor under **normal** operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges for other gases, liquids and/or operating conditions, consult the factory.

Note the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient "K"	Operating Ranges Air @ 60°F & 14.7 psia (D/P Inches W.C.)	Operating Ranges Water @ 70°F (D/P Inches W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1¼	0.58	1.15 to 157	4.18 to 566	113 to 170
1½	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2½	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid
$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas
$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas
$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T+460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid
$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas
$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128.900}$$

3. Any Gas
$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T+460)}{K^2 \times D^4 \times P \times 16.590}$$

TECHNICAL NOTATIONS

The following notations apply:

ΔP = Differential pressure expressed in inches of water column.
Q = Flow expressed in GPM, SCFM or PPH as shown in equation.
K = Flow coefficient — See Values Tabulated on page 3.
D = Inside diameter of line size expressed in inches. For square & rectangular ducts use $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460=°Rankin)
p = Density of medium in pounds per cubic foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right)\left(\frac{520^\circ}{460 + {}^\circ F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right)\left(\frac{460 + {}^\circ F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right)\left(\frac{460 + {}^\circ F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right)\left(\frac{520}{460 + {}^\circ F}\right)$$

1 CUBIC FOOT OF AIR = 0.076 POUNDS PER CUBIC FOOT AT 60°F AND 14.7 PSIA

*(520 = 460 + 60°) Std. Temp. Rankine

Printed in U.S.A. 6/96

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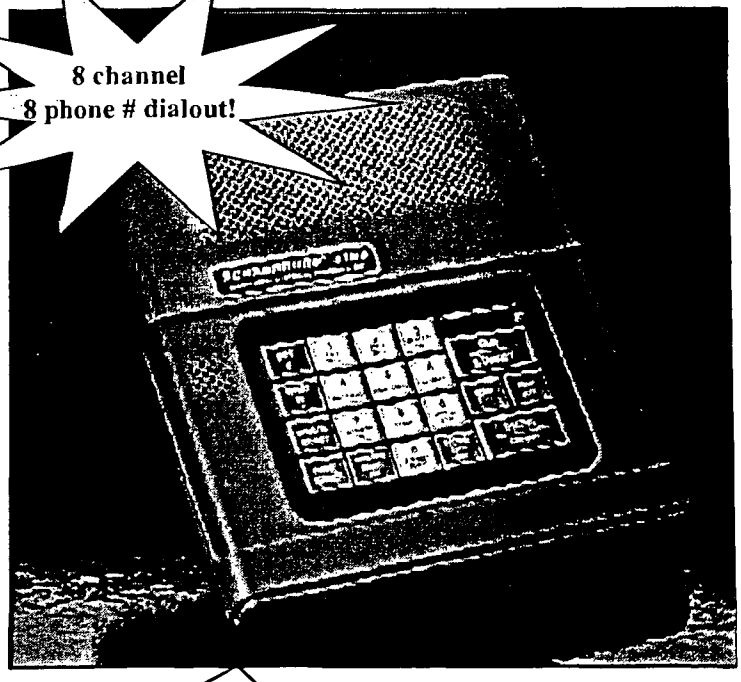
DWYER INSTRUMENTS, INC.
P.O. Box 373, Michigan City, Indiana 46361, U.S.A.
Phone: 219/879-8000 Fax: 219/872-9057

SENSAPHONE 1108

Sensaphone® 1108

Desktop Monitoring System

Environmental/Process monitoring over telephone lines with full programming capabilities



- ☐ The versatile Model 1108 is designed for programming flexibility
- ☐ Variable alarm recognition and "listen-in" time, with alarm disable, security code access, remote sensing, and other programming features
- ☐ Monitors power, temperature, and other important environmental conditions to protect computers, equipment, and processes
- ☐ Automatically contacts you at up to 8 locations if unsafe conditions occur
- ☐ Allows you to contact your system using any telephone, to receive status reports and listen-in to on-site sounds
- ☐ Helps you detect problems before they turn into disasters

CONDITIONS MONITORED:
Temperature
Humidity
Electricity
Water Incursion
Smoke
Sound
Windows & Doors
...and more!

ALERT

UP TO 8 DIAL-OUT NUMBERS:
If unsafe conditions occur, the Sensaphone will automatically dial up to eight numbers *in sequence to advise you of the problem.* *Numbers may be up to 32 digits each, with your choice of pulse or tone dial-out.*

COMMUNICATES OVER STANDARD PHONE LINES:
Call-in for periodic status reports on all *monitored conditions, using any telephone.* The Sensaphone communicates in simple voice-synthesized English.

<u>Now you can protect your equipment and processes even when you can't be there</u> - The Sensaphone 1108 monitors your computer rooms, equipment centers, offices, or any unattended facility to detect power failures, temperature extremes, intrusions, water incursion, sounds such as smoke and burglar alarms, and other conditions of your choice.

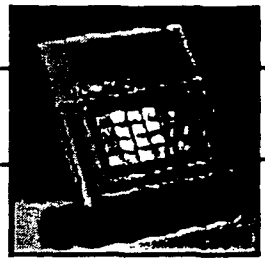
<u>Alerts you immediately if problems arise</u> - The Sensaphone 1108 automatically contacts you by phone at up to eight different phone numbers, to alert you of unsafe conditions. The system communicates in voice-synthesized English, and even lets you "listen-in" to actual on-site sounds.

Phonetics, Inc.

901 Tryens Road, Aston, PA 19014 610-558-2700 FAX: 610-558-0222
http://www.sensaphone.com

See reverse side for a list of the Sensaphone's outstanding features and capabilities.

Sensaphone® 1108



Ideal for a variety of applications - The Sensaphone is useful wherever there is a need for monitoring of temperature, humidity, or other conditions. Sensors and input devices are available to suit a wide range of applications.

- ☐ HVAC Equipment
- ☐ Computer rooms
- ☐ Refrigeration and freezers
- ☐ Health care centers
- ☐ Offices
- ☐ Warehouses
- ☐ Livestock and egg/poultry
- ☐ Home & property
- ☐ Greenhouses

...and many others!

BUILT-IN FEATURES

- ☐ 8 User-selectable inputs, temperature or dry-contact
- ☐ Microphone monitors high sound alarms and enables remote listen-in
- ☐ AC Power failure sensing with variable recognition time
- ☐ Battery condition monitor
- ☐ Clock

ADVANCED CAPABILITIES

- ☐ User Programmable: Alarm recognition time, Call delay, Inter-call delay, Message repetitions
- ☐ Temperature sensing in Fahrenheit (-20°F to 150°F), or Celsius (-29°C to 65°C)
- ☐ Individual temperature input calibration
- ☐ Nonvolatile memory for all programmed parameters

VERSATILE DIAL-OUT CAPABILITIES

- ☐ Alert sensors trigger pulse or tone dialout automatically
- ☐ Dials up to 8 numbers, up to 32 digits each
- ☐ Continues dialing numbers in sequence, until acknowledged
- ☐ Call Progress: Intelligently detects ringing or busy signal
- ☐ Intelligent dial out to beepers and pagers

EASY CONTROL ACCESS:

- ☐ Keypad for local programming and status report
- ☐ Unit can be called from any phone to verify status of all monitored conditions
- ☐ Local or remote enabling/disabling of all dial-out conditions
- ☐ Can share a single phone line with an answering machine, allowing full operation of both units
- ☐ Programmable security code access

SPECIFICATIONS

Size: 7.5" W, 2" H, 8.5" D
Power Requirements: 120 VAC 60Hz 15W
Batteries: (6) 1.5 Volt "D" cell alkaline (not included)
Telephone Interface: FCC approved RJ-11 plug-in modular connector with 6' cord
Operating Range: Unit should be kept between 32° F and 120° F.
Temperature Sensing Range: -20° F to 150° F with remote temperature sensor.
Shipping Weight: 4 lbs.
NRTL listed for compliance with U.L. Standard 1459.
Technical data subject to change without notice.

We'd like to show you how the Sensaphone 1108 can help you monitor your equipment and facilities. Give us a call to find out more! Or listen to an actual Sensaphone report by calling 610-558-4591.

Phonetics, Inc.

901 Tryens Road, Aston, PA 19014 610-558-2700 FAX: 610-558-0222
http://www.sensaphone.com

Made in the U.S.A

ENGINEERING SPECIFICATIONS
SENSAPHONE® 1108 and 1118

I. General

The Automatic dialer shall be a self-contained microprocessor controlled system capable of monitoring up to 8 alarm channels, sound level and AC power. The system shall be configured for operation by the user by means of the built-in keypad. Characteristics of Input channels include Dry Contact and Temperature.

