

CERTIFIED MAIL

January 30, 2009
In Reply Refer to SHEA 108213



Mr. Norman Riley
Project Director
California Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826

**RE: Workplan Groundwater Interim Measures Addendum
Santa Susana Field Laboratory – Ventura County, California**

Dear Mr. Riley:

Pursuant to DTSC's letter of November 2008 and subsequent email communication, Boeing is submitting the Workplan – Groundwater Interim Measures Addendum, Santa Susan Filed Laboratory, prepared by MWH and dated February 2009 in behalf of the Boeing Company, the Department of Energy, and the National Aeronautics and Space Administration. This workplan is being submitted under separate cover today.

Please address any questions regarding this workplan to Mr. David Dassler at (661)210-5673.

Sincerely,

A handwritten signature in blue ink, appearing to read "Randy Chelici - for".

Mr. Thomas Gallacher

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: Randy Ueshi for Tom Gallacher
Name: Randy Ueshi for Tom Gallacher
Title: SSFL EHS Site Executive
Date: 1/28/09



TDG:bjw

Enclosures (as noted)

cc: Mr. G. Abrams, DTSC Sacramento	(8 hard copies, 12 CDs)
Mr. T. Seckington, DTSC, Cypress	(2 hard copies, 2 CDs)
Ms. S. Houghton, DTSC, Berkeley	(1 CD)
Ms. K. Grisso, CH2M Hill	(1 CD)
Mr. W. Jeffers, DTSC, Chatsworth	(1 hard copy, 1 CD)
Mr. A. Elliott, NASA, MSFC	(1 hard copy, 1 CD)
Mr. T. Johnson, DOE, SSFL	(1 hard copy, 1 CD)
Ms. P. Berry, DOE, Oakland	(1 hard copy, 1 CD)
Mr. R. Marshall, CSUN, Oviatt Library	(1 hard copy)
Ms. D. Redfield, Simi Valley Library	(1 hard copy)
Ms. L. Light, LA Public Library, Platt Branch	(1 hard copy)

TRANSMITTAL

**MWH**

2121 N California Blvd. Suite 600
Walnut Creek, California 94596

Date: January 30, 2009

Tel: 925/627-4500
Fax: 925/627-4501

To: Gerard Abrams
DTSC Regional Office
8800 Cal Center Drive
Sacramento, CA 95826-3200

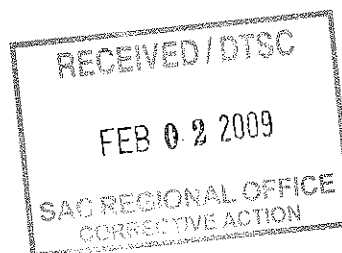
From: Rich Andrachek
Re: Santa Susana Field Laboratory,
Ventura County, CA

The following items are:

☐ Requested	☒ Enclosed	☐ Sent Separately via _____
☒ Report	☐ Specification	☐ Cost Estimate
☐ Test Result	☐ Prints	☐ Shop Drawings
		☐ Other

No. of Copies	Description
8 Hard Copy 12 Electronic on CD	Addendum to the Groundwater Interim Measures Work Plan (Rev 2), Santa Susana Field Laboratory

Copy: Dave Dassler, The Boeing Company



**ADDENDUM TO REVISION 2 OF THE WORK PLAN FOR
GROUNDWATER INTERIM MEASURES**

**SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA**

February 2009

Prepared for:

The Boeing Company
The National Aeronautics and Space Administration
The United States Department of Energy

Prepared by:

MWH
618 Michillinda Avenue
Suite 200
Arcadia, California 91007

Hargis + Associates
Mission City Corporate Center
2365 Northside Drive
Suite C-100
San Diego, California 92108

Professional Certification
Groundwater Interim Measures Work Plan Addendum
Santa Susana Field Laboratory
Ventura County, California
February 2009

This work plan addendum has been prepared by a team of qualified professionals under the supervision of the senior staff whose seals and signatures appear below. The findings, interpretations of data, drawings, specifications or professional opinions are presented within the limits of the available information at the time this document was prepared, in accordance with generally accepted professional geologic and engineering practices and within the requirements of the clients. There is no other warranty, either expressed or implied.

Information included in this document is based on available data obtained from public and private sources. Additional work may or may not disclose information that may modify its findings or conclusions. In the event that there are appreciable changes in the nature and/or design of the project, or if additional subsurface data become available, the findings and/or conclusions contained in this document may require further evaluation by the qualified professionals who participated in its preparation.


Simon Bluestone, P.G.
MWH Americas, Inc.




Christopher Liles, P.E.
Hargis + Associates



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B	Process Description
C	Description of Planned Construction and Groundwater Interim Measures Extraction Wells and GETS and Project Schedule
D	Operation and Maintenance and Monitoring Manual, Santa Susana Field Laboratory, Extraction and Treatment System, December 2008

1.0 INTRODUCTION

This document is an addendum to revision 2 of the Groundwater Interim Measures Work Plan (MWH, 2008, GW IM Work Plan) for the Santa Susana Field Laboratory (SSFL) in Ventura County, CA. This addendum is being provided in response to comments on the GW IM Work Plan provided by the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) in a letter dated November 3, 2008. A copy of DTSC's November 3, 2008 comment letter is provided in Attachment A. The SSFL is jointly owned by The Boeing Company (Boeing) and the federal government (administered by the National Aeronautics and Space Administration [NASA]), portions of which are or have been operated by Boeing. The U.S. Department of Energy (DOE) owns facilities and structures on a portion of the SSFL. However, there are no longer any active DOE operations and some of the facilities have undergone decommissioning and demolition.

The SSFL is located in the southeast corner of Ventura County, 29 miles northwest of downtown Los Angeles, California. The location of the SSFL and its surrounding vicinity is shown on Figure 1-1. Previous environmental investigations have shown that the groundwater beneath portions of the SSFL has been impacted by historic releases of chemicals from operational activities, with trichloroethene (TCE) being the compound detected at the highest concentration and with the greatest frequency. This addendum to the GW IM Work Plan has been prepared by MWH and Hargis+Associates on behalf of Boeing, NASA and DOE.

2.0 FORMAT AND CONTENT OF ADDENDUM

DTSC's comments to the GW IM Work Plan required new and/or additional information beyond that provided in the GW IM Work Plan. As such, the SSFL made a request of DTSC to allow the submittal of new and/or additional information to be provided as an addendum to the IM work plan. This request was memorialized in a letter to DTSC from Boeing dated December 1, 2008 (copy provided in Attachment A). The letter also requested an extension of the required submittal date of responses to DTSC's comments to February 1, 2009. DTSC subsequently approved of the SSFL's request in an electronic mail transmittal dated December 10, 2008 (copy provided in Attachment A).

This addendum includes a series of attachments that contain the new and/or additional information that is being requested by DTSC in their comments. Table 1 identifies the information requested by DTSC, the corresponding attachment within this addendum where the information is provided and a descriptive response to the comment provided by DTSC.

TABLE 1

Table 1
New/Additional Information Requirements for the Groundwater Interim Measures Work Plan (Rev 2)
Contained in DTSC's Letter Dated 11/3/08

DTSC Requirement	Information Contained in Attachment	Description of Response:
1. Detailed maps, figures and narratives must be included to describe construction of the conveyance piping from the extraction wells to the new Groundwater Extraction and Treatment System (GETS). Information must be included in sufficient detail so that a CEQA determination can be made regarding environmental impacts that the construction of the piping may have.	D	Maps and figures of the planned alignment for the extraction well piping are provided as Figures D-1 and D-2 in Attachment D of this addendum. A narrative description of the construction of the conveyance piping from the extraction wells to the new GETS is provided in section 2.2.1 of Attachment D.
2. Planned GETS must be described via maps, figures, and, narratives. The capacity of the GETS and the flow from each planned extraction well should be shown clearly. Show the total capacity of the GETS and what part of the capacity will be used by the GW IM extraction wells.	B & D	A narrative description of the GETS that identifies the capacity of the GETS and that part of the capacity to be used for the GW IM extraction wells is provided in Attachment B. The flow from each well is shown on Figure D-1 provided in Attachment D. The GETS process equipment is shown on Figure D-3.
3. Narrative description and schedules of the integration of the GW IM Work Plan and the GETS must be included to show the planned construction of both projects.	C	A narrative description of the schedule integrating the GW IM Work Plan and the GETS that shows the planned construction of both projects is provided in Attachment C. This attachment also depicts the detail for implementing the groundwater interim measures.
4. Submit detailed schedule for the implementation of the GW IM.		
5. Submit construction and equipment details for the well	D	Construction details for the well pumps, valves, well placement and conveyance piping are shown in Figure D-2 of Attachment D.

DTSC Requirement	Information Contained in Attachment	Description of Response:
pumps, valves, well placement, and conveyance piping.		Equipment details are provided as appendices in Attachment D.
6. Submit operation and maintenance plan that includes performance standards, a list and schedule of monitoring data needed to determine if the performance standards are being met, procedures to maintain/adjust the system to meet performance standards and quarterly reporting to DTSC regarding system performance and any requirement to modify or adjust the system.	D	An operation, maintenance and monitoring manual is provided in Attachment D. Normal operating procedures are described in section 5 of Attachment D. Performance objectives, data needs and procedures for the groundwater interim measures extraction wells are provided in Table D-2. Permit compliance on the performance of the GETS will be consistent with that specified in the NPDES and Ventura County APCD operating permits, copies of which are provided in Appendix A of Attachment D.

ATTACHMENTS

ATTACHMENT A

CORRESPONDENCE BETWEEN DTSC AND BOEING



Linda S. Adams
Secretary for
Environmental Protection



Department of Toxic Substances Control

Maureen F. Gorsen, Director
5796 Corporate Avenue
Cypress, California 90630



Arnold Schwarzenegger
Governor

To: Christopher Sherman, P.E.
Senior Engineer
Brownfields and Environmental Restoration Program

From: Thomas M. Seckington, C.H.G. *THS*
Senior Engineering Geologist
Geological Services Unit - Cypress
Geology and Remediation Engineering

Date: September 8, 2008

Subject: Work Plan (Revision 2), Groundwater Interim Measures
Santa Susana Field Laboratory dated July 2008

PCA: 22120

Site Code: 300381-48

MPC: 37

The Geological Services Unit (GSU) has reviewed the Work Plan (Revision 2), Groundwater Interim Measures (work plan). The work plan proposes groundwater extraction at 14 locations at the Santa Susana Field Laboratory (SSFL) and generally meets the requirements in the May 16, 2008 DTSC letter.

The GSU recommends approval of the scope of work described in the work plan with the following clarifications and requirements.

1. Similar to previous revisions of the work plan, a significant portion of this revision presents the Boeing Company's site conceptual model (SCM) for the fate and transport of the contaminants in the groundwater at the site. In general, the SCM states that contaminant movement is strongly attenuated through several physical, chemical, and biological processes. The most dominant of these processes is matrix diffusion, in which active remediation would be inefficient and unnecessary. It is DTSC's position that the SCM is a working hypothesis. Characterization activities are not completed at the site and new emerging remediation approaches have not been sufficiently evaluated at the site. Furthermore, The Boeing Company (Boeing) has conceded that several key elements of the conceptual model still require additional evaluation and data collection.

It is therefore appropriate and necessary to initiate groundwater interim measures that this time. The groundwater is contaminated with elevated

concentrations of TCE and perchlorate near the former release locations. The overlying unsaturated zone is contaminated and raising water levels could remobilize these contaminant masses. There is movement of contaminants in the southern buffer zone and offsite to the northeast.

2. The work plan does not present an Operation and Maintenance Plan or any performance standards for the groundwater interim measures. The facility should submit the following:
 - Detailed schedule for the implementation of the groundwater interim measures should be submitted within 30 days. The work plan only states "Once operational, groundwater extraction wells will be brought on line over a period of 90 days leading to a fully operational target date in late-May or early-June of 2009."
 - Construction and equipment details for the well pumps, valves, well placement, and conveyance piping. These details should be submitted within 30 days.
 - Operation and Maintenance (O&M) Plan which would include, at a minimum, performance standards, a list and schedule of monitoring data needed to determine if the performance standards are being met, described procedures to maintain/adjust the system to meet performance standards, and quarterly reporting to DTSC regarding the performance of the system and any requirement modifications/adjustments to the system.

The GSU acknowledges that several of these elements may be duplicated in a separate operation and maintenance document(s) associated with the proposed groundwater extraction treatment system (GETS). The GSU would recommend that a single O&M Plan be considered that includes both the GETS and the associated extraction wells and conveyance piping. The O&M Plan should be submitted to DTSC within 90 days to ensure approval prior to the scheduled implementation of interim measures. Additional discussions, regarding the specific elements of the O&M plan, will likely be necessary between DTSC and the facility.

3. In Section 4.1, Source Area Definition, states that DTSC defined source zones as *"any monitoring wells where the reported concentrations of TCE have been 1,000 micrograms per liter (µg/L) or higher."* The purpose of pointing this statement out is not clear but it should be noted that the full statement was as follows:
"Specifically, groundwater extraction should be initiated at all groundwater monitoring wells within source zones, defined as any monitoring wells where the reported concentrations of TCE have been 1,000 micrograms per liter (µg/L) or higher and/or any monitoring wells where TCE concentrations and water levels are trending higher since shut-down of groundwater extraction wells." GSU's

Mr. Christopher Sherman
September 8, 2008
Page 3 of 3

intent, as stated in the beginning of the memorandum, was to provide clear direction to the facility. In fact, prior to this statement, the GSU stated in the memorandum that the definition of "source zone" was ambiguous. It was therefore reasonable to explicitly state how "source zone" should be considered as it related to groundwater interim measures and "source zone containment". The GSU understands that the facility believes TCE as DNAPL is no longer present in the groundwater at the site and that they equate "source zone" with the presence of DNAPL.

4. In Section 4.6, Annual Report and Performance Evaluation, the work plan states, *"Source area interim measures will continue until the time that the plume retardation processes are verified through the acquisition of additional field data. Upon completion of the northeast transect, an evaluation will be performed in the context of contaminant attenuation regarding the need for continuing groundwater extraction interim measures. This is expected to occur during the second half of 2009."* Groundwater interim measures will likely continue until characterization activities are completed, a corrective measures study has been completed, and a groundwater final remedy has been selected and implemented.

If you have any questions, please contact me at 714 484-5424.

Mr. Tom Gallacher, Mr. Allen Elliot, and Mr. Thomas Johnson
November 3, 2008
Page 2

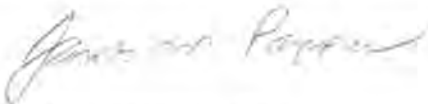
review if DTSC's comments are incorporated satisfactorily. The CEQA process must be completed prior to formal approval of the final Work Plan by the DTSC.

In addition, the revised draft Work Plan must include the following:

1. Detailed maps, figures, and narratives must be included to describe construction of the conveyance piping from the extraction wells to the new Groundwater Extraction and Treatment System (GETS). The information must be included in sufficient detail so that a CEQA determination can be made regarding the environmental impacts that the construction of the piping may have;
2. The planned GETS must be described via maps, figures, and narratives. Individual treatment units do not need to be described in detail but the capacity of the GETS and the flow from each planned extraction well should be shown clearly. Show the total capacity of the GETS and what part of the capacity will be used by the GWIM extraction wells; and
3. A narrative description and schedules of the integration of the Ground Water Interim Measures Work Plan and the GETS must be included to show the planned construction of both projects.

DTSC hereby directs Boeing to submit within 60 days of the date of this letter a revised draft Ground Water Interim Measures Work Plan correcting all of the deficiencies cited in this letter and the attached Geological Services Unit memo. The Interim Measures must meet the objectives of active technologies for source zone remediation and plume front containment. As set forth in the August 16, 2007 Consent Order (Order), Respondents are liable for fulfilling all obligations and requirements of the Order. Failure to submit a revised draft Ground Water Interim Measures Work Plan that adequately addresses these requirements will result in a finding of noncompliance with the Order and Respondents will be assessed penalties as specified in Section 4.19 of the Order.

If you have any questions, please contact me at (916) 255-3572.



James M. Pappas, P.E.
Santa Susana Field Laboratory Project Team

Attachment: DTSC Geological Services Unit Memo dated September 8, 2008

cc: See next page

Mr. Tom Gallacher, Mr. Allen Elliot, Mr. Thomas Johnson
November 3, 2008
Page 3

cc: Mr. Dave Dassler
Environmental Remediation
The Boeing Company
6633 Canoga Avenue
Post Office Box 7922
Canoga Park, California 91309-7922

Mr. Arthur Lenox
Environmental Remediation
The Boeing Company
Santa Susana Field Laboratory
5800 Woolsey Canyon Road
Canoga Park, California 91304-1148

Mr. Norman E. Riley
Santa Susana Field Laboratory, Project Director
Department of Toxic Substances Control
1001 "I" Street, 25th Floor
Post Office Box 806
Sacramento, California 95812-0806

Mr. Gerard Abrams
Senior Engineering Geologist, C.H.G.
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, California 95826-3200

Mr. Christopher P. Sherman, P.E.
Senior Hazardous Substances Engineer
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, California 95826-3200

Mr. Thomas M. Seckington, C.H.G.
Senior Engineering Geologist
Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, California 90630

#107985



Linda S. Adams
Secretary for
Environmental Protection

Department of Toxic Substances Control

Maureen F. Gorsen, Director
8800 Cal Center Drive
Sacramento, California 95826-3200



Arnold Schwarzenegger
Governor

November 3, 2008

Mr. Allen Elliot
National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Mail Code: AS10
Marshall Space Flight Center, Alabama 35812

Certified Mail #70031680000430243438

Mr. Tom Gallacher
The Boeing Company
5800 Woolsey Canyon Road
MC T-487
Canoga Park, California 91304-1148

Certified Mail #70031680000430243445

Mr. Thomas Johnson
U.S. Department of Energy
5800 Woolsey Canyon Road
MC T-487
Canoga Park, California 91304-1148

Certified Mail #70031680000430243452

GROUNDWATER INTERIM MEASURES WORK PLAN, SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA, DATED JULY 14, 2008

Dear Messrs. Elliot, Gallacher, and Johnson,

The Department of Toxic Substances Control (DTSC) has reviewed the draft Groundwater Interim Measures Work Plan (Work Plan) for the Santa Susana Field Laboratory, dated July 14, 2008 submitted by The Boeing Company (Boeing). The draft Work Plan was submitted pursuant to DTSC's letter of May 16, 2008.

The DTSC Geological Services Unit (GSU) reviewed the July 14, 2008 draft Work Plan and its analysis, conclusions, and requirements are provided in the attached memo dated September 8, 2008. These requirements must be incorporated into your submittal of a revised draft Ground Water Interim Measures Work Plan.

We anticipate that the revised draft Work Plan will be sufficient to begin the process for California Environmental Quality Act (CEQA) analysis and determination and public

Mr. Tom Gallacher, Mr. Allen Elliot, Mr. Thomas Johnson
November 3, 2008
Page 4

cc: Ms. Karen Baker, Performance Manager
Geology & Remediation Engineering
Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, California 90630

Mr. Larry Woodson
Public Participation Supervisor
Office of External Affairs
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, California 95826-3200

Mr. Eric Maher
Senior Hazardous Substances Scientist
Office of Environmental Planning and Analysis
Department of Toxic Substances Control
Post Office, Box 806
Sacramento, California 95812-0806

Certified Mail

December 1, 2008

In reply refer to SHEA-108060



Mr. James Pappas
Santa Susana Field Laboratory Project Team
California Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826

RE: Workplan Groundwater Interim Measures
Santa Susana Field Laboratory, Ventura County, California

Dear Mr. Pappas:

On behalf of the National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), and the Boeing Company, Boeing is responding to DTSC's letter of November 3, 2008, same subject. We request an extension due to the occurrence of several national holidays during the response period and the level of effort necessary to complete draft engineering designs to adequately respond to DTSC's directive. Specifically, we request an extension for the submittal of our response to February 1, 2009.

We have discussed the nature of the response with DTSC staff and suggest it is appropriate to submit an amendment to the workplan rather than revise the workplan since the information requested by DTSC is new and not revision to existing information or text. The submittal will primarily consist of design drawings, calculations, schedules, and a construction execution plan. DTSC review will be simplified by the submittal of an addendum and will avoid reprinting and distribution costs for the workplan itself.

Please confirm your approval of this extension in writing, as well as, the format of the submittal at your earliest convenience. Address any questions regarding this topic to the undersigned at (661)210-5672.

Sincerely,

A handwritten signature in blue ink, appearing to read "David Dassler", followed by a small flourish.

David Dassler
Environmental Remediation

DWD:bjc

cc: Mr. Norman Riley, DTSC
Mr. Gerard Abrams, DTSC
Mr. Chris Sherman, DTSC
Mr. Thomas Seckington, DTSC
Mr. Allen Elliot, NASA
Mr. Thomas Johnson, DOE
Ms. Patricia Berry, DOE
Mr. Thomas Gallacher, The Boeing Company



"Christopher Sherman "
<CSherman@dtsc.ca.gov>
12/10/2008 01:45 PM

To "David W EXT-Dassler" <David.W.Dassler@boeing.com>
cc "Arthur J Lenox" <arthur.j.lenox@boeing.com>, "John R
Scott" <john.r.scott@boeing.com>, "Ravnesht Amar"
<ravnesht.amar@boeing.com>, "Thomas D Gallacher"
bcc
Subject Re: SSFL Groundwater Interim Measures Work Plan

Dave,

We concur with your request to extend the deadline to submit the Revised Groundwater Interim Measures Workplan to a new date of February 1, 2009.

Consider this e-mail as the written approval that you sought in your December 1, 2008 letter.

Thanks for all your efforts on the project,

Chris

Christopher P. C. Sherman, P.E.
Senior Hazardous Substances Engineer
Legacy Landfills and Corrective Action Office
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826

Tel: (916) 255-3673
Fax: (916) 255-3596
csherman@dtsc.ca.gov

>>> "EXT-Dassler, David W" <David.W.Dassler@boeing.com> 12/2/2008 1:22 PM >>>
Chris,

Confirming our conversation last week, attached is the request for a time extension on the submittal until February 1, 2009. Please call me if there are any questions on this. Thanks.

<<108060.pdf>>

ATTACHMENT B
PROCESS DESCRIPTION

ATTACHMENT B

AREA I GETS PROCESS DESCRIPTION

SANTA SUSANA FIELD LABORATORY VENTURA COUNTY, CALIFORNIA

B.1 BACKGROUND

The Area I GETS will treat groundwater from Boeing Area I & III (RD-84, RD-72, C-1, RD-1, RD-46A and HAR-18), National Aeronautics and Space Administration (NASA) Area II (WS-9A, HAR-7, RD-41B, WS-9, RD-4, HAR-20, and RD-49A), and Department of Energy (DOE) Area IV (RS-54). The Area I GETS will also treat purge, well installation and development, decontamination, or pump test water generated during field activities at the Boeing, NASA, DOE, and off-site areas of the Santa Susana Field Laboratory (SSFL) Site. The primary compounds of concern (COCs) are volatile organic compounds (VOCs), primarily trichloroethylene and its daughter products; semi-volatile organic compounds (SVOCs), primarily 1,4-dioxane and n-nitrosodimethylamine (NDMA); and perchlorate.

B.2 GW IM EXTRACTION WELL CONVEYANCE PIPELINE AND CONDUIT

Impacted groundwater will be conveyed from fourteen (14) existing extraction wells at a target flow rate of 59 gallons per minute (gpm). Each extraction well will consist of:

- Below-grade well vault and piping (except for WS-9A which will remain above-grade);
- An electric submersible pump;
- Level controller (except for WS-9A which will be operated off a variable speed drive);
- Flow meter with totalizer;
- Pressure indicator;
- Check valve;
- Globe valve;

- “Y” Strainer;
- Sample port; and
- Below-grade galvanized schedule 40 carbon steel vault piping and double contained high density polyethylene (DCHDPE) conveyance piping (except for the pipeline section from Extraction Well WS-9A to Delta which will be above-grade DCHDPE piping sleeved in carbon steel).

The extracted groundwater will be conveyed through below-grade DCHDPE conveyance pipelines which range in size from 1”x3” thru 4”x8” and will be located within or alongside existing roadways. Air pressure relief and system bypass valves will be located along the conveyance pipeline as necessary.

Electrical power for the GW IM extraction wells will be supplied from existing overhead power lines and transformers located in the vicinity of each extraction well. Distribution power will be conveyed to the individual wellheads via below-grade schedule 40 polyvinyl chloride (PVC) conduit. At the extraction well vault, the conduit will transition to rigid steel conduit terminating at the well. Installation of the distribution may include:

- Above-grade power poles, conductors, bus bars, etc.;
- Above-grade transformers and junction boxes; and
- Below-grade conduit and wiring

Each extraction well will be operated off of flow control and a level switch (with the exception of WS-9A). During operation of the extraction wells, the flow control valve will be manually adjusted until the individual well flow rate is within the user-specified range. The level switch for each extraction well will also be set at a user-specified pre-determined shut off depth (Table 1) within the well such that it automatically shuts down the pump if the groundwater level falls below the set depth. Additionally, each extraction well will be in direct communication with the main control system via radio telemetry. In the event the GETS shuts down, the main control panel sends a signal to the extraction wells shutting down the pumps.

B.3 AREA I GETS

Extracted groundwater shall be conveyed through the below-grade DCHDPE conveyance pipelines to a polyethylene storage tank located at the treatment system. The maximum design flow rate for the treatment system is 100 gpm, of which 59 percent will be utilized by the groundwater interim measure (GW IM) wells. Initially purge, well installation and development, decontamination, or pump test water generated during field activities at the Boeing, NASA, DOE, and off-site areas of the SSFL will be trucked to the treatment system and pumped into a separate polyethylene storage tank. This water will be blended with the groundwater at a nominal flow rate of 2-10 gpm. It is expected these volumes will decrease over time as future quarterly sampling will be conducted with low-flow or no-flow sampling methods in accordance with the revised SSFL work plan.

Preliminary process equipment flow diagrams and on-pad equipment layout diagrams are provided as Figures 5 and 6, respectively, of Attachment D of this addendum. The combined process water will be initially pumped through particulate filters for the removal of sand and silt (if present). Process water may then flow through green sand filters, where potassium permanganate and sodium hypochlorite may be added to the process water, if necessary for additional filtration. Green sand filtration will only be incorporated if the concentrations of iron and manganese in treated groundwater are present at concentrations above the NPDES discharge limits. This will be determined during start-up and testing of the GETS. Post filtration, the process water is conveyed through two ion exchange (IX) vessels for the reduction of perchlorate. Following IX, the process water is conveyed through a shallow tray air stripper for the reduction of VOC and SVOC concentrations in extracted groundwater. Effluent vapor generated from the air stripping process is passed through two vapor phase granular activated carbon (GAC) adsorber vessels for the reduction of VOC and SVOC concentrations in vapor prior to discharge to the atmosphere. Following air stripping, process water passes through two liquid phase GAC adsorber vessels. Post GAC, hydrogen peroxide is injected into the process water which then flows through a ultraviolet (UV) tower for the reduction of 1,4-dioxane, NDMA, and any remaining VOCs and SVOCs before finally passing through a flow meter with totalizer prior to discharge. All saturated GAC and IX

resin will be returned to the GAC and/or IX vendor for disposal or regeneration at an authorized off-site, licensed facility. Three-valve manifolds will be provided at all equipment for bypassing a treatment process, if not required, and/or future system expansion, if required.

The treated effluent will be conveyed through an above-grade high density conveyance pipeline and discharged to NPDES-permitted Outfall #19 located southwest of Perimeter Pond.

ATTACHMENT C

**DESCRIPTION OF PLANNED CONSTRUCTION AND GROUNDWATER
INTERIM MEASURES EXTRACTION WELLS AND GETS AND PROJECT
SCHEDULE**

ATTACHMENT C

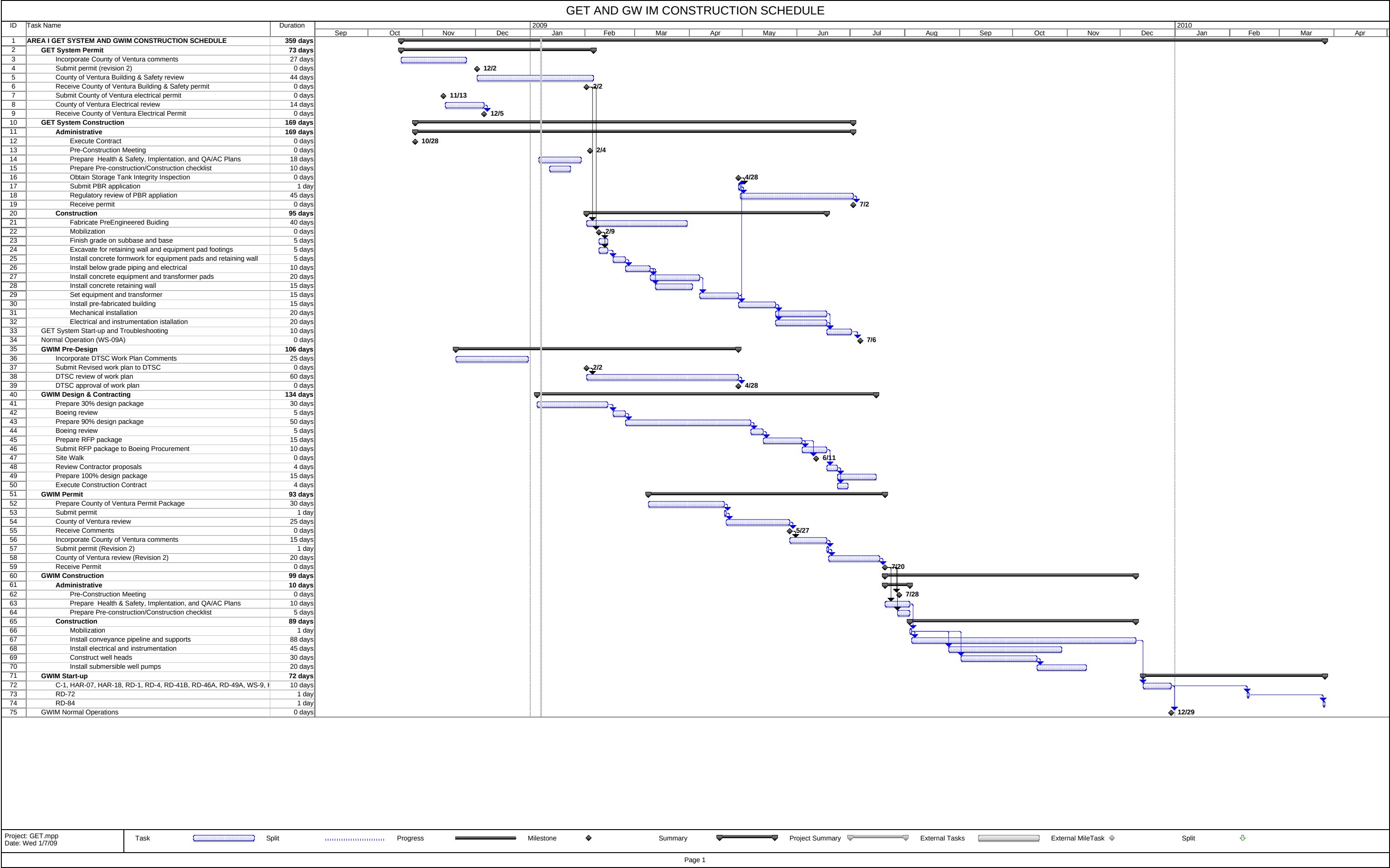
DESCRIPTION OF PLANNED CONSTRUCTION OF GROUNDWATER INTERIM MEASURES EXTRACTION WELLS AND GETS

As requested by the DTSC, the planned construction for both the GW IM extraction wells and the GETS has been integrated into a single project schedule that is presented in this Attachment. As shown on the schedule, the GETS project is divided into two sub-projects. GETS permitting has been initiated and is currently under regulatory review. Construction of the GETS is projected to start in February 2009, with normal operations commencing with the extraction of groundwater from well WS-9A in July of 2009. Administrative activities for GETS construction include those associated with obtaining a permit-by-rule (PBR) for the treatment of the extracted groundwater from the DTSC. The PBR permit package is planned to be submitted at the end of April 2009, with an estimated 45 day review of the permit package by DTSC.

The GW IM extraction well project has been divided into five sub-projects: pre-design, design/contracting, permitting, construction and start-up. Pre-design activities include preparation of the necessary documentation presented in this addendum and DTSC's subsequent review and approval, which is planned for completion by the end of April 2009. Design and contracting activities were initiated in early January 2009 and are forecast to be completed by the end of June 2009 with the issuance of a construction contract for extraction well head completions and conveyance pipeline installation(s), which will be identified during final design. As appropriate, NASA may retrofit pipeline design to allow for independent autonomous operation and may choose to construct portions of the pipeline within Administrative Area II of the SSFL aboveground pending development of final design details. Permitting for the GW IM extraction well project is anticipated to start in March of 2009 and take about four months to complete. Construction of the well heads and conveyance piping is scheduled to commence in early August 2009 and is projected to take about 4 months to complete. Start-up of the remaining extraction wells is projected to commence in December of 2009 with all wells except two being operational before the end of 2009. Start-up of the two remaining wells

is linked to observed drawdown from wells located in higher concentration portions of the plume located in the northeast portion of the SSFL.

Note: The construction schedule does not take into account the DTSC's CEQA review schedule. It is Boeing's interpretation that DTSC will take the lead on the determination of the CEQA review process and schedule and that these are outside of Boeing's control. Any delay incurred during this review process has the potential of further delaying the construction schedule provided.



ATTACHMENT D

**OPERATION AND MAINTENANCE AND MONITORING MANUAL, SANTA
SUSANA FIELD LABORATORY, EXTRACTION AND TREATMENT SYSTEM,
DECEMBER 2008**

**ATTACHMENT D
OPERATION, MAINTENANCE, AND MONITORING MANUAL
DECEMBER 2008**

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APPENDICES*

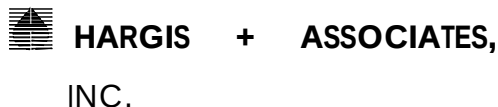
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* Note, appendices provided on CD and incorporated directly into portable download format (pdf) electronic copies.