Upon detection of any alarm or status change, the system shall commence dialing telephone numbers and deliver a voice message identifying and describing the alarm condition(s). The alarm message shall be delivered in digitized human voice using messages from the unit's internal vocabulary. The system will continue to call telephone numbers in succession until a positive acknowledgment of the alarm message is received. Acknowledgment is accomplished by depressing tone keys from the called telephone, or by calling the system back within a programmed time period. The alarm may also be acknowledged using the local keypad. In addition, the system shall be able to receive incoming telephone calls. Upon answering, the system shall recite a status report and allow enabling and disabling of monitored conditions.

The system shall be FCC and DOC registered for direct connection to the telephone network. The system shall be NRTL listed in compliance with UL Standard 1459. The system shall have a one year warranty from the manufacturer. The system shall be a Sensaphone® 1108 by Phonetics, Inc.

II. I/O Channel Attributes and Features

A. Inputs

The system shall come standard with 8 input channels, configurable as NO or NC digital dry contact or temperature.

The system shall have the following built-in monitoring features:

1. AC power failure detection
2. Temperature with pre-wired 2.8K thermistor (-20°F to 150° F) on input #1.
3. High sound level detection.

All monitored channels, including built-in monitoring features, shall allow local keypad programming of pertinent operational data including, but not limited to:

1. Input type (NO/NC or temperature)
2. High and Low limits (temperature)
3. Calibration of temperature inputs (-10° to +10°)
4. Input recognition time (0 seconds to 272 minutes)
5. Enable/disable for each channel to dialout for alarm

III. Communications Features

A. Telephone Specifications

The system shall connect to a standard 2-wire telephone line using pulse or tone, with loop start only. The system shall recognize ringer frequencies from 16 to 60 Hz. No leased or dedicated lines shall be required. The system shall also be capable of being used on the same telephone line as other answering devices. Call progress detection shall ensure that the alarm dialout is not hindered by no answers or busy signals.

B. Telephone Numbers

The system shall be capable of dialing up to 8 telephone numbers, 32 digits each. The system shall allow local keypad programming of the following telephone dialing information:

1. Dialing method (Pulse or tone)
2. Message repetitions (0 to 10)
3. Maximum number of calls (0 to 255)
4. Call delay time (0 seconds to 60 minutes)
5. Intercall delay time (10 seconds to 60 minutes)

C. Beeper/Pager Dialout

The system shall be capable of intelligently dialing out to a numeric beeper or pager. The dialing sequence shall be programmable such that the pager number is dialed, the system waits for the telephone to be answered, and then additional identification DTMF digits are transmitted.

D. Line Seizure Feature (Model 1118 only)

The system automatically seizes control of the phone line to make an alarm phone call when the alarm occurs. All other calls, including current calls, will disconnect and all extensions will be disabled. Extensions will remain cut off until the alarm is acknowledged.

IV. Programming

A. Local Programming

The System shall contain an integral, sealed keypad for the purpose of locally programming all system data. Programming is assisted by digitized voice guidance.

B. Remote Programming

The system shall be remotely programmable using a standard touch-tone telephone. The following parameters may be remotely programmed:

1. Disable/enable inputs
2. Disable/enable AC power monitoring

G. Environmental

The system shall function over an operating range of 32° F - 120° F at up to 0 - 90% RH, non-condensing.

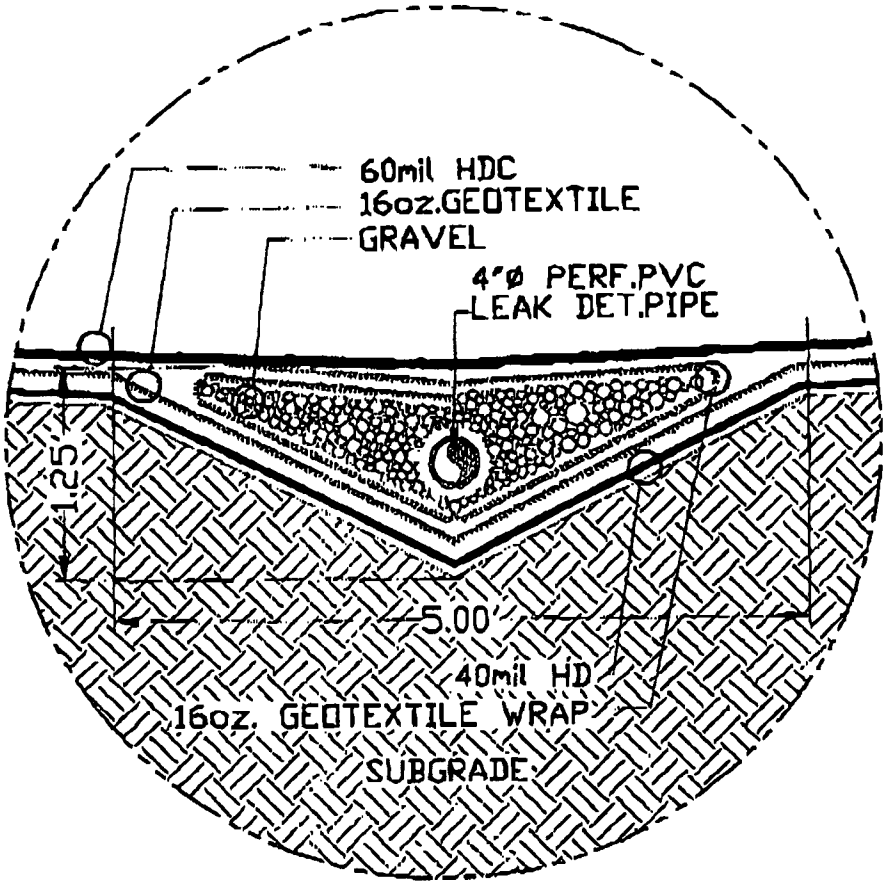
H. Maintenance

The system manufacturer shall have in-house service facilities and technical assistance available during normal business hours , Monday-Friday, 8am-5pm (EST).

Specifications subject to change without notice.

Phonetics, Inc.
901 Tryens Road
Aston, PA 19014
Phone: (610)558-2700 FAX: (610)558-0222
www.sensaphone.com

EVAPORATION POND DETAILS



LEACHATE DETAIL

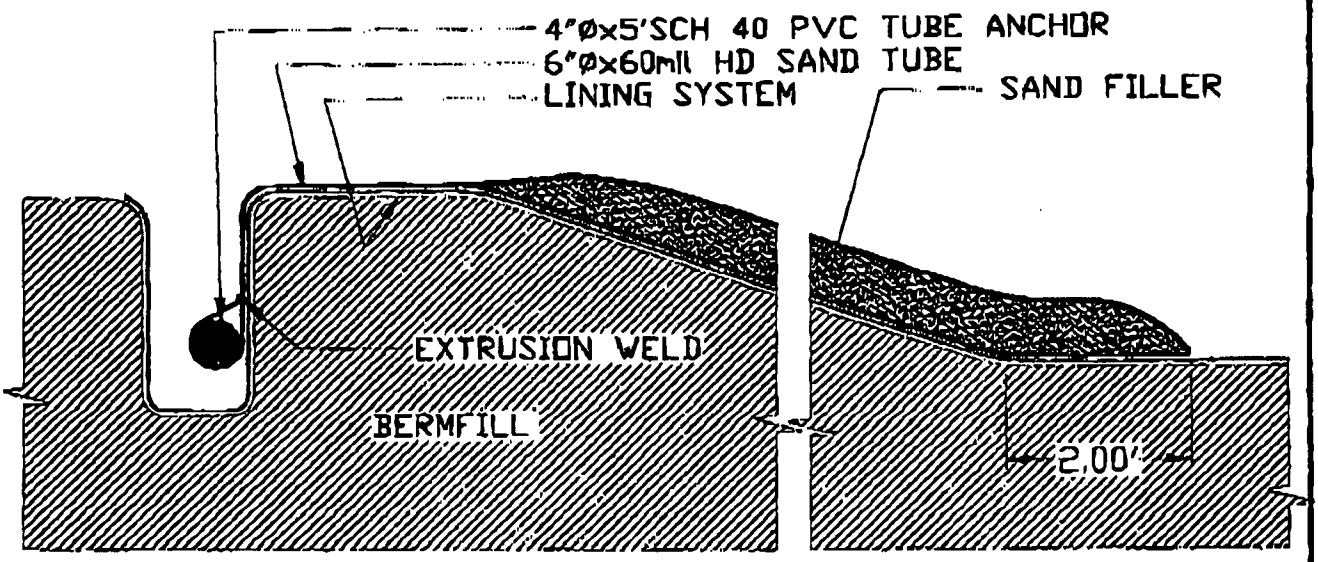
FALCON ENVIRONMENTAL
LINING SYSTEMS, INC.
5200 Johnson Road, Odessa, Tx. 79760
(915) 366 2911 FAX - 366 2999

DRAWN BY: JASON
DATE: 01/28/03
APPROVED BY:
DATE:
SCALE: AS SHOWN

DRAWING TITLE
LEACHATE DETAIL
PROJECT/LOCATION
PHASE II

MATERIALS
60 MIL HD
60 MIL HDPE
GEOCOMPOSITE
GEOTEXTILE

PROJECT NO.
DRAWING NO. 1/1



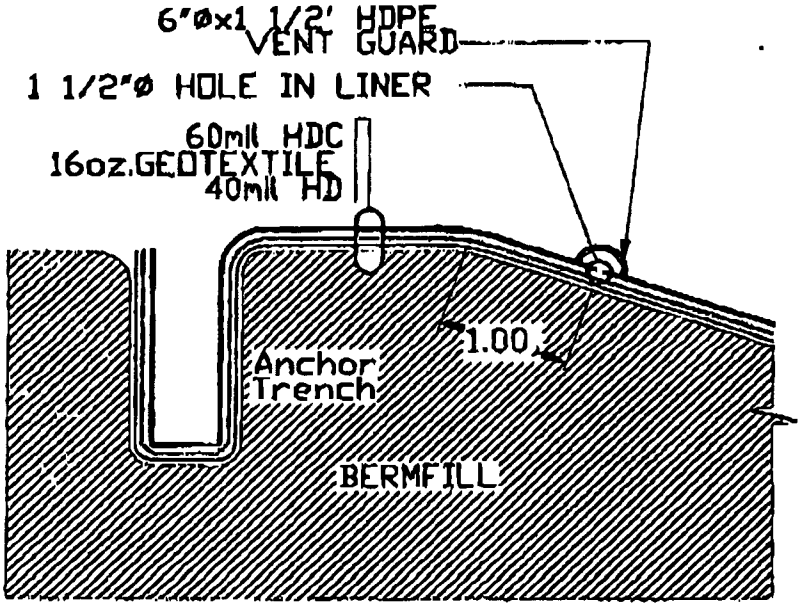
SAND TUBE DETAIL

FALCON ENVIRONMENTAL
LINING SYSTEMS, INC.
8200 Johnson Road, Odessa, Tx. 79760
(915) 366 2911 FAX - 366 2999

DRAWN BY: JASMIN
DATE: 12/11/02
APPROVED BY:
DATE:
SCALE: As noted

DRAWING TITLE
SAND TUBE DETAIL
PROJECT/LOCATION
LINER INSTALLATION DETAILS

MATERIAL: HDPE
PROJECT NO.
DRAWING NO.



AIR VENT DETAIL

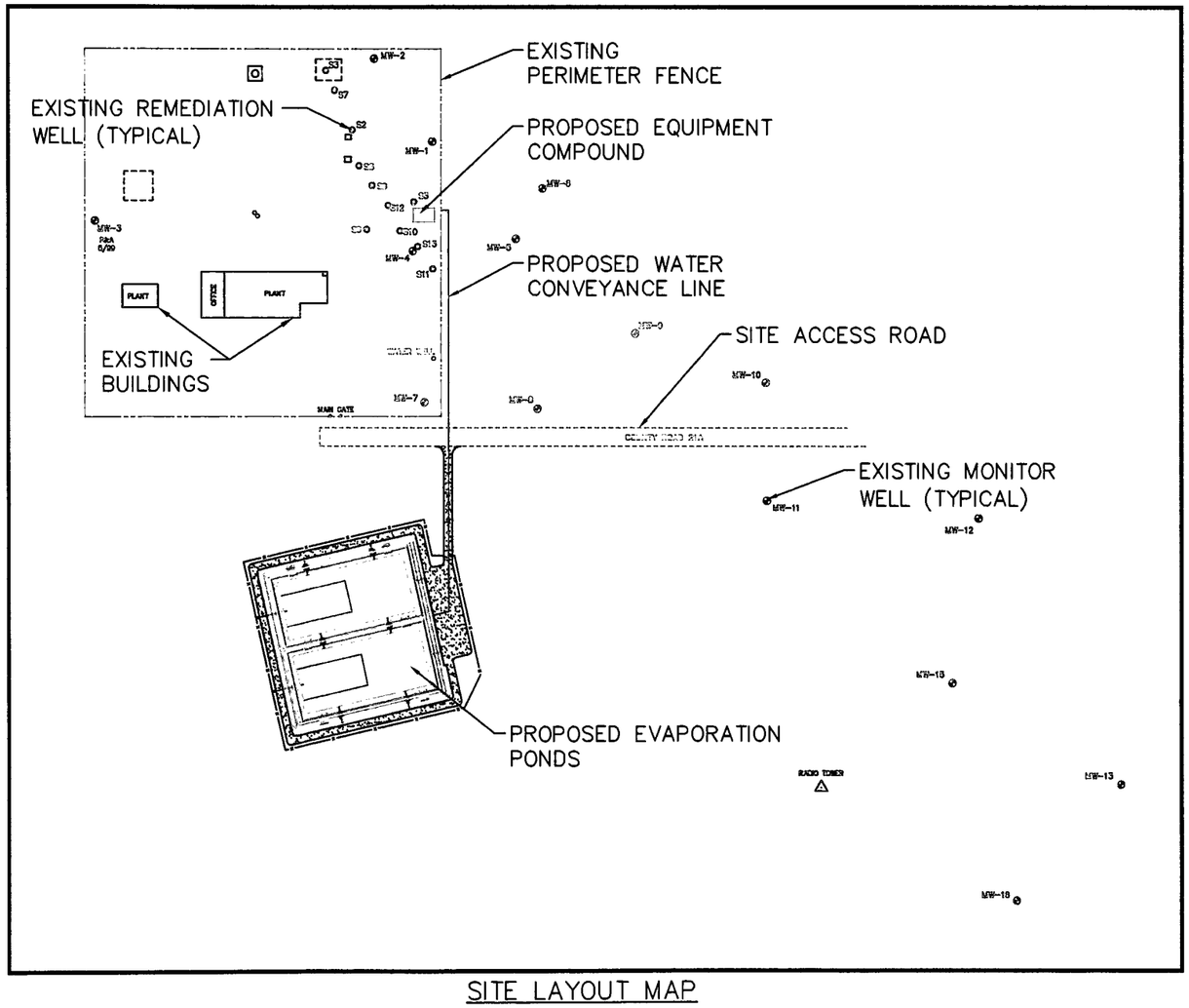
FALCON ENVIRONMENTAL
LINING SYSTEMS, INC.
5900 Johnson Road, Odessa, Tx. 79760
(915) 366 2911 FAX - 366 2999

DRAWN BY: JAKMIN	DRAWING TITLE: AIR VENT DETAIL
DATE: 12/11/02	PROJECT/LOCATION: LINER INSTALLATION DETAILS
APPROVED BY:	MATERIALS:
DATE:	PROJECT NO.
SCALE: As Shown	DRAWING NO. 1 of 1

APPENDIX E
DESIGN DRAWINGS

INDEX OF DRAWINGS

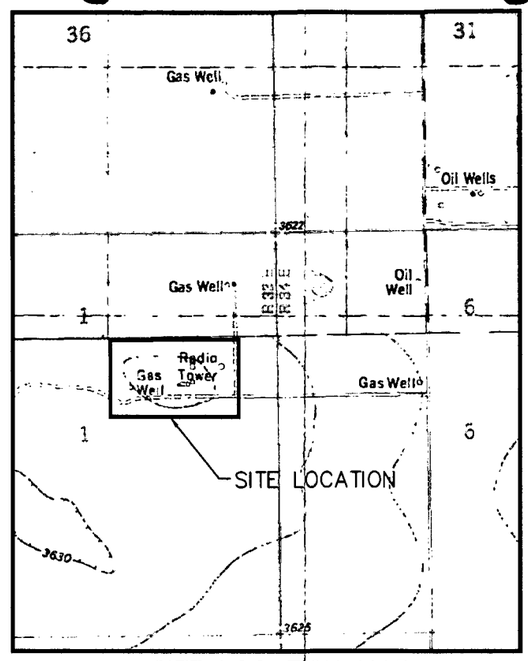
Dwg	Description
G-1	Index of Drawings, Vicinity Map, Site Location Map and Site Layout Map
G-2	Distribution of Groundwater Contamination–Benzene
C-1	Site Plan and Equipment Layout
C-2	SVE Wellhead, Valve Box and Trench Details
C-3	Manifold Details
C-4	Evaporation Pond Grading Plan
C-5	Evaporation Pond Grading Plan Details
P-1	Process Flow Diagram