ACRONYMS AND ABBREVIATIONS

AOC	area of concern
COCs	contaminants of concern
Cy	cubic yard
DCHDPE	double contained high density polyethylene
EDMS	Electronic Data Management System
EPA	U.S. Environmental Protection Agency
EW	extraction well
GETS	Groundwater Extraction and Treatment
gpm	gallon per minute
GS	green sand filters
GW IM	Groundwater Interim Measures
H+A	Hargis + Associates, Inc.
HDPE	high density polyethylene
IX	ion exchange
lb	pound
LOTTO	Lock-Out, Tag, Try-Out
LGAC	Liquid Phase Granular Activated Carbon
OMM	operation, maintenance, and monitoring
NDMA	N-nitrosodimethylamine
NPDES	National Pollutant Discharge Elimination System
PLC	programmable logic controller
PPE	personal protective equipment
psi	pound per square inch
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
SSFL	Santa Susana Field Laboratory
SVOC	semi-volatile organic compound
SWMU	solid waste management units
TCE	trichloroethene
VCAQMD	Ventura County Air Quality Management District
VGAC	Vapor Phase Granular Activated Carbon
VOA	volatile organic analysis
VOC	volatile organic compound



OPERATION, MAINTENANCE, AND MONITORING MANUAL
DECEMBER 2008

THE BOEING COMPANY
SANTA SUSANA FIELD LABORATORY
EXTRACTION AND TREATMENT SYSTEM
CANOGA PARK, CALIFORNIA

1.0 INTRODUCTION

H+A has prepared this Operation, Maintenance and Monitoring (OMM) Manual on behalf of the Boeing Company (Boeing) to provide system information required to efficiently operate, maintain and monitor the Area I Groundwater Extraction and Treatment (GETS) system and fourteen groundwater interim measure (GW IM) extraction wells (EWs); RD-84, RD-72, C-1, RD-1, RD-46A, HAR-18, WS-9A, HAR-7, RD-41B, WS-9, RD-4, HAR-20, RD-49A, and RS-54 located at the Santa Susana Field Laboratory (SSFL), Canoga Park, California (Figure 1).

Groundwater at the SSFL is impacted with volatile organic compounds (VOCs), primarily trichloroethene (TCE); semi-volatile organic compounds (SVOCs), primarily 1,4-dioxane and N-nitrosodimethylamine (NDMA); perchlorate. The GETS and GW IM systems consist of 14 EWs and a groundwater treatment system. Electric submersible pumps installed in each EW will convey groundwater to the treatment system via below-grade double contained high density polyethylene (DCHDPE) pipe which ranges in size from 1"x3" to 4"x8", with exception of the pipeline from WS-9A to Delta Air Stripper, which will remain above-grade. The DCHDPE pipe was deliberately oversized to accommodate additional capacity from the existing EWs or future EWs. The GETS will be located within a pre-engineered steel building at the intersection of the Area I and III roadways and consists of particulate filtration, green sand filtration if necessary, ion exchange, air stripping, liquid and vapor phase carbon adsorption, operated in series, and an ultraviolet peroxide system. Treated water will be discharged through 6" below-grade high density polyethylene (HDPE) to Outfall #19 under the site specific National Pollutant Discharge Elimination System (NDPES) discharge permit. The effluent flow will be measured by a flow meter with totalizer located at the treatment system prior to discharge. A control panel located

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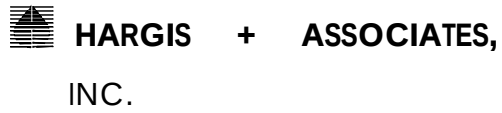
at the treatment system provides continuous automated system operation and monitors alarm conditions of the GETS and GW IM EWs. An automated telephone dialer located inside the control panel alerts OMM technicians of any alarm conditions.

The GETS and GW IM Extraction Well Field consists of the following key components:

- thirteen below-grade extraction wells (WS-9A shall remain above-grade);
- below-grade DCHDPE conveyance pipelines;
- above-grade DCHDPE conveyance pipeline WS-9A;
- below-grade carbon steel or PVC electrical conduit;
- pressure transmitters, pressure gauges, flowmeters, and level switches;
- fourteen Grundfos electric submersible pumps and level controllers;
- two centrifugal transfer pumps;
- control panel w/ Allen Bradley SLC5/05 programmable logic controller (PLC);
- Allen Bradley RSLogix 500 Standard telemetry system;
- two 2,000 pound (lb) liquid phase granular activated carbon vessels;
- two 2,000 lb vapor phase granular activated carbon vessels;
- four Filter Specialist Inc. particulate filters;
- one Stat 80 Shallow Tray Air Stripper;
- two 300 cubic foot (ft³) ion exchange vessels;
- two 300 ft³ green sand filtration vessels (future);
- one 2-30 kilowatt ultraviolet/H₂O₂ Rayox Tower;
- one 6,500 gallon high density polyethylene storage tank;
- one 10,500 gallon high density polyethylene storage tank;
- radio transmitter towers and hardware.

Quality assurance/quality control (QA/QC) protocols will be followed in accordance with Boeing standard documents and site specific procedures.

The OMM program for the GETS will also be subject to internal QA/QC procedures which focus on an in-house peer and professional review system. Senior staff review project performance



and technical documentation to maintain precision and accuracy. Project Managers interface with the entire project team and client personnel on a regular basis to maintain the work and submittal schedules and project goals.

2.0 OVERVIEW OF SYSTEM COMPONENTS

The GETS and GW IM Extraction Well Field comprises of the following major systems:

1. Groundwater EWs.
2. Above-grade double contained conveyance pipeline WS-9A and below-ground double contained conveyance pipeline and conduit.
3. Groundwater treatment system equipment and infrastructure.
4. Control panel and automated telephone dialer.

Additional documentation on these four principle systems and their associated components are presented in Appendices B through L. The following sections provide further detail on the components included in each system.

2.1 Extraction Wells

The following details and components constitute the system of fourteen (14) groundwater EWs:

- compression-plate-style well seal;
- sample port;
- flow indicating totalizer;
- check valve;
- globe valve;
- pressure gauge;
- Y-strainer;
- Grundfos submersible pumps. EW pump intake set depths and target drawdown depths are presented in Table 1.
- Each extraction well will be operated off a level controller, with the exception of extraction well WS-9A. The level controller will be set at a predetermined depth within the well such that it automatically shuts down the pump if the groundwater level falls below the preset level. Extraction well WS-9A is operated off a variable frequency with flow rates varying off extraction well groundwater levels.

2.2 Below-Ground Double Contained Conveyance Pipeline and Conduit

The following details and components constitute the system of conveyance pipelines and conduit utilized for the transport of extracted groundwater (Figure 2):

- Below-ground DCHDPE conveyance piping shall be Poly-Flo® pipe manufactured by Asahi/America® or equal. Poly-Flo pipe is an integrated double-walled containment piping system.
- Below-ground HDPE discharge piping.
- All DCHDPE and HDPE piping will be connected in two ways: fusion welding performed by a certified staff of qualified welders or by the use of pre-fabricated flanged fittings.
- Electrical conduits utilized for the distribution of power and delivery of control signals shall be installed in accordance with the sizes and types detailed in the conduit and wiring schedules to be provided in “Groundwater Interim Measures Design Package”. All conduits shall be installed in accordance with standard methods and work practices.

2.2.1 GW IM Extraction Wellhead and Conveyance Pipeline Construction

The GW IM system consists of 13 below-grade extraction wellheads, 1 above-grade extraction wellhead, approximately 30,000 lineal feet of above- and below-grade double contained high density polyethylene (DCHDPE) conveyance pipeline, and 3,000 lineal feet of below-grade electrical conduit.

All conveyance pipelines and conduit will be installed below-grade within trenches approximately 12-inches wide by 30-inches deep located beside existing roadways throughout the SSFL. The trenching activities will result in excavation of approximately 3,000 cubic yards of material (2,300 cy and 700 cy of soil and asphalt respectively). The excavated soil will be stockpiled along side the trenches for reuse, while the asphalt will be disposed of on-site at a location determined by Boeing. It is estimated approximately 1,700 cubic yards (75%) of the excavated soil material will be reused as backfill in the trenches. The excess soil material will be located within the unimproved areas alongside the trenches and will be graded and blended with the existing soil on-site. All excavated soil material will be monitored for VOCs using a

photoionization detector (PID) direct reading instrument. If observed concentrations are above action limits as described in Ventura County Air Pollution District Rule 74.29 are detected, excavation activities will be curtailed until the appropriate controls can be instituted.

As stated above, the conveyance pipelines and conduit will be located beside existing roadways and/or pipeline corridors throughout the SSFL and therefore are not expected to cross within or traverse any impacted soils within solid waste management units (SWMUs) or areas of concern (AOCs), nor are they projected to be constructed through any sensitive habitat areas. Figure 3 shows the pipeline routing relative to the SWMUs and AOCs at the SSFL RFI sites and Figure 4 shows the pipeline routing relative to the cover (e.g. developed, vegetative, etc) at the land surface at the SSFL.

2.3 Groundwater Treatment System

A preliminary process equipment diagram for the groundwater treatment system is shown in Figure 5 and on-pad equipment and piping layout is shown in Figure 6.

The following major components constitute the GETS:

- Particulate filtration vessels (F-200 thru F-203);
- Two Siemens 300-ft³ green sand filtration vessels (V-200 and V-201), future (if necessary, based on iron and manganese concentrations in treated groundwater);
- Two Siemens Magflex 300-ft³ ion exchange vessels (V-202 and V-203);
- One STAT 80 shallow tray air stripper (V-204);
- Two 2,000-lb Siemens LGAC vessels (V-205 and V-206);
- Two 2,000-lb Siemens VGAC vessels (V-207 and V-208);
- One 6,500-gallon influent surge tank (T-200);
- One 10,500-gallon purge water surge Tank (T-201);
- System instrumentation and control.

2.4 Control Panel

The following details and components constitute the control system designed and built for use with the GETS:

- Variable Frequency Drive (SIC-200);
- The PLC and associated control components were programmed and constructed by Bisco Environmental, Inc.
- The control system main panel communicates with equipment, transmitters, and pumps located at the GWIM EWs and within the treatment system compound.
- Allan Bradley RSLogix 500 Standard telemetry unit;
- 'System Start' and 'System Stop' push buttons;
- Major Alarm lights include:
 - o Dike Switch High Water Level;
 - o High Pressure (differential pressure measured across particulate filter);
 - o Surge Tank High Water Level;
 - o Surge Tank Low Water Level;
 - o Low Flow (magnetic flow meter);
 - o Operation Status of Green Sand Filters (future);
 - o High Pressure (burst plate rupture ion exchange vessels)¹
 - o Operational Status of Air Stripper;
 - o High Pressure (burst plate rupture liquid carbon vessels) (see footnote 1 also)

¹ The GET system is situated on a bermed concrete equipment pad with dike level switch to prevent process water from leaving the GET system facility. In the event the burst plates on either the ion exchange vessels or the liquid phase carbon adsorbers rupture the GET system will automatically shutdown and the process water will flow from the equipment to a below-grade sump. The water can then be pumped to storage tank T-201 for storage until the burst plate is replaced and the system re-started. If the GET system does not shutdown on burst plate rupture, process water will continue to rise until triggering a dike level installed on the bermed wall. This level switch, if triggered, will shutdown the GET system, thus providing redundancy to ensure process water does not leave the GET system equipment pad.

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- o Operational Status of UV/H₂O₂;
 - o Master Lockout Alarm (illuminates on any full system shutdown event).
- power indication light;
- Emergency Stop push button (de-energizes all control power except telemetry).



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3.0 HEALTH AND SAFETY

Safety is the responsibility of every person that enters the GETS site and each person and activity will be held responsible for following the procedures described in the Site Safety and Health Plan and will be able to stand up to the periodic audits performed at the discretion of Boeing, Hargis + Associates, Inc. (H+A), and the OMM Contractor.

Health and safety concerns shall be reported directly to the OMM Contractor Project Manager. All issues will be addressed by the OMM Contractor Health and Safety Committee, Boeing, and H+A.

4.0 START-UP PROCEDURES FOR GETS AND GW IM EXTRACTION WELLS

The start-up procedures presented in this section should be followed when turning on the GETS and GW IM EWs. Some of these procedures may not be required if the system is temporarily shut down for routine tasks, maintenance, trouble-shooting, or any other tasks being completed while someone is on site. When starting the GETS, complete all of the steps as presented below in this section.

4.1 Baseline Sampling

All baseline sampling, monitoring, and groundwater level measurements will be conducted in accordance with the existing SSFL site specific procedures and permits.

4.2 Groundwater Treatment System and Extraction Well Start-Up Procedure

The major start-up procedures for the GETS and GWIM extraction wells include the following:

1. Complete Boeing's start-up checklist.
2. Remove Lock out, tag, try out (LOTTO) safety equipment.
3. Beginning at each extraction well, verify pump set depth in accordance with Table 1. Once the pump set-depth is verified Contractor shall verify all globe valves are in the "open" position approximately 50%. Note RD-72 and RD-84 will be started in accordance with Table 2, approximately 30 and 60 days following initial start-up, respectively, to reduce the potential transport of groundwater containing higher concentrations of VOCs to areas with lower concentrations.
4. Open valve (VF-201) at effluent of influent surge tank (T-200)
5. Open particulate filter vessels (F-202 and F-203) and install 10 micron filter bags and open particulate filter vessels (F-200 and F-201) and install 25 micron filter bags.
6. Open primary particulate filter vessel (F-202) valves (VF-204 and VF-205). Verify secondary particulate filter vessel (F-203) valves (VF-206 and VF-207) are in the "closed" position.
7. Verify particulate filter vessel (F-200 and F-201) valves (VF-217 thru VF-220) are in the "closed" position.



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8. Verify VF-251 and VF-260 are in the “closed” position.
9. Verify valve at effluent of purge water surge tank (T-201) is in the “closed” position.
10. Open bypass valve (VF-208) and close GS valves (VF-209, VF-250, and VF-251).
11. Check ion exchange vessel manifold valve to ensure influent water is routed through designated lead vessel first and then through lag vessel.
12. Check liquid carbon vessel manifold valves to ensure influent water is routed through designated primary vessel first and then through the polish vessel.
13. Check vapor carbon vessel manifold valves to ensure influent vapor is routed through designated primary vessel first and then through the polish vessel.
14. Verify all flow through valves are in the “open” position.
15. Verify all bypass valves are in the “closed” position with the exception of VF-208 as indicated above.
16. Verify all drain valves and sample ports are in the “closed” position.
17. Verify ion exchange resin delivery (pre-soaked and back-flushed, if necessary).
18. Verify liquid carbon delivery (pre-soaked and back-flushed).
19. Verify air stripper power is on and in the “auto” position.
20. Open air stripper panel and set the variable speed controller potentiometer to desired output level.
21. Verify UV/H₂O₂ system power is on and in the “auto” position.
22. Turn on main power to Control Panel and wait several minutes to allow program to load.
23. Once program has loaded-well pumps will be in auto-run mode and, once started, will cycle on/off based upon the water level in the well read by the level controller submersed in each well.
24. Press the green “System Start” button.
25. Open the main control panel at GETS and remote panel at WS-9A and set variable speed control potentiometer to desired output level.
26. Close control panel door and turn main power switch to ON.
27. It will be necessary to return to each well to adjust the flow rate as the pressure caused by an overall increase in flow rate may cause a decrease in individual flow rates.
28. Return to the main Control Panel and verify on the Human Interface Display (HID) that WS-9A has achieved and has stabilized at the targeted water drawdown level the remaining thirteen wells (13) will need to be verified manually in the field. Press the ‘page up’ and ‘page down’ arrows to scroll through the data for WS-9A.

4.3 Quarterly Purge Water Treatment Procedure

Purge and decontamination water will be generated quarterly from wells located within Areas I, II, III, IV, and offsite at the SSFL facility and transported to the GETS for treatment. Purge and decontamination water collected from these wells will likely contain VOCs, SVOCs (primarily 1,4-dioxane and NDMA), and perchlorate. Initially, it is estimated that approximately 75,000 – 100,000 gallons will be generated during each quarterly event, however it is expected that these volumes will decrease over time as future quarterly well sampling is conducted using low-flow or no-flow sampling methods in accordance with the revised SSFL work plan. Purge water will be pumped into storage tank (T-201) and integrated into the GETS at a nominal flow rate of 2-10 gallons per minute (gpm) until all purge water has been treated. Purge water collection and treatment will adhere to the following sequence of events:

1. Groundwater will be collected in temporary storage tanks and/or vacuum trucks, transported to the GETS and pumped into the 10,500-gallon storage tank (T-201).
2. Start-up of the purge system shall be done in the following order:
 - a. Open valve VF-251.
 - b. Open purge water storage tank (T-201) effluent valve (VF-221).
 - c. Prior to introduction of the purge water into storage tank (T-201), open particulate filter vessel (F-202) valves (VF-217 and VF-218). Particulate filter vessel (F-203) shall remain closed until high pressure alarm is indicated by DPS-201 at which point filter vessel (F-203) valves (VF-219 and VF-220) are opened and filter vessel (F-202) valves (VF-217 and VF-218) are closed.
 - d. Press “System Start” button for PC-201.
 - e. Return to the main Control Panel and verify on the HID that PC-201 is operating.
3. Verify purge system is operating at chosen flow rate and equipment is functioning properly.

5.0 NORMAL OPERATING PROCEDURES

Normal operating procedures typically include some or all of the following tasks:

- Performance monitoring schedule and tasks;
- Maintenance schedule and tasks;
- Ion exchange vessel breakthrough and profiling procedure;
- Ion exchange resin change-out procedure;
- Liquid and vapor phase carbon vessel breakthrough and profiling procedure;
- Carbon change-out procedure;
- Particulate filter change-out procedure;
- Shutdown procedure;
- Permit compliance;
- Reporting procedures.

The GETS and GW IM systems will be visited, inspected and monitored monthly and on an as-needed basis dependent on system flows, resin and carbon loading rates, timing of GS, IX, LGAC, and VGAC vessel breakthrough and change-outs, NPDES and Ventura County Air Quality Management District (VCAQMD) required permit sampling, system alarm conditions, and other operational parameters and objectives.

When conducting routine OMM visits, system operational information shall be recorded on OMM forms developed specifically for the GETS by the OMM Contractor. These forms will be used to analyze data and optimize treatment system operations (including flow rates, chemical injection flow rates, resin and carbon usage rates, etc). These data will be utilized to assist with system optimization and troubleshooting if the system fails to meet performance criteria as outlined in Table 2. It is anticipated new tasks may be required based on new operational conditions identified during these routine visits or during system optimization review meetings.

Completion of these tasks is necessary to assure the system is operating properly, safely, and in compliance with the site specific NPDES and VCAQMD permits. Each of these tasks is described below.

5.1 Performance Monitoring Schedule and Tasks

The performance monitoring scheduled visit may include the following tasks as necessary to assist in optimizing system operations:

GETS

- Record totalizer readings (gallons).
- Record transfer pump pressure (pound per square inch [psi]).
- Record influent and effluent flowmeter readings (gallons) and flow rate (gpm).
- Record vapor discharge flowmeter reading in standard cubic feet per minute (scfm).
- Record system pressures at: transfer pumps; pre-filters; post filters; lead GS vessel inlet; lag GS vessel inlet; lag GS vessel outlet; lead IX vessel inlet; lag IX vessel inlet; lag IX vessel outlet; air stripper blower; air stripper pump; lead LGAC vessel inlet; lag LGAC vessel inlet; lag LGAC vessel outlet; lead VGAC vessel inlet; lag VGAC vessel inlet; lag VGAC vessel outlet; inlet UV/H₂O₂ vessel; and outlet UV/H₂O₂.
- Examine bag filters and replace as necessary.
- Record influent storage tank, purge water storage tank and hydrogen peroxide tank levels (inches) and indicate condition of water and tanks.
- Collect treated water and vapor samples in accordance with the NPDES and VCAQMD permits.

GW IM EXTRACTION WELLS

- Record individual well totalizer reading (gallons).
- Measure individual well flow rate (gpm).
- Record pump pressure (psi) at each well.
- Measure depth to water and total depth (feet) at each well.
- Record EW on/off status.

Detailed GW IM extraction well performance standards including a list and schedule of monitoring data to determine if the standards are being met and procedures for maintaining and/or adjusting the GW IM EWs to meet the performance standards are provided in Table 2.

5.2 Maintenance Schedule and Tasks

The maintenance schedule and tasks should include the items below, as necessary. If during routine inspection and monitoring, operational performance and efficiency has decreased or an equipment malfunction is identified, the OMM contractor shall institute the necessary operational modifications and/or replace the damaged equipment within 30 days of realization.

- The Y-strainers in the EWs should be cleaned a minimum of once a quarter or when an EW experiences an unexplained decrease in flow.
- The submersible pumps should be pulled and serviced in accordance with manufacturer's specifications or when other system operations allow for convenient maintenance.
- The transfer pumps should be serviced in accordance with manufacturer's specification or when other system operations allow for convenient maintenance.
- The air stripper should be serviced in accordance with manufacturer's specification or when other system operations allow for convenient maintenance.
- Valves and instrumentation should be serviced in accordance with the manufacturer's specification or when other system operations allow for convenient maintenance.
- The UV/H₂O₂ system should be serviced in accordance with manufacturer's specification or when other system operations allow for convenient maintenance.
- The fire extinguisher(s) located at the GETS compound will be inspected monthly and certified annually.
- Instrument calibration for flow meters differential pressure transmitters and air flow meters shall be performed at a minimum of annually for the flow meters and biannually for the differential pressure transmitter, and in accordance with the manufacturer's specifications.

5.3 Ion Exchange Breakthrough and Profiling Procedure

When breakthrough concentration(s) at or near discharge permit limits are detected at the outlet of the primary or lead vessel, the system should be temporarily shut down and the vessel

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opened to collect a "profile for disposal" sample. This sample will be provided to the resin supplier for their use. If a valid profile already exists for the spent resin, it is not necessary to sample the vessel. When the resin supplier has completed the analysis of the sample, or if no sample is required, the resin supplier should be contacted immediately to arrange for a "remove and replace" service. The system should be operated in the existing Lead/Lag mode until the resin in the lead vessel is changed.

5.4 Resin Change-Out Procedure

Prior to the scheduled resin change-out service, the system should be shut down, and the water should be removed from the lead vessel by means of air pressure. Pressure should be controlled by use of a regulator set at a pressure no greater than 20 pounds per square inch gauge (psig). The regulator output pressure should be pre-set so that it cannot exceed the working pressure of the vessel. The air should be introduced to the vessel slowly so that it approximates the normal flow parameters. The water from the lead vessel will be "pushed" by the compressed air through the lag vessel of the treatment system.

Once the water is removed from the vessel, hose connections and valves should be set so that the lead vessel is isolated from the lag vessel.

When the resin service contractor arrives on site, a safety tailgate meeting will be held with all personnel and companies on site for this work. Delivery paperwork shall be inspected to assure that the correct resin type and sieve size has been delivered.

The resin service company will begin the removal of spent resin. This resin will be collected in drums, supersacks, or truck-mounted containers. If the resin is to be regenerated, the contractor will take the resin with them. If the resin profile indicates that the resin cannot be regenerated, it will be drummed and removed for disposal by the contractor.

When the spent resin has been removed, the OMM Contractor will visually inspect the interior of the vessel to verify that all resin has been removed. During this inspection, internal structures

such as underdrains will be inspected to determine that no damage has occurred. The lining of the vessel will also be inspected to verify that the lining material is intact.

The vessel shall also be inspected by the OMM Contractor after the resin has been installed in the vessel to verify that the proper amount of resin is in the vessel, and that the top of the resin is flat and even. The manway or lid seal should be inspected to assure it is in good condition.

The system connections controlling the flow pathway should be configured so that the vessel with the fresh resin is placed in the lag position. The vessels shall remain isolated from each other. Magnetic signage should be changed to reflect the new relative positions of the vessels. The vessel should then be filled with clean potable water and allowed to soak for a minimum of 24 hours. The vessel should be inspected for leaks prior to restarting, as well as upon system restart when the system achieves normal working pressure. After the initial soak period, the system can be restarted in the new configuration.

5.5 Liquid Carbon Vessel Breakthrough and Profiling Procedure

When breakthrough concentration(s) at or near discharge permit limits are detected at the outlet of the primary or lead vessel, the system should be temporarily shut down and the vessel opened to collect a "profile for disposal" sample. This sample will be provided to the carbon supplier for their use. If a valid profile already exists for the spent carbon, it is not necessary to sample the vessel. When the carbon supplier has completed the analysis of the sample, or if no sample is required, the carbon supplier should be contacted immediately to arrange for a "remove and replace" service. The fresh carbon must be ordered as pre-wetted (or "pre-soaked") and acid-washed. Use of non-pre-wetted and non-acid-washed carbon will likely result in initial discharge water that exhibits a high pH and may exceed the site specific NPDES pH limitations.

The system should be operated in the existing Lead/Lag mode until the carbon in the lead vessel is changed.

5.6 Liquid Carbon Change-Out Procedure

Prior to the scheduled carbon change-out service, the system should be shut down, and the water should be removed from the lead vessel by means of air pressure. Pressure should be controlled by use of a regulator set at a pressure no greater than 20 psig. The regulator output pressure should be pre-set so that it cannot exceed the working pressure of the vessel. The air should be introduced to the vessel slowly so that it approximates the normal flow parameters. The water from the lead vessel will be "pushed" by the compressed air through the lag vessel through the treatment system.

Once the water is removed from the vessel, hose connections and valves should be set so that the lead vessel is isolated from the lag vessel.

When the carbon service contractor arrives on site, a safety tailgate meeting will be held with all personnel and companies on site for this work. Delivery paperwork shall be inspected to assure that the correct carbon type and sieve size has been delivered.

The carbon service company will begin the removal of spent carbon. This carbon will be collected in drums, supersacks, or truck-mounted containers. If the carbon is to be regenerated, the contractor will take the carbon with them. If the carbon profile indicates that the carbon cannot be regenerated, the carbon will be drummed and disposed off by the contractor.

When the spent carbon has been removed, the OMM Contractor will visually inspect the interior of the vessel to verify that all carbon has been removed. During this inspection, internal structures such as underdrains will be inspected to determine that no damage has occurred. The lining of the vessel will also be inspected to verify that the lining material is intact.

The vessel shall also be inspected by the OMM Contractor after the carbon has been installed in the vessel to verify that the proper amount of carbon is in the vessel, and that the top of the carbon is flat and even. The manway or lid seal should be inspected to assure it is in good condition.

The system connections controlling the flow pathway should be configured so that the vessel with the fresh pre-wetted and acid-washed carbon is placed in the lag position. The vessels shall remain isolated from each other. Magnetic signage should be changed to reflect the new relative positions of the vessels. The vessel should then be filled with clean potable water obtained and allowed to soak for a minimum of 24 hours. The vessel should be inspected for leaks prior to restarting, as well as upon system restart when the system achieves normal working pressure. After the initial soak period, the system can be restarted in the new configuration.

5.7 Vapor Carbon Vessel Breakthrough and Profiling Procedure

When breakthrough concentration(s) at or near discharge permit limits are detected at the outlet of the primary or lead vessel, the system should be temporarily shut down and the vessel opened to collect a "profile for disposal" sample. This sample will be provided to the carbon supplier for their use. If a valid profile already exists for the spent carbon, it is not necessary to sample the vessel. When the carbon supplier has completed the analysis of the sample, or if no sample is required, the carbon supplier should be contacted immediately to arrange for a "remove and replace" service.

The system should be operated in the existing Lead/Lag mode until the carbon in the lead vessel is changed.

5.8 Vapor Carbon Change-Out Procedure

Prior to the scheduled carbon change-out service, the system should be shut down and hose connections and valves should be set so that the lead vessel is isolated from the lag vessel.

 HARGIS + ASSOCIATES,
INC.

When the carbon service contractor arrives on site, a safety tailgate meeting will be held with all personnel and companies on site for this work. Delivery paperwork shall be inspected to assure that the correct carbon type and sieve size has been delivered.

The carbon service company will begin the removal of spent carbon. This carbon will be collected in drums, supersacks, or truck-mounted containers. If the carbon is to be regenerated, the contractor will take the carbon with them. If the carbon profile indicates that the carbon cannot be regenerated, the carbon will be drummed and disposed of by the contractor.

When the spent carbon has been removed, the OMM Contractor will visually inspect the interior of the vessel to verify that all carbon has been removed. During this inspection, internal structures such as underdrains will be inspected to determine that no damage has occurred. The lining of the vessel will also be inspected to verify that the lining material is intact.

The vessel shall also be inspected by the OMM Contractor after the carbon has been installed in the vessel to verify that the proper amount of carbon is in the vessel, and that the top of the carbon is flat and even. The manway or lid seal should be inspected to assure it is in good condition. Magnetic signage should be changed to reflect the new relative positions of the vessels.

5.9 Particulate Filter Change-Out Procedure

The particulate filter(s) shall be changed following a high-differential-pressure alarm (DPIT-200/DPS-201). Once the alarm has been acknowledged, the OMM Contractor shall then open the influent and effluent valves located on the secondary filtration unit. The OMM contractor will then slowly close the influent and effluent valve on the primary filtration unit until the entire flow is channeled through the secondary filter. Once the flow has been completely channeled through the secondary filtration unit the OMM Contractor shall reset the alarm at the HID and proceed with replacing the spent filters within the primary unit.

5.10 Shutdown Procedures

These shutdown procedures should be followed whenever the system will be shut down and left unattended for a period of time longer than one week. These procedures are not required if the system is temporarily shut down for routine tasks, maintenance, troubleshooting, or other tasks being completed while someone is on site and able to monitor the system.

- Press system stop button and verify on HID that the GETS and GW IM extraction well pump(s) are “Off”.
- Proceed to GW IM EWS and turn well control panel switches to ‘off’ and close globe valves.
- Close influent storage and purge tank effluent valves (VF-201 and VF-221).
- Verify all flow through and bypass valves are in the “closed” position to prevent system drainage.
- Turn air stripper control panel power disconnect switch to ‘off’ position.
- Turn UV/H₂O₂ control panel power disconnect switch to the ‘off’ position.
- Turn main control panel power disconnect switch to ‘off’ position.
- If needed, bleed areas of high pressure using sample port locations.
- Affix LOTTO safety equipment to EW well pump controller boxes and treatment system control panel and equipment as appropriate

5.11 Permit Compliance and Reporting Procedures

Reporting on the performance of the GETS and GWIM extraction wells, monitoring data, analytical results, and any adjustments made to the GETS or GW IM wellfield will be submitted every calendar quarter as a section in the quarterly groundwater monitoring and sampling report submitted to the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC).

 HARGIS + ASSOCIATES,
INC.

Tasks included in the permit compliance and reporting procedures category are as follows:

- Prepare operational reports for the GETS and GW IM extraction wells per the standardized Boeing formats, if necessary.
- Attend quarterly status and project review meetings, if necessary.
- Upload all information to the Boeing EDMS portal in a timely manner.
- Self-Monitoring Reports are due to California Environmental Protection Agency, DTSC every 3 months on the following schedule:

Reporting Period	Due Date
January – March	May 31
April – June	August 31
July – September	November 30
October – December	February 28

- The OMM Contractor will schedule and perform quarterly groundwater sample collection from sample port SP-280 which will be analyzed for the suite of analyses as stated in the NPDES Order No. R4-2007-0055 (Appendix A)
- The OMM Contractor will schedule and perform monthly vapor sample collection from sample port SP-270 which will be analyzed for the suite of analyses as stated in the VCAQMD Authority to Construct No. 00232-390.
- The OMM Contractor will schedule and perform monthly groundwater sample collection from influent sample port SP-275 and air stripper effluent sample port(s) SP-253 or SP-259 which will be analyzed for the suite of analyses as stated in the VCAQMD Authority to Construct No. 00232-390.
- The Self-Monitoring Report(s) as required by the NPDES and VCAQMD permits will be prepared by the OMM Contractor and submitted to Boeing for review within 30 days of the end of the reporting period.
- Maintain all NPDES and VCAQMD permit required information and keep records for delivery to Boeing upon project termination.

TABLES

TABLE D-1
EXTRACTION WELL ELEVATION DATA
GROUNDWATER INTERIM MEASURE WELL FIELD

COUNT	EXTRACTION WELL IDENTIFICATION	MINIMUM EXTRACTION RATE (GPM)	TARGET EXTRACTION RATE (GPM)	MAXIMUM EXTRACTION RATE (GPM)	PUMP INTAKE SET DEPTH (ft TOC)	Q3 08 DTW (ft)	TOTAL DEPTH (ft TOC)	Open INTERVAL (ft TOC)	ALARM SETPOINT (ft TOC)
BOEING									
1	RD-84	0.1	0.5	3.1	160	133.48	171	40-171	140
2	RD-72	0.5	2	5.2	160	95.6	182	27-182	140
3	C-1	10.4	20	31.3	300	~90	600	48.6-600	280
4	RD-1	0.1	2	5.2	441	202.51	506	26-506	421
5	RD-46A	0.1	1	5.2	120	76.04	140	29.5-140	100
6	HAR-18	0.1	1	5.2	64	22.3	80	30-80	44
NASA									
7	WS-9A	0.1	10	10.4	315	24.42	539	20-539, screened	295
8	HAR-7	0.1	0.5	0.5	85	67.74	100	30-100	65
9	RD-41B	0.1	2	3.1	375	113.31	390	340-390	355
10	WS-9	1.0	10	20.8	654	284.34	1800	15"dia:17-690, 10" dia:690-1800	634
11	RD-4	1.0	10	20.8	481	285.3	496	27-496	461
12	HAR-20	0.1	0.1	3.1	220	186.26	230	30-230	200
13	RD-49A	0.1	0.2	5.2	45	23.69	50	18-50	25
DOE									
14	RS-54	0.1	0.1	3.1	36	25.84	38	7-38	16

TABLE D-2
PERFORMANCE OBJECTIVES, DATA NEEDS AND PROCURDURES FOR INTERIM MEASURES EXTRACTION WELLS

Well Identifier	Target Extraction Rate (GPM)	Interim Measure Pumping Objective	Performance Standard	List & Schedule of Monitoring Data Needed to Assess Achievement of Performance Standard	Procedures for Achieving Performance Standard
WS-9A	10	Dewater FDP 881 and 890, intercept leading edge of impacted groundwater	Extract groundwater at sufficient rate to keep seeps FDP 881 and 890 dewatered and reduce concentration of TCE in WS-9A below 1,000 ug/L	Monthly observations of groundwater emergence at seeps FDP 890 and 881. Annual TCE concentrations in groundwater extracted from WS-9A.	Increase extraction rate from WS-9A if discharges of groundwater are observed at seeps FDP 881 or 890. Reduce extraction rate if TCE concentrations in WS-9A are appreciably below 1,000 ug/L, while preventing discharge at seeps.
C-1	20	Northeast plume front	Augment natural containment of off-site plume and reduce concentration of TCE in C-1 below 1,000 ug/L	Semi-annual water level measurements in extraction wells. Annual TCE concentrations in groundwater extracted from C-1.	See note 1 below for start-up procedure. After start-up is achieved, adjust extraction rates from wells to achieve 10 feet of drawdown at RD-84. Reduce extraction rate in C-1 if TCE concentrations are appreciably below 1,000 ug/L while maintaining sufficient drawdown at RD-84.
RD-72	2				
RD-84	0.5				
HAR-7	0.5	Source zone mass removal from wells with TCE >1,000 ug/L	Prevent further increases in groundwater elevations and/or reduce concentration of TCE below 1,000 ug/L.	Semi-annual water level measurements and annual TCE concentrations in groundwater from extraction wells.	Adjust extraction rates to reduce water levels to elevations a minimum of five feet below static water levels at the time that extraction is initiated. Reduce extraction rate if TCE concentrations are appreciably below 1,000 ug/L while maintaining minimal drawdown.
HAR-18	1				
RD-1	2				
RD-4	10				
RD-41B	2				
RD-46A	1				
RD-49A	0.2				
RS-54	0.1				
WS-9	10				
HAR-20	0.1	Stop increasing TCE and groundwater elevation trend	Maintain or lower groundwater elevation or TCE concentration	Semi-annual water level measurements and annual TCE concentrations in groundwater from extraction well.	Adjust extraction rates to reduce water levels to elevations a minimum of 5 feet below static water levels at the time extraction is initiated. Continue extraction until TCE concentrations are reduced.
Total Extraction Rate:	59	Note 1: At start-up, initiate extraction from C-1 and monitor water levels in RD-72 and RD-84 with downhole level loggers. Initiate extraction from RD-72 after influence from pumping at C-1 is observed in RD-72. Similarly, initiate extraction from RD-84 after influence from extraction at RD-72 is observed.			