SITE LAYOUT MAP

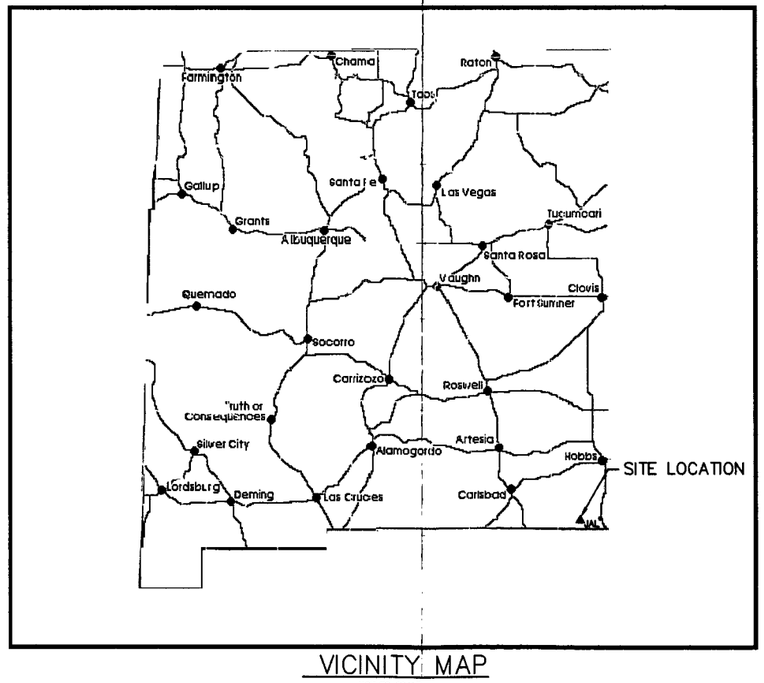
0 50 100 200 250 300 feet

SCALE 1"=200'



SITE LOCATION MAP

SCALE 1"=2000'



VICINITY MAP

NOT TO SCALE

S:\DATASHAR\Cypress Engineering\Bell Lake\Figures\Sheets\G-1.dwg

REVISIONS

REV.	DATE	DRWN	CHKD	REMARKS

Tetra Tech EM Inc.

DESIGNED BY: RM
DRAWN BY: RM
CHECKED BY: RM

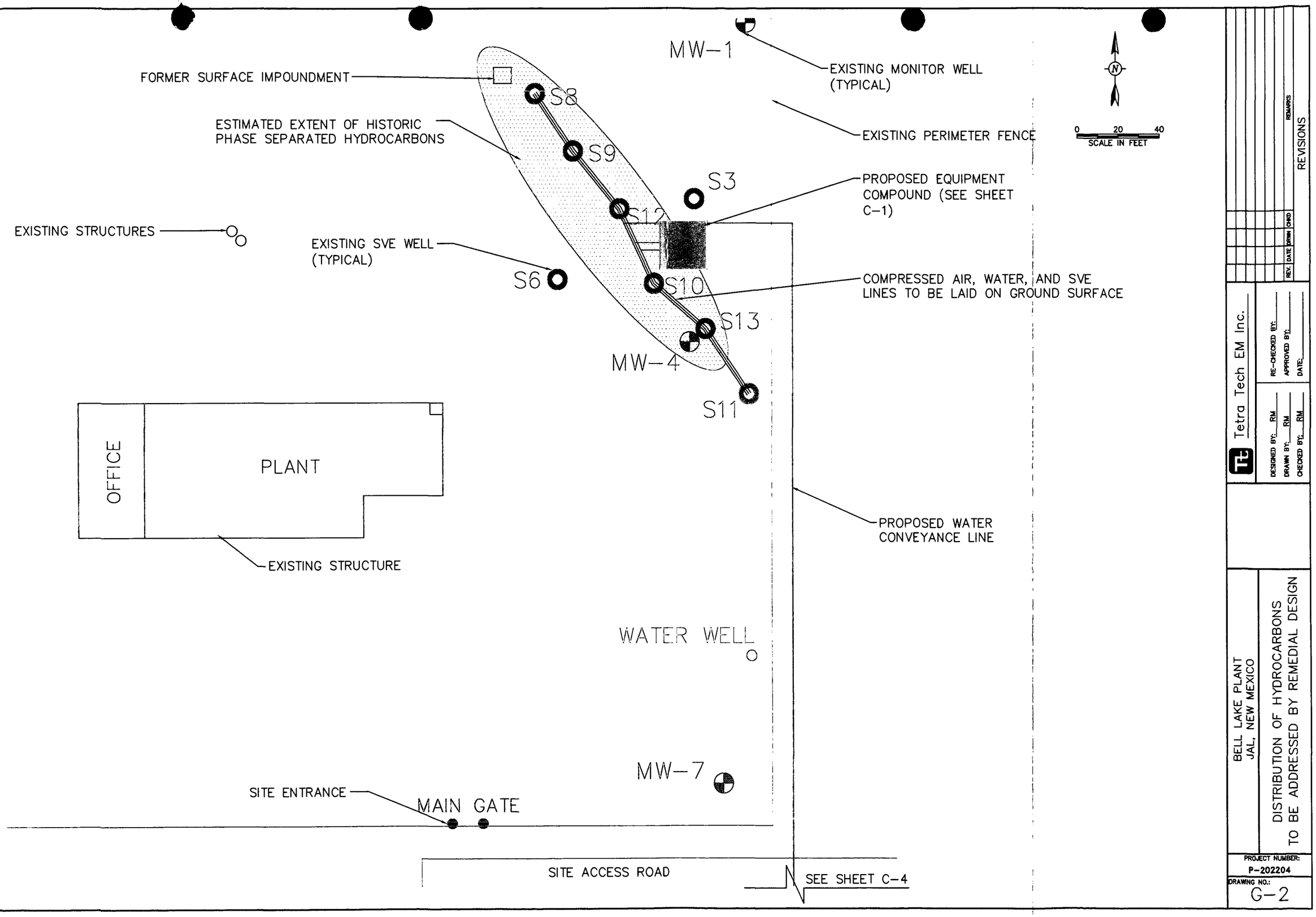
RE-CHECKED BY:
APPROVED BY:
DATE:

BELL LAKE PLANT
JAL, NEW MEXICO

INDEX OF DRAWINGS, VICINITY MAP, SITE LOCATION MAP AND SITE LAYOUT MAP

PROJECT NUMBER: P-202204

DRAWING NO.: G-1



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Tetra Tech EM Inc.

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RE-CHECKED BY:
APPROVED BY:
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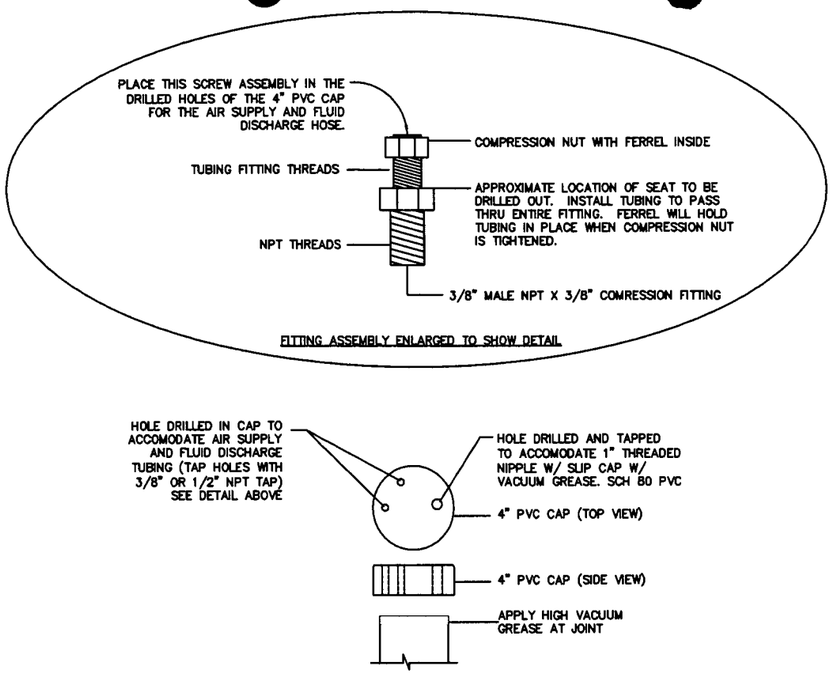
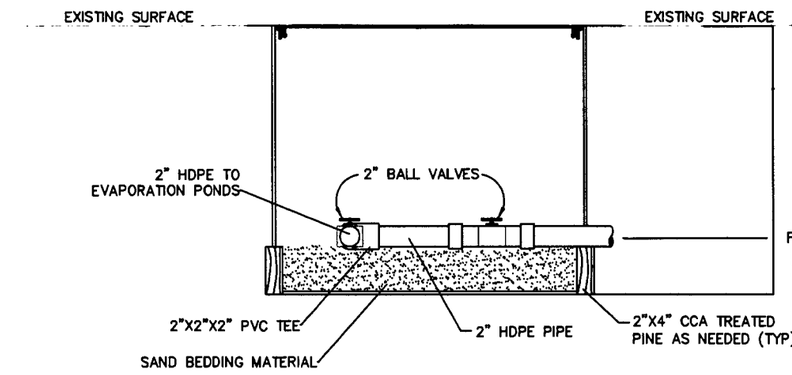
BELL LAKE PLANT
JAL, NEW MEXICO