Abbreviations:

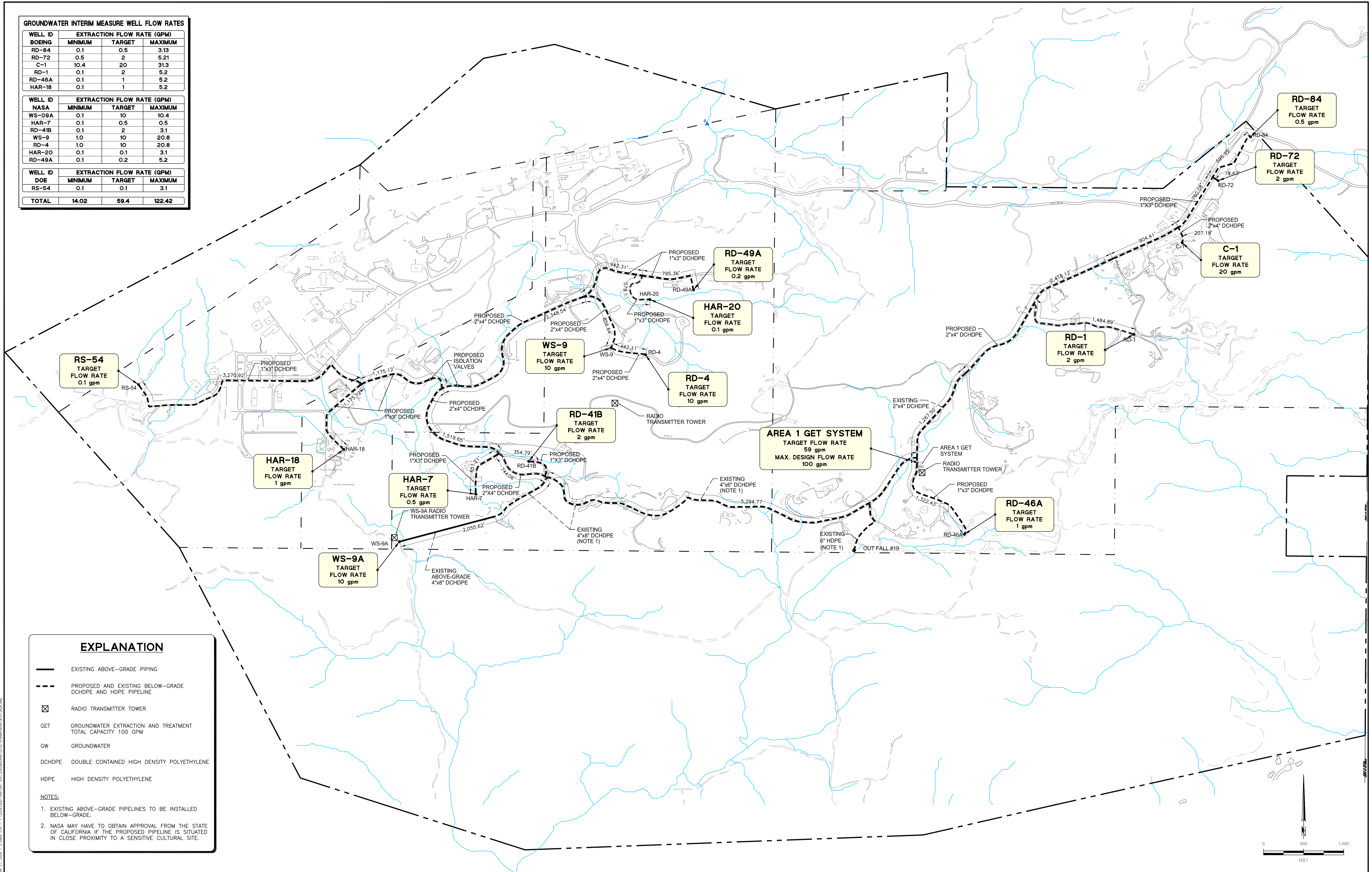
GPM - gallons per minute
ug/L - micrograms per liter
TCE - trichloroethene
FDP - Field Data Point
ft - feet
msl - mean sea level

FIGURES

GROUNDWATER INTERIM MEASURE WELL FLOW RATES			
WELL ID	EXTRACTION FLOW RATE (GPM)		
	MINIMUM	TARGET	MAXIMUM
RD-84	0.1	0.5	3.13
RD-72	0.5	2	5.21
C-1	10.4	20	31.3
RD-1	0.1	2	5.2
RD-46A	0.1	1	5.2
HAR-18	0.1	1	5.2

WELL ID	EXTRACTION FLOW RATE (GPM)		
	MINIMUM	TARGET	MAXIMUM
WS-09A	0.1	10	10.4
HAR-7	0.1	0.5	0.5
RD-41B	0.1	2	3.1
WS-9	1.0	10	20.8
RD-4	1.0	10	20.8
HAR-20	0.1	0.1	3.1
RD-49A	0.1	0.2	5.2

WELL ID	EXTRACTION FLOW RATE (GPM)		
	MINIMUM	TARGET	MAXIMUM
RS-54	0.1	0.1	3.1
TOTAL	14.02	59.4	122.42



EXPLANATION

EXISTING ABOVE-GRADE PIPING

PROPOSED AND EXISTING BELOW-GRADE DCHDPE AND HDPE PIPELINE

RADIO TRANSMITTER TOWER

GET

GROUNDWATER EXTRACTION AND TREATMENT
TOTAL CAPACITY 100 GPM

GW

GROUNDWATER

DCHDPE

DOUBLE CONTAINED HIGH DENSITY POLYETHYLENE

HDPE

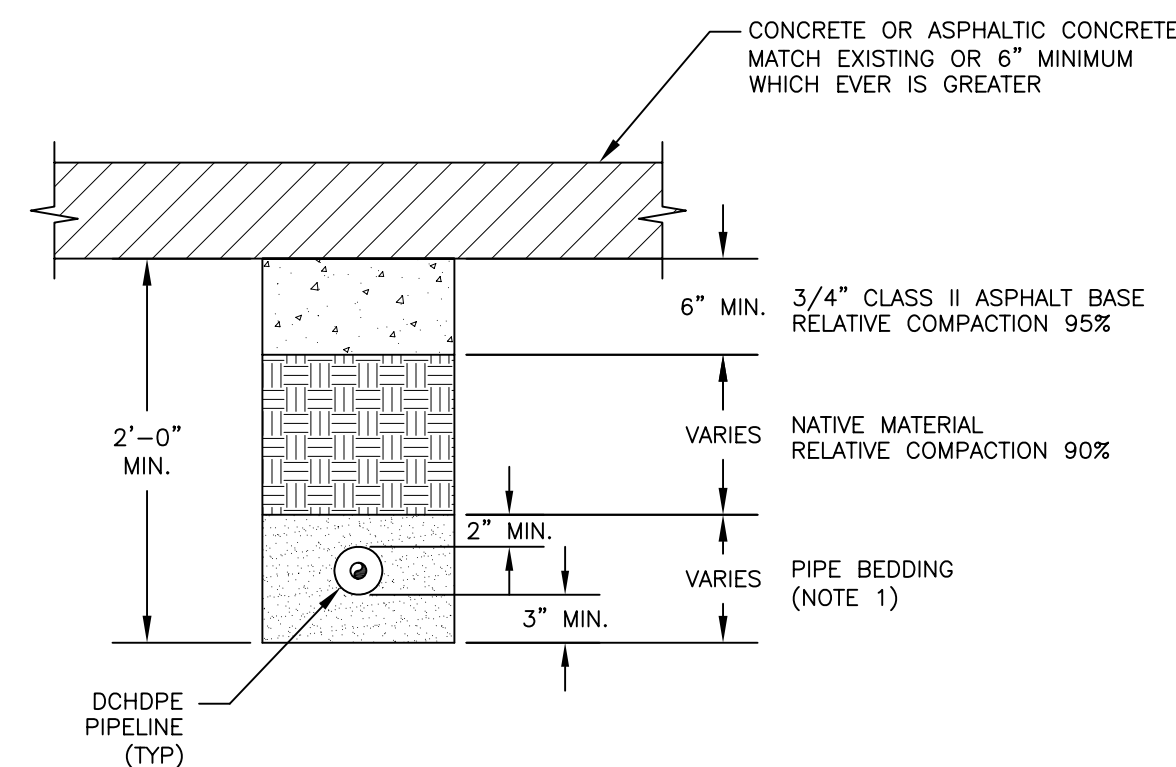
HIGH DENSITY POLYETHYLENE

NOTES:

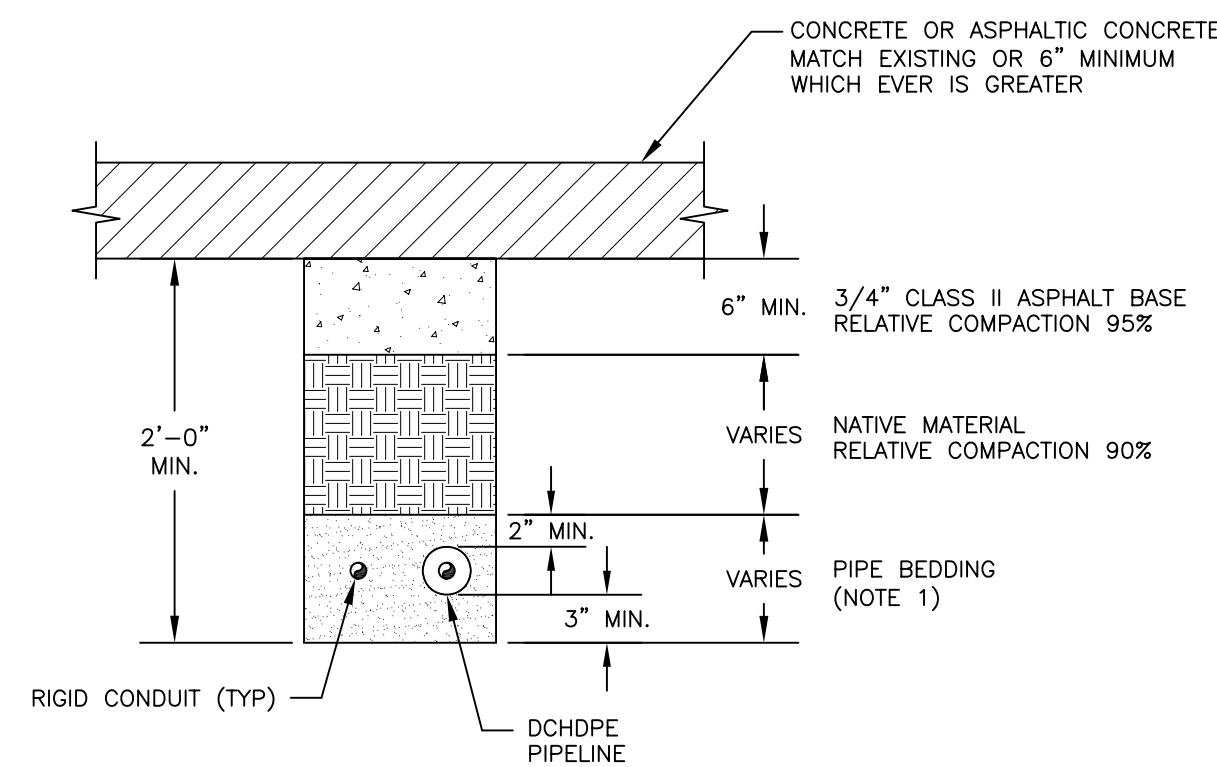
1. EXISTING ABOVE-GRADE PIPELINES TO BE INSTALLED BELOW-GRADE.

2. NASA MAY HAVE TO OBTAIN APPROVAL FROM THE STATE OF CALIFORNIA IF THE PROPOSED PIPELINE IS SITUATED IN CLOSE PROXIMITY TO A SENSITIVE CULTURAL SITE.

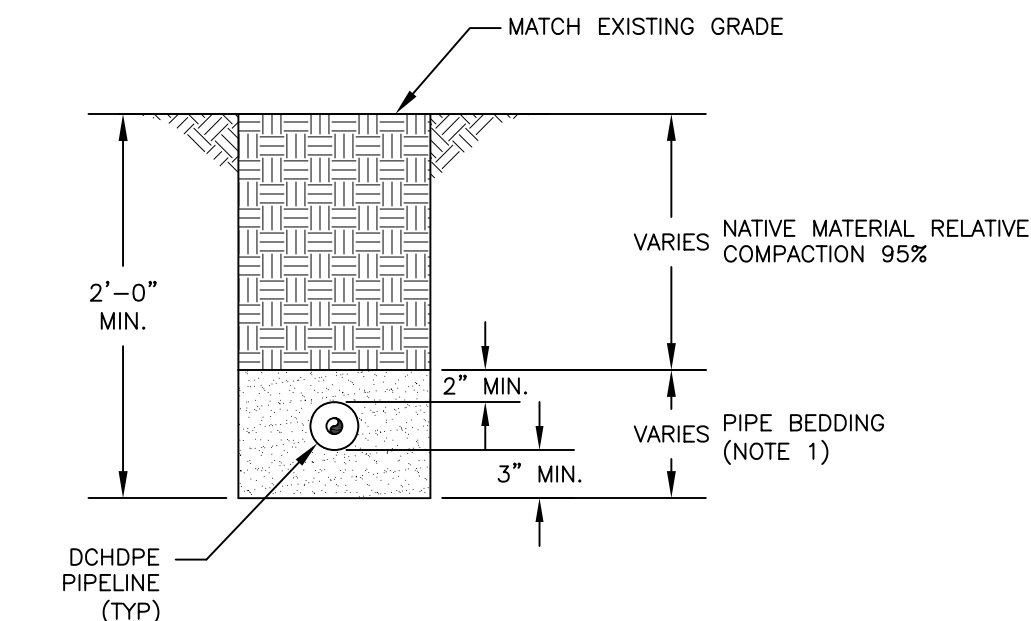
FIGURE 1. GROUNDWATER INTERIM MEASURE WELLS – CONCEPTUAL PIPELINE ROUTING



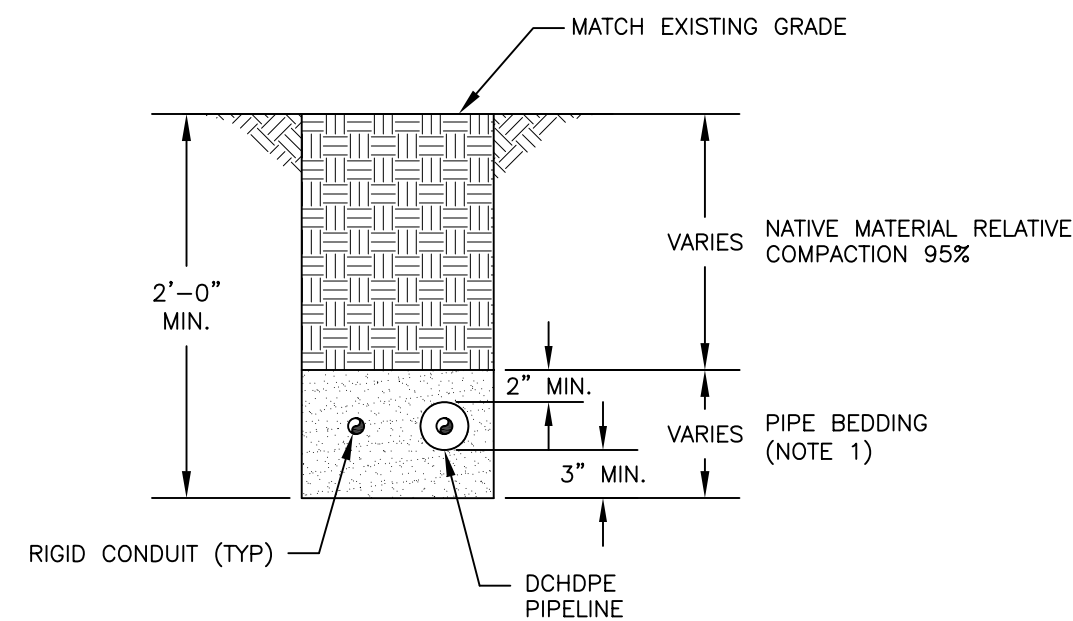
1 TYPICAL TRENCH IMPROVED
SCALE: 1"=1'



2 TYPICAL TRENCH W/ CONDUIT IMPROVED
SCALE: 1"=1'



3 TYPICAL TRENCH UNIMPROVED
SCALE: 1"=1'



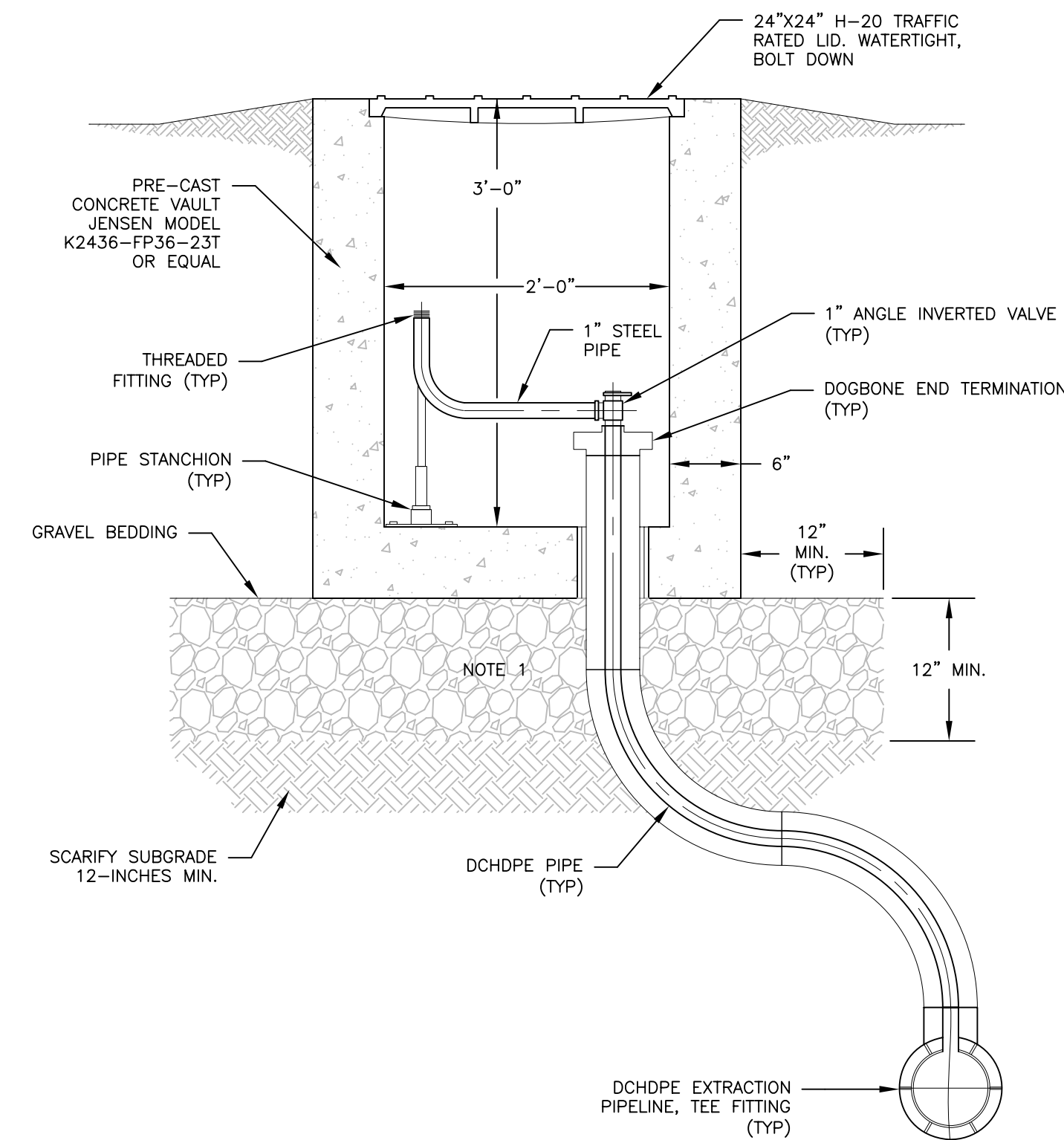
4 TYPICAL TRENCH W/ CONDUIT UNIMPROVED
SCALE: 1"=1'

EXPLANATION

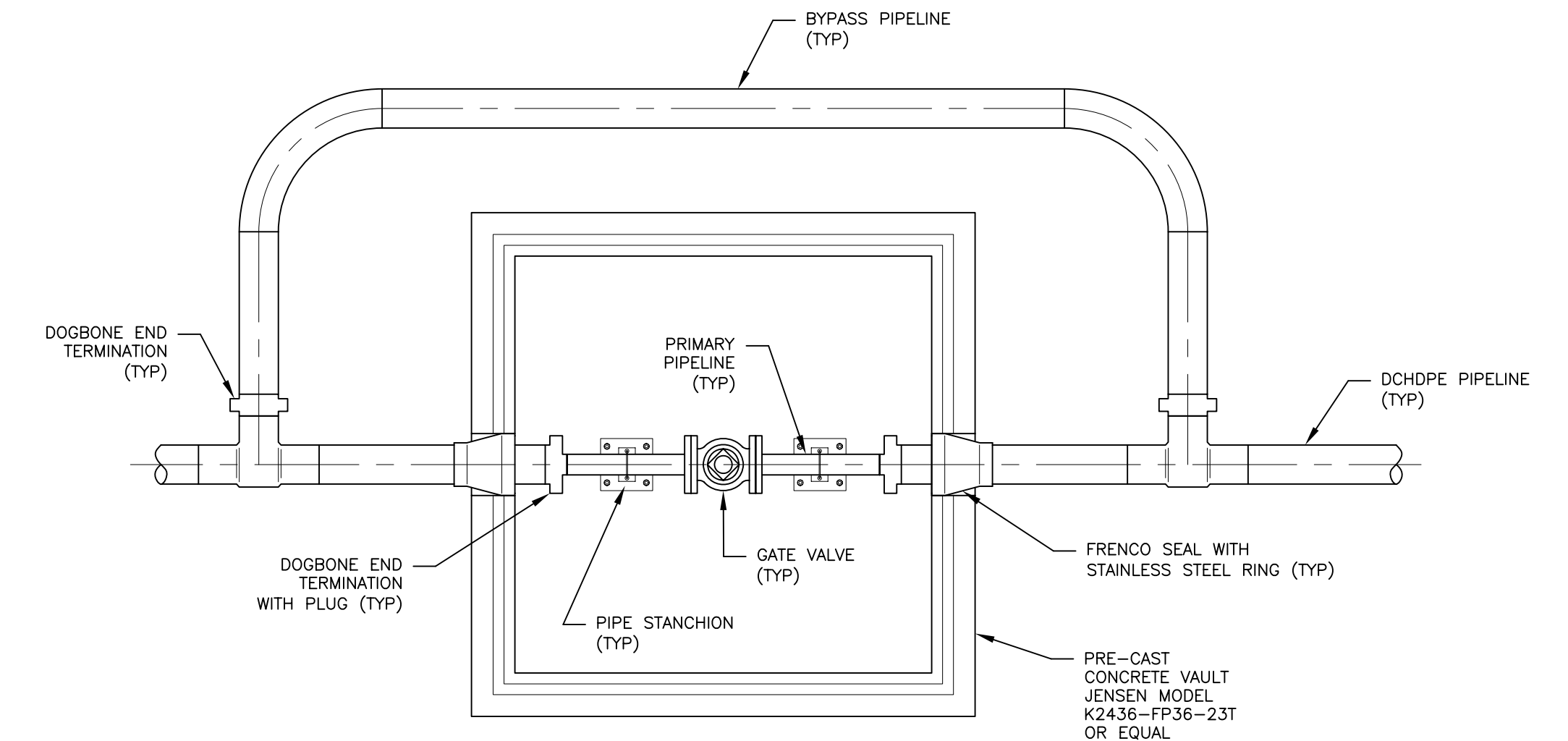
FQI - FLOW QUANTITY INDICATOR - TURBINE METER
VC - CHECK VALVE
VG - GLOBE VALVE
PI - PRESSURE INDICATOR
AA - CARBON STEEL, SCHEDULE 40
BC - DOUBLE CONTAINED HIGH DENSITY POLYETHYLENE
LC - LEVEL CONTROLLER
SP - SAMPLE PORT
VB - BALL VALVE

NOTES:

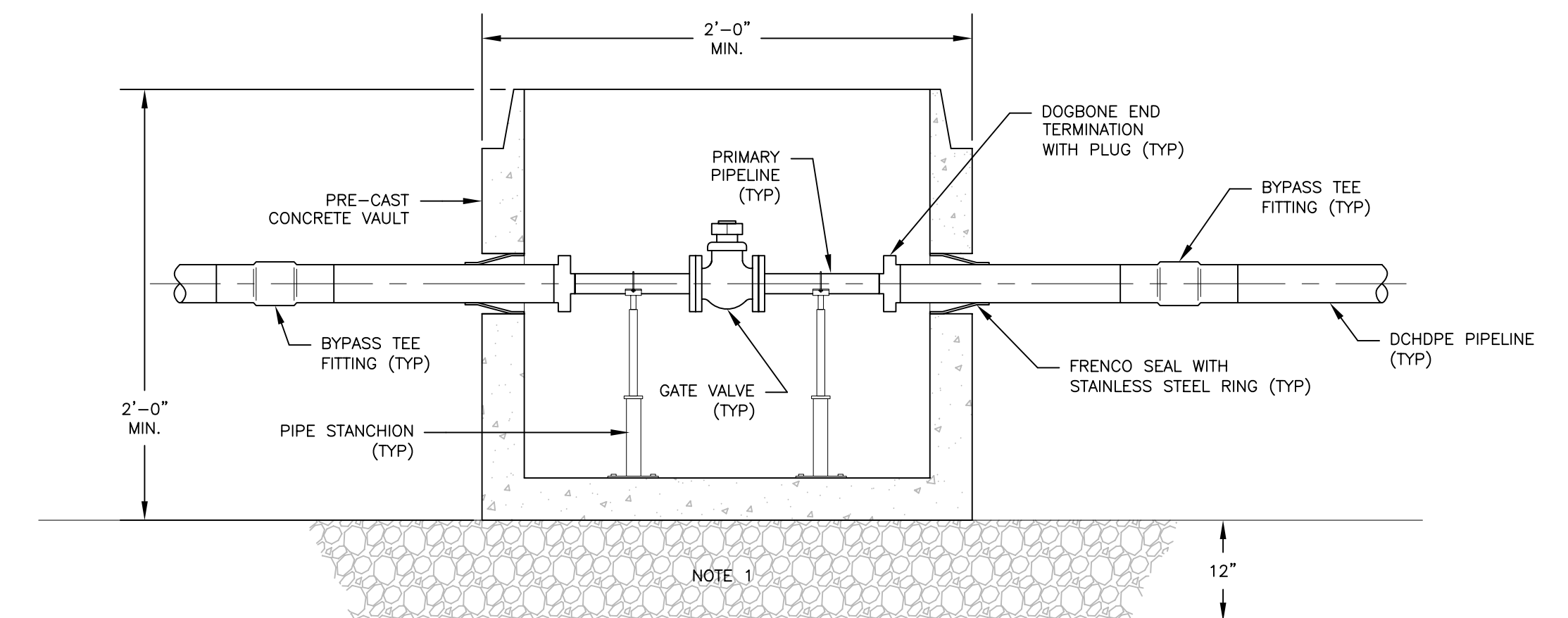
- BEDDING SHALL BE A MINIMUM OF 1-FOOT OF 1/2"-INCH CRUSHED ROCK
- DCHDPE - DOUBLE CONTAINED HIGH DENSITY POLYETHYLENE.
- TRENCH SECTIONS SHOW TYPICAL, ACTUAL DEPTHS AND PIPELINE SIZES WILL VARY PENDING FINAL DESIGN.



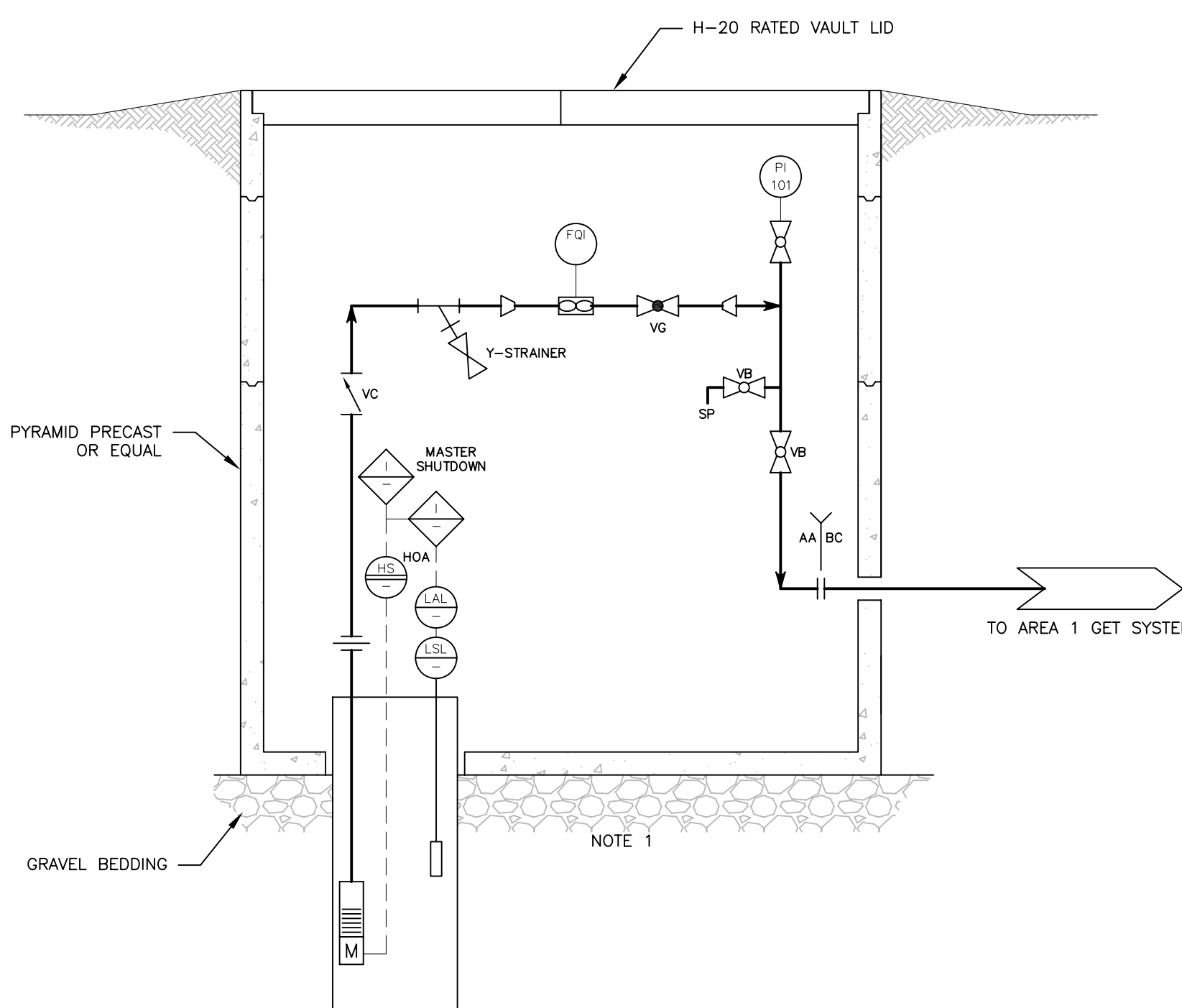
5 AIR RELEASE VALVE VAULT (TYP)
NOT TO SCALE



6 BELOW-GRADE EXTRACTION WELL (TYP)
NOT TO SCALE

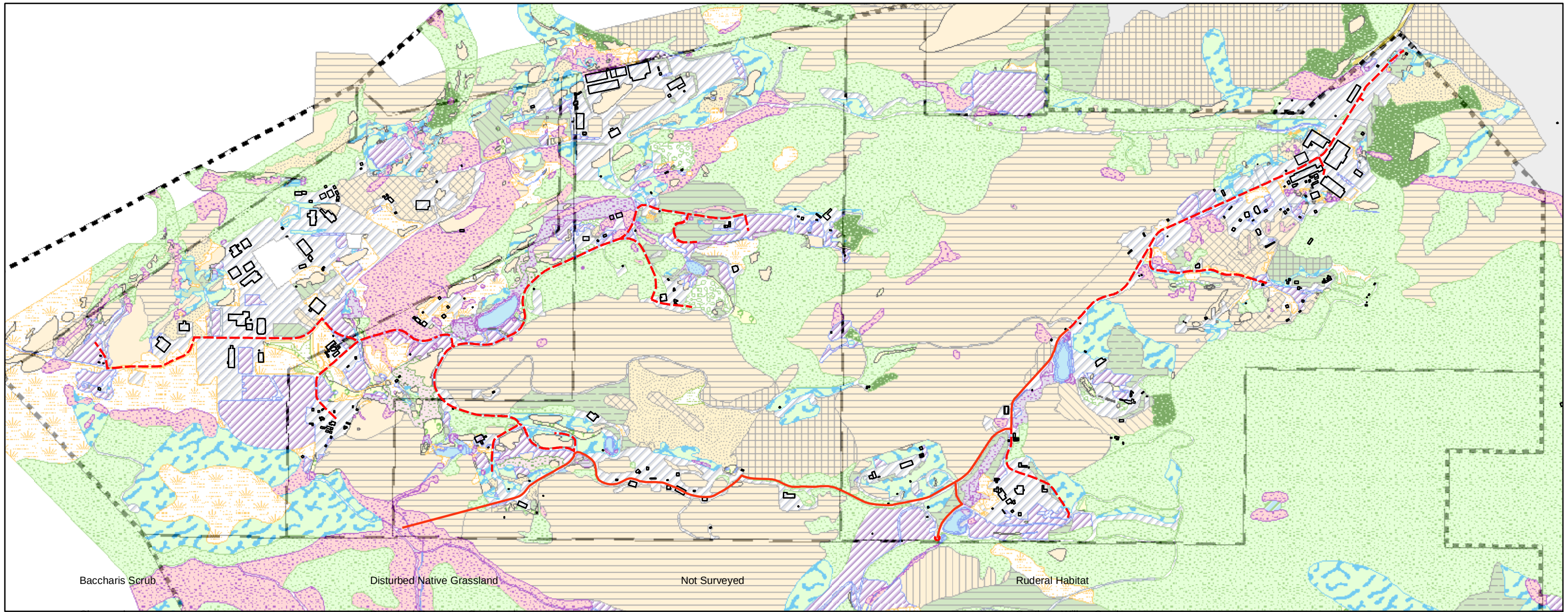


7 CONVEYANCE ISOLATION VALVE (TYP)
NOT TO SCALE



6 BELOW-GRADE EXTRACTION WELL (TYP)
NOT TO SCALE

FIGURE 2. GROUNDWATER INTERIM MEASURE WELLS - TYPICAL CONSTRUCTION DETAILS

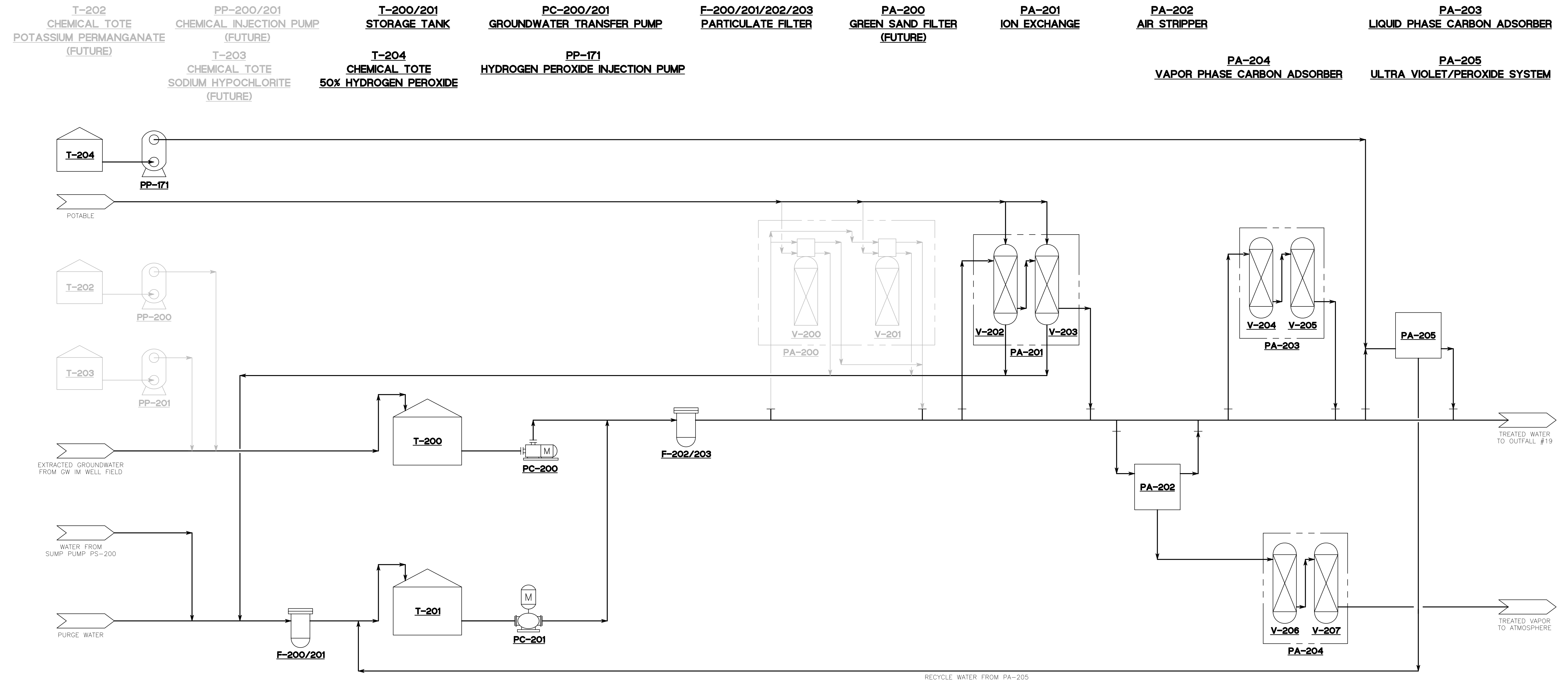


Legend

	Chaparral/Venturan Coastal Sage Scrub		Disturbed Venturan Coastal Sage Scrub		Rock Outcrop		Southern Willow Scrub/Mulefat Scrub
	Coast Live Oak Riparian Forest		Disturbed Venturan Coastal Sage Scrub/Chaparral		Rock Outcrop/Chaparral		Unknown
	Coast Live Oak Woodland		Disturbed Wetland		Rock Outcrop/Chaparral/Coast Live Oak Woodland		Venturan Coastal Sage Scrub
	Developed		Eucalyptus Woodland		Rock Outcrop/Chaparral/Venturan Coastal Sage Scrub		Waters of the US
	Disturbed		Freshwater Marsh		Rock Outcrop/Coast Live Oak Woodland		Wetland
	Disturbed Chaparral		Mulefat Scrub		Rock Outcrop/Disturbed Venturan Coastal Sage Scrub		Existing Pipeline
	Disturbed Chaparral/Coast Live Oak Woodland		Native Grassland		Rock Outcrop/Nonnative Grassland		Proposed Pipeline
	Disturbed Mulefat Scrub		Nonnative Grassland		Rock Outcrop/Venturan Coastal Sage Scrub		SSFL Property Boundary
	Baccharis Scrub						
	Chaparral						
	Disturbed Native Grassland						
	Disturbed Nonnative Grassland						
	Open Water						
	Ruderal Habitat						
	Southern Willow Scrub						

***Santa Susana Field Laboratory
Pipeline Routing and
Ground Surface Cover***

FIGURE
4



EXPLANATION

GET — GROUNDWATER EXTRACTION AND TREATMENT
 GW IM — GROUNDWATER INTERIM MEASURE

FIGURE 5. GROUNDWATER INTERIM MEASURE WELLS – GET PROCESS EQUIPMENT

Jun 06, 2009 - 11:27am csh - T:\2009\600-599\607-505\WORKING\PRESENTATION\FIG-244.dwg

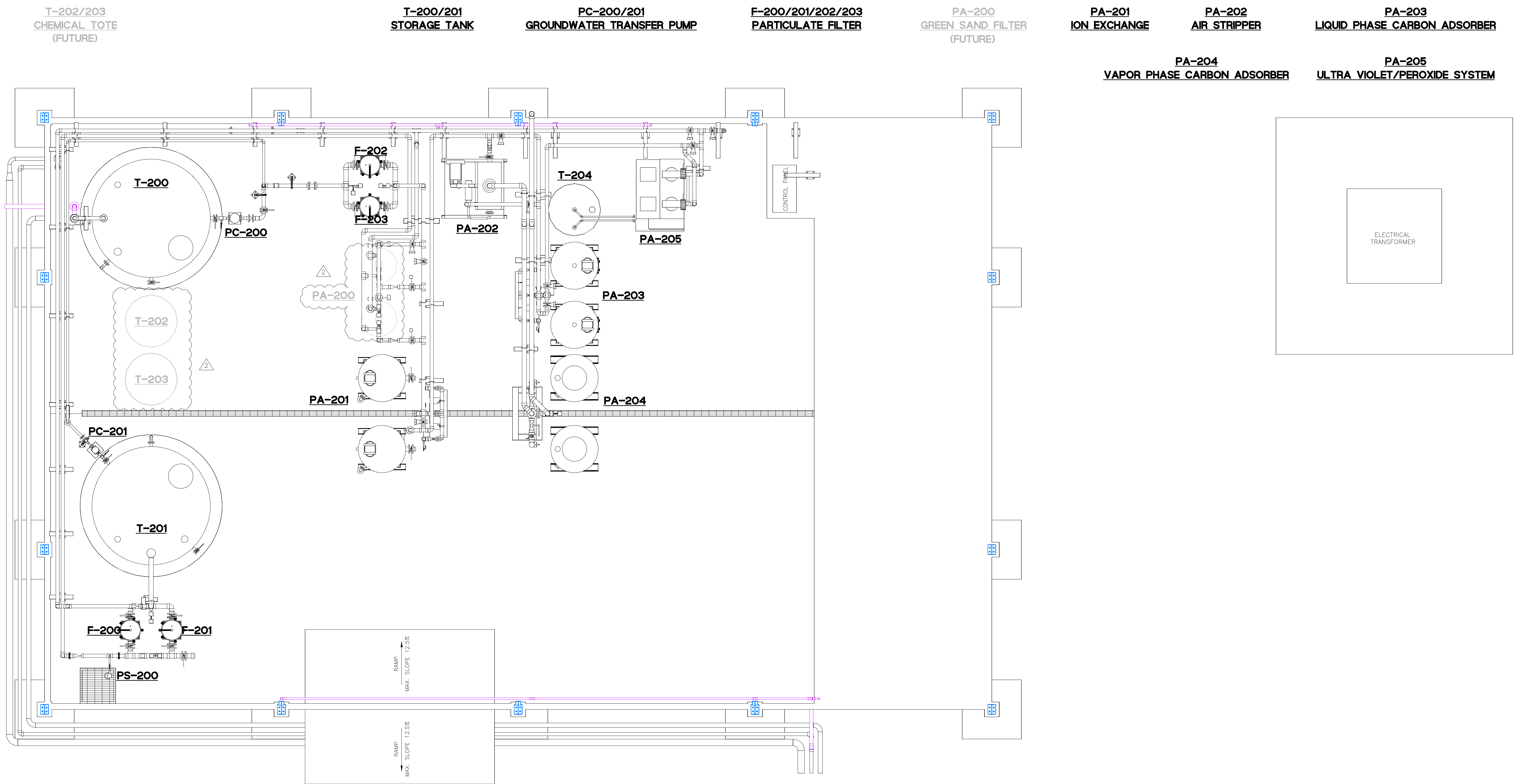


FIGURE 6. GET SYSTEM EQUIPMENT AND PIPING LAYOUT

APPENDICES

APPENDIX A
NPDES AND VCAQMD PERMITS



California Regional Water Quality Control Board

Los Angeles Region



Recipient of the 2001 *Environmental Leadership Award* from Keep California Beautiful

Linda S. Adams
Agency Secretary

320 W. 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576-6600 FAX (213) 576-6640 - Internet Address: <http://www.waterboards.ca.gov/losangeles>

Arnold Schwarzenegger
Governor

November 9, 2007

Mr. Thomas D. Gallacher, Director
SSFL – Safety, Health & Environmental Affairs
The Boeing Company
Santa Susana Field Laboratory
5800 Woolsey Canyon Road
Canoga Park, CA 91304-1148

VIA CERTIFIED MAIL
RETURN RECEIPT REQUESTED
No. 7007 0710 0003 2453 2111

Dear Mr. Gallacher:

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT (NPDES) (ORDER NO. R4-2007-0055) AND CEASE AND DESIST ORDER (ORDER NO. R4-2007-0056) FOR THE BOEING COMPANY, SANTA SUSANA FIELD LABORATORY, CANOGA PARK. NPDES NO. CA0001309, CI NO. 6027

Our letter dated October 16, 2007, transmitted the revised-tentative Order and the revised-tentative Cease and Desist Order for the above referenced facility.

Pursuant to Division 7 of the California Water Code, this Regional Board at a public hearing held on November 1, 2007, reviewed the revised-tentative requirements, considered all factors in the case, and adopted the proposed NPDES permit with the following revisions.

1. Revised-Tentative Waste Discharge Requirements, Page 59, Item D, was updated to read: "This Order may be reopened and modified to consider incorporation of a site specific or regional design storm (based on the evaluation of the results of the Design Storm Project) and subsequent policy considerations.
2. Monitoring and Reporting Program No. 6027, Page T-9, the monitoring frequency for the radionuclides including Gross Alpha, Gross Beta, Combined Radium 226 Combined Radium 228, Tritium, Strontium-90, Radioactive Hydrogen (Tritium), Potassium-40, Cesium 137, and Uranium at outfalls 001, 002, 011, 018, and 019 has been increased to once per discharge event. The same change in the monitoring frequency has been implemented at Outfalls 003 through 010 in the table which appears in Item B, which begins on Page T-10.
3. Monitoring and Reporting Program No. 6027, Page T10 for Outfalls 001, 002, 011, 018, and 019, and on Page T-11, for Outfalls 003 through 010, the monitoring frequency for chronic toxicity has been increased to the first and second rain event of each year.

The Regional Board adopted the revised-tentative requirements incorporating the changes enumerated above. The adopted Order (Order R4-2007-0055) serves as an NPDES permit,

California Environmental Protection Agency



Recycled Paper

Our mission is to preserve and enhance the quality of California's water resources for the benefit of present and future generations.

Mr. Thomas D. Gallacher
The Boeing Company

- 2 -

November 9, 2007

and expires on June 10, 2009. Section 13376 of the California Water Code requires that an application/Report of Waste Discharge for a new permit must be filed at least 180 days before the expiration date. The Regional Board also adopted the revised tentative Cease and Desist Order incorporating the changes included in the Fact Sheet (Order R4-2007-0056).

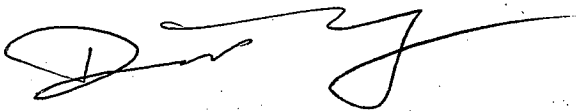
The "Monitoring and Reporting Program" requires you to implement the monitoring program on the effective date of this Order (December 20, 2007). Your first monitoring report for the period of December 2007 is due by February 15, 2008. Monitoring reports should be sent to the Regional Board, ATTN: Information Technology Unit.

When submitting monitoring or technical reports to the Regional Board per these requirements, please include a reference to Compliance File CI-6027 and NPDES No. CA0001309, which will assure that the reports, are directed to the appropriate file and staff. Please do not combine your discharge monitoring reports with other reports, such as progress reports. Submit each type of report as a separate document.

We are sending the final copy of the permit and the Cease and Desist Order only to the Discharger. For those on the mailing list who would like access to a copy of these orders, please go to the Regional Board's website at www.swrcb.ca.gov/rwqcb4/html/permits/generalpermits.html.

If you have any questions please contact Cassandra Owens at (213) 576-6750.

Sincerely,

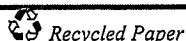


David Hung, Chief
Watershed Regulatory Section

Enclosures: Waste Discharge Requirements
Fact Sheet
Monitoring and Reporting Program
Cease and Desist Order

cc: Honorable Sheila Kuehl, Senator, 23rd District
Assemblymember Pedro Nava, Assemblymember 35th District
Ms. Rondi Guthrie, c/o Assemblywoman Audra Strickland
Environmental Protection Agency, Region 9, Permits Branch (WTR-5)
Mr. Thomas Kelly, Environmental Protection Agency, Region 9, (WTR-5)
Environmental Protection Agency, Region 9, Office of Radiation Programs
Mr. Michael Lopez, U.S.D.O.E., Oakland
Mr. Thomas Johnson, ETEC Project Manager, United States Department of Energy
Ms. Rebecca Tadesse, Branch Chief of Materials Decommissioning, U.S. Nuclear
Regulatory Commission
U.S. Army Corps of Engineers
NOAA, National Marine Fisheries Service

California Environmental Protection Agency



Our mission is to preserve and enhance the quality of California's water resources for the benefit of present and future generations.

State of California
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER NO. R4-2007-0055
AMENDING ORDER NO. R4-2006-0036
AMENDING ORDER NO. R4-2006-0008
AMENDING ORDER NO. R4-2004-0111

WASTE DISCHARGE REQUIREMENTS
FOR
THE BOEING COMPANY
(Santa Susana Field Laboratory)
(NPDES NO. CA0001309)

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board), finds:

Background

1. The Boeing Company (hereinafter Boeing or Discharger) discharged waste from its Santa Susana Field Laboratory (SSFL) facility under waste discharge requirements, which serve as a National Pollutant Discharge Elimination System (NPDES) permit, contained in Order No. 98-051 adopted by this Regional Board on June 29, 1998 (NPDES Permit No. CA0001309).
2. Boeing filed a report of waste discharge and applied for renewal of its waste discharge requirements and NPDES permit for discharge of wastes to surface waters. Order R4-2004-0111, adopted on July 1, 2004, incorporated effluent limitations based on the California Toxics Rule (CTR) criteria where appropriate and added nine new compliance points for a total of eighteen compliance points at the SSFL facility.
3. Order R4-2006-0008 (adopted January 19, 2006) amended Order No R4-2004-0111. Order R4-2006-0008 was the result of new information incorporated into the Order after one year of compliance and routine monitoring based on Monitoring and Reporting Program (MRP) No. 6027. Order R4-2006-0036 (adopted March 9, 2006) incorporated the waste load allocations (WLAs) from Total Maximum Daily Loads (TMDLs) for the Los Angeles River and for Calleguas Creek.
4. This Order amends Order R4-2006-0036 to comply with directives given to the Regional Board in Order WQ 2006-0012 issued by the State Water Resources Control Board in the matter of the Petition of the Boeing Company for Review of Waste Discharge Requirements (WDR) Orders R4-2004-0111, R4-2006-0008, and R4-2006-0036 for the Santa Susana Field Laboratory. The Order also includes revisions based on the results of the reasonable potential analysis which includes the data collected through May 22, 2006.

July 30, 2007
Revised: October 15, 2007
Revised: November 1, 2007

Description of Facility

5. SSFL is located at the top of Woolsey Canyon Road in the Simi Hills, Ventura County, California (Figure 1). The developed portion of the site comprises approximately 1,500 acres. There are 1,200-acres of undeveloped land located to the south. In 1998, undeveloped land was purchased to the north of the site. SSFL is owned by both Boeing and the National Aeronautics and Space Administration (NASA). The United States Department of Energy (DOE) also owns several buildings located in Area IV, with the land being under the ownership of Boeing.
6. Boeing and its predecessors' operations at SSFL since 1950 include research, development, assembly, disassembly, and testing of rocket engines, missile components, and chemical lasers. DOE conducted past operations in research and development of energy related programs, and seismic testing experiments. Current DOE activities onsite are solely related to facility decontamination, decommissioning, and environmental remediation and restoration.
7. Historical Boeing activities at SSFL that contributed to discharges from the site include rocket engine testing where water was used to cool flame deflectors, fire suppression equipment, and pressure testing of equipment used to support rocket engine testing. Other facility support activities such as cooling, heating, domestic waste treatment, and ground water treatment contributed to discharges from the site as well.
8. Surface Impoundments: There are nine closed surface impoundments at the SSFL that are regulated under the Resource Conservation and Recovery Act (RCRA). The nine impoundments are closed and regulated by Department of Toxic Substances Control (DTSC) under two postclosure permits issued in 1995. These impoundments include: Engineering Chemistry Laboratory (ECL), Advanced Propulsion Test Facility (APTF) 1 & 2, Storable Propellant Area (SPA) 1 & 2, Systems Test Lab (STL) IV 1 & 2, Delta skim pond and the Alfa Bravo skim pond. A tenth surface impoundment, the Propellant Load Facility (PLF), was clean closed and did not require a postclosure permit.
9. Nuclear Operations Decontamination and Decommissioning: Nuclear research and development for the U.S. Department of Energy (DOE) and its predecessors was conducted at the SSFL from 1954 – 1989. The activities included developing and operating reactors, and fabricating and disassembling nuclear fuel. The federal government began to phase out the program in the 1960s. The last reactor was shut down in 1980, and nuclear research was terminated in 1989. This research and the associated activities resulted in residual contamination in Area IV.

There are currently no programs at the SSFL that employ special nuclear materials. Current decommissioning activities have reduced the inventory of radioactive waste to approximately 5 curies. Previously all of this material was stored in shielded vaults located at the Radioactive Materials Handling Facility (RMHF), near Outfall 003. More recently, any radioactive material stored onsite is located in a separate building at a RMHF. SSFL continues to utilize radioisotopes in the form of calibration sources that are necessary to calibrate radiation detectors and counting equipment. Periodic radiological monitoring of surface waters is conducted under the existing NPDES permit.

One radiological facility located in Area IV, Building 4059, was decommissioned in 2004. Two radiological facilities located in Area IV of the SSFL remain to be decommissioned and storm water run-off from the area is monitored for radioactivity. The DOE is responsible for the cost of decontamination and decommissioning, and the California Department of Public Health (Radiologic Health Branch) has radiological oversight responsibilities at SSFL including a radioactive materials license.

10. Monomethyl Hydrazine Usage: Monomethyl hydrazine (MMH), a propellant, has been used for research, development and testing of rocket engines at SSFL since 1955. MMH that is released as a result of testing operations is captured and treated by an ozonation unit under a variance granted by DTSC. MMH is no longer used at SSFL.
11. Energy Technology Engineering Center (ETEC) Cogeneration Operations: The Sodium Component Testing Installation (SCTI) (cogeneration) unit of ETEC utilized two cooling tower operations, Power Pac and E-5. Both systems have been shut down and will not be reactivated. The facility has been decommissioned and was demolished in July, 2003.
12. Rocket Engine and Component Testing: An engine test consisted of a cycle of one to three engine runs lasting one to three minutes each. A test cycle would take one to two weeks to complete. Each engine run resulted in the use of 50,000 to 200,000 gallons of deluge/cooling water that may have come in contact with fuels such as LOX or kerosene and associated combustion products. The frequency of testing historically varied depending on production requirements. In July 2004 the frequency of testing was one test cycle every one to two months. In January 2006 the Discharger indicated that the frequency of testing had significantly decreased over the past year and was likely to shut down completely during the life of this permit. The updated ROWD submitted in February 2007 provided documentation that rocket engine and component testing operations at the facility had terminated.
13. CTL-3 Chemical Laser Testing: CTL-3 was not operational in 2004. In 2005, limited operations resumed at the facility. There is no discharge to surface waters from this area.
14. Future Operations: Since SSFL is a test facility, it is difficult to anticipate future test projects and possible wastewater generation. Following are discussions of potential future operations:

Treatment Under Tiered Permitting Rules: Boeing is exploring the feasibility of treating certain waste streams by either a mobile or fixed hazardous waste treatment unit operating under DTSC Permit-By-Rule requirements. The waste streams to be treated would be classified under these regulations as non-RCRA, or RCRA exempt hazardous waste. Treated effluent would then be released at a separate outfall.

Description of Waste Discharge

15. SSFL has the potential (based on a 24-hour duration, 10 year return storm event) to discharge a total of approximately 168 million gallons per day (MGD) of storm water runoff that has the potential to contain pollutants from the facilities. Approximately 70% of the discharge exits the property via two southerly discharge points (Discharge Outfalls 001 and 002) to Bell Creek, a tributary to the Los Angeles River, a water of the United States, with its confluence located near the intersection of Bassett Street and Owensmouth Avenue in Canoga Park (see Figure 1).

The storm water from the northern boundaries of the site is discharged via Outfalls 003 through 007, 009 and 010 to the northwest toward the Arroyo Simi. The storm water runoff from Happy Valley (Outfall 008) flows via Dayton Canyon Creek to Chatsworth Creek. Chatsworth Creek flows south to Bell Creek southwest of the intersection of Shoup Avenue and Sherman Way. Bell Creek subsequently flows southeast to the Los Angeles River.

16. Groundwater Remediation: During the early 1950s to the mid-1970s, volatile organic compounds were utilized for the cleaning of hardware and rocket engine thrust chambers, and for the cleaning of other equipment. These solvents migrated into the subsurface, contaminating groundwater primarily with trichloroethylene (TCE) and 1,2-dichloroethylene (1,2-DCE).

An extensive groundwater remediation/investigation program has been ongoing at the SSFL, has included pumping, treating and storing groundwater at the facility. In July 2004, this system was composed of eight treatment systems, five active and three inactive, which have the capability of producing up to 578 million gallons per year of groundwater treated to remove the volatile and, in some cases, semi-volatile organic compounds. The treatment system was not designed to treat other pollutants such as perchlorate or metals. Treated groundwater was discharged directly into one of five ponds included in the water reclamation system via naturally occurring streambeds and in some cases man made watercourses present onsite. The chemical treatment used for the groundwater treatment systems consisted of ultraviolet light and hydrogen peroxide oxidation, and carbon adsorption. The physical treatment consisted of air stripping towers. Two of the eight treatment systems described are currently operating.

These treatment systems were regulated under RCRA hazardous waste permits or administrative order issued by DTSC, and various air quality control permits issued by Ventura County. Boeing plans to treat effluent from SSFL groundwater remediation operations in either a mobile or fixed hazardous waste treatment unit operating under DTSC Permit-By-Rule requirements. The waste streams to be treated would be classified under these regulations as non-RCRA or RCRA exempt hazardous waste. Treated groundwater effluent would then be released at a separate outfall.

17. Water used at SSFL for personnel and for industrial purposes is supplied by both the Calleguas Municipal Water District and a bottled water supplier. The water used for industrial purposes historically after use was discharged to the onsite streambeds, watercourses, and ponds.

18. Two package-type activated sludge sewage treatment plants (STP1 and STP3) previously provided secondary and tertiary treatment for most of the domestic sewage generated onsite. Disinfected sewage effluent from the activated sludge facilities was directed to the reclaimed water system reservoirs (unlined ponds). Water from the reservoirs was routinely reused for industrial purposes. A third activated sludge sewage treatment plant (STP2) is a transfer holding tank and only used for storage.

Operations terminated at STP3 in October 2001 and at STP1 in December 2001. Domestic sewage, which was previously treated at the sewage treatment plants, is being shipped offsite. The STP1 and STP3 basins are currently used as collection points for wastewater generated onsite. Every few days, vacuum trucks transport the accumulated waste off site for treatment. One of the Joint Outfalls (Los Angeles County Sanitation District's) facilities are routinely used for disposal of the waste.

19. The SSFL previously utilized a system of natural, unlined and man-made ponds and channels to collect and reuse water as a cooling media and for fire suppression during rocket engine and component hot fire testing and to provide for storm water settling as a BMP. Water supplied to the system came from any one, or a combination of the following, sources: storm water, treated groundwater, tertiary treated sanitary sewage, recycled test cooling water, or domestic water purchased from an established purveyor. The water was stored in a series of steel tanks located in Area 2 called Skyline. The water was transferred by gravity to either the Alfa or Bravo test facilities for use as cooling and fire protection water during test operations. Excess water from these operations was returned to the ponds through open, unlined channels. The water was then pumped back to the storage tanks at Skyline for reuse. If the demand for water exceeds the reclaimed water supply, domestic water was used to make up the difference. The reclaimed water system is separated from the domestic water supply by air gaps and backflow prevention devices. The reclaim water is no longer used in the reclaim system. Water used for industrial purposes was replaced by domestic water supplied by Calleguas Municipal Water District.

Historically, Area I utilized the R-1 Pond as a reservoir for the reclaimed water system. Water retained in the R-1 Pond was comprised of primarily effluent from the groundwater treatment systems. Other sources included effluent from Sewage Treatment Plant 1 and seasonal rain events. If the supply of reclaimed water exceeds requirements, the R-1 Pond will overflow into Perimeter Pond; excess water from Perimeter Pond will then flow south to Bell Creek through Outfall 001. Discharges through Outfall 001 are rare, and will usually only occur after rainfall over an extended period.

Historically, Areas II, III, and IV shared a common system for reclaimed water collection and distribution, is referred to as Area IV. Area IV used Silvernale Pond and R-2A Pond as reservoirs for the reclaimed water system. As in Area I, the primary source of water stored in the ponds came from groundwater treatment operations. Other sources include effluent from Sewage Treatment Plant 3, cooling water runoff from test operations and seasonal rain events. If the supply of reclaimed water exceeded requirements, the water was discharged to the south through R-2A Pond, and then to

Bell Creek through Outfall 002. Reclaimed water could be pumped from either Silvernale or R-2A Pond to the reclaimed water storage tanks located at Skyline, as needed.

Industrial operations onsite historically discharged untreated wastewater directly to either constructed or natural drainage areas and streambeds. The wastewater flowed to ponds located onsite and was subsequently used in other industrial activities such as quenching operations during engine tests. These natural drainage areas and streambeds are waters of the United States.

20. The five active ponds used historically for collection and storage of reclaimed water are:

R-1 Pond	capacity 3.7 million gallons
Perimeter Pond	capacity 1.3 million gallons
Silvernale Pond	capacity 6.0 million gallons
R2-B Pond	capacity 200,000 gallons
R2-A Pond	capacity 2.5 million gallons

The Coca Pond was previously used as a retention basin to collect water from the space shuttle main engine testing area. When Coca Pond is filled to capacity, it discharges to the R-2 Pond. The pond was historically used to collect water that leaked from the fire suppression system located in the former test area. If sufficient leaks occurred, the pond discharged to R-2. However, this permit prohibits discharges of non storm water to the onsite waterways and ponds.

21. SSFL has the capability to redirect the flow in each of the five ponds via unlined channels, water lines, or pumping into water storage tanks as follows:

R-1 Pond	Flow may be discharged to Perimeter Pond or pumped to the Reclaimed Water Storage Tanks.
Perimeter Pond (PP)	Flow may be released to Bell Canyon or pumped to R-1 Pond.
Silvernale Pond	Effluent flows by gravity to R2-A Pond.
R2-B Pond	This pond is a silt inlet to R-2A Pond. Flow goes directly to R-2A Pond.
R2-A Pond	Flow may be released to Bell Canyon or pumped to Silvernale Pond.

Air agitation is used at these ponds to control algae blooms. Chemical addition, such as copper sulfate, bromine or chlorine, is not used, but may become necessary in the future if agitation alone proves to be inadequate to control algae blooms.

22. The SSFL is underlain by alluvium, weathered bedrock and unweathered bedrock. The alluvium occurs in narrow drainages and alluvial valleys. The alluvium is underlain by the Chatsworth Formation. The Chatsworth Formation consists of fractured sandstone with interbeds of siltstone and claystone, which can transmit water as well as contaminants.

The groundwater system at the SSFL is divided into two aquifers; the shallow and the deep. The alluvium and weathered bedrock comprise the shallow aquifer, and the unweathered and fractured Chatsworth Formation comprise the deep aquifer.

The groundwater surface in the shallow aquifer generally reflects surface topography. In April 2002, groundwater depths in the shallow aquifer ranged from approximately 6 feet to 40 feet below grade. Wells in the deeper aquifer contained groundwater between approximately 23 feet to approximately 520 feet below grade.

23. Previously, excess water from the onsite wastewater reclamation system was intermittently discharged to the southern Discharge Outfalls 001 and 002

The intermittent wastewater flows are listed below.

LOCATION		<u>Domestic Wastewater</u> FLOWS (MGD)		
<u>From</u>	<u>To</u>	<u>Max</u>	<u>Average</u>	<u>Design</u>
Area I	R-1 (PP)	0.012	0.012	0.04
Area II	Area III	0.0	0.0	0.05
Area III	R-2	<u>0.022</u>	<u>0.008</u>	<u>0.0236</u>
Totals		0.034	0.000	0.1136

Industrial Wastewater

LOCATION		FLOWS (MGD)		
<u>From</u>	<u>To</u>	<u>Max</u>	<u>Average</u>	<u>Design</u>
APTF	R-1	0.013	0.0003	0.013
Alfa Test Area 1	R-2	0.002	0.002	0.002
Alfa Test Area 3	R-2	0.002	0.002	0.002
Bravo Test Area	R-2	0.00003	0.0000	0.00003
Groundwater	R-2	0.835	0.050	0.835
Groundwater	PP	0.648	0.000	0.648
STL-IV	R-2B	0.0016	0.0000	0.0016
(Alt. Test)				
STL-IV	R-2B	0.0005	0.0000	0.0005
(AM. Test)				
STL-IV	R-2B	0.00004	0.00000	0.00004
(Firex)				
RNTF Bldg. 222	R-2	0.0004	0.0004	0.0004
CTL-3	R-1	<u>0.0100</u>	<u>0.0000</u>	<u>0.0100</u>
Totals		1.5123	0.0547	1.5123

The ROWD submitted by the Discharger in February 2007 indicates that the onsite reclamation system is no longer in use. Wastewater discharges to surface waters will occur solely from the Groundwater Extraction Treatment System (Outfall 019). Other facility support activities such as fire suppression equipment, cooling, and heating will not discharge to onsite drainages or to the onsite ponds.

24. Order 98-051 included estimates of discharges from the Seismic Test Area of 0.0002 mgd. The operations at that area have ceased, the building is inactive and scheduled for demolition. Hence, there are no projected discharges from that location.

Order No. 98-051 also includes a total design flow from industrial discharges of 1.6338 mgd. The design flow in Order R4-2004-0111 is 1.5123 mgd. The decrease in the design flow is due to operations that have ceased, facilities that have been demolished, and a decrease in the pump rate for the groundwater treatment systems.