DISTRIBUTION OF HYDROCARBONS TO BE ADDRESSED BY REMEDIAL DESIGN

PROJECT NUMBER: P-202204
DRAWING NO.: G-2

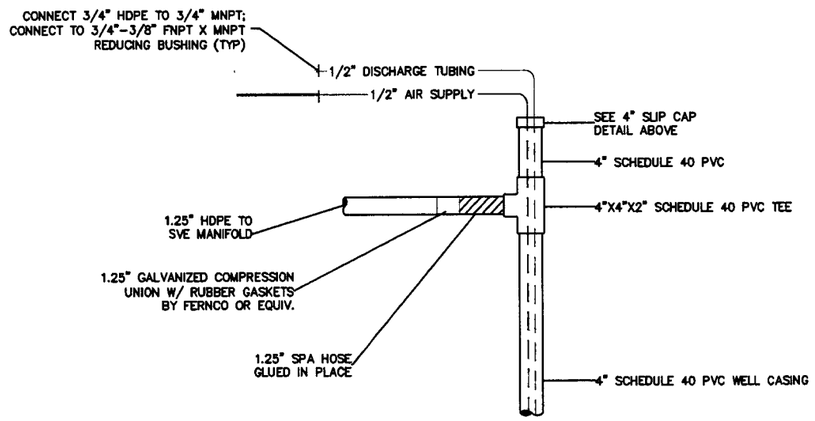


4" PVC SLIP CAP AND FITTING ASSEMBLY DETAIL
NTS

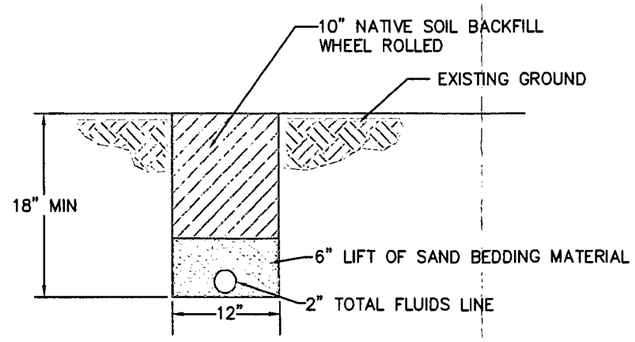


NOTE:
IRRIGATION VALVE BOX SHALL BE 13"X24"X15" DEEP, NDS 125BCB OR EQUIVALENT. EXTENSIONS BELOW BOXES (AS NEEDED) SHALL BE CONSTRUCTED OF CCA-TREATED PINE.

2" WATER CONVEYANCE LINE VALVE BOX DETAIL
NTS



SVE WELLHEAD DETAIL
NTS



TRENCH DETAIL-TYPICAL
NTS

REVISIONS				
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Tetra Tech EM Inc.

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BELL LAKE PLANT
JAL, NEW MEXICO

SVE WELLHEAD, VALVE BOX, AND TRENCH DETAILS

PROJECT NUMBER: P-202204
DRAWING NO.: C-2

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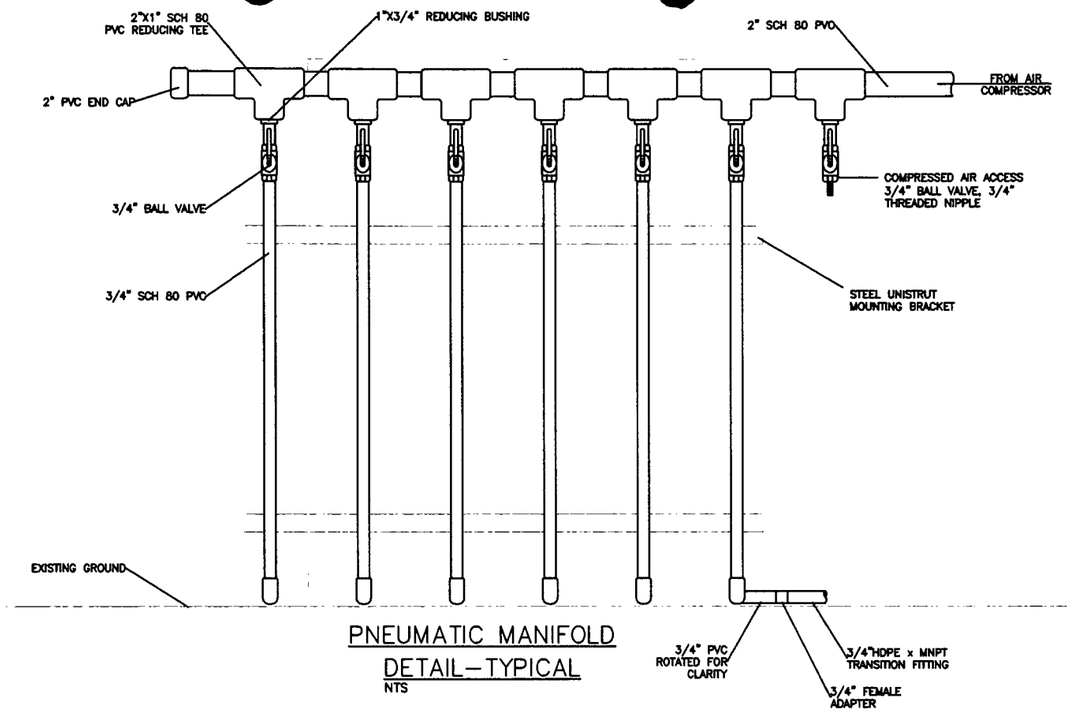
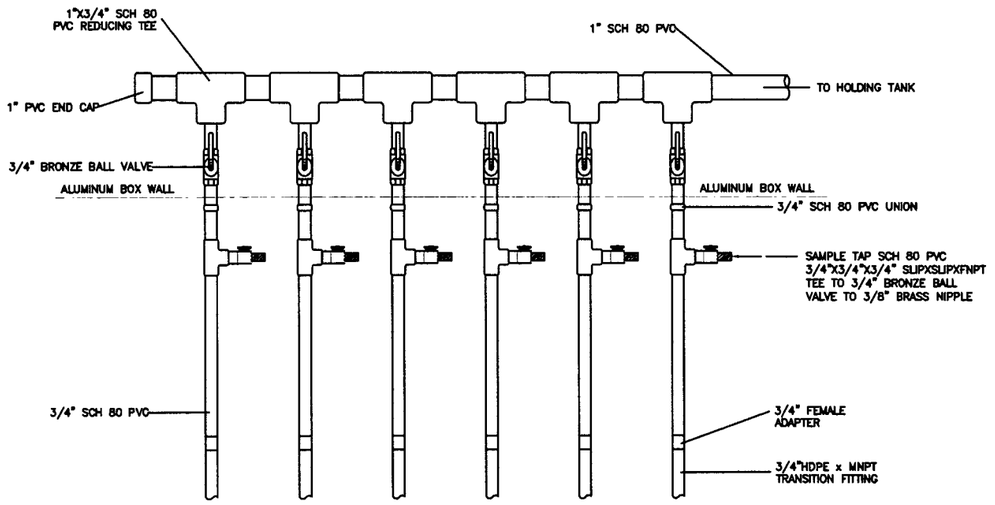


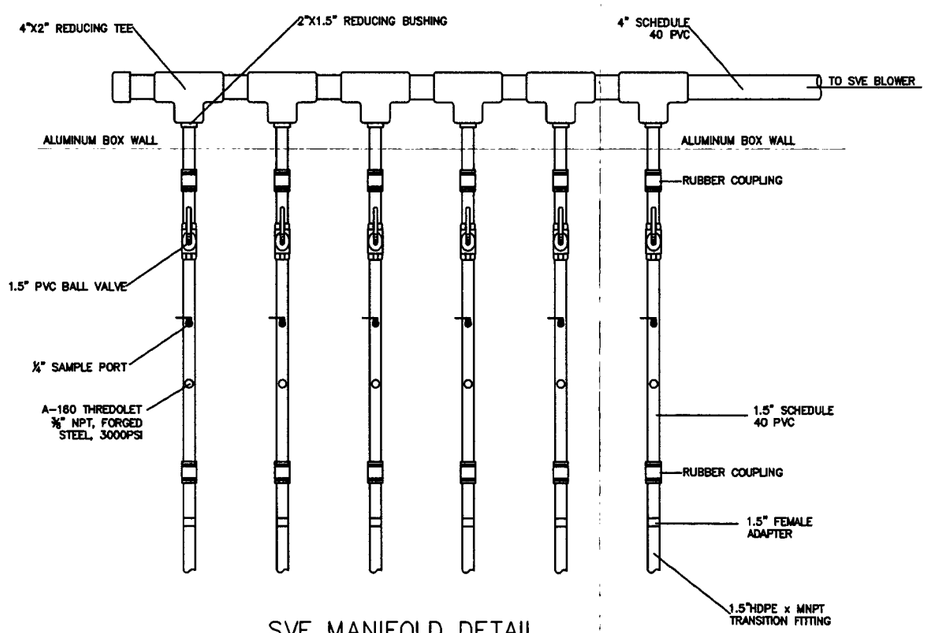
PNEUMATIC MANIFOLD DETAIL–TYPICAL
NTS

NOTES

SEE PHOTOGRAPHS AND SPECIFICATIONS FOR BELOW GRADE BOX WITH KNOCKOUT (MOISTURE SEPARATOR).



TOTAL FLUIDS MANIFOLD DETAIL–PLAN VIEW (TYP)
NTS



SVE MANIFOLD DETAIL PLAN VIEW (TYP)
NTS

REVISIONS				
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Tetra Tech EM Inc.

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BELL LAKE PLANT
JAL, NEW MEXICO

MANIFOLD DETAILS

PROJECT NUMBER: P-202204

DRAWING NO.: C-3

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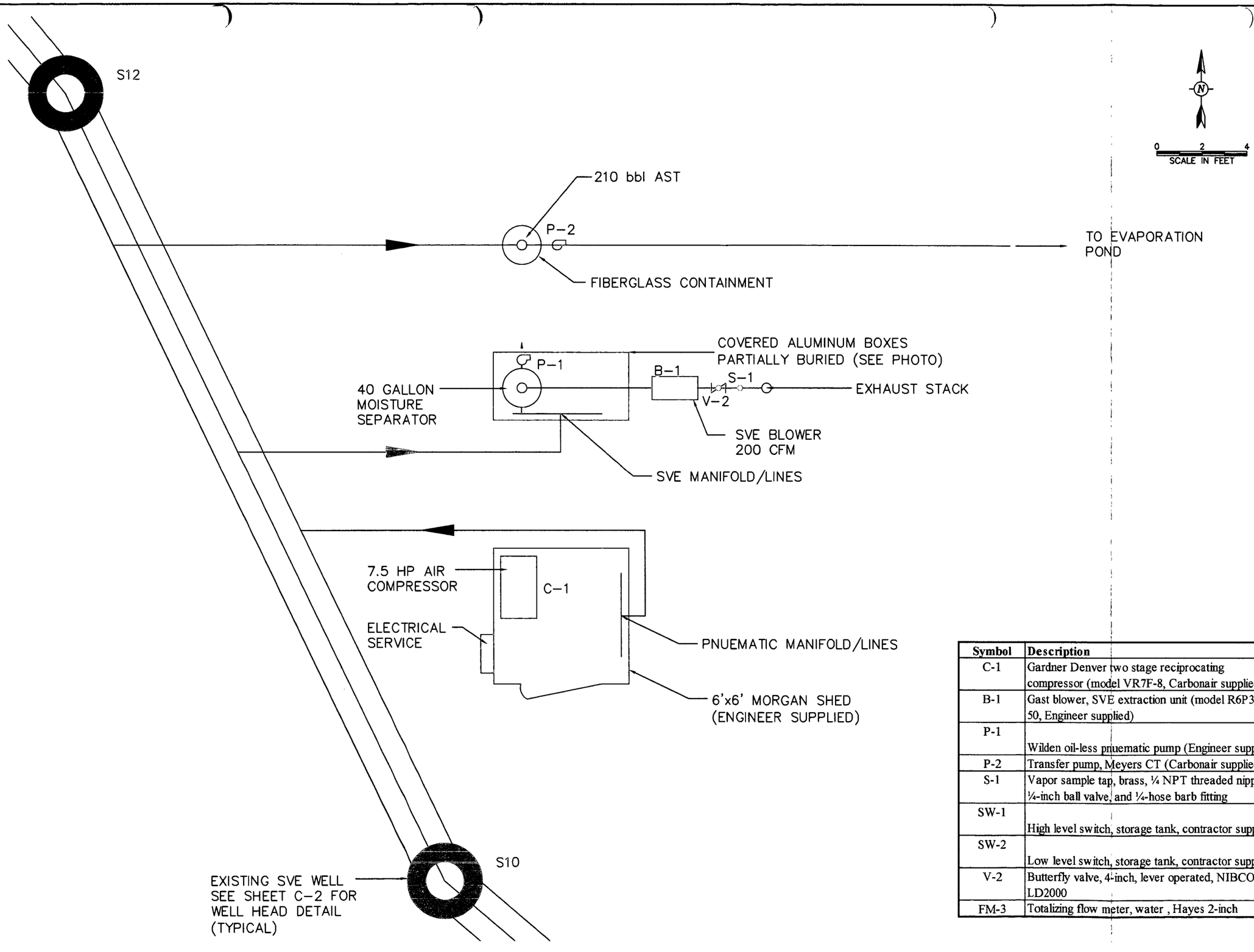

Symbol	Description	Number
C-1	Gardner Denver two stage reciprocating compressor (model VR7F-8, Carbonair supplied)	1
B-1	Gast blower, SVE extraction unit (model R6P355R-50, Engineer supplied)	1
P-1	Wilden oil-less pnuematic pump (Engineer supplied)	1
P-2	Transfer pump, Meyers CT (Carbonair supplied)	2
S-1	Vapor sample tap, brass, ¼ NPT threaded nipple, ¼-inch ball valve, and ¼-hose barb fitting	1
SW-1	High level switch, storage tank, contractor supplied	1
SW-2	Low level switch, storage tank, contractor supplied	1
V-2	Butterfly valve, 4-inch, lever operated, NIBCO # LD2000	1
FM-3	Totalizing flow meter, water , Hayes 2-inch	1

REVISIONS

REV.	DATE	DRWN	CHKD	REMARKS

Tetra Tech EM Inc.