25. Previously, in dry weather, ongoing activities were normally sufficient to use the water generated from the onsite groundwater treatment systems. However, in recent years this water balance has changed. Water now being added into the system from the Calleguas Municipal Water District, plus the reduction of testing activities, has caused releases from R-2A Pond (located upstream from Outfall 002) to become intermittent. During hot weather, the water released will either evaporate or percolate into the ground without reaching Discharge Outfall 002. Thus, offsite discharge of water rarely occurs during dry weather.
26. The wastewater, which was a combination of storm water runoff, treated sewage effluent, treated groundwater, and water from industrial processes, was discharged offsite through Outfall 001, located at Latitude 34° 12' 49.7" North and Longitude 118°

41' 43.7" West, or through Outfall 002, located at Latitude 34° 13' 2.4" North and Longitude 118° 42' 15.4" West. These two discharge outfalls are located a maximum 6,000 feet south of the final retention ponds located at the edge of the developed portion of the site.

27. Many of the areas that discharged wastewater to the drainage areas and streambeds are associated with activities that are being regulated by DTSC under RCRA. DTSC is exercising its RCRA authority through Post Closure Permits and corrective action oversight of contaminated areas. The corrective action oversight includes delineation of areas of contamination, as well as subsequent cleanup operations at solid waste management units (SWMUs) and areas of concern onsite. The Post Closure Permits cover the operation of the groundwater treatment systems used during the cleanup.
28. The 1995 Final SB 1082 Framework which was issued on December 14, 1995 documents the framework for implementing Health and Safety Code Section 25204.6(b) dealing with jurisdictional overlap between the DTSC and the Regional Water Quality Control Boards (RWQCBs). SB 1082 requires that "sole jurisdiction over the supervision of that action [meaning oversight of those corrective action activities] is vested in either the department or the State Water Resources Control Board and the California Regional Water Quality Control Boards." Since many of the identified wastewater sources are currently involved in the RCRA corrective action or the Post Closure Permits with DTSC as the oversight agency and consistent with RCRA, DTSC will ensure that the discharges from these operations meet the substantive Clean Water Act requirements. Regional Board staff was provided with the opportunity to comment during the revision of the RCRA permits to ensure the Clean Water Act, Porter-Cologne Act, and the Basin Plan requirements are met. The final revised permits have not been issued. Order R4-2004-0111, R4-2006-0008, R4-2006-0036 required the final, downstream outfalls (Serial Nos. 001 and 002) to comply with water quality standards, and these outfalls were regulated under these Orders. Order R4-2007-0055 regulates with numeric effluent limitations discharges from Outfalls 011 and 018 and includes requirements for monitoring at Outfalls 001 and 002

There were several other operations that were ongoing, which are not included in the RCRA corrective action, that discharge wastewater to the onsite drainageways and streambeds. These activities were covered by the NPDES permit.

29. The operations evaluated at SSFL during the development of Order R4-2004-0111 and the agency (RWQCB or DTSC) with primary oversight authority and the NPDES outfall number associated with the operation if the Regional Board has oversight are listed below (Figure 2).

Operation	Current NPDES Outfall No.	Agency
1. Wastewater and Storm water runoff	001	RWQCB
2. Wastewater and storm water runoff	002	RWQCB
3. Storm water Radioactive Material Handling Facility	003	RWQCB

Operation	Current NPDES Outfall No.	Agency
4. Storm water Sodium Reactor Exp.	004	RWQCB
5. Storm water Sodium Burn Pit 1	005	RWQCB
6. Storm water Sodium Burn Pit 2	006	RWQCB
7. Storm water Building 100	007	RWQCB
8. Storm water Happy Valley	008	RWQCB
9. Storm water WS-13 Drainage	009	RWQCB
10. Storm water Building 203	010	RWQCB
11. R-1 Pond	----	DTSC
12. Perimeter Pond	011	RWQCB
13. R-2 Ponds (R-2A and R-2B)	----	DTSC
14. R-2 Spillway	018	RWQCB
15. Silvernale Pond	----	DTSC
16. Alfa Test Stand	012	RWQCB
17. Bravo Test Stand	013	RWQCB
18. WS-5 Groundwater Treatment System (GWTS)/ Ultraviolet light/peroxidation (UV/P)	----	DTSC
19. RD-9 GWTS UV/P	----	DTSC
20. Alfa GWTS/Air Stripping Towers (AST)	----	DTSC
21. Delta GWTS/AST	----	DTSC
22. STLV-IV GWTS/AST	----	DTSC
23. Area 1 Road GWTS/AST	----	DTSC
24. Bravo GWTS/AST	----	DTSC
25. Canyon GWTS/AST	----	DTSC
26. Interim GWTS near FSDF*	----	DTSC
27. Interim GWTS near Bldg 59*	----	DTSC
28. Interim GWTS near RMHF*	----	DTSC
29. APTF	014	RWQCB
30. STP-1 – effluent	015	RWQCB
31. STP-2 – effluent	016	RWQCB
32. STP-3 – effluent	017	RWQCB
33. Groundwater Treatment System	019	RWQCB

Implemented in Interim Measures at the site. If the systems continue to operate they will be included in the revised Post Closure Permit.

Operations at the test stands (Outfalls 012 – 014) and the sewage treatment plants (Outfalls 015 – 017) have ceased. No further process waste discharges are expected from these areas. The groundwater treatment systems listed will be taken off line when the groundwater treatment system operating under Permit-by-Rule requirements becomes operational. Effluent from the groundwater treatment operations will be discharged at Outfall 019 in the vicinity of CTL III during routine operations.

30. The updated ROWD submitted on February 20, 2007, included a request to discharge treated groundwater to the streambed downstream of Outfall 011 and upstream of Outfall 001. The treated groundwater is a wastewater from a point source and thus will be

regulated by RWQCB in this permit at a new outfall (Outfall 019), which is included in the previous table. Outfall 019 is located in the vicinity of CTL III and during dry weather operations a sample will be collected post treatment at that location. During storm events the discharge from Outfall 019 will be piped downstream of the engineered BMPs located at Outfall 011 but prior to the area where the sample is collected. Therefore, the sample collected at Outfall 011 during storm events will have mixed wastewater; storm water runoff and effluent from the groundwater treatment unit.

Description of Storm Water Sampling

31. One objective of this Order is to protect the beneficial uses of receiving waters. To meet this objective, storm water runoff discharges from the SSFL are subject to requirements stipulated in this NPDES permit and the Discharger will be required to comply with all applicable provisions of the Storm Water Pollution Prevention Plan (Attachment A). This plan includes requirements to develop, implement, and when appropriate update a Storm Water Pollution Prevention Plan (SWPPP) along with Best Management Practices (BMPs) with the intent of preventing all pollutants from contacting storm water and with the intent of keeping all contaminants of concern from moving into receiving waters.
32. Past operations at SSFL have resulted not only in contamination of the groundwater with volatiles but also with various types of surface and near surface soil contamination. Previous investigations and sampling has confirmed the presence of elevated concentrations of mercury and perchlorate in soil, which has been present in storm water runoff in elevated concentrations. The persistent transport of these contaminants offsite in storm water requires that these contaminants have effluent limits in this Order.
33. Storm water from APTF flows toward Bell Creek and the Los Angeles River. Operations at the facility included small engine testing using kerosene (RP-1), hydrogen, potentially alcohol, methanol, peroxide, and liquid oxygen (LOX). Nitrogen is also used for purge gas. After testing, the staging areas were not routinely washed down to remove residual contaminants from the test operations. In July 2004, the Discharger indicated that during normal operations, testing may occur during storm events.

Outfall 014, located at the former location of APTF, was established in Order R4-2004-0111. No test operations have occurred at this location since the adoption of the Order in 2004 and the ROWD submitted in February 2007 indicates that testing operations at the facility have ceased.
34. Storm water runoff from the area that drains to discharge points 001 and 002 is estimated at 34 and 51 MGD respectively (based on a 24-hour duration, 10-year return storm). Historically, this runoff was mixed with industrial waste collected in the ponds prior to discharge.
35. The estimated flow from the area that drains storm water only from the northwest slope and discharges it via discharge points 003, 004, 005, 006, 007, 008, 009, and 010 are 0.79, 0.55, 0.015, 0.81, 0.2, 3.3, 32, and 0.38 MGD respectively. The flow from these locations exits the site leading to Meier Canyon towards the Arroyo Simi (Figure 2). The

Arroyo Simi is a tributary to Calleguas Creek, a water of the United States. The locations and the associated drainage areas are listed below for each of the seven storm water only discharge locations:

<u>Discharge Outfall</u>	<u>Latitude (North)</u>	<u>Longitude (West)</u>	<u>Vicinity</u>
003 (RMHF)	34° 14' 4.0"	118° 42' 38.4"	Radioactive Materials Handling Facility
004 (SRE)	34° 14' 9.1"	118° 42' 23.9"	Former Sodium Reactor Experiment
005 (SBP-1)	34° 13' 48.1"	118° 43' 3.9"	Former Sodium Burn Pit 1
006 (SBP 2)	34° 13' 50.7"	118° 42' 59.9"	Former Sodium Burn Pit 2
007 (B100)	34° 13' 50.2"	118° 42' 52.5"	Building 100
009(WS-13)	34° 14' 19"	118° 41' 38"	WS-13 Drainage Area
010(Bldg. 203)	34° 14' 17"	118° 41' 56"	Building 203

There is no flow from these locations except during heavy rainfall. For purposes of access and safety, these sampling stations have been established inside the SSFL northwest property boundary. The stations are located in close proximity to past and/or existing radiological facilities or other operations, as is noted in the vicinity column above. Additional storm water flow exits the site via various drainage channels into Meir, Runkle and Woolsey Canyons.

36. Storm water runoff from the northwest slope of the facility is monitored at Discharge Outfalls 003, 004, 005, 006, 007, 009, and 010 which discharge towards the Arroyo Simi. The outfall locations near the Northwest slope are located such that they capture runoff from past and existing radiological facilities.
37. The WS-13 Drainage (Outfall 009) area begins near the entrance to the property and traverses several potential areas of concern. The WS-13 drainage area collects storm water runoff from the Area 1 and Area 2 Landfill, and the former LOX plant located on NASA owned property. In addition, WS-13 picks up storm water run on from Sage Ranch where agricultural operations took place and a gun shooting range was located. The storm water runoff from the WS-13 drainage area is sampled at Discharge Outfall 009. This outfall drains to Arroyo Simi.
38. Building 203 (Outfall 010) was formerly used as an instrumentation laboratory where various types of instrumentation were repaired and calibrated. The instrumentation included but was not limited to, thermometers and manometers that contained mercury. Also historically, a photographic processing lab was present in Building 202. Currently Building 203 is used for laser research and Building 202 is inactive. Operations in Building 203 include polishing, cleaning (using solvents and other chemicals), assembly and testing of various components in both open warehouse and clean room environments. All wastes are currently containerized and transported off site for disposal.

Building 203 has been added as Solid Waste Management Unit (SWMU) 5.2 under the RCRA corrective action program due to mercury contamination. Mercury has also been detected downgradient of the building in the surface soils of the adjacent drainage. An

interim measure to remove the surface soil and the associated contamination was completed in the summer of 2004.. The storm water runoff from Building 203 will be sampled at Discharge Outfall 010. Discharges from Building 203 drains to the Arroyo Simi and subsequently to Calleguas Creek.

39. The area commonly referred to as Happy Valley receives storm water runoff from the former solid propellant testing area. A major component of the propellant was perchlorate. The propellant testing area is inactive and buildings have been demolished. Since the propellant has been used in the area and reasonable potential existed for the constituent to cause or contribute to an exceedance, an effluent limit for perchlorate and a requirement to sample the runoff for all other constituents tested for at Discharge Outfalls 003 through 007, has been included in Order R4-2004-0111. The Discharger with DTSC oversight implemented an interim measure (soil removal activity) for soils contaminated with elevated levels of perchlorate during Fall 2003. This project was completed in early 2004. This new storm water monitoring location is Discharge Outfall 008. Following the completion of the interim measure perchlorate has not exceeded the effluent limit. Storm water from Happy Valley flows to Dayton Canyon Creek which merges with Chatsworth Creek. Chatsworth Creek which flows south to Bell Creek southwest of the intersection of Shoup Avenue and Sherman Way. Bell Creek subsequently flows east and merges with Calabasas Creek at the Los Angeles River near the intersection of Vanowen Street and Owensmouth Avenue.

Description of Groundwater Treatment System, and Water Reclamation System

40. The groundwater treatment systems were designed to treat VOC contaminated groundwater. The groundwater is treated and subsequently discharged to channels that transport it around the site for reuse. Perchlorate has been detected in some of the wells. Since the five active RCRA permitted treatment systems are not designed to treat perchlorate, the Discharger has in some instances terminated the treatment of the pumped groundwater from the locations where perchlorate has been detected.

The groundwater treatment systems monitoring and discharge requirements are included in the Hazardous Waste Facility Post-Closure Permit for SSFL which is managed by DTSC. Consequently, all activities associated with the groundwater treatment systems and discharges associated therewith will continue to be managed by DTSC. DTSC is required by RCRA to ensure that the requirements implemented in its permits comply with all applicable and appropriate Regional Board requirements. The treated groundwater and storm water runoff is regulated at Outfall 001

41. A new groundwater treatment system is in the design phase for the SSFL. The groundwater treatment system will be located near CTL-III and will treat water from extraction wells, purge water generated during groundwater sampling events, and groundwater generated during well installations or pumping tests. The treated effluent will be discharged near CTL III (Outfall 019) which is located upstream of Outfall 011. The system's anticipated completion date is September 15, 2007.

During storm events the discharge from Outfall 019 will be piped downstream of the engineered BMPs located at Outfall 011 but prior to the area where the sample is collected. Therefore, the sample collected at Outfall 011 during storm events will have mixed wastewater; storm water runoff and effluent from the groundwater treatment unit.

42. The rocket engine test stands were used to test fire rocket engines built onsite. The fire suppression and cooling water used during testing may contain residual fuels and solvents. This wastewater was directed via lined and unlined channels to the reclamation ponds, which were used to store wastewater collected from the various onsite operations along with any storm water runoff for reuse onsite.

The Regional Board had oversight of the discharges from the active engine test stands. Order No. R4-2004-0111 included requirements for monitoring of the discharges. The data collected was used to evaluate reasonable potential of the discharge to exceed applicable requirements and if warranted; effluent limits were implemented for the discharges in Order Nos. R4-2006-0008 and R4-2006-0036.

43. The sewage treatment plants were also managed by the Regional Board. The sewage treatment plants historically collected only domestic waste generated onsite. There is no pretreatment program in place since the facility does not handle any industrial waste. To implement Clean Water Act section 405(d), on February 19, 1993, USEPA promulgated 40 CFR Part 503 to regulate the use and disposal of municipal sewage sludge. Orders R4-2004-0111, R4-2006-0008, and R4-2006-00036 implement the regulations and it is the responsibility of the Discharger to comply with said regulations; which are enforceable by USEPA.

The plants (STP-1 and STP-3) were activated sludge sewage treatment plants that provided secondary and tertiary treatment for the domestic sewage from the facility. The disinfected sewage effluents were subsequently directed to the reclaimed water system reservoir. The two plants are currently being used as collection reservoirs only. They previously had effluent limits for BOD₅20°C, coliform, and turbidity on discharges from the facilities. Sewage sludge generated was hauled offsite to the one of the facilities operated by Los Angeles County Sanitation Districts. The monitoring program for the sewage treatment plants included requirements for the previously mentioned constituents as well as pH, oil and grease and suspended solids. Order R4-2004-0111 included requirements to monitor for priority pollutants, perchlorate, N-nitrosodimethylamine, 1,4-dioxane, and 1,2,3-trichloropropane to provide the data required to evaluate reasonable potential. Data collected provided the basis for establishing additional effluent limits for the sewage treatment plants in Orders R4-2006-0008 and R4-2006-0036.

After the State Board decision to remand the permit to the Regional Board in Order WQ 2006-0012, Boeing on February 21, 2007, submitted an updated Report of Waste Discharge (ROWD) to the Regional Board. The ROWD included a request to remove the sewage treatment plant outfalls (Outfall 015 – 017). The Discharger is currently using the facilities as collection reservoirs; periodically they are pumped out and the waste is disposed of at the County of Los Angeles Sanitation Districts' facilities. The Discharger does not plan to discharge from the locations in the future.

44. The water reclamation system consisted of five ponds located throughout the developed portion of the site. The treated groundwater, engine test stand wastewater and collected storm water historically traveled around the site, for months prior to being discharged offsite. The natural water courses located onsite are waters of the United States and are subject to regulation under the National Pollutant Discharge Elimination System provisions of the Clean Water Act. Since many of these ponds and water courses that connect these ponds are unlined, contaminants in the water may be deposited on surface soils or they may percolate down to shallow groundwater. Subsequent discharges offsite via these waterways may also transport these contaminants offsite.

The ponds, which were used to store the wastewater for future use, are in all cases included in solid waste management units (SWMUs) currently being investigated by DTSC. These areas are included in the ongoing RCRA characterization and cleanup at the site and are managed by DTSC. There are two special cases, Perimeter Pond and the R-2 Pond Spillway which includes runoff from both R-2A and R-2B Ponds. The ponds are SWMUs and cleanup and characterization will proceed with DTSC oversight. The effluent from Perimeter Pond and the R-2 Pond Spillway will have Regional Board oversight for the required monitoring since the discharges routinely occur as a result of storm events and the discharge is to waters of the United States. The ponds also collected wastewater from a number of areas involved in cleanup operations that may contribute constituent concentrations to the discharge. The water reclamation system at SSFL is no longer operational.

45. On December 17, 2003, the Regional Board received the December 2003 *Technical Memorandum Analysis of Groundwater Recharge, Santa Susana Field Laboratory, Ventura County, California*, prepared by Montgomery Watson Harza on behalf of the Boeing Company. This document was submitted to DTSC in order to present a qualitative and quantitative analysis of groundwater recharge at the Santa Susana Field Laboratory. Regional Board staff has also reviewed this document and find that a reasonable conclusion for the amount of rainfall that infiltrates soil using a water balance method is between 23% to 26%. Using a chloride mass balance method resulted in a range of 1% to 12% rainfall infiltration. As these calculations by different methodologies differ significantly and are inconclusive, Regional Board staff find that there is insufficient data to suggest that rainfall will not significantly recharge groundwater in the underlying surficial soils, weathered and fractured bedrock. In addition, there has been no site-specific soil attenuation factor/model submitted for Regional Board staff review. Inasmuch, those limits placed in this Order to protect groundwater recharge beneficial uses and beneficial uses of underlying groundwater apply at end-of-pipe.

Applicable Plans, Policies, and Regulations

46. On June 13, 1994, the Regional Board adopted a revised *Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan) as amended on January 27, 1997, by Regional Board Resolution No. 97-02. The Basin Plan (i) designates beneficial uses for surface and groundwaters, (ii) sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state antidegradation policy (*Statement of Policy with Respect to Maintaining High Quality Waters in California*, State Board Resolution No. 68-16,

October 28, 1968), and (iii) describes implementation programs to protect all waters in the Region. In addition, the Basin Plan incorporates all applicable State and Regional Board plans and policies and other pertinent water quality policies and regulations. The Regional Board prepared the 1994 update of the Basin Plan to be consistent with all previously adopted State and Regional Board plans and policies. This Order implements the plans, policies and provisions of the Regional Board's Basin Plan.

47. The receiving water for discharges from Outfall 008 enters Dayton Canyon Creek, flows via Chatsworth Creek to Bell Creek, southwest of the intersection of Sherman Way and Shoup Avenue, and subsequently to the Los Angeles River. The receiving water for Outfalls 001, and 002 is Bell Creek and subsequently to the Los Angeles River. The Basin Plan contains water quality objectives for, and lists the following beneficial uses for Dayton Canyon Creek, Bell Creek, and the Los Angeles River.

Dayton Canyon Creek – Hydrologic Unit 405.21

Existing: wildlife habitat
Intermittent: groundwater recharge, contact and non-contact water recreation; warm freshwater habitat.

Bell Creek – Hydrologic Unit 405.21

Existing: wildlife habitat
Intermittent: groundwater recharge, contact and non-contact water recreation; warm freshwater habitat.

The Los Angeles River upstream of Figueroa Street – Hydrologic Unit 405.21:

Existing: groundwater recharge; contact and non-contact water recreation, warm freshwater habitat; wildlife habitat; and wetland habitat.
Potential: industrial service supply.

Los Angeles River downstream of Figueroa Street – Hydrologic Unit 405.15

Existing: groundwater recharge, contact and non-contact water recreation, and warm freshwater habitat.
Potential: industrial service supply and wildlife habitat.

Los Angeles River downstream of Figueroa Street – Hydrologic Unit 405.12

Existing: groundwater recharge; contact and noncontact water recreation; warm freshwater habitat; marine habitat; wildlife habitat; and rare, threatened, or endangered species.
Potential: industrial service supply; industrial process supply; migration of aquatic organisms; spawning, reproduction, and/or early development; and shellfish harvesting.

Los Angeles River Estuary – Hydrologic Unit 405.12

Existing: industrial service supply; navigation; contact and non-contact water recreation; commercial and sport fishing; estuarine habitat; marine habitat; wildlife habitat; rare, threatened, or endangered species; migration of aquatic organisms; spawning, reproduction, and/or early development; and wetland habitat.

Potential: shellfish harvesting.

Dayton Canyon Creek, Bell Creek and all of the reaches of the Los Angeles River listed, except for the estuary, also have municipal and domestic supply (MUN) listed as a potential beneficial use with an asterisk in the Basin Plan. This is consistent with Regional Board Resolution 89-03; however the Regional Board has only conditionally designated the MUN beneficial uses and at this time cannot establish effluent limitations designed to protect the conditional designation.

48. The storm water runoff discharges from the northwest side of SSFL (Outfalls 003 through 007) exit the site and flow down the Meier and Runkle Canyons toward the Arroyo Simi. The Arroyo Simi is tributary to the Calleguas Creek. The beneficial uses of the Arroyo Simi and other tributaries of the Calleguas Creek are:

Arroyo Simi – Hydrologic Unit 403.62

Existing: wildlife habitat, rare, threatened, or endangered species habitat,

Intermittent: industrial process supply, groundwater recharge, freshwater replenishment, contact and non-contact water recreation, warm freshwater habitat;

Arroyo Las Posas – Hydrologic Unit 403.62

Existing: groundwater recharge, freshwater replenishment, contact and non-contact water recreation, warm freshwater habitat, wildlife habitat,

Potential: industrial process supply, industrial service supply, agricultural supply, and cold freshwater habitat.

Calleguas Creek – Hydrologic Unit 403.12

Existing: industrial service supply, industrial process supply, agricultural supply, groundwater recharge, contact and non-contact water recreation, warm freshwater habitat, and wildlife habitat,

Calleguas Creek – Hydrologic Unit 403.11

Existing: agricultural supply, groundwater recharge, freshwater replenishment; contact and non-contact water recreation, warm freshwater habitat, cold freshwater habitat, wildlife habitat, rare, threatened or endangered species, and wetland habitat,

Calleguas Creek Estuary – Hydrologic Unit 403.11

Existing: noncontact water recreation, commercial and sport fishing, estuarine habitat, wildlife habitat, rare, threatened or endangered species, migration of aquatic organisms, spawning, reproduction, and/or early development, and wetland habitat;
Potential: navigation and water contact recreation.

Mugu Lagoon – Hydrologic Unit 403.11

Existing: navigation, non-contact water recreation, commercial and sport fishing, estuarine habitat, marine habitat, preservation of biological habitats, wildlife habitat, rare, threatened or endangered species, migration of aquatic organisms, spawning, reproduction, and/or early development, shellfish harvesting, and wetland habitat,
Potential: water contact recreation.

All of the reaches of Calleguas Creek, except the estuary, also include conditional municipal and domestic supply designations as an intermittent or potential beneficial use in the Basin Plan.

49. **Ammonia Basin Plan Amendment.** The 1994 Basin Plan provided water quality objectives for ammonia to protect aquatic life, in Tables 3-1 through Tables 3-4. However, those ammonia objectives were revised on April 25, 2002, by the Regional Board with the adoption of Resolution No. 2002-011, *Amendment to the Water Quality Control Plan for the Los Angeles Region to Update the Ammonia Objectives for Inland Surface Waters (including enclosed bays, estuaries and wetlands) with Beneficial Use designations for protection of Aquatic Life*. The ammonia Basin Plan amendment was approved by the State Board, the Office of Administrative Law, and USEPA on April 30, 2003, June 5, 2003, and June 19, 2003, respectively. Although the revised ammonia water quality objectives may be less stringent than those contained in the 1994 Basin Plan, they are still protective of aquatic life and are consistent with USEPA's 1999 ammonia criteria update.
50. **Title 22 of the California Code of Regulations.** The California Department of Health Services (DHS) established primary and secondary maximum contaminant levels (MCLs) for a number of chemical and radioactive contaminants. These MCLs can be found in Title 22, California Code of Regulations (Title 22). Chapter 3 of the Basin Plan incorporates portions of Title 22 by reference. In addition, narrative objectives require that ground waters shall not contain taste or odor-producing substances in concentrations that affect beneficial uses. The secondary MCLs in Title 22 are designed to ensure that water's taste and odor does not affect its suitability to drink. Title 22 MCLs have been incorporated into NPDES permits and Non-Chapter 15 WDRs to protect the municipal and domestic supply (MUN) and groundwater recharge (GWR), where the underlying groundwater is designated MUN, beneficial uses.

Groundwater Recharge. Sections of Bell Creek and Arroyo Simi, near the SSFL discharge points, are designated as GWR indicating that groundwater recharge is a

beneficial use. Surface water from the Bell Creek enter the Los Angeles River Watershed. The headwaters of the Los Angeles River originate in the Santa Monica, Santa Susana, and San Gabriel Mountains. Four basins in the San Fernando Valley area contain substantial deep groundwater reserves and are recharged mainly through runoff and infiltration.

Surface water discharges from the north west edge of the SSFL are directed to Arroyo Simi a tributary located in the Calleguas Creek Watershed. Supplies of groundwater are critical to agricultural operations and industry (sand and gravel mining) in this watershed. Moreover, much of the population in the watershed relies upon groundwater for drinking. Since groundwater from these basins is used to provide drinking water to a large portion of the population, Title 22-based limits are needed to protect that drinking water supply. By limiting the contaminants in the SSFL discharges, the amount of pollutants entering the surface waters and groundwater basins are correspondingly reduced. Once groundwater basins are contaminated, it may take years to clean up, depending on the pollutant. Compared to surface water pollution, investigations and remediation of groundwater are often more difficult, costly, and extremely slow. For these reasons Title 22-based limits will remain in the NPDES permit where there is reasonable potential.

Notification Level for Perchlorate. DHS also establishes Notification Levels (NLs), or health-based advisory levels for chemicals in drinking water that lack MCLs. Through 2004, the Notification Levels were referred to as Action Levels. An NL is the concentration of a chemical in drinking water that is considered not to pose a significant health risk to people ingesting that water on a daily basis. NLs may be established by DHS for non-regulated chemical contaminants when one of the following occurs:

1. A chemical is found in an actual or proposed drinking water source, or
2. A chemical is in proximity to a drinking water source, and guidance is needed, should it reach the source.

A NL is calculated using standard risk assessment methods for non-cancer and cancer endpoints, and typical exposure assumptions, including a 2-liter per day ingestion rate, a 70-kilogram adult body weight, and a 70-year lifetime. For chemicals that are considered carcinogens, the NL is considered to pose "de minimus" risk, i.e., a theoretical lifetime risk of up to one excess case of cancer in a population of 1,000,000 people – the 10^{-6} risk level. (In that population, approximately 250,000 – 300,000 cases of cancer would be anticipated to occur naturally.) NLs may be revised from time to time to reflect new risk assessment information. Chemicals for which NLs are established may eventually be regulated by MCLs, depending on the extent of contamination, the levels observed, and the risk to human health. A number of the contaminants for which action levels were originally established now have MCLs.

In 1997, DHS established an 18 $\mu\text{g/L}$ action level for perchlorate. DHS used the upper value of the 4 to 18 $\mu\text{g/L}$ range that resulted from the provisional reference dose that USEPA prepared in support of its Superfund activities. A revised external review draft perchlorate reference dose corresponding to a drinking water concentration of 1 $\mu\text{g/L}$ was released in 2002. DHS concluded that the action level needed to be revised downward. On January 18, 2002, DHS reduced the perchlorate action level to 4 $\mu\text{g/L}$.

The revised action level coincided with the analytical detection limit for purposes of reporting and was at the lower end of the 4 to 18 µg/L range from the USEPA 1992-1995 assessment. The Public Health Goal (PHG) for perchlorate was developed by Office of Environmental Health Hazard Assessment based on a contemporary health risk assessment. This new information was provided to DHS and on March 11, 2004, the NL for perchlorate was revised to 6 µg/L, a value identical to the PHG that will be used by DHS to develop the MCL for perchlorate. The effluent limit for perchlorate (6 µg/L) included in this WDR has been updated to reflect the change implemented by DHS.

Perchlorate and its salts are used in, but not limited to, solid propellant for rockets, missiles, and fireworks. The defense and aerospace industries purchase more than 90 percent of all the perchlorate manufactured. Perchlorate has historically been used at SSFL and thus is considered a chemical of concern at the site. Monitoring data collected during the tenure of the current permit indicates that perchlorate is present in the storm water runoff in Happy Valley and it has been detected in some of the groundwater wells utilized in the cleanup operations ongoing with DTSC oversight.

Perchlorate can interfere with iodide uptake by the thyroid gland; this can result in a decrease in the production of thyroid hormones, which are needed for prenatal and postnatal growth and development, as well as for normal body metabolism. Neither the CTR, NTR, or the Basin Plan has requirements stipulated for perchlorate. Since there is no drinking waters standard, or maximum contaminant level (MCL), the DHS uses the NL as an advisory level. The Regional Board, exercising its best professional judgement, in the review of the "best available science" has in the past considered and used ALs when deemed appropriate to establish final effluent limitations in WDRs and NPDES permits adopted by this Board, to implement the Basin Plan narrative WQO, "*all waters shall be maintained free of toxic substance that produce detrimental physiological responses in human, plant, animal, or aquatic life,*" and to prevent degradation of valuable groundwater sources of drinking water.

51. Under title 40 Code of Federal Regulations (40 CFR) section 122.44(d), *Water Quality Standards and State Requirements*, "Limitations must control all pollutants or pollutant parameters (either conventional, non-conventional, or toxic pollutants), which the Director determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any State water quality standard, including State narrative criteria for water quality." Where numeric effluent limitations for a pollutant or pollutant parameter have not been established in the applicable state water quality control plan, 40 CFR section 122.44(d)(1)(vi) specifies that water quality-based effluent limitations (WQBELs) may be set based on United States Environmental Protection Agency (USEPA) criteria, and may be supplemented where necessary by other relevant information to attain and maintain narrative water quality criteria, and to fully protect designated beneficial uses.
52. Section 402(p) of the federal Clean Water Act (CWA), as amended by the Water Quality Act of 1987, requires NPDES permits for storm water discharges. The Discharger, in addition to meeting the effluent limits included in this permit for storm water discharges only, will be required to develop and implement a SWPPP as stipulated in Finding 27.

These requirements, as they are met, will protect and maintain existing beneficial uses of the receiving water.

53. Effluent limitation guidelines requiring the application of best practicable control technology currently available (BPT), best conventional pollutant control technology (BCT), and best available technology economically achievable (BAT), were promulgated by the USEPA for some pollutants in this discharge. Effluent limitations for pollutants not subject to the USEPA effluent limitation guidelines are based on one of the following: best professional judgment (BPJ) of BPT, BCT or BAT; current plant performance; or water quality based effluent limits (WQBELs). The WQBELs are based on the Basin Plan, other State plans and policies, or USEPA water quality criteria which are taken from the CTR. These requirements, as they are met, will protect and maintain existing beneficial uses of the receiving water. The attached Fact Sheet for this Order, which has been reviewed and considered by the Regional Board, is considered part of this Order. The Fact Sheet includes specific bases for the effluent limitations, including the basis for determining reasonable potential for a pollutant to cause or contribute to an exceedance of water quality standards.
54. 40 CFR section 122.45(f)(1) requires that except under certain conditions, all permit limits, standards, or prohibitions be expressed in terms of mass units. 40 CFR section 122.45(f)(2) allows the permit writer, at its discretion, to express limits in additional units (e.g., concentration units). The regulations mandate that, where limits are expressed in more than one unit, the permittee must comply with both. Generally, mass-based effluent limits would ensure that proper treatment, and not dilution, is employed to comply with the final effluent concentration limits. Concentration-based effluent limits, on the other hand, would discourage the reduction in treatment efficiency during low flow periods and would require proper operation of treatment units at all times. In the absence of concentration-based effluent limits, a permittee would be able to increase its effluent concentration (i.e., reduce its level of treatment) during low flow periods and still meet its mass-based effluent limits.
55. Effluent limitations established pursuant to sections 301 (Effluent Limitations), 302 (Water Quality-Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 304 (Information and Guidelines), and 402 (NPDES) of the CWA and amendments thereto, are applicable to the discharges herein.
56. The influent to the package type sewage treatment plants located at SSFL meet the requirements for the special consideration for less concentrated influent wastewaters. Section 133.103 of 40 CFR provides guidance on special considerations for secondary treated effluent. Paragraph (d) addresses less concentrated influent wastewater for separate sewers. The regulation states that:

"The Regional Administrator or, if appropriate, State Director is authorized to substitute either a lower percent removal requirement or a mass loading limit for the percent removal requirements set forth in sections 133.102 (a) (3), 133.102 (a) (4) (iii), 133.102 (b) (3), 102.105 (a) (3), 133.105(b) (3) and 133.105(e) (1) (iii) provided that the permittee satisfactorily demonstrates that: (1) The treatment works is consistently meeting, or will consistently meet, its permit effluent

concentration limits but its percent removal requirements cannot be due to less concentrated influent wastewater (2) to meet the percent removal requirements, the treatment works would have to achieve significantly more stringent limitations than would otherwise be required by the concentration-based standard, and (3) the less concentrated influent wastewater is not the result of excessive infiltration/inflow."

Consequently, Order R4-2004-0111 and subsequent orders regulating discharges from the sewage treatment plants substituted the mass loading limit for the percent removal requirement. Due to decreased site activities, all wastewater from the sewage treatment plant (STPs) is currently hauled offsite and managed appropriately. No further discharges from the STPs – Outfalls 015, 016, and 017 are anticipated. Discharges from these locations are no longer permitted and this order removes these outfalls.