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BELL LAKE PLANT
JAL, NEW MEXICO

ON-SITE EQUIPMENT LAYOUT

PROJECT NUMBER: P-202204
DRAWING NO.: C-1

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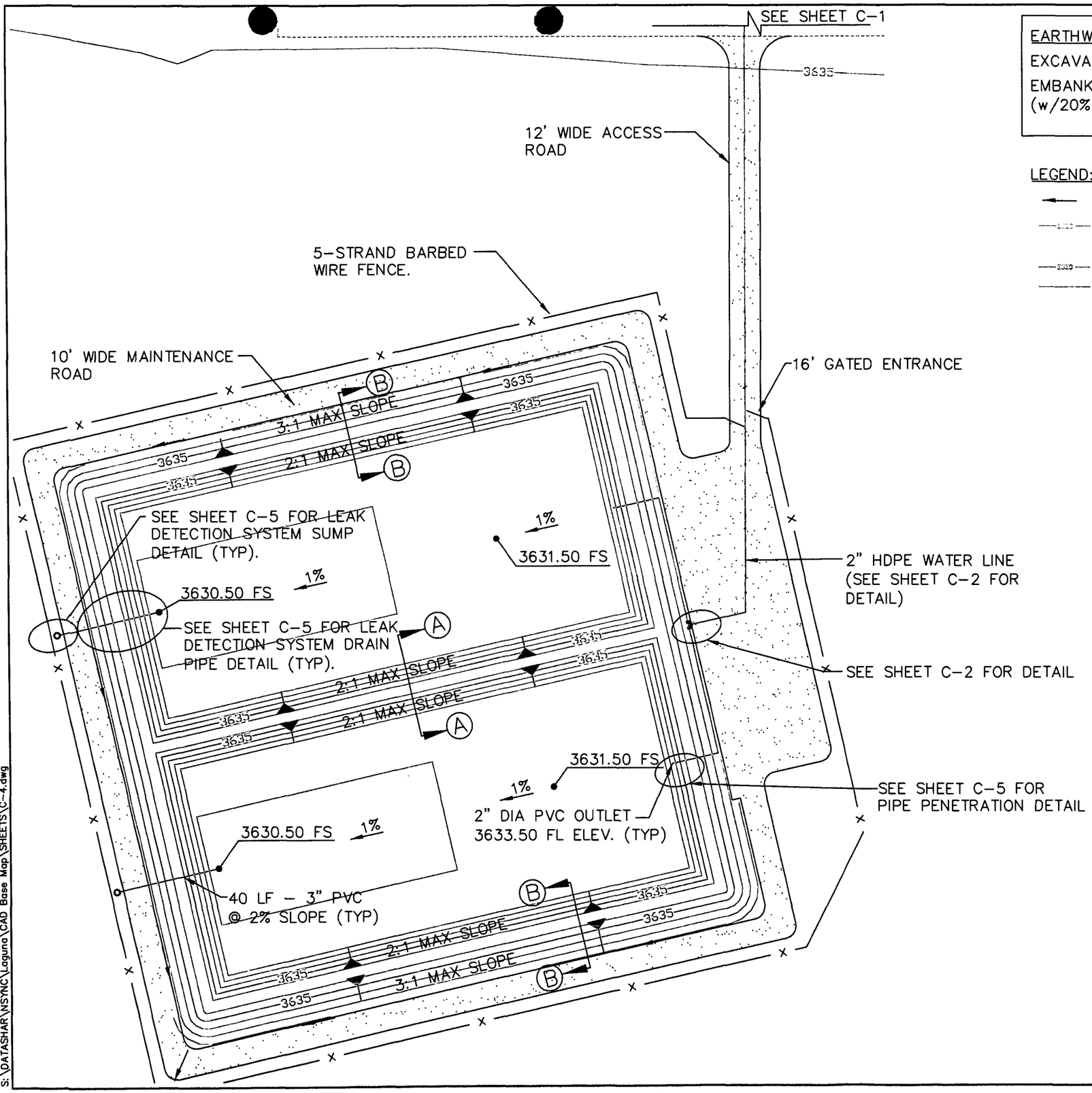

EARTHWORK:	
EXCAVATION:	1,760 CY
EMBANKMENT: (w/20% EXPANSION)	1,950 CY

N

0 20 40
SCALE IN FEET

LEGEND:

- DIRECTION OF SURFACE FLOW
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED CONTOUR

NOTES:

1. EVAPORATION PONDS TO BE CONSTRUCTED WITH CLEAN EMBANKMENT FREE OF ROCKS, STUMPS, CLODS, OR OTHER DEBRIS. BED OF PONDS AND INSIDE GRADE OF LEVEE SHALL BE COMPACTED TO A SMOOTH FINISH.
2. PRIMARY HDPE LINER SHALL BE A MIN OF 60 MIL THICK AND SECONDARY HDPE LINER SHALL BE A MIN OF 40 MIL THICK AND SHALL HAVE A RESISTANCE TO TEARS OR PUNCTURES AND ULTRAVIOLET LIGHT. A 200 MIL THICK HDPE GEONET LAYER SHALL BE PLACED BETWEEN THE PRIMARY AND SECONDARY LINER.
3. THE LINER SHALL BE PLACED IN THE ANCHOR TRENCH AND THE TRENCH BACKFILLED. THE ANCHOR TRENCH SHALL EXTEND THE ENTIRE PERIMETER OF THE POND.
4. SAND TUBES AS SHOWN IN APPENDIX D OF REMEDIATION PLAN SHALL BE INSTALLED APPROXIMATELY EVERY 50 FEET ALONG THE POND PERIMETER.
5. AIR VENTS AS SHOWN IN APPENDIX D OF REMEDIATION PLAN SHALL BE INSTALLED APPROXIMATELY EVERY 100 FEET ALONG THE POND PERIMETER.

REVISIONS

REV.	DATE	DRWN	CHKD	REMARKS

Tetra Tech EM Inc.

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APPROVED BY:
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BELL LAKE PLANT
JAL, NEW MEXICO

EVAPORATION POND
GRADING PLAN

PROJECT NUMBER: P-202204
DRAWING NO.: C-4

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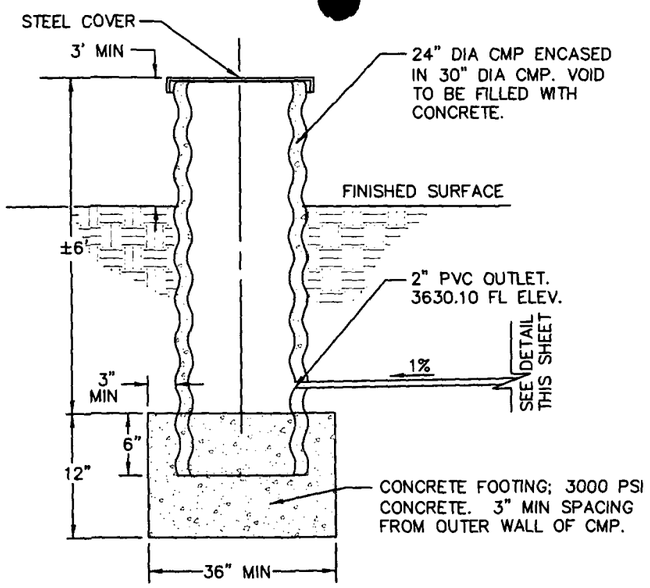
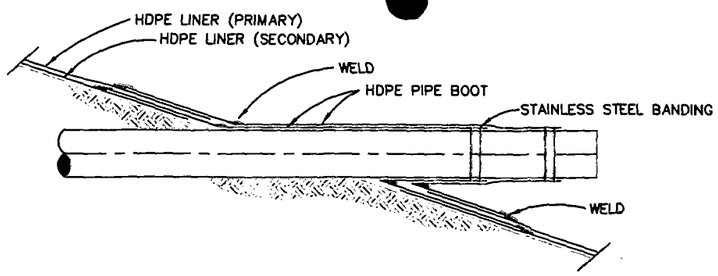
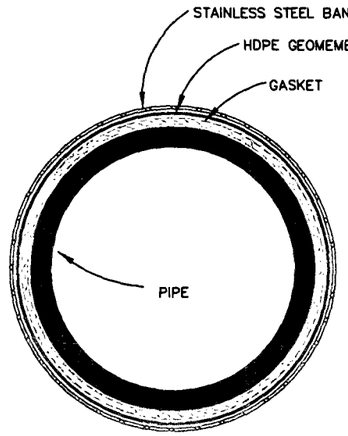


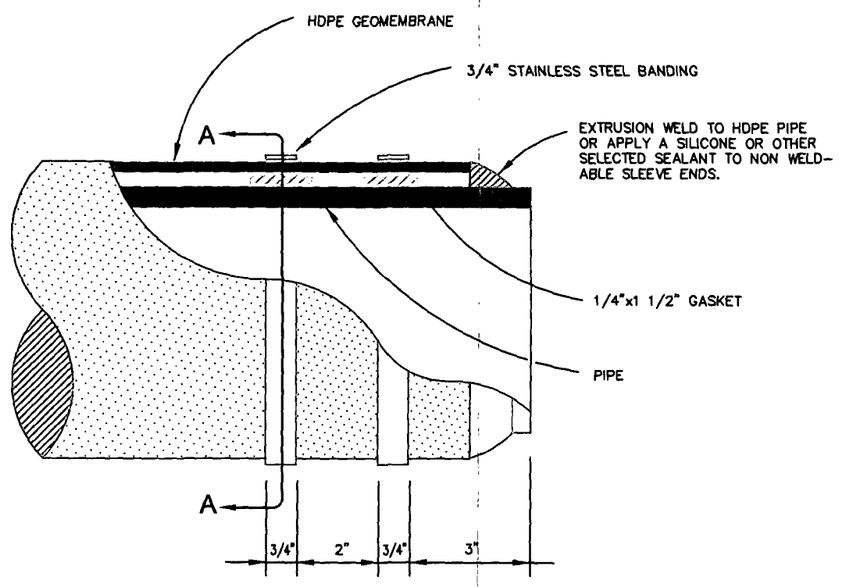
LEAK DETECTION SYSTEM SUMP DETAIL (TYPICAL)
NTS