On May 18, 2000, the USEPA promulgated numeric criteria for priority pollutants for the State of California [known as the CTR and codified as 40 CFR section 131.38]. On March 2, 2000, the State Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy or SIP)*. The SIP was effective on April 28, 2000 with respect to the priority pollutant criteria promulgated for California by the USEPA through National Toxics Rule (NTR) and to the priority pollutant objectives established by the Regional Boards in their Basin Plans, with the exception of the provision on alternate test procedures for individual discharges that have been approved by the USEPA Regional Administrator. The alternate test procedures provision was effective on May 22, 2000. The SIP was effective on May 18, 2000, with respect to the priority pollutant criteria promulgated by the USEPA through the CTR. The State Board adopted an amendment to the SIP on February 24, 2005 that became effective on July 13, 2005. The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for chronic toxicity control. Requirements in this Order implement the SIP.

57. The CTR and SIP require dischargers' submittal of data to the Regional Board to: (1) determine if WQBELs for priority pollutants are required; and (2) to calculate effluent limitations, if required. The policy further provides that the time schedule for providing the data shall be as short as practicable but not to exceed three years from the date of the SIP, which was May 22, 2000.
58. The CTR criteria for freshwater or human health for consumption of organisms, whichever is more stringent, were used to prescribe the effluent limitations in this Order to protect the beneficial uses of the Los Angeles River and the Calleguas Creek.
59. Under 40 CFR section 131.38(e)(6), the CTR authorizes the Regional Board to grant a compliance schedule for WQBELs based on CTR criteria for a period up to five years from the date of permit issuance, reissuance, or modification. The SIP provides a compliance schedule for WQBELs (up to five years) and for WQBELs based upon Total Maximum Daily Loads (TMDL) and Waste Load Allocations development (up to 15 years). However, the USEPA has not yet approved the longer of the two compliance schedules nor depromulgated the five-year maximum in the CTR to allow for the 15

years in the SIP. Therefore, the more stringent provision, allowing a compliance schedule of five years, is the maximum duration authorized.

61. State and Federal antibacksliding and antidegradation policies require Regional Board actions ensure that the waterbody will not be further degraded. Antibacksliding provisions are contained in Section 303(d)(4) and 402(o) of the CWA, and in 40 CFR section 122.44(l). Those provisions require a reissued permit to be as stringent as the previous permit with some exceptions where effluent limitations may be relaxed. For those limits carried forward, the Regional Board has determined that there is reasonable potential for the pollutant to cause or contribute to an exceedance of water quality standards in accordance with State Board Order No. WQ 2003-0009. Reasonable potential is determined using the procedures established in the SIP, which includes a three-tiered approach involving statistical analysis supplemented by best professional judgment.
62. On October 28, 1968, the State Board adopted Resolution No. 68-16, Maintaining High Quality Water, which established an antidegradation policy for State and Regional Boards. Similarly, the CWA (section 304(d)(4)(B)) and USEPA regulations (40 CFR section 131.12) requires that all NPDES permitting actions be consistent with the federal antidegradation policy. Specifically, waters that are of a higher quality than needed to maintain designated as beneficial shall be maintained at the higher water quality unless specific findings are made.

Watershed Management Approach and Total Maximum Daily Loads (TMDLs)

63. The Regional Board has implemented the Watershed Management Approach to address water quality issues in the region. Watershed management may include diverse issues as defined by stakeholders to identify comprehensive solutions to protect maintain, enhance, and restore water quality and beneficial uses. To achieve this goal, the Watershed Management Approach integrates the Regional Board's many diverse programs, particularly TMDLs, to better assess cumulative impacts of pollutants from all point and nonpoint sources. A TMDL is a tool for implementing water quality standards and is based on the relationship between pollution sources and in-stream water quality conditions. The TMDL establishes the allowable loadings or other quantifiable parameters for a waterbody and thereby provides the basis to establish water quality-based controls. These controls should provide the pollution reduction necessary for a waterbody to meet water quality standards. This process facilitates the development of watershed-specific solutions that balance the environmental and economic impacts within the watershed. The TMDLs will establish waste load allocations (WLAs) and load allocations (LAs) for point and non-point sources, and will result in achieving water quality standards for the waterbody.
64. The Los Angeles River watershed is one of the largest in the Region. The headwaters of the Los Angeles River originate in the Santa Monica, Santa Susana, and San Gabriel Mountains. The river flows through industrial and commercial areas and is bordered by rail yards, freeways, and major commercial and government buildings. The Los Angeles River tidal prism/estuary begins in Long Beach at Willow Street and runs approximately three miles before joining with Queensway Bay located between the Port of Long Beach and the City of Long Beach.

The surface water discharges from Outfalls 001 and 002 to Bell Creek, a tributary to the Los Angeles River. Storm water only from Happy Valley, Discharge Serial 008 exits the site toward Dayton Canyon Creek, which flows into Chatsworth Creek. Chatsworth Creek flows southward to Bell Creek, near the intersection of Sherman Way and Shoup Avenue, and subsequently the Los Angeles River. The area where the facility is located is largely undeveloped. The majority of the Los Angeles River Watershed is considered impaired due to a variety of point and nonpoint sources. Bell Creek, which is the receiving water for the wastewater discharge from the SSFL, is on the 2002 303(d) list. High coliform count is the stressor listed for Bell Creek. Downstream receiving waters are listed for high coliform counts, volatiles (1,1-Dichloroethylene, tetrachloroethylene, and trichloroethylene), nutrients, oil, ammonia and others.

The TMDL for Nitrogen (nutrients) in the Los Angeles River received Regional Board approval on July 10, 2003 (Resolution No. 03-009) and State Board approval with adoption of Order 2003-0074 on November 19, 2003. The Office of Administrative Law (OAL) and USEPA approval dates were February 27, 2003 and March 18, 2003, respectively. The Regional Board filed a Notice of Decision with the California Resources Agency on March 23, 2004 and the TMDL was effective as of that date. The Los Angeles River Nutrient TMDL revision with Interim WLAs was approved by the Regional Board on December 4, 2003 (Resolution No. 2003-016). The State Board approved the TMDL with Resolution 2004-0014 on March 24, 2004. OAL approved it on September 27, 2004, and the effective date for the Order was September 27, 2004. This permit includes effluent limits based on the WLAs established for the Los Angeles River.

65. The TMDL for metals in the Los Angeles River was approved by the Regional Board during the June 2, 2005 hearing (Resolution No. 2005-006). The State Board approved the TMDL on October 20, 2005; OAL and EPA approvals were received on December 9, 2005 and December 22, 2005 respectively.

The metals TMDL establishes numeric water quality targets that are based on objectives established by USEPA in the CTR. Targets for copper, lead, zinc and/or selenium (total recoverable) are established in designated reaches of the Los Angeles River. Separate water quality targets are established for dry and wet weather discharges.

66. The Los Angeles River Trash TMDL was adopted by the Regional Board on September 19, 2001. The TMDL established a numeric target of zero trash in the river. The TMDL was to be implemented via storm water permits in a phased reduction for a period of ten years. The LA River Trash TMDL was approved by the State Water Resources Control Board on February 19, 2002, the Office of Administrative Law on July 16, 2002 and by the US EPA on August 1, 2002. The TMDL became effective on August 28, 2002.

There were a number of challenges to the LA River Trash TMDL. The consideration of the challenges resulted in a requirement that the TMDL be set aside and not implemented until the California Environmental Quality Act (CEQA) requirements have been satisfied. On June 8, 2006, the Los Angeles Regional Water Quality Control Board adopted a resolution to set aside the adopted TMDL. On July 17, 2006, the State Board adopted Resolution 2006-0051, setting the TMDL aside.

The Regional Board on August 9, 2007, adopted a new TMDL for trash in the Los Angeles River Watershed that includes WLAs of zero for trash. This TMDL will become effective after approval from the State Board, OAL, and EPA. When the TMDL is effective, the WLA for trash will be incorporated in this permit.

67. Storm water runoff from Outfalls 003 through 007, 009 and 010 exiting the SSFL site does so near the northwest site boundary. The receiving water for the storm water runoff is the Arroyo Simi, a tributary of the Calleguas Creek. The Calleguas Creek Watershed extends from the Santa Monica Mountains and the Simi Hills in the south, to the Santa Susana Mountains, South Mountain, and Oak Ridge in the north. Land uses vary throughout the watershed. Urban developments are generally restricted to the city limits of Simi Valley, Moorpark, Thousand Oaks, and Camarillo. Agricultural activities are spread out along valleys and on the Oxnard Plain.

Storm water runoff exits the site and travels down Meier and Runkle Canyons towards the Arroyo Simi. Most of the land use around the facility is open area. Overall the Calleguas Creek Watershed is considered an impaired watershed. It appears that the sources of many of the pollutants in the watershed are agricultural activities, runoff from open space, runoff from industrial areas and publicly owned treatment works (POTWs). Approximately fifty percent of the watershed is still open space, although there is a severe lack of benthic and riparian habitat present. The runoff, when it is sufficient to reach the Arroyo Simi, enters it in Reach 1 – Hydrological Unit 403.62. The stressors listed in the 1998 State Board's California 303(d) list for this reach are ammonia, boron, chloride, sulfates and total dissolved solids. Elevated levels of chromium, nickel, selenium, silver and zinc were also reported in tissue samples.

In the 2002 State Board 303(d) list, Reach 1 of Arroyo Simi is grouped with Reach 2 and has been renamed Calleguas Creek Reach 7. The listed stressors for Calleguas Creek Reach 7 included fecal coliform, organophosphorus pesticides and sedimentation/siltation in addition to those listed in the 1998 303(d) list. The 2002 303(d) list does not include the metals reported with elevated tissue samples in the 1998 303(d) list. These metals were also not included in the 2006 303(d) list.

68. Chloride TMDL and Chloride Limits. On March 22, 2002, the consent decree deadline for the establishment of a chloride TMDL, USEPA Region 9 established the Calleguas Creek Total Maximum Daily Load for chloride. The TMDL adopted by USEPA was based largely on the technical efforts produced by the Regional Board staff.

The Calleguas Creek Watershed Group in collaboration with USEPA Region 9 and the Regional Board is developing the *Calleguas Creek Watershed Salts TMDL*. The work plan addresses chloride, TDS, sulfate and boron in the watershed. The Regional Board and USEPA is using the work product from the Calleguas Creek Watershed Group to establish a subsequent TMDL for chloride in the Calleguas Creek Watershed.

Discharges from SSFL enters the Calleguas Creek Watershed in Arroyo Simi Reach 7, which is included on the 303 (d) list as a chloride water quality limited segment in the Calleguas Creek Watershed. There are no waste load allocations (WLAs) for point

source discharges or load allocations (LAs) for nonpoint sources that apply to storm conditions in the TMDL. Since all discharges from the SSFL to the Arroyo Simi occur as a result of storm water runoff, no chloride WLAs will be included in this Order for discharges from Outfalls 003 through 007, 009 and 010 to Arroyo Simi. Based on existing data, SSFL does not appear to contribute chloride loading to the watershed at levels that would alter the assumptions of the TMDL or contribute to further impairment.

Nitrogen Compounds and Related Effects TMDL. On October 24, 2002, the Regional Board adopted Resolution No. 2002-017, Amendment to the *Basin Plan for the Los Angeles Region* to Include a TMDL for Nitrogen Compounds and Related Effects in Calleguas Creek (*Nitrogen Compounds and Related Effects TMDL*). The State Board approved the Nitrogen Compounds and Related Effects TMDL on March 19, 2003. The Office of Administrative Law approved the TMDL on June 5, 2003 and USEPA approved it on June 20, 2003.

The *Nitrogen Compounds and Related Effects TMDL* includes waste load allocations for ammonia (NH_3), nitrite as nitrogen ($\text{NO}_2\text{-N}$), nitrate as nitrogen ($\text{NO}_3\text{-N}$), and nitrate plus nitrite as nitrogen ($\text{NO}_2\text{-N} + \text{NO}_3\text{-N}$). The TMDL authorizes interim limits (expressed as interim waste allocations) for total nitrogen ($\text{NO}_3\text{-N} + \text{NO}_2\text{-N}$). The WLA applied to the publicly owned treatment works (POTW) in the watershed and the LAs are specified for agricultural discharges. Hence, this Order does not include the TMDL limits for ammonia, nitrate as nitrogen, nitrite as nitrogen, or nitrate plus nitrite as nitrogen for discharges of storm water only from the SSFL to Arroyo Simi and Calleguas Creek. However, based on existing data, SSFL does not appear to contribute nitrogen loading to the watershed at levels that would alter the assumptions of the TMDL or contribute to further impairment.

The Regional Board approved the Basin Plan amendment to incorporate the TMDL for toxicity, chlorpyrifos, and diazinon in the Calleguas Creek, its tributaries and Mugu Lagoon (Resolution No. R4-2005-009) on July 7, 2005. The TMDL addresses impairment to water quality due to elevated levels of chlorpyrifos, diazinon, other pesticides and/or other toxicants. The amendment includes numeric targets, WLAs, and load allocations for Toxicity Unit Chronic, chlorpyrifos, and diazinon. It also includes a compliance schedule of two years from the effective date of the TMDL to meet the final WLAs and ten years to meet the LAs applied to nonpoint sources.

The State Board approved the TMDL on September 22, 2005 (Resolution No. 2005-0067). OAL and EPA approvals were effective on November 27, 2005, and March 14, 2006, respectively. The TMDL became effective on March 24, 2006. A waste load allocation of 1.0 TUC is allocated to the major point sources (POTWs) and minor point sources discharging to the Calleguas Creek Watershed. Interim and final waste load allocations and were also established for chlorpyrifos and diazinon. The implementation schedule specifies that the interim limits for chlorpyrifos and diazinon in storm water NPDES permits be in stream limits. The appropriate waste load allocations are translated into permit limits and included in this Order beginning in "resolved" paragraph no. I.B., "Effluent Limitations."

Resolution No. R4-2005-0010, a TMDL for organochlorine (OC) pesticides, polychlorinated biphenyl (PCBs) and siltation in Calleguas Creek, its tributaries, and

Mugu Lagoon, was also approved by the Regional Board on July 7, 2005. The TMDL addresses impairment to water quality due to elevated concentrations of OC pesticides and PCBs, which can bioaccumulate in fish tissue and cause toxicity to aquatic life in estuarine and inland waters. Siltation may transport these contaminants to surface waters and impair aquatic life and wildlife habitats. The TMDL establishes water column targets, fish tissue targets, and sediment targets to ensure the protection of beneficial uses. The TMDL establishes a twenty-year plan for reducing OC pesticides, PCBs and siltation loads from point sources and nonpoint sources.

The State Board approved the TMDL on September 22, 2005 (Resolution No. 2005-0068). OAL and EPA approvals are followed on January 20, 2006, and March 14, 2006, respectively. The TMDL was effective on March 24, 2006. The appropriate targets will apply to discharges from Outfalls 003 through 007, 009, and 010 which enter Arroyo Simi, a tributary of Calleguas Creek.

The TMDL includes waste load allocations for OC pesticides and PCBs in sediment in Calleguas Creek and its tributaries. The waste load allocations have been translated directly into ambient contaminant concentrations in the sediment of Arroyo Simi. Those ambient contaminant concentrations will be compared directly to sediment concentrations measured in the samples collected to determine compliance with the interim waste load allocations stipulated. The interim waste load allocations are effective throughout the tenure of this permit.

The waste load allocations in the water column are translated into effluent limitations utilizing the steady state model from the SIP. The calculated effluent limits are included as receiving water effluent limits in "resolved" paragraph I.C.1. Since the discharge is storm water and it is near the top of the watershed, the Discharger may utilize the option of sampling the discharge for the OC pesticides and PCBs or sampling the receiving water. The Discharger may also choose to join the Calleguas Creek Watershed TMDL Monitoring Program (CCWTMP) and monitor at an established compliance sampling location in Arroyo Simi.

Resolution R4-2006-012, the TMDL for metals and selenium for Calleguas Creek, its tributaries and Mugu Lagoon was adopted by the Los Angeles Regional Board on June 8, 2006. The TMDL establishes numeric targets for dissolved copper, nickel, and zinc, and in total recoverable mercury and selenium. It also includes fish tissue targets for mercury, bird egg targets for mercury and selenium and sediment quality guidelines for copper, nickel, and zinc.

The State Board approved the TMDL on October 25, 2006 (Resolution No. 2006-0078). OAL and EPA approval the TMDL on February 6, 2007 and March 26, 2007 respectively. The TMDL became effective on March 26, 2007. This permit implements the TMDL.

Discharges from the Boeing SSFL site (Outfalls 003 through 007, 009, and 010) enter Calleguas Creek in Reach 7, which was Arroyo Simi Reaches 1 and 2 in the 1998 303(d) List. Dry weather discharges from this area do not reach Calleguas Creek and Mugu Lagoon. Therefore, no dry weather waste load allocations are established for the

constituents in the water column. Selenium waste load allocations have not been developed for this reach as it is not on the 303 (d) list. The final waste load allocation developed for mercury was 0.051 µg/L. The mercury waste load allocation was used to develop a daily maximum effluent limit, implemented at Outfalls 003 through 007, 009, and 010.

Final waste load allocations for wet daily maximum concentrations of copper and nickel are stipulated as 31.0 and 958 µg/L, respectively. The daily maximum limit for copper is included in the permit. The TMDL-based daily maximum for nickel, 958 µg/L, was developed to protect aquatic life in the lower Calleguas Creek and Mugu Lagoon and it is greater than the Title 22-based MCL limit of 100 µg/L. Since the groundwater basin beneath the Arroyo Simi has municipal and domestic supply as an existing beneficial use, and Arroyo Simi has groundwater recharge as an intermittent beneficial use, the effluent limitation implemented must be protective of both groundwater recharge and the downstream aquatic life beneficial uses. Therefore, the 100 µg/L effluent limitation, which is protective of the beneficial uses of Arroyo Simi and the groundwater basin beneath it, has been implemented for nickel.

69. To prevent further degradation of the water quality of Los Angeles River and the Calleguas Creek (Arroyo Simi), and to protect its beneficial uses, mixing zones and dilution credits are not considered in derivation of the effluent limitations in this Order.

This determination is based on:

- Many of the beneficial uses stipulated are intermittent for Dayton Canyon Creek, Bell Creek and the Arroyo Simi. The discharges from SSFL in many cases provide a significant portion of the headwaters for these waterbodies, specifically for Dayton Canyon Creek and Bell Creek. Since there is little assimilative capacity for Dayton Canyon Creek and Bell Creek, a dilution factor is not appropriate and the final WQBEL should be a numeric objective applied end-of-pipe. The assimilative capacity for Arroyo Simi, which is the receiving water for storm water discharges from the northern boundary of SSFL, has not been evaluated and consequently no dilution has been given for discharges to that receiving water.
- The discharge may contain the 303(d) listed pollutants that are bioaccumulative such as metals. These pollutants, when exceeding water quality criteria within the mixing zone, can potentially result in tissue contamination of an organism directly or indirectly through contamination of bed sediments with subsequent incorporation into the food chain. The SIP, section 1.4.2.2.B. states that the "Regional Board shall deny or significantly limit a mixing zone and dilution credit as necessary to protect beneficial uses..." It continues that "such situations may exist based upon the quality of the discharge... or the overall discharge environment (including ... potential for bioaccumulation)."

70. The Discharger may provide the information needed by the Regional Board to make a site-specific determination on allowing a mixing zone, including the calculations for deriving the appropriate receiving water and effluent flows, and/or the results of a mixing zone study. Upon receiving such data, the Regional Board will re-evaluate its

determination for the need to incorporate dilution credits and will revise the effluent limitations as necessary.

Reasonable Potential Analysis

71. Discharges from the engine test stands, which generated wastewater, had not been regulated independently prior to Order R4-2004-0111. These discharges did not have specific monitoring requirements or effluent limits. Order R4-2004-0111, in an effort to collect the data required to complete a reasonable potential analysis, includes monitoring requirements for discharges from the engine test stands and from the sewage treatment plants for priority pollutants. The subsequent Orders (R4-2006-00008 and R4-2006-0036) included effluent limits for discharges from the engine test stands and the sewage treatment plants.
72. 40 CFR section 122.44(d)(1)(i) and (ii) require that each toxic pollutant be analyzed with respect to its reasonable potential when determining whether a discharge (1) causes, (2) has the reasonable potential to cause, or (3) contributes to the exceedance of a receiving water quality objective. This is done by conducting a reasonable potential analysis (RPA) for each pollutant. In performing the RPA, the permitting authority uses procedures that account for existing controls on point and nonpoint sources of pollution, the variability of the pollutant or pollutant parameter in the effluent, and the sensitivity of the test species to toxicity testing (when evaluating whole effluent toxicity). Because of effluent variability, there is always some degree of uncertainty in determining an effluent's impact on the receiving water. The SIP addresses this issue by suggesting the use of a statistical approach.

Order R4-2004-0111

73. Section 1.3 of the SIP requires that a limit be imposed for a toxic pollutant if (1) the maximum effluent concentration (MEC) is greater than the most stringent CTR criteria, (2) the background concentration is greater than the CTR criteria, or (3) other available information. These three criteria are routinely referred to as triggers. For the pollutants on the 303(d) list, which have been present in the effluent during past monitoring events, effluent limits derived using the CTR criteria will be imposed in the permit.

The first two triggers were evaluated using the California Permit Writers Training Tool (CAPWTT). While on contract with the State Board, Scientific Applications International Corporation (SAIC) developed this software to determine RPAs and, when reasonable potential exists, calculate the WQBELs, following procedures in the SIP. The third trigger is evaluated by the permit writer utilizing all other information available to determine if a water quality-based effluent limitation is required to protect beneficial uses.

74. RPAs were performed for each of 126 priority pollutants for which effluent data were available. The basis for each RPA determination is identified in the attached Fact Sheet, which is part of this Order. The input data for the RPAs were provided in the Self-Monitoring Reports submitted by the Discharger. One RPA was performed for discharges from Outfalls 001 and 002, which are composed of treated wastewater,

water from the groundwater treatment systems, excess reclaimed water, water from the engine test stands, and storm water. Four analytes had reasonable potential to exceed WQBELs: copper, lead, mercury, and TCDD. Three of these analytes (copper, lead, and mercury) had effluent limitations in the previous order (Order No. 98-051).

The Discharger also submitted data for the receiving water associated with discharges from Outfalls 001 and 002. This data was collected using elevated detection limits and hence several other constituents had reasonable potential. The constituents are 2,4,6-trichlorophenol, 2,4-dinitrotoluene, alpha-BHC, bis (2-ethylhexyl) phthalate, N-nitrosodimethylamine and pentachlorophenol. Effluent limits for these constituents have also been included in this Order.

Since perchlorate has been detected above the Department of Health Services action level in storm water runoff from the facility and it has been detected in the influent to some of the groundwater treatment systems, SIP RPA Trigger 3 and BPJ have been used to establish reasonable potential for it to be present in discharges from the site via Outfalls 001 and 002. Consequently an effluent limit for perchlorate has been included in this Order for these discharges. Further, since perchlorate is not a naturally occurring pollutant and its presence in the receiving waters is the result of operations at the facility, the effluent limitation was developed based on anti-degradation grounds (State Board Res. No. 68-16 and 40 CFR § 131.12). The effluent limitation was therefore set at 6 µg/L, which would prevent the degradation of receiving waters and maintain and protect receiving water quality. Effluent limits for a number of volatiles, which were included in the current Order and are believed to be present in the groundwater contaminant plume, have also been included in this Order.

Discharges from Outfalls 003 through 007 are storm water runoff only. Daily maximum and monthly average limits for storm water were included in Order No. 98-051. This Order does not include monthly average limits for priority pollutants in storm water only discharges since storm events are infrequent and often occur less than once per month during the rainy season. This is consistent with permits adopted by the Regional Board for storm water discharges only.

A second statistical analysis using CAPWTT was completed for discharges of storm water only from locations 003, 004, 005, 006, and 007. This analysis yielded a positive RPA for five analytes: cadmium, copper, cyanide, mercury, and TCDD. Cyanide was detected only once during the period evaluated at a concentration of 5.8 micrograms/liter (µg/L). That detection triggered the reasonable potential since it exceeds that calculated average monthly effluent limit (AMEL). However, the discharges evaluated are storm water only discharges, which do not have monthly average limits. When the maximum effluent concentration (MEC) of 5.8 µg/L is compared to the maximum daily effluent limit (MDEL) the MEC is less than the MDEL. Consequently, Order R4-2004-0111 does not include an effluent limit for cyanide in the storm water only discharges. CTR-WQBELs for cadmium, copper, mercury and TCDD have been included in this Order. The previous order (Order 98-051) included effluent limits for all of these analytes except TCDD. The statistical analysis did not indicate that antimony or thallium had reasonable potential. However, Order 98-051 included limits for these analytes (MCL) from Title 22 from the Basin Plan since groundwater recharge is an intermittent beneficial use and the

groundwater basin has an existing municipal and domestic supply beneficial use. The MCL for these constituents is more stringent than the CTR limits. The compliance history reveals that the effluent limit for antimony ($6 \mu\text{g/L}$) was exceeded at Outfalls 005 and 007 in 1999 and the limit for thallium ($2 \mu\text{g/L}$) was exceeded at Outfall 005 on March 8, 2000. Hence, limits for these constituents have also been included, since reasonable potential does exist for the applicable limit to be exceeded.

The effluent limits included in order R4-2004-0111 and subsequent updates thereto (R4-2006-0008 and R4-2006-0036) for the analytes with a positive statistical or best professional judgment RPA are the most stringent of the limit included in Order 98-051, and the applicable CTR criteria which include the freshwater aquatic life criteria, and the human health criteria for consumption of organisms only.

75. As set forth above, Section 1.3 of the State Board's State Implementation Plan (SIP) establishes a stepwise procedure for determining which toxic pollutants require water quality-based effluent limitations in conformance with 40 C.F.R. § 122.44(d). This stepwise procedure for toxic pollutants is called a reasonable potential analysis. The SIP's reasonable potential analysis applies to water quality standards for priority pollutants, whether promulgated by USEPA or established as water quality objectives by the Regional Board. Steps 1 through 6 establish an analytical procedure for requiring water quality-based limitations based solely on discharge and ambient receiving water data. Except as noted in Finding 73, reasonable potential for toxic pollutants regulated by Order R4-2004-0111 and subsequent updates was determined using the analytical procedure in Steps 1 through 6 of SIP section 1.3 as explained in Finding 71 and the Fact Sheet.
76. Step 7 of SIP Section 1.3 recognizes that in certain instances a rote, mathematical analysis of the data will not be sufficient to protect beneficial uses. Step 7 therefore reserves for the Regional Board the obligation to "review other available information to determine if a water quality-based effluent limitation is required, notwithstanding the above analysis in Steps 1 through 6, to protect beneficial uses." Among the factors the State Board identifies as relevant to the Step 7 analysis are: the facility type, discharge type, and potential toxic impact of the discharge. With respect to the Facility, the Regional Board finds sufficient, unusual circumstances to require a water quality-based effluent limitation for trichloroethylene (TCE). Data and testimony indicate that approximately 530,000 gallons of TCE were released to the soil and groundwater at the Facility. The tremendous volume of TCE released at the site warrants significant scrutiny. While recent monitoring data do not show TCE in surface water discharges, scouring from large storm events may release soils with adsorbed TCE. The large volumes of TCE in scoured soils may become chemically available in the surface water runoff and cause or contribute to an exceedance of the water quality standard. In addition, the existing monitoring data has been collected far downstream from on-site sources. The data may not reliably indicate the presence of TCE in waters of the United States because the turbid conditions may have volatilized the TCE before it reached existing monitoring points (Outfalls 001 and 002). Further, contamination is spotty and not completely characterized; pathways are not always predictable and are not fully characterized; and the site is in a hilly environment with uncertain pathways and seeps which could possibly lead to surfacing of water with contamination that cannot be

predicted. Finally, TCE is a probable carcinogen that can cause skin rashes on contact, and when ingested has been associated with liver and kidney damage, impaired immune system function, and in large volumes unconsciousness, impaired heart function, or death. Considering the toxic nature of TCE and that past practices at the site released extraordinary volumes of TCE into the environment that can leach into surface water through the scouring from storm events, and further considering that the existing monitoring data may not be representative of direct discharges to waters of the United States since the data were collected downstream of the initial discharge, the Regional Board has determined that a water quality-based effluent limitation for TCE is necessary to protect beneficial uses.

77. Order R4-2004-0111 included eleven new compliance points. These compliance points mark the location of engine test operations, onsite sewage treatment plants, and three new storm water monitoring locations where the associated discharges enter waters of the United States and two discharges from ponds located near the boundary of the developed portion of the site. The associated operations and outfalls for the new compliance points are listed in Finding 29.

78. For pollutants or discharges that lacked effluent data, interim requirements, as described below, were assigned. For these pollutants, the Discharger must submit to this Regional Board effluent concentration data, so that complete reasonable potential analyses can be performed and the need for effluent limitations can be determined.

Pollutants that lacked sufficient data to do RPAs are subject to interim monitoring requirements.

79. Interim requirements were developed according to the following:

- Interim requirements in the form of monitoring were prescribed for constituents with no monitoring data or with "non-detectable" (ND) data, where all of the reported detection limits were greater than or equal to the CTR criterion. Monitoring is required for priority pollutants and emergent chemicals in discharges from the sewage treatment plants and the engine test stands.
- No interim monitoring requirements or limits were prescribed for constituents whose highest monitoring data points or lowest detection limits (in case of ND) were below their respective CTR criterion.

80. For some pollutants, including aldrin, alpha-BHC, chlordane, DDT, dieldrin, heptachlor, heptachlor epoxide, several PAHs, PCBs, TCDD equivalents, and toxaphene the applicable water quality objectives are below the levels that current analytical techniques can measure. Reasonable potential analyses have been completed on each of these constituents and two of them had reasonable potential: alpha-BHC and TCDD equivalents. The MEC detected for TCDD exceeded the CTR criterion and the detection limits for alpha-BHC in the receiving water and the effluent exceeded the criterion.

81. For 303(d) listed pollutants, the Regional Board plans to develop and adopt TMDLs, which will specify WLAs for point sources and LAs for non-point sources, as appropriate. Following the adoption of TMDLs by the Regional Board, NPDES permits will be issued with effluent limits for water quality based on applicable WLAs. In the absence of a TMDL, effluent limits for 303(d) listed pollutants for which RPA indicates a reasonable potential, will be established for (1) concentration based on the most stringent applicable CTR criterion and/or Basin Plan objective, and (2) mass emission based on the maximum discharge flow rate and concentration limitation.
82. As such, water quality objectives/criteria specified in the Basin Plan, the CTR, or the effluent limits from the existing permit were used to set the limits for pollutants that are believed to be present in the effluent and have reasonable potential of exceeding the water quality criteria. Other pollutants may only be monitored to gather data to be used in RPAs for future permit renewals and updates.

R4-2006-0008

83. After the adoption of Order R4-2004-0111, the Discharger collected data at most of the new compliance locations specified in the Order. This Order (R4-2006-0008) amends Order R4-2004-0111 and includes effluent limits for the constituents that have, as a result of the monitoring and compliance sampling, demonstrated reasonable potential (RP).
84. Discharges from Outfalls 011 and 018 were evaluated with discharges from Outfalls 001 and 002. Outfalls 011 and 018 are the Perimeter Pond and the R-2 Pond Spillway, respectively. Discharges from these outfalls receive no additional treatment prior to exiting the site at Outfalls 001 and 002. However, additional storm water runoff which may also transport site contaminants will enter the streambed and contribute flow after the discharge exits Outfalls 011 and 018 and prior to it passing Outfalls 001 and 002, respectively. RP at these locations using only the data collected from August 20, 2005 through May 5, 2005 was evaluated using an excel spreadsheet. This analysis yielded statistical reasonable potential for the following priority pollutants: copper, lead, mercury, and TCDD. BPJ was used to establish effluent limits for all other priority pollutants that have reasonable potential at Outfalls 001 and 002.

The Technical Support Document (TSD) for Water Quality-based Toxics Control (EPA/505/2-90-001) methodology for evaluating RP was used for all other constituents of concern (Page 53, Box 3-2). This evaluation resulted in statistical RP for iron, manganese, settleable solids, MBAS, TSS, perchlorate, nitrate + nitrite as Nitrogen, oil and grease, sulfate, BOD, and total dissolved solids. Effluent limits for barium, fluoride, residual chlorine and chloride were retained after the completion of the BPJ analysis.

Storm Water Outfalls. Outfalls 003 through 007 had a robust data set to evaluate prior to the adoption of Order R4-2004-0111. Outfall 008 was a monitoring location for perchlorate and had no data for other priority pollutants. Outfalls 009 and 010 are new storm water compliance points and they had no data available prior to August 2004. The data collected at Outfalls 008 through 010 indicates that the discharges are very similar to

those observed at the other storm water locations (Outfalls 003 through 007). Therefore, the analyses were combined and one evaluation was completed for all storm water only discharges (Outfalls 003 through 010).

The data yielded statistical RP for the following priority pollutants: copper, lead, mercury, and TCDD. Historical monitoring data, effluent violations, and site history were incorporated during the BPJ analysis, which resulted in establishing effluent limits at Outfalls 008 through 010 consistent with those at Outfalls 003 through 007.

RP for constituents of concern in addition to the priority pollutants was also evaluated. Statistical RP exists for total suspended solids, perchlorate, boron, sulfate, total dissolved solids, oil and grease, and nitrate + nitrite as nitrogen. No new data was available for fluoride. Effluent limits for chloride and fluoride are included based on BPJ.

85. Engine Test Stands. Wastewater data collected at the engine test stands Outfalls 012 through 014 from August 20, 2004 through March 30, 2005, was evaluated for reasonable potential. During this time discharges only occurred at Outfall 012. The RPA completed using the SIP methodology revealed reasonable potential of the wastewater for priority pollutants including copper, lead, mercury and TCDD. The analysis for other chemicals of concern was completed as per the TSD. The constituents with statistical RP are oil and grease, settleable solids, suspended solids, 1,4-dioxane, total petroleum hydrocarbons, naphthalene, tertiary butyl alcohol and ethylene dibromide. Effluent limits for these constituents were therefore included in Order R4-2006-0036. Effluent limits for total dissolved solids and for perchlorate were retained based on BPJ.
86. Sewage Treatment Plants. The sewage treatment plants, Outfalls 015 through 017, were evaluated and yielded statistical RP for cadmium, chromium III, copper, mercury, nickel, TCDD, MBAS, total suspended solids, perchlorate, BOD, oil and grease, total residual chlorine, total coliform, and nitrite as nitrogen.