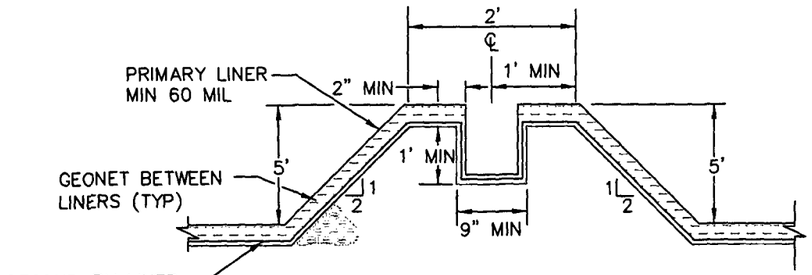
DOUBLE BOOTED PIPE PENETRATION DETAIL (TYP)
NTS



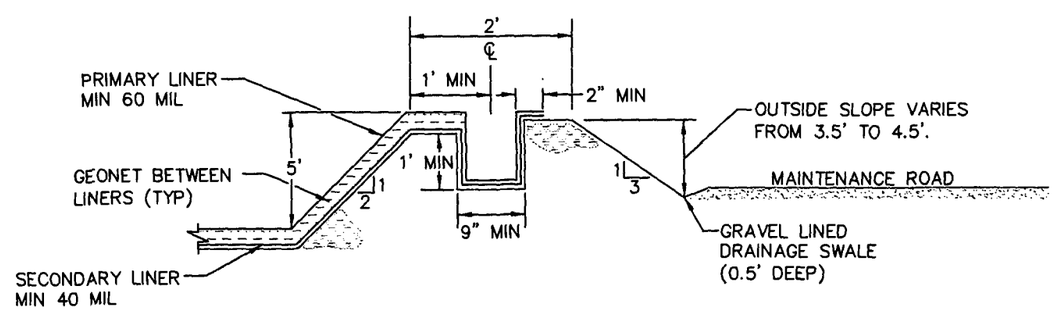
SECTION A-A



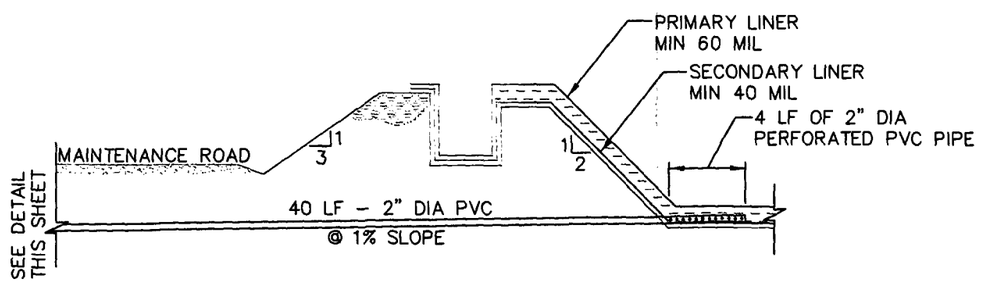
PIPE PENETRATION SEAL DETAIL (VERTICAL OR HORIZONTAL)
NTS



BERM DETAIL A (TYPICAL)
NTS



BERM DETAIL B (TYPICAL)
NTS



LEAK DETECTION SYSTEM DRAIN PIPE DETAIL (TYPICAL)
NTS

REVISIONS				
REV.	DATE	DRWN	CHKD	REMARKS

Tetra Tech EM Inc.

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DRAWN BY: RM
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RE-CHECKED BY:
APPROVED BY:
DATE:

BELL LAKE PLANT
JAL, NEW MEXICO

EVAPORATION POND
GRADING PLAN

PROJECT NUMBER:
P-202204

DRAWING NO.:
C-5

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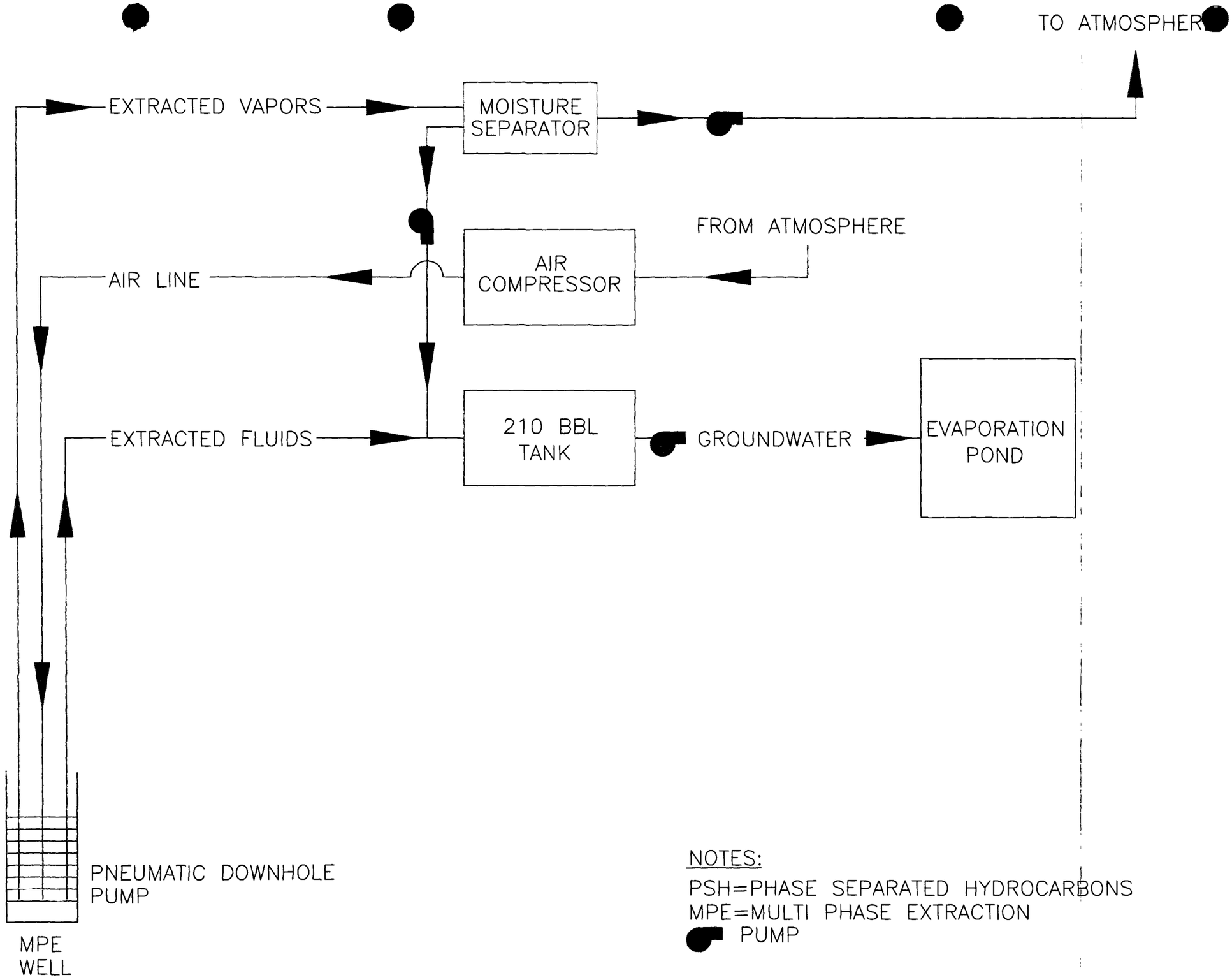

NOTES:

PSH=PHASE SEPARATED HYDROCARBONS
MPE=MULTI PHASE EXTRACTION
PUMP

Tetra Tech EM Inc.

REVISIONS

REV.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: RM
DRAWN BY: RM
CHECKED BY: RM
RE-CHECKED BY:
APPROVED BY:
DATE:

BELL LAKE PLANT
JAL, NEW MEXICO

PROCESS FLOW DIAGRAM

PROJECT NUMBER: P-202204

DRAWING NO.: P-1