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87. Discharges from Outfalls 001, 002, 011 and 018 flow to Bell Creek a tributary of the LA River. The TMDL for metals in the Los Angeles River assigned WLAs to all point source discharges to LA River and all upstream reaches and tributaries (including Bell Creek and tributaries to Bell Creek). Effluent limits for cadmium, copper, lead, zinc, and selenium at the aforementioned outfalls are based on WLAs established by the TMDL or existing effluent limits, whichever are more protective. The LA River Nutrient TMDL requires WLAs for ammonia-N, nitrate-N, and nitrite-N, which are included for these outfalls.
88. The storm water discharges (Outfalls 003 through 010) did not have reasonable potential for zinc. Outfalls 003 through 007, 009, and 010 flow to Arroyo Simi, a tributary to Calleguas Creek. However, discharges from Outfall 008 flow to the LA River, which has the LA River Metals TMDL that provides a WLA for zinc. That WLA has been incorporated as an effluent limitation at Outfall 008 only. The LA River Nutrient TMDL requires WLAs for ammonia-N, nitrate-N, and nitrite-N, which were also included for this outfall.

89. Rocket Engine Test Stands (Outfalls 012 through 014). Discharges from Outfalls 012 through 014 exit the site via tributaries to Bell Creek. The metals that have TMDL WLAs that do not have reasonable potential at these outfalls are cadmium, selenium and zinc. Effluent limits for these constituents are included based on the TMDL. The Los Angeles River Nutrient TMDL developed WLAs for ammonia-N, nitrate-N, and nitrite-N. Daily maximum effluent limitations for these constituents are also applicable and included for discharges from these locations. The LA River Nutrient TMDL requires WLAs for ammonia-N, nitrate-N, and nitrite-N, which are included for these outfalls.
90. Sewage Treatment Plants (Outfalls 015 through 017). Discharges from Outfalls 015 through 017 also exit the site via tributaries to Bell Creek. The Metals TMDL resulted in new WLAs for lead and selenium and a wet weather discharge WLA for cadmium. The LA River Nutrient TMDL requires WLAs for ammonia-N, nitrate-N, and nitrite-N, which are included for these outfalls

Remand

91. On December 13, 2006, in Order WQ 2006-0012, the State Board concluded that the compliance locations at Outfalls 001 and 011 were duplicative. It further concluded that compliance locations at Outfalls 002 and 018 were also duplicative. The order required that one set of the compliance points (outfalls with numeric effluent limits) be deleted.

Figure 2 shows the Outfall locations as specified in Order R4-2004-0111 and its subsequent revisions. Outfall 011 is located at the Perimeter Pond. The Perimeter Pond is the final collection basin near the boundary of the developed property that storm water runoff collects prior to entering the undeveloped portion of the property and subsequently exiting the site after passing through Outfall 001.

Outfall 018, the R2-Pond Spillway, is located near the western edge of Area II. The R2 Pond collects storm water runoff from Areas II and III. Storm water runoff entering the R2 Pond has traversed several RCRA areas of concern, each of which have a host of contaminants of concern currently being investigated. The storm water runoff entering the R-2 Pond exits the pond via the R-2 Pond Spillway and travels southward into the undeveloped portion of the site through Outfall 002 prior to exiting the property.

The developed portion of the site has a number of areas of concern that are included in the RCRA assessment and cleanup proceeding with DTSC oversight. Each of these areas has the potential to contribute contaminants to the storm water runoff traversing it. Since Outfalls 011 and 018 are near the boundary of the developed portion of the site, the Regional Board has decided to retain them as compliance points with numeric effluent limits. However, runoff from a couple of areas of concern may not be captured in monitoring which occurs at these outfalls. Therefore, the Discharger will be required to continue monitoring at Outfalls 001 and 002.

A "benchmark" is a water quality based effluent limit or a performance based limit that is used to evaluate the performance of BMPs with regard to the removal of contaminants present in the discharge. In this permit, the benchmarks are established based on water quality based effluent limits. Exceedance of a benchmark triggers an evaluation of the

BMPs implemented at the site. The evaluation may determine that the BMPs require augmentation, upgrade, or replacement. If so, the Discharger must update the BMP Compliance Plan, secure the required approval from the Executive Officer, and implement the required upgrades. Section II.C.7., that follows includes the requirements for implementing the BMP Plan for compliance with the benchmarks specified in this permit.

The numeric effluent limits from Outfalls 011 and 018 will be used as benchmarks to evaluate the efficiency of BMPs implemented at Outfalls 001 and 002. This data will also provide information about the concentration of the contaminants entering the closest residential area and entering Bell Creek.

R4-2007-0055

92. A reasonable potential analysis was completed for data collected through May 22, 2006. The analysis did not result in the inclusion of any new constituents with effluent limitations in this Order.
93. The Topanga Fire resulted in significant alterations to the site. The exposure of the surface soils with no vegetative cover to runoff has increased the potential for the transport of those surface soils and associated contaminants offsite as a result of the fire. The fire created runoff conditions at SSFL over which the Discharger has limited control. Over 70 percent of the SSFL burned with significant areas denuded of vegetation, making much of the steep terrain highly erodible. Boeing hydromulched upwards of 800 acres and installed erosion control devices throughout much of the SSFL after the fire which occurred on September 28, 2005, and prior to the January 19, 2006 Board Hearing.

After the fire Boeing immediately began efforts to replace the BMPs that were destroyed. Many of the drainage areas were vacuumed to remove accumulated ash. The Discharger hydromulched in excess of 800 acres onsite and installed erosion control devices throughout much of the SSFL site prior to the January 19, 2006 Board Meeting. BMPs implemented prior to the fire were typical of those routinely used at construction sites to retard the transport of sediment (silt fences, plastic sheeting, etc). In most cases, the BMPs implemented after the fire were designed to slow flows (i.e. using underdrain systems) and to treat specific contaminant groups (i.e. metals) using bags filled with carbon or vermiculite. Most recently, the BMPs implemented have been designed to treat the runoff from a storm with the flow of 2.3 inches of rain.

On May 24, 2007, Boeing submitted to the Regional Board the *Phase 2 Post-Fire Vegetation Recovery Assessment Report* prepared for Geosyntech Consultants by Western Botanical Services, Inc. The report assessed the status of and time to recovery of chaparral and scrub at the project site subsequent to the Topanga Fire. The executive summary of the report asserts that chaparral and scrub represent the dominant vegetation types at SSFL and that these plant communities represent an important natural vegetation-based means of erosion control at the site. It further states that the "perennial plant cover differed by significantly more than 30 percent between burned and unburned transects, total vegetative cover differed by significantly greater

than 20 percent cover and ground cover differed by significantly more than 30 percent cover." The executive summary also states that the burned chaparral and scrub vegetation will likely recover to near pre-fire conditions within five to ten years.

The report also includes a section titled *Chaparral Recovery after Fire*. The section includes summaries of other studies completed on chaparral. Several studies (Guo 2001, Grace & Keeley 2006, Keeley & Keeley 1981, Horton & Kraebel 1955, Robi Chaud et al 2000) concluded that the total vegetative cover is generally high in the first two years following a fire: reported values are from 11 to 85 percent. The report estimates that between March 26 and April 12, 2007, the mean total vegetative cover within the burned areas is 46.6 percent.

94. Discharges from Outfalls 012 (Alpha Test Stand) and 013 (Bravo Test Stand) flowed to Silvernale Pond, into R-2 Pond, which discharges at Outfall 018 and ultimately to Outfall 002. Discharges from Outfall 014 (APTF) flowed to R-1 Pond, into Perimeter Pond, which discharges at Outfall 011, and ultimately to Outfall 001. The ROWD submitted on February 21, 2007, stated that all rocket engine testing activities have ceased and will not recur. Order R4-2006-0036 included effluent limits for discharges from the rocket engine test stands and required monitoring during testing events. Those requirements will not be included in the current Order (R4-2007-0055).

However, years of testing have resulted not only in groundwater contamination but in surface and subsurface soil contamination. These contaminants may be mobilized by storm water traversing these areas. Therefore, this Order includes a requirement to implement BMPs around these areas and to monitor the storm water runoff for contaminants of concern. The previous effluent limits for discharges from the engine test stands provide benchmarks, to evaluate the effectiveness of the BMPs with controlling the transport of contaminants from the areas.

95. Sewage Treatment Plants (Outfalls 015 through 17). The most recent ROWD states that all discharges from Outfalls 015 through 017 have ceased. The basins at the facilities will continue to be used for the collection of sewage. The collection tanks at the sewage treatment plants have sewage level measuring instruments and alarms. Routine removal and hauling of the sewage takes place before the sewage levels reach the levels that would trigger the alarms. Should the amount of sewage in the holding tanks reach the level which would trigger the alarms, the sewage is transferred to additional tanks onsite and sewage hauling contractors are mobilized to move the sewage for offsite treatment and disposal

This protocol alleviates discharges from this area. Thus requirements for monitoring at these locations will be eliminated.

96. The discharge from SSFL (Outfalls 001 through 018) is primarily storm water runoff which may contain mobilized contaminants from the site. Outfall 019 will discharge treated groundwater from onsite cleanup operations. Discharges from Outfall 019 will enter the drainage way upstream of Outfall 011. The size of the site and the volume of storm water runoff generated presents challenges with treating the entire volume of rainfall. The BMPs for Outfalls 003 through 007 and 010 are designed to treat the storm water runoff

generated from a 2.3 inch storm which represents the 85th percentile of the 1-year 24-hour storm event using the Los Angeles County Department of Public Works (LACDPW) estimation models.

97. Over the last two years, the Regional Board has been working with the Southern California Coastal Water Research Project (SCCWRP) and a cross-section of stakeholders in the region known as the Design Storm Project Steering Committee to evaluate potential design storms in terms of capturing storm water runoff, achieving water quality standards, and implementability. A "design storm" is a specific size storm event used to plan for and design storm water controls. A draft report is scheduled for circulation in early September 2007, which will summarize the results of the first two years of the project; discuss the complexities of establishing a regional design storm; and set forth recommendations for additional technical studies, sensitivity analysis and modeling.

Any effort to develop a regional design storm requires that assumptions and generalizations are made. Regional Board staff anticipates that further work will be needed, before proposing a regional design storm policy or any site-specific design storm, in order to further explore these assumptions and generalizations; evaluate the efficacy of the design storm for different pollutants and land uses; refine the data used in modeling the water quality outcomes of potential design storms; and to consider policy with regard to incorporating design storms into permits.

Compliance Schedules and Interim Limitations

98. Order R4-2006-0008. A compliance schedule, which terminates one year after adoption of the permit, with an interim effluent concentration of 4 µg/L is included for discharges from Outfalls 015 through 017. The 4 µg/L interim effluent concentration is based on the daily maximum effluent limit for cadmium that is included in Order R4-2006-0008.

Order R4-2007-0055. Discharges from Outfalls 015 through 017 have terminated. Therefore the interim and final effluent limits associated with discharges from these locations are no longer effective.

Double Counting of Violations

100. In several cases; Order R4-2006-0008 and Order R4-2006-0036 included numeric effluent limits downstream of a compliance point which also had numeric effluent limits. Concerns were raised by the State Board regarding the potential for double counting violations. Following is a description of how the monitoring was configured which demonstrates that there was little potential for double counting of violations. Specifically, discharges from Outfall 012 (Alfa Test Stand) had numeric effluent limits. The discharge from Outfall 012 (rocket engine test firing) was monitored when it occurred. The samples were collected and a determination of compliance was made on that specific event. The discharged wastewater flowed through several RCRA Facility Investigation (RFI) sites included the Bravo Test Stand, Storable Propellant Area (SPA), and Alfa/Bravo Fuel Farm (ABFF) prior to mixing with other wastewater in the Silvernale Pond. At each of the RFI sites there is the potential for the discharged wastewater to pick up additional contaminants in the surface soils or subsurface soils. The Silvernale

Pond is also an RFI site with contaminants present in the sediment. The mixed wastewater will sit in Silvernale until the level of wastewater present is enough to cause the pond to overflow. The flow from Silvernale traverses two other RFI sites prior to entering the R-2 Pond. There the flow from Silvernale, which is much different than the flow from Alfa Test Stand (Outfall 012) during a rocket engine test, and any other wastewater in R-2 Pond mixes. Discharges from R-2 Pond (Outfall 018) have effluent limits. However, historically discharges from the ponds do not occur at the same time that rocket engine tests occur. Discharges from R-2 Pond have routinely occurred only after storm events. Since the discharge from Outfall 012 occurs in some cases months prior to discharges from Outfall 018 and since the discharges from Outfall 012 traverse several RCRA RFI sites where contaminants are present prior to entering the R-2 Pond (Outfall 018), there is little probability that "double counting" occurs at this location.

Background and Rationale for Requirements.

101. The Regional Water Board's developed the requirements in this Order based on information submitted as part of the application, through monitoring and reporting programs, and through special studies. The Fact Sheet, which contains background information and rationale for Order requirements, is hereby incorporated into this Order and constitutes part of the Findings for this Order. The Monitoring and Reporting Program (Attachment T) and all other attachments are also incorporated into this Order.

CEQA and Notifications

102. The Regional Board has notified the Discharger and interested agencies and persons of its intent to issue waste discharge requirements for this discharge and has provided them with an opportunity to submit their written views and recommendations.
103. The Regional Board, in a public hearing, heard and considered all comments pertaining to the discharge and to the tentative requirements.
104. This Order shall serve as a NPDES permit pursuant to Section 402 of the Federal Clean Water Act or amendments thereto, and shall take effect in accordance with federal law, provided the Regional Administrator, USEPA, has no objections.
105. Pursuant to California Water Code Section 13320, any aggrieved party may seek review of this Order by filing a petition to the State Board. A petition must be sent to the State Water Resources Control Board, Office of Chief Counsel, Attn: Elizabeth Miller Jennings, Senior Staff Counsel, 1001 I Street, 22nd Floor, Sacramento, CA 95814, within 30 days of adoption of this Order.
106. The issuance of waste discharge requirements for this discharge is exempt from the provisions of Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code (CEQA) in accordance with the California Water Code, Section 13389.

IT IS HEREBY ORDERED that The Boeing Company (Santa Susana Field Laboratory), in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, and the provisions of the Federal Clean Water Act and regulations and guidelines adopted thereunder, shall comply with the following:

I. Discharge Requirements

A. Discharge Prohibition

1. Wastes discharged shall be limited to treated groundwater, fire suppression water, and storm water runoff, as proposed.
2. Discharges of water, materials, radiologic wastes, thermal wastes, elevated temperature wastes, toxic wastes, deleterious substances, or wastes other than those authorized by this Order, to the Arroyo Simi and tributaries to Calleguas Creek, to Dayton Canyon Creek, Bell Creek, and tributaries to the Los Angeles River, or waters of the United States, are prohibited.

B. Effluent Limitations

1. The pH of wastes discharged shall at all times be within the range 6.5 to 8.5.
2. The temperature of wastes discharged shall not exceed 86°F.
3. The discharge of an effluent from Outfall 018 with constituents in excess of the daily maximum limits listed below are prohibited for storm water runoff. The discharge of an effluent from Outfall 011 and 019 must demonstrate compliance with both the daily maximum and monthly average effluent limitations listed below.

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u>	<u>Limitations</u>
		<u>Monthly Average</u>	<u>Daily Maximum</u>
Total suspended solids ¹	mg/L lbs/day ²	15 20,016	45 60,048
BOD ₅ 20°C	mg/L lbs/day ²	20 26,700	30 40,032
Oil and grease	mg/L lbs/day ²	10 13,344	15 20,016
Settleable solids ¹	ml/L	0.1	0.3
Total residual chlorine	mg/L lbs/day ²	---- ----	0.1 133
Total dissolved solids	mg/L lbs/day ²	---- ----	950 1,270,000
Chloride	mg/L lbs/day ²	---- ----	150 200,160
Sulfate	mg/L lbs/day ²	---- ----	300 400,320
Barium ³	mg/L lbs/day ²	---- ----	1.0 1,330
Fluoride ³	mg/L lbs/day ¹	---- ----	1.6 2135
Iron ³	mg/L lbs/day ²	---- ----	0.3 400
Detergents (as MBAS)	mg/L lbs/day ²	---- ----	0.5 667
Nitrate + Nitrite-N	mg/L lbs/day ²	---- ----	8.0 10,700
Ammonia-N	mg/L lbs/day ²	1.96© 2,615	10.1® 13,500
Nitrate-N	mg/L lbs/day ²	---- ----	8.0 10,700

¹ The effluent limitations for total suspended solids and settleable solids are not applicable for discharges during wet weather. During wet weather flow, a discharge event is greater than 0.1 inch of rainfall in a 24-hour period. No more than one sample per week need be obtained during extended periods of rainfall and a storm must be preceded by at least 72 hours of dry weather.

² The mass is calculated using the maximum permitted flow of 160 mgd for Outfalls 001 and 002. The flow used to calculate the mass for Outfalls 003 through 010 is 17.8 mgd. The flow used for Outfalls 012 through 014 was 0.004 MGD and the flow used for Outfalls 015 through 017 is 0.06 MGD. If the recorded flow is different the mass should be recalculated using the equation: Mass (lbs/day) = Flow (mgd) * 8.34 * concentration (mg/L).

© Thirty day average at pH = 7.9 and 20°C, when hourly samples are collected and composited or only one grab sample is collected. Analysis for the temperature and pH of the receiving water at the same time as the discharge would provide data for a site specific determination of the ammonia limit using Attachment H to the WDR. Shall there be no receiving water present, the pH and temperature of the effluent at the monitoring location shall be determined and reported.

® One hour average WLA at 7.9 pH and 20°C, applies if hourly samples are taken throughout the storm and each is analyzed. No single sample may exceed the 10.1 mg/L limit. Analysis for the temperature and pH of the receiving water at the same time as the discharge would provide data for a site specific determination of the ammonia limit using Attachment H to the WDR. Shall there be no receiving water present, the pH and temperature of the effluent at the end of pipe shall be determined and reported.

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u>	<u>Limitations</u>
		<u>Monthly Average</u>	<u>Daily Maximum</u>
Nitrite-N	mg/L	----	1.0
	lbs/day ²	----	1,334
Manganese ³	µg/L	----	50
	lbs/day ²	----	66.7
Cyanide ³	µg/L	4.3	8.5
	lbs/day ²	5.7	11.3
Antimony ³	µg/L	----	6.0
	lbs/day ²	----	8.01
Arsenic ^{3,4}	µg/L	----	10
	lbs/day ²	----	66.7
Beryllium ³	µg/L	----	4.0
	lbs/day ²	----	5.34
Cadmium ^{3,4}	µg/L	2.0	4.0/3.1 ^{*β}
	lbs/day ²	2.7	5.34/4.14 ^{*β}
Chromium (VI) ⁵	µg/L	8.1	16.3
	lbs/day ²	10.8	21.8
Copper ^{3,4}	µg/L	7.1	14.0
	lbs/day ²	9.5	18.7
Lead ^{3,4}	µg/L	2.6	5.2
	lbs/day ²	3.5	6.94
Mercury ³	µg/L	0.05	0.10
	lbs/day ²	0.07	0.13
Nickel ^{3,4}	µg/L	35	96
	lbs/day ²	47	128
Selenium ³	µg/L	4.1	8.2/5 ^{#β}
	lbs/day ²	5.5	10.9/6.67 ^{#β}
Silver ^{3,4}	µg/L	2.0	4.1
	lbs/day ²	2.7	5.5
Thallium ³	µg/L	----	2.0
	lbs/day ²	----	2.7

³ These discharge limits are expressed as total recoverable.

⁴ Concentrations correspond to a total hardness of 100 mg/L. For other conditions where total hardness exceeds 100 mg/L, the limits can be calculated by following the instructions outlined in 40 CFR Part 131.

⁵ The Discharger has the option to meet the hexavalent chromium limitations with a total chromium analysis. However, if the total chromium level exceeds the hexavalent chromium limitation, it will be considered a violation unless an analysis has been made for hexavalent chromium in replicate sample and the result reported is within the hexavalent chromium limits.

* Effluent limit applies only during wet weather discharges. Wet Weather conditions occur between October and March.

^β This effluent limit shall be deemed vacated at such time as Regional Board Resolutions R05-006 and R05-007 are vacated in compliance with a writ of mandate in the matter of Cities of Bellflower et al v. State Water Resources Control Board et al, Los Angeles Superior Court # BS101732. The Regional Board shall provide notice to the discharger of any such action.

Effluent limit applies only during dry weather discharges. Dry weather conditions occur from April through September.

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>
Zinc ^{3,4}	µg/L lbs/day ²	54 72	119 159
1,1-Dichloroethylene	µg/L lbs/day ²	3.2 4.3	6.0 8.0
Trichloroethylene	µg/L lbs/day ²	---- ----	5.0 6.7
Perchlorate	µg/L lbs/day ²	---- ----	6.0 8.0
TCDD	µg/L lbs/day	1.4E-08 1.9E-08	2.8E-08 3.7E-08
2,4,6-Trichlorophenol	µg/L lbs/day	6.5 8.7	13.0 17
2,4-Dinitrotoluene	µg/L lbs/day	9.1 12	18.3 24
Alpha BHC	µg/L lbs/day	0.01 0.013	0.03 0.04
Bis(2-ethylhexyl)phthalate	µg/L lbs/day	---- ----	4.0 5.3
N-Nitrosodimethylamine	µg/L lbs/day	8.1 10.8	16.3 21.8
Pentachlorophenol	µg/L lbs/day	8.2 10.9	16.5 22
Radioactivity Gross Alpha Gross Beta	pCi/L pCi/L	---- ----	15 50
Combined Radium-226 & Radium-228	pCi/L	----	5.0
Tritium	pCi/L	----	20,000
Strontium-90	pCi/L	----	8.0

The limits included in the table above are also benchmarks at Outfalls 001 and 002. The daily maximum and monthly average effluent limitations are benchmarks for Outfall 001 and the daily maximum effluent limitations are benchmarks for Outfall 002.

4. The discharge of storm water runoff only from Discharge Nos. 003 through 010 with constituents in excess of the following limits is prohibited:

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>
Oil and grease	mg/L lbs/day ²	----- -----	15 2,227
Total dissolved solids	mg/L lbs/day ²	----- -----	850 126,184
Total dissolved solids	mg/L lbs/day ²	----- -----	950 ⁶ 141,029
Chloride	mg/L lbs/day ²	----- -----	150 22,268
Boron ³	mg/L lbs/day ²	----- -----	1.0 148
Sulfate	mg/L lbs/day ²	----- -----	250 ⁷ 37,113
Sulfate	mg/L lbs/day ²	----- -----	300 ⁶ 44,536
Fluoride	mg/L lbs/day ²	----- -----	1.6 238
Nitrate + Nitrite-N	mg/L lbs/day ²	----- -----	10 ⁷ 1,485
Nitrate + Nitrite-N	mg/L lbs/day ²	----- -----	8.0 ⁶ 1,188
Ammonia-N (Outfall 008 only)	mg/L lbs/day	----- -----	10.1® 1,500
Nitrate-N (Outfall 008 only)	mg/L lbs/day	----- -----	8.0 1,190
Nitrite-N (Outfall 008 only)	mg/L lbs/day	----- -----	1.0 148
Selenium (Outfall 008 only)	µg/L lbs/day	----- -----	5 ^{#B} 0.7 ^{#B}
Zinc (Outfall 008 only)	µg/L lbs/day	----- -----	159* ^B 23.6* ^B
Perchlorate	µg/L lbs/day ²	----- -----	6.0 0.89
Antimony ³	µg/L lbs/day ²	----- -----	6.0 0.89
Cadmium ^{3,4}	µg/L lbs/day ²	----- -----	4.0/(3.1* ^B (Outfall 008 only)) 0.59/(0.46* ^B (Outfall 008 only))
Copper ^{3,4}	µg/L lbs/day ²	----- -----	14.0 2.08
Mercury ³	µg/L lbs/day ²	----- -----	0.13 0.02

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>
Nickel ³	µg/L lbs/day ²	----- -----	100 [®] 14.9
Thallium ³	µg/L lbs/day ²	----- -----	2.0 0.3
Lead ³	µg/L lbs/day ²	----- -----	5.2 0.77
TCDD	µg/L lbs/day ²	----- -----	2.8E-08 4.2E-09
Chronic toxicity	TU _c	-----	1 ^a
Radioactivity			
Gross Alpha	pCi/L	-----	15
Gross Beta	pCi/L	-----	50
Combined Radium-226 & Radium-228	pCi/L	----- -----	5
Tritium	pCi/L	-----	20,000
Strontium-90	pCi/L	-----	8

The effluent limitations in the table above serve as benchmarks, as defined in finding 91, paragraph five, for the storm water runoff from Outfalls 008 and 009, from November 1, 2007, through June 10, 2009. Discharges after June 10, 2009, from Outfalls 008 and 009 must comply with the final effluent limitations.

5. Benchmarks for storm water at the former locations of Outfalls 012, 013, and 014 are:

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>
Oil and grease	mg/L lbs/day ²	----- -----	15 0.5
Total dissolved solids	mg/L lbs/day ²	----- -----	950 31.7
Total suspended solids	mg/L lbs/day ²	----- -----	45 1.5
Settleable solids	ml/L	-----	0.3
Chloride	mg/L lbs/day ²	----- -----	150 5.0
Boron ^{3,7}	mg/L lbs/day ²	----- -----	1.0 0.03
Sulfate	mg/L lbs/day ²	----- -----	300 ⁶ 10
Fluoride	mg/L lbs/day ²	----- -----	1.6 0.05

^a The chronic toxicity limit is effective at Outfalls 003 through 007, 009, and 010. The limit is included in the Calleguas Creek Toxicity TMDL.

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>
Nitrate + Nitrite-N	mg/L lbs/day ²	---- ----	8.0 ⁶ 0.3
Ammonia-N	mg/L lbs/day	---- ----	10.1 [®] 0.34
Nitrate-N	mg/L lbs/day	---- ----	8.0 0.27
Nitrite-N	mg/L lbs/day	---- ----	1.0 0.03
Cadmium	µg/L lbs/day	---- ----	3.1* ^β 0.0001* ^β
Selenium	µg/L lbs/day	---- ----	5* ^β 0.0002* ^β
Zinc	µg/L lbs/day	---- ----	159* ^β 0.005* ^β
Copper ^{3,4}	µg/L lbs/day ²	---- ----	13.5 0.0004
Lead ³	µg/L lbs/day ²	---- ----	5.2 0.0002
Mercury ³	µg/L lbs/day ²	---- ----	0.10 0.000003
TCDD	µg/L lbs/day ²	---- ----	2.8E-08 9.3E-12
Naphthalene	µg/L lbs/day ²	---- ----	21 0.0007
Total petroleum hydrocarbons	µg/L lbs/day ²	---- ----	100 0.003
Ethylene dibromide	µg/L lbs/day ²	---- ----	50 0.002
Tertiary butyl alcohol	µg/L lbs/day ²	---- ----	12 0.0004
1,4-Dioxane	µg/L lbs/day ²	---- ----	3 0.0001
Perchlorate	µg/L lbs/day ²	---- ----	6.0 0.0002

6. With the exception of Outfalls 001 and 002, in the event that an effluent limitation set forth above for a pollutant other than a radioactive material is exceeded and the Discharger presents within 30 days of the date of discovery documentation that (i) discharges from a solid waste management unit (unit) regulated by DTSC are causing or contributing to the violation, and (ii) the Discharger was in compliance with all applicable

⁶ The limit applies to discharges from Outfall 008 only.

⁷ The limit is applicable for discharges from Outfalls 003 through 007, 009 and 010 which flows to Calleguas Creek. It is not applicable at Outfall 008 which discharges to Bell Creek and subsequently the Los Angeles River.

requirements of DTSC permits and corrective action requirements for the unit, and (iii) modifications to DTSC's permit or corrective action requirements are necessary to consistently comply with this Order, then the Discharger, DTSC, and Regional Board will work cooperatively to develop a schedule that is as short as possible to take appropriate actions under the RCRA corrective action requirements or permits, as appropriate, to ensure compliance with this Order. This Order may be reopened and modified, in accordance with applicable laws and regulations, or a Time Schedule Order issued to incorporate appropriate interim limits while the appropriate actions are being taken under the RCRA corrective action requirements or permits.

C. Receiving Water Limitations

1. The discharge shall not cause the concentration of constituents in Arroyo Simi in the vicinity of the discharges, from Outfalls 003 through 007, 009, and 010, to exceed the following limits:

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>
Chlorpyrifos	µg/L	---	0.02 ¹
Diazinon	µg/L	---	0.16 ¹
Chlordane	µg/L	---	0.001
4,4-DDD	µg/L	---	0.0014
4,4-DDE	µg/L	---	0.001
4,4-DDT	µg/L	---	0.001
Dieldrin	µg/L	---	0.0002
PCBs	µg/L	---	0.0003
Toxaphene	µg/L	---	0.0003

¹ Limit effective March 24, 2008. The TMDL specifies interim limits which are effective from March 24, 2006 through March 23, 2008.

2. Interim receiving water limitations effective from the effective date of the permit through March 23, 2008 for discharges to Arroyo Simi from Outfalls 003 through 007, 009, and 010. The final effluent limitations in Section I.C.1. above for these constituents are effective from March 24, 2008 through the term of the permit.

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>
Chlorpyrifos	µg/L	---	0.74
Diazinon	µg/L	---	0.91

3. The discharge shall not cause any of the following conditions to exist in the receiving waters at any time:
 - a. Floating, suspended or deposited macroscopic particulate matter or foam;
 - b. Alteration of temperature, turbidity, or apparent color beyond present natural background levels;
 - c. Visible, floating, suspended or deposited oil or other products of petroleum origin;
 - d. Bottom deposits or aquatic growth; or,
 - e. Toxic or other deleterious substances to be present in concentrations or quantities which cause deleterious effects on aquatic biota, wildlife, or waterfowl or render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentration.
2. No discharge shall cause a surface water temperature rise greater than 5°F above the natural temperature of the receiving waters at any time or place.
3. The discharge shall not cause the following limits to be exceeded in the receiving waters at any place within one foot of the water surface:
 - a. The pH shall not be depressed below 6.5 nor raised above 8.5, nor caused to vary from normal ambient pH levels by more than 0.5 units;
 - b. Dissolved oxygen shall not be less than 5.0 mg/L anytime, and the median dissolved oxygen concentration for any three consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation;
 - c. Dissolved sulfide shall not be greater than 0.1 mg/L;
4. Toxicity limitations for discharges from Outfalls 001 through 014, 018, and Outfall 019:
 - a. Acute Toxicity Limitation and Requirements
 1. The acute toxicity of the effluent shall be such that: (i) the average survival in the undiluted effluent for any three (3) consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, and (ii) no single test producing less than 70 % survival.

2. If either of the above requirements (Section I.C.4.a.1) is not met, the Discharger shall conduct six additional tests over a six-week period. The discharger shall ensure that they receive results of a failing acute toxicity test within 24 hours of the close of the test and the additional tests shall begin within 3 business days of the receipt of the result. If the additional tests indicate compliance with acute toxicity limitation, the discharger may resume regular testing. However, if the results of any two of the six accelerated tests are less than 90% survival, then the Discharger shall begin a Toxicity Identification Evaluation (TIE). The TIE shall include all reasonable steps to identify the sources of toxicity. Once the sources are identified, the Discharger shall take all reasonable steps to reduce toxicity to meet the objective.
 3. If the initial test and any of the additional six acute toxicity bioassay test result in less than 70% survival, including the initial test, the Discharger shall immediately begin a TIE.
 4. The Discharger shall conduct acute toxicity monitoring as specified in Monitoring and Reporting Program No. 6027.
- b. Chronic Toxicity Limitation and Requirements:
1. This Order includes a chronic testing toxicity trigger defined as an exceedance of 1.0 TU_c in a critical life stage test for 100% effluent. (The monthly median for chronic toxicity of 100% effluent shall not exceed 1.0 TU_c in a critical life stage test.)
 2. If the chronic toxicity of the effluent exceeds 1.0 TU_c , the Discharger shall immediately implement an accelerated chronic toxicity testing according to MRP No. 6027, Section IV.D. If the results of two of the six accelerated tests exceed 1.0 TU_c , the Discharger shall initiate a TIE and implement the Initial Investigation TRE Workplan. (see MRP No. 6027, Section IV.E.).
 3. The Discharger shall conduct chronic toxicity monitoring as specified in MRP No. 6027.
 4. The chronic toxicity of the effluent shall be expressed and reported in toxic units, where:

$$TU_c = \frac{100}{NOEC}$$

The No Observable Effect Concentration (NOEC) is expressed as the maximum percent effluent concentration that causes no observable effect on test organisms, as determined by the results of a critical life stage toxicity test.

5. Preparation of an Initial Investigation TRE Workplan

- i. The Discharger shall submit a detailed initial investigation Toxicity Reduction Evaluation (TRE) workplan to the Executive Officer of the Regional Board for approval within 90 days of the effective date of this permit. The Discharger shall use EPA manuals EPA/600/2-88/070 (industrial) or EPA/833B-99/002 (municipal) as guidance or current versions. At a minimum, the TRE workplan must contain the provisions in Attachment C. This workplan shall describe the steps the Discharger intends to follow if toxicity is detected, and should include, at a minimum:
- ii. A description of the investigation and evaluation techniques that would be used to identify potential causes and sources of toxicity, effluent variability, and treatment system efficiency;
- iii. A description of the facility's methods of maximizing in-house treatment efficiency and good housekeeping practices, and a list of all chemicals used in operation of the facility; and,
- iv. If a toxicity identification evaluation (TIE) is necessary, an indication of the person who would conduct the TIEs (i.e., an in-house expert or an outside contractor) (See MRP Section IV.E.3. for guidance manuals).

5. The discharge shall not cause a violation of any applicable water quality standard for receiving waters.

If more stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Clean Water Act, or amendments, thereto, the Regional Board will revise and modify this Order in accordance with such standards.

D. Final Ambient WLAs for Pollutants in Sediment for Storm Water Dischargers

The following are the final ambient WLAs. They are measured as in-stream annual averages at the base of each subwatershed where the discharges are located.

The final WLAs must be achieved and become sediment limits after the sampling indicates that the Discharger is able to comply with the final WLAs or at the end of the 20-year compliance schedule specified in the TMDL (March 24, 2026), whichever occurs first. In either event, the permit will be reopened at that time to include appropriate sediment limits.

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>
Chlordane	µg/g	--	0.0033
4,4-DDD	µg/g	--	0.002
4,4-DDE	µg/g	--	0.0014
4,4-DDT	µg/g	--	0.0003
Dieldrin	µg/g	--	0.0002
PCBs	µg/g	--	0.12
Toxaphene	µg/g	--	0.0006

E. Interim Ambient WLAs for Pollutants in Sediment for Storm Water Dischargers

The following sediment interim WLAs are effective as sediment limitations from November 23, 2007, through June 10, 2009. If the permit is administratively extended, these WLAs will continue to be in effect up to November 23, 2012 (five years from the effective date of this permit).

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>
Chlordane	µg/g	--	0.0033
4,4-DDD	µg/g	--	0.014
4,4-DDE	µg/g	--	0.17
4,4-DDT	µg/g	--	0.025
Dieldrin	µg/g	--	0.0011
PCBs	µg/g	--	25.7
Toxaphene	µg/g	--	0.23

The implementation schedule for the TMDL (Resolution No. R4-2005-0010) provides for interim sediment limitations through March 24, 2026 (twenty years from the effective date of the Basin Plan Amendment).

II. Requirements

A. Pollution Prevention and Best Management Practices Plans

The Discharger shall develop, within 90 days of the effective date of this Order, the following plans. If necessary, the plans shall be updated to address any changes in operation and/or management of the facility. Updated plans shall be submitted to the Regional Board within 30 days of revision.

1. A *Storm Water Pollution Prevention Plan* (SWPPP) that describes site-specific management practices for minimizing storm water runoff from being contaminated, and for preventing contaminated storm water runoff from being discharged directly to waters of the State. The SWPPP shall be

developed in accordance with the requirements contained in Attachment A and submitted to the Regional Board within 90 days of the effective date of this Order.

2. *A Best Management Practices Plan (BMPP)*. The purpose of the BMPP is to establish site-specific procedures that will prevent the discharge of pollutants in non-storm water discharges. The BMPP shall be site-specific and shall cover all areas of the facility.
3. *Compliance Plan*. The interim sediment limitations stipulated in section I.E. of this Order for OC Pesticides and PCBs in sediment shall be in effect for a period not to extend beyond November 23, 2012. Thereafter, the Discharger shall comply with the limitations specified for OC Pesticides and PCBs in section I.D. in of this Order.
4. The Discharger shall develop and submit, within one year of the effective date of this Order, a compliance plan that will identify the measures that will be taken to reduce the concentrations of OC Pesticides and PCBs in sediment at the base of the subwatershed discharging to Arroyo Simi. This plan must evaluate options to achieve compliance with the final sediment limitations within the deadline specified above.
5. The Discharger shall submit annual reports to describe the progress of studies and or actions undertaken to reduce the OC Pesticides and PCBs in the effluent and the sediment, and to achieve compliance with the limitations in this Order by the deadline specified above. The Regional Water Board shall receive the first annual progress report at the same time the annual summary report is due, as required in section VI. of the MRP.
6. *Pollutant Minimization Plan (PMP)*. The purpose of the BMPP is to establish site-specific procedures that will prevent the discharge of pollutants in non-storm water discharges. The BMPP shall be site-specific and shall cover all areas of the facility.
 - i. The Discharger shall develop a PMP to maintain effluent concentrations of OC Pesticides and PCBs at or below the effluent limitations specified in Receiving Water Limitations section I.C.1 and Interim Ambient Mass of Pollutants in Sediment for Storm water Dischargers specified in section I.E. of this Order. The PMP shall include the following:
 - a. Annual review and monitoring of the receiving water, sediment in the receiving water; and the effluent for OC Pesticides and PCBs;
 - b. Submittal of a control strategy designed to proceed toward the goal of maintaining effluent concentrations at or below the effluent limitation;

- c. Implementation of appropriate cost-effective control measures consistent with the control strategy;
 - d. An annual status report that shall be sent to the Regional Water Board at the same time the annual summary report is submitted in accordance with section I.B of the MRP, and include:
 - (i) All PMP monitoring results for the previous year;
 - (ii) A list of potential sources of OC Pesticides and PCBs;
 - (iii) A summary of all actions undertaken pursuant to the control strategy;
 - (iv) A description of actions to be taken in the following year.
- B. Pursuant to the requirements of 40 CFR 122.42(a), the Discharger must notify the Board as soon as it knows, or has reason to believe (1) that it has begun or expected to begin, to use or manufacture a toxic pollutant not reported in the permit application, or (2) a discharge of toxic pollutant not limited by this Order has occurred, or will occur, in concentrations that exceed the specified limitations in 40 CFR 122.42(a).
- C. Compliance Determination
- 1. Compliance with single constituent effluent limitation – If the concentration of the pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reported Minimum Level (see Reporting Requirement II. C. of *M&RP*), then the Discharger is out of compliance.
 - 2. Compliance with monthly average limitations - In determining compliance with monthly average limitations, the following provisions shall apply to all constituents:
 - a. If the analytical result of a single sample, monitored monthly, quarterly, semiannually, or annually, does not exceed the monthly average limit for that constituent, the Discharger has demonstrated compliance with the monthly average limit for that month.
 - b. If the analytical result of a single sample, monitored monthly, quarterly, semiannually, or annually, exceeds the monthly average limit for any constituent, the Discharger shall collect four additional samples as early as flow is available during the month. All five analytical results shall be reported in the monitoring report for that quarter, or 45 days after results for the additional samples were received, whichever is later.

When all sample results are greater than or equal to the reported Minimum Level (see Reporting Requirement II. C. of M&RP), the numerical average of the analytical results of these five samples will be used for compliance determination.

When one or more sample results are reported as "Not-Detected (ND)" or "Detected, but Not Quantified (DNQ)" (see Reporting Requirement II. C. of M&RP), the median value of these four samples shall be used for compliance determination. If one or both of the middle values is ND or DNQ, the median shall be the lower of the two middle values.

- c. In the event of noncompliance with a monthly average effluent limitation, the sampling frequency for that constituent shall be increased to weekly and shall continue at this level until compliance with the monthly average effluent limitation has been demonstrated.
 - d. If only one sample was obtained for the month or more than a monthly period and the result exceed the monthly average, then the Discharger is in violation of the monthly average limit.
3. Compliance with effluent limitations expressed as a sum of several constituents – If the sum of the individual pollutant concentrations is greater than the effluent limitation, then the Discharger is out of compliance. In calculating the sum of the concentrations of a group of pollutants, consider constituents reported as ND or DNQ to have concentrations equal to zero, provided that the applicable ML is used.
 4. Compliance with effluent limitations expressed as a median – in determining compliance with a median limitation, the analytical results in a set of data will be arranged in order of magnitude (either increasing or decreasing order); and
 - a. If the number of measurements (n) is odd, then the median will be calculated as $= X_{(n+1)/2}$, or
 - b. If the number of measurements (n) is even, then the median will be calculated as $= [X_{n/2} + X_{(n/2)+1}]$, i.e. the midpoint between the $n/2$ and $n/2+1$ data points.
 5. Compliance with the pH limitation – If the receiving water pH downstream of the discharge, exceeds 8.5 pH units as a result of:
 - a. high pH in the storm water, or
 - b. elevated pH in the receiving water upstream of the discharge,then the exceedance shall not be considered a violation.

6. Compliance with the temperature limitation – If the receiving water temperature downstream of the discharge, exceeds 86°F as a result of:
 - a. high temperature in the ambient air, or
 - b. elevated temperature in the receiving water upstream of the discharge,then the exceedance shall not be considered a violation.
7. The Discharger shall comply with benchmarks and receiving water limitations through timely implementation of control measures and other actions to reduce pollutants in the discharges in accordance with the BMP plan and its components and other requirements of this Order including any modifications. The BMP plan and its components shall be designed to achieve compliance with receiving water limitations. If exceedances of Water Quality Objectives or Water Quality Standards (collectively, Water Quality Standards) persist, notwithstanding implementation of the BMP and its components and other requirements of this permit, the Discharger shall assure compliance with discharge prohibitions and receiving water limitations by complying with the following procedure:
 - a. Upon a determination by either the Permittee or the Regional Board that discharges are causing or contributing to an exceedance of an applicable Water Quality Standard, the Discharger shall within 24 hours notify and thereafter submit a revised BMP compliance report (as described in the Monitoring and Reporting Program) to the Regional Board that describes the BMPs that are currently being implemented and additional BMPs that will be implemented to prevent or reduce any pollutants that are causing or contributing to the exceedances of Water Quality Standards. This BMP Compliance Report is due to the Regional Board 60 days after the second reported exceedance of a benchmark. The BMP Compliance Report shall include an implementation schedule along with descriptions and proposed installation locations of the upgrades or new BMPs. The Executive Officer at the Regional Board may require modifications to the BMP Compliance Report.
 - b. Submit any modifications to the BMP Compliance Report required by the Regional Board within 30 days of notification.
 - c. Within 30 days following the approval of the BMP Compliance Report, the Discharger shall revise the BMP Plan and its components and monitoring program to incorporate the approved modifications that have been and will be implemented; and implementation schedule, and any additional monitoring required.
 - d. Implement the revised BMP plan and its components and monitoring program according to the approved schedule.

8. So long as the Discharger has complied with the procedures set forth above and is implementing the revised BMP plan and its components, the Discharger does not have to repeat the same procedure for continuing or recurring exceedances of the same effluent limitations or receiving water limitation unless directed by the Regional Board to develop additional BMPs.
- D. In calculating mass emission rates from the monthly average concentrations, use one half of the method detection limit for "Not Detected" (ND) and the estimated concentration for "Detected, but Not Quantified" (DNQ) for the calculation of the monthly average concentration. To be consistent with section II.E.3., if all pollutants belonging to the same group are reported as ND or DNQ, the sum of the individual pollutant concentrations should be considered as zero for the calculation of the monthly average concentration.
- E. The discharge of any product registered under the Federal Insecticide, Fungicide, and Rodenticide Act to any waste stream which may ultimately be released to waters of the United States is prohibited unless specifically authorized elsewhere in this permit. This requirement is not applicable to products used for lawn and agricultural purposes. Discharge of chlorine for disinfection in plant potable and service water systems and in sewage treatment is authorized.
- F. The discharge of any waste resulting from the combustion of toxic or hazardous wastes to any waste stream which ultimately discharges to waters of the United States is prohibited, unless specifically authorized elsewhere in this permit.
- G. There shall be no discharge of PCB compounds, such as those once commonly used for transformer fluid.
- H. Compliance with the sediment effluent concentrations will be determined by calculating the in-stream annual average at the base of each subwatershed where the discharges are located. The Boeing SSFL discharge is located in Arroyo Simi and the sediment concentration at Arroyo Simi East of Hitch Boulevard or at Simi Valley Water Quality Control Plant should not exceed the interim effluent limitations. Since the facility is located near the top of the watershed, the Discharger may choose to collect the sediment samples closer to the facility.
- I. The Discharger shall notify the Executive Officer in writing no later than six months prior to planned discharge of any chemical, other than chlorine or other product previously reported to the Executive Officer, which may be toxic to aquatic life. Such notification shall include:
 - a. Name and general composition of the chemical,
 - b. Frequency of use,
 - c. Quantities to be used,
 - d. Proposed discharge concentrations, and
 - e. USEPA registration number, if applicable.

No discharge of such chemical shall be made prior to the Executive Officer's approval.

- J. The Regional Board and USEPA shall be notified immediately by telephone, of the presence of adverse conditions in the receiving waters or on beaches and shores as a result of wastes discharged; written confirmation shall follow as soon as possible but not later than five working days after occurrence.

III. Provisions

- A. This Order includes the attached *Standard Provisions and General Monitoring and Reporting Requirements* (Standard Provisions, Attachment N). If there is any conflict between provisions stated hereinbefore and the attached Standard Provisions, those provisions attached herein prevail. Boeing shall report to the Regional Board any monitoring data that exceeds the detection limit for monitored constituents without effluent limitations. The report shall be reported, via facsimile, within 24 hours of the Discharger receiving the data from the lab. Regional Board staff will bring a reopener to the Regional Board within 90 days of determining that reasonable potential exists to cause or to contribute to an exceedance of water quality standards.
- B. This Order includes the attached Monitoring and Reporting Program (Attachment T). If there is any conflict between provisions stated in the Monitoring and Reporting Program and the Standard Provisions, those provisions stated in the Monitoring and Reporting Program prevail.
- C. This Order may be modified, revoked, and reissued or terminated in accordance with the provisions of 40 CFR sections 122.44, 122.62, 122.63, 122.64, 125.62, and 125.64. Causes for taking such actions include, but are not limited to: failure to comply with any condition of this order and permit, endangerment to human health or the environment resulting from the permitted activity; or acquisition of newly obtained information which would have justified the application of different conditions if known at the time of Order adoption. The filing of a request by the discharger for an Order modification, revocation, and issuance or termination, or a notification of planned changes or anticipated noncompliance does not stay any condition of this Order.
- D. The Discharger must comply with the lawful requirements of municipalities, counties, drainage districts, and other local agencies regarding discharges of storm water to storm drain systems or other water courses under their jurisdiction; including applicable requirements in municipal storm water management program developed to comply with NPDES permits issued by the Regional Board to local agencies.
- E. Discharge of wastes to any point other than specifically described in this Order and permit is prohibited and constitutes a violation thereof.
- F. The Discharger shall comply with all applicable effluent limitations, national standards of performance, toxic effluent standards, and all federal regulations

established pursuant to Sections 301, 302, 303(d), 304, 306, 307, 316, and 423 of the Federal Clean Water Act and amendments thereto.

IV. Reopeners

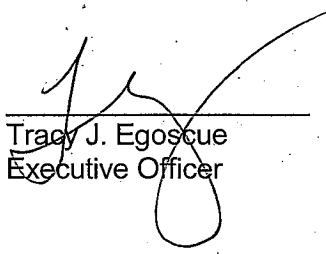
- A. This Order may be reopened and modified, in accordance with SIP Section 2.2.2.A, to incorporate new limits based on future reasonable potential analysis to be conducted, upon completion of the collection of additional data by the discharger. Notwithstanding the foregoing, in the event that reasonable potential analyses indicate that a pollutant has reasonable potential, the Regional Board staff shall bring an appropriate modification to the Regional Board, at the next practicable Board meeting.
- B. This Order may be reopened and modified, in accordance with the provisions set forth in 40 CFR Parts 122 and 124, to include requirements for the implementation of the watershed management approach.
- C. This Order may be reopened and modified, in accordance with the provisions set forth in 40 CFR Parts 122 and 124, to include new minimum levels (MLs).
- D. This Order may be reopened and modified to consider incorporation of a site specific or regional design storm (based on the evaluation of the results of the Design Storm Project) and subsequent policy considerations.
- E. This Order may be reopened and modified, to revise effluent limitations as a result of future Basin Plan Amendments, such as an update of an objective or the adoption of a TMDL for Los Angeles River or the Calleguas Creek.
- F. This Order may be reopened upon the submission by the discharger, of adequate information, as determined by the Regional Board, to provide for dilution credits or a mixing zone, as may be appropriate.
- G. This Order may be reopened and modified, to revise the toxicity language once that language becomes standardized.
- H. In accordance with Provision I.B.7, this Order may be reopened and modified to incorporate interim limits, to the extent authorized by law, while DTSC revises and reissues updated RCRA corrective action requirements or permits, as appropriate, to ensure compliance with this Order.
- I. This Order may also be reopened and modified, revoked, and reissued or terminated in accordance with the provisions of 40 CFR sections 122.44, 122.62 to 122.64, 125.62, and 125.64. Causes for taking such actions include, but are not limited to, failure to comply with any condition of this order and permit, endangerment to human health or the environment resulting from the permitted activity.

V. Expiration Date

This Order expires on June 10, 2009.

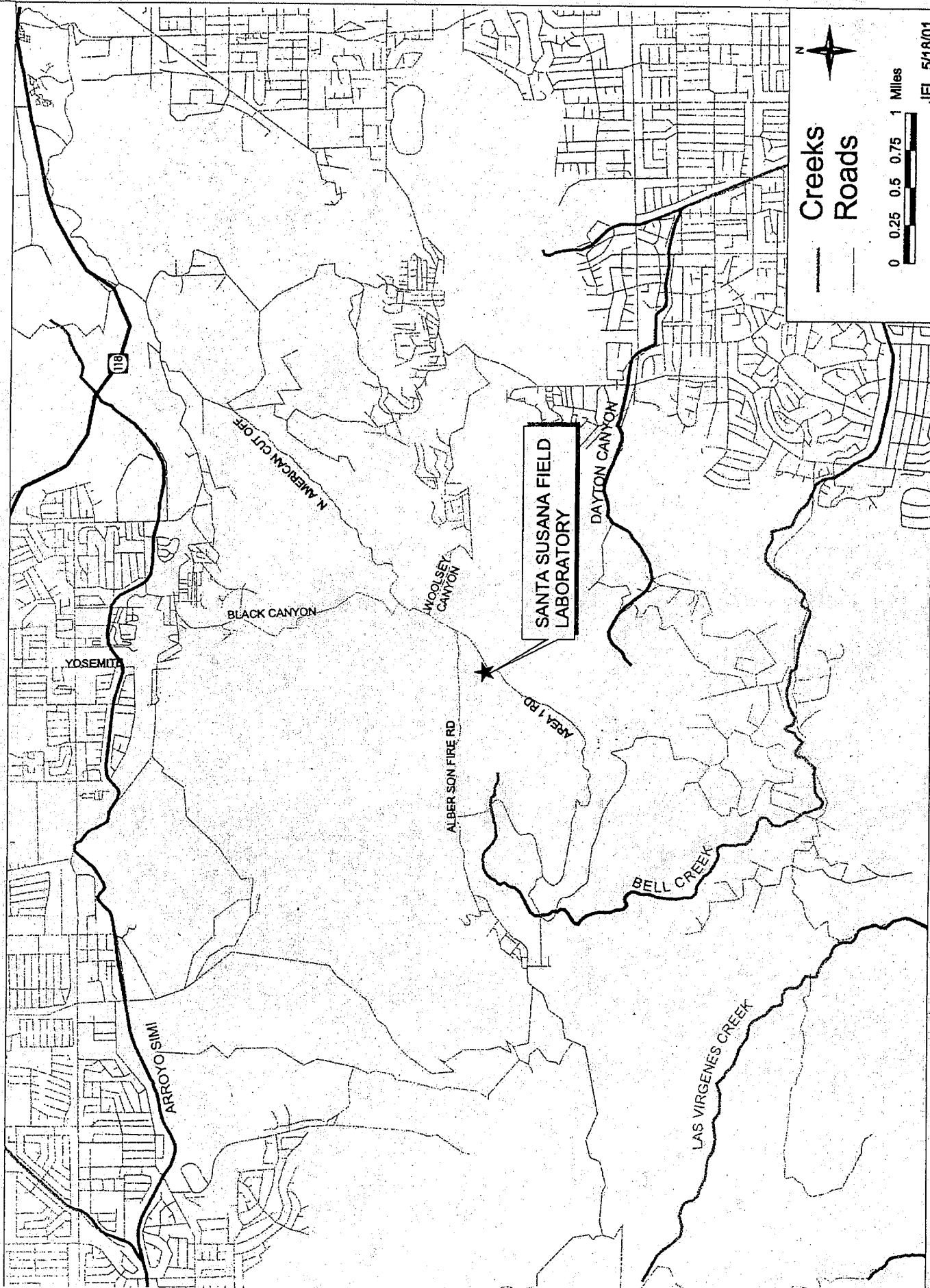
The Discharger must file a Report of Waste Discharge in accordance with Title 23, California Code of Regulations, not later than 180 days in advance of the expiration date as application for issuance of new waste discharge requirements.

I, Tracy J. Egoscue, Executive Officer, do hereby certify that the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, Los Angeles Region on November 1, 2007.



Tracy J. Egoscue
Executive Officer

SANTA SUSANA FIELD LABORATORY AND VICINTY - FIGURE 1



SECTION A: STORM WATER POLLUTION PREVENTION PLAN REQUIREMENTS

1. Implementation Schedule

A storm water pollution prevention plan (SWPPP) shall be developed and implemented for each facility covered by this General Permit in accordance with the following schedule.

- a. Facility operators beginning industrial activities before October 1, 1992 shall develop and implement the SWPPP no later than October 1, 1992. Facility operators beginning industrial activities after October 1, 1992 shall develop and implement the SWPPP when industrial activities begin.
- b. Existing facility operators that submitted a Notice of Intent (NOI), pursuant to State Water Resources Control Board (State Water Board) Order No. 91-013-DWQ (as amended by Order No. 92-12) or San Francisco Bay Regional Water Quality Control Board (Regional Water Board) Order No. 92-11 (as amended by Order No. 92-116), shall continue to implement their existing SWPPP and shall implement any necessary revisions to their SWPPP in a timely manner, but in no case later than August 1, 1997.

2. Objectives

The SWPPP has two major objectives: (a) to identify and evaluate sources of pollutants associated with industrial activities that may affect the quality of storm water discharges and authorized non-storm water discharges from the facility; and (b) to identify and implement site-specific best management practices (BMPs) to reduce or prevent pollutants associated with industrial activities in storm water discharges and authorized non-storm water discharges. BMPs may include a variety of pollution prevention measures or other low-cost and pollution control measures. They are generally categorized as non-structural BMPs (activity schedules, prohibitions of practices, maintenance procedures, and other low-cost measures) and as structural BMPs (treatment measures, run-off controls, overhead coverage.) To achieve these objectives, facility operators should consider the five phase process for SWPPP development and implementation as shown in Table A.

The SWPPP requirements are designed to be sufficiently flexible to meet the needs of various facilities. SWPPP requirements that are not applicable to a facility should not be included in the SWPPP.

A facility's SWPPP is a written document that shall contain a compliance activity schedule, a description of industrial activities and pollutant sources, descriptions of BMPs, drawings, maps, and relevant copies or references of parts of other plans. The SWPPP shall be revised whenever appropriate and shall be readily available for review by facility employees or Regional Water Board inspectors.

3. Planning and Organizationa. Pollution Prevention Team

The SWPPP shall identify a specific individual or individuals and their positions within the facility organization as members of a storm water pollution prevention team responsible for developing the SWPPP, assisting the facility manager in SWPPP implementation and revision, and conducting all monitoring program activities required in Section 8 of this General Permit. The SWPPP shall clearly identify the General Permit related responsibilities, duties, and activities of each team member. For small facilities, storm water pollution prevention teams may consist of one individual where appropriate.

b. Review Other Requirements and Existing Facility Plans

The SWPPP may incorporate or reference the appropriate elements of other regulatory requirements. Facility operators should review all local, State, and Federal requirements that impact, complement, or are consistent with the requirements of this General Permit. Facility operators should identify any existing facility plans that contain storm water pollutant control measures or relate to the requirements of this General Permit. As examples, facility operators whose facilities are subject to Federal Spill Prevention Control and Countermeasures' requirements should already have instituted a plan to control spills of certain hazardous materials. Similarly, facility operators whose facilities are subject to air quality related permits and regulations may already have evaluated industrial activities that generate dust or particulates.

4. Site Map

The SWPPP shall include a site map. The site map shall be provided on an 8-1/2 x 11 inch or larger sheet and include notes, legends, and other data as appropriate to ensure that the site map is clear and understandable. If necessary, facility operators may provide the required information on multiple site maps.

6. Description of Potential Pollutant Sources

a. The SWPPP shall include a narrative description of the facility's industrial activities, as identified in Section A.4.e above, associated potential pollutant sources, and potential pollutants that could be discharged in storm water discharges or authorized non-storm water discharges. At a minimum, the following items related to a facility's industrial activities shall be considered:

i. Industrial Processes

Describe each industrial process, the type, characteristics, and quantity of significant materials used in or resulting from the process, and a description of the manufacturing, cleaning, rinsing, recycling, disposal, or other activities related to the process. Where applicable, areas protected by containment structures and the corresponding containment capacity shall be described.

ii. Material Handling and Storage Areas

Describe each handling and storage area, type, characteristics, and quantity of significant materials handled or stored, description of the shipping, receiving, and loading procedures, and the spill or leak prevention and response procedures. Where applicable, areas protected by containment structures and the corresponding containment capacity shall be described.

iii. Dust and Particulate Generating Activities

Describe all industrial activities that generate dust or particulates that may be deposited within the facility's boundaries and identify their discharge locations; the characteristics of dust and particulate pollutants; the approximate quantity of dust and particulate pollutants that may be deposited within the facility boundaries; and a description of the primary areas of the facility where dust and particulate pollutants would settle.

iv. Significant Spills and Leaks

Describe materials that have spilled or leaked in significant quantities in storm water discharges or non-storm water discharges since April 17, 1994. Include toxic chemicals (listed in 40 CFR, Part 302)

that have been discharged to storm water as reported on U.S. Environmental Protection Agency (U.S. EPA) Form R, and oil and hazardous substances in excess of reportable quantities (see 40 Code of Federal Regulations [CFR], Parts 110, 117, and 302).

The description shall include the type, characteristics, and approximate quantity of the material spilled or leaked, the cleanup or remedial actions that have occurred or are planned, the approximate remaining quantity of materials that may be exposed to storm water or non-storm water discharges, and the preventative measures taken to ensure spill or leaks do not reoccur. Such list shall be updated as appropriate during the term of this General Permit.

v. Non-Storm Water Discharges

Facility operators shall investigate the facility to identify all non-storm water discharges and their sources. As part of this investigation, all drains (inlets and outlets) shall be evaluated to identify whether they connect to the storm drain system.

All non-storm water discharges shall be described. This shall include the source, quantity, frequency, and characteristics of the non-storm water discharges and associated drainage area.

Non-storm water discharges that contain significant quantities of pollutants or that do not meet the conditions provided in Special Conditions D. are prohibited by this General Permit (Examples of prohibited non-storm water discharges are contact and non-contact cooling water, boiler blowdown, rinse water, wash water, etc.). Non-storm water discharges that meet the conditions provided in Special Condition D. are authorized by this General Permit. The SWPPP must include BMPs to prevent or reduce contact of non-storm water discharges with significant materials or equipment.

vi. Soil Erosion

Describe the facility locations where soil erosion may occur as a result of industrial activity, storm water discharges associated with industrial activity, or authorized non-storm water discharges.

b. The SWPPP shall include a summary of all areas of industrial activities, potential pollutant sources, and

The description of the BMPs shall identify the BMPs as (1) existing BMPs, (2) existing BMPs to be revised and implemented, or (3) new BMPs to be implemented. The description shall also include a discussion on the effectiveness of each BMP to reduce or prevent pollutants in storm water discharges and authorized non-storm water discharges. The SWPPP shall provide a summary of all BMPs implemented for each pollutant source. This information should be summarized similar to Table B.

Facility operators shall consider the following BMPs for implementation at the facility:

a. Non-Structural BMPs

Non-structural BMPs generally consist of processes, prohibitions, procedures, schedule of activities, etc., that prevent pollutants associated with industrial activity from contacting with storm water discharges and authorized non-storm water discharges. They are considered low technology, cost-effective measures. Facility operators should consider all possible non-structural BMPs options before considering additional structural BMPs (see Section A.8.b. below). Below is a list of non-structural BMPs that should be considered:

i. Good Housekeeping

Good housekeeping generally consist of practical procedures to maintain a clean and orderly facility.

ii. Preventive Maintenance

Preventive maintenance includes the regular inspection and maintenance of structural storm water controls (catch basins, oil/water separators, etc.) as well as other facility equipment and systems.

iii. Spill Response

This includes spill clean-up procedures and necessary clean-up equipment based upon the quantities and locations of significant materials that may spill or leak.

iv. Material Handling and Storage

This includes all procedures to minimize the potential for spills and leaks and to minimize exposure of significant materials to storm water and authorized non-storm water discharges.

v. Employee Training

This includes training of personnel who are responsible for (1) implementing activities identified in the SWPPP, (2) conducting inspections, sampling, and visual observations, and (3) managing storm water. Training should address topics such as spill response, good housekeeping, and material handling procedures, and actions necessary to implement all BMPs identified in the SWPPP. The SWPPP shall identify periodic dates for such training. Records shall be maintained of all training sessions held.

vi. Waste Handling/Recycling

This includes the procedures or processes to handle, store, or dispose of waste materials or recyclable materials.

vii. Recordkeeping and Internal Reporting

This includes the procedures to ensure that all records of inspections, spills, maintenance activities, corrective actions, visual observations, etc., are developed, retained, and provided, as necessary, to the appropriate facility personnel.

viii. Erosion Control and Site Stabilization

This includes a description of all sediment and erosion control activities. This may include the planting and maintenance of vegetation, diversion of run-on and runoff, placement of sandbags, silt screens, or other sediment control devices, etc.

ix. Inspections

This includes, in addition to the preventative maintenance inspections identified above, an inspection schedule of all potential pollutant sources. Tracking and follow-up procedures shall be described to ensure adequate corrective actions are taken and SWPPPs are made.

x. Quality Assurance

This includes the procedures to ensure that all elements of the SWPPP and Monitoring Program are adequately conducted.

- c. The SWPPP shall be revised, as appropriate, and implemented prior to changes in industrial activities which (i) may significantly increase the quantities of pollutants in storm water discharge, (ii) cause a new area of industrial activity at the facility to be exposed to storm water, or (iii) begin an industrial activity which would introduce a new pollutant source at the facility.
- d. Other than as provided in Provisions B.11, B.12, and E.2 of the General Permit, the SWPPP shall be revised and implemented in a timely manner, but in no case more than 90 days after a facility operator determines that the SWPPP is in violation of any requirement(s) of this General Permit.
- e. When any part of the SWPPP is infeasible to implement by the deadlines specified in Provision E.2 or Sections A.1, A.9, A.10.c, and A.10.d of this General Permit due to proposed significant structural changes, the facility operator shall submit a report to the Regional Water Board prior to the applicable deadline that (i) describes the portion of the SWPPP that is infeasible to implement by the deadline, (ii) provides justification for a time extension, (iii) provides a schedule for completing and implementing that portion of the SWPPP, and (iv) describes the BMPs that will be implemented in the interim period to reduce or prevent pollutants in storm water discharges and authorized non-storm water discharges. Such reports are subject to Regional Water Board approval and/or modifications. Facility operators shall provide written notification to the Regional Water Board within 14 days after the SWPPP revisions are implemented.
- f. The SWPPP shall be provided, upon request, to the Regional Water Board. The SWPPP is considered a report that shall be available to the public by the Regional Water Board under Section 308(b) of the Clean Water Act.

Attachment C

GENERIC TOXICITY REDUCTION EVALUATION WORKPLAN (TRE) INDUSTRIAL

1. Information and Data Acquisition
 - a. Regulatory information
 - i. NPDES permit limits
 - ii. Trigger
 - b. Facility monitoring data
 - i. NPDES monitoring data
 - ii. In-house monitoring data
 - iii. State agency monitoring data
 - c. Plant and Process Description
 - i. Process and treatment plant description
 - (1) numbers and types of streams
 - (2) their size
 - (3) scheduled changes or events in process-stream operation
 - (4) types and configurations of equipment
 - (5) flow equalization facilities
 - (6) records of treatment plant upsets
 - ii. Physical/chemical monitoring data
 - (1) chemical analyses of process streams
 - (2) physical/chemical analyses of treatment streams
2. Housekeeping
 - a. Initiation of housekeeping study
 - i. Identify areas which may contribute to toxicity
 - ii. Reduce these contributions through best management practices (BMPs), administrative, and procedural controls
 - b. Evaluation of housekeeping practices
 - i. Review of plant policies
 - ii. "Walk-through" inspection
 - c. Identification of potential problem areas
 - i. Probability of release of toxic material
 - ii. Type and frequency of release which may occur
 - iii. Quantity of toxic substances involved
 - iv. Toxicity of substances released
 - v. Potential downstream impact of the substances released
 - vi. Effect of release on final effluent
 - d. Identification of corrective measures
 - i. Area cleanup
 - ii. Process or operational changes
 - iii. Material loss collection and recovery
 - iv. Chemical and biological testing of contained waters prior to release from diked storage areas
 - v. Increased storage capacity for contained waters
 - vi. Equipment modifications or changes
 - e. Selection of corrective measures
 - f. Implementation of corrective measures
3. Treatment Plant Optimization
 - a. Evaluation of influent wastestreams
 - i. Raw chemicals or materials used in the process
 - ii. Byproducts or reaction products produced during the process
 - iii. Reaction vessels, valves, piping systems, overflow points, and other mechanical aspects of the system
 - iv. Wastestreams produced, volumes, and routing paths

- v. Non-point sources
 - b. Description and evaluation of the treatment system
 - i. Design basis for each constituent, including variability in flow conditions and concentrations
 - ii. Treatment sequence
 - iii. Performance projections by constituents
 - iv. Operational flexibility of each process
 - v. Treatment objectives and projected effluent standards
 - c. Analysis of treatment system operation
 - i. Flow loading
 - ii. Mass loading
 - iii. Frequency and impact of shock loadings
 - (1) normal cleaning and maintenance
 - (2) spills and upsets
 - iv. Changes in operating procedures
- 4. Chemical optimization
 - a. Information gathering
 - i. Examination of wastestreams produced by specific production processes
 - ii. Chemicals and raw materials and their contaminants and by-products used in the process
 - iii. Chemicals used in treatment
 - iv. Chemicals and material use rates
 - v. Percentage of chemical in final product
 - vi. Chemical reuse and waste recycling activities
 - b. Process chemical review
 - i. List all chemicals used
 - ii. List all quantities
 - iii. Determine pounds per product
 - iv. Determine pounds per gallon of wastewater discharged
 - c. MSDS information review
 - i. Obtain MSDS for all process chemicals discharged
 - ii. Highlight MSDS sections on aquatic toxicity
 - iii. Examine Hazardous Ingredient section and note "hazardous substances" listed
 - iv. Categorize all chemicals by hazard and irritation potential and use standard references to obtain aquatic toxicity information, if possible
 - d. Chemical composition screen of incoming raw materials
 - e. Outcome of chemical optimization phase
 - i. List of all chemicals used in processing and manufacturing the product
 - ii. MSDS and literature reviews will be on file when needed
 - iii. List of all chemicals and raw material purchased on a monthly basis and a record of production volumes during the same time period

REVISED ATTACHMENT H

Table 3-1. One-hour Average Objective for Ammonia-N for Freshwaters (mg N/L)

<u>pH</u>	<u>Waters Designated COLD and/or MIGR</u>	<u>Waters Not Designated COLD and/or MIGR</u>
<u>6.5</u>	<u>32.6</u>	<u>48.8</u>
<u>6.6</u>	<u>31.3</u>	<u>46.8</u>
<u>6.7</u>	<u>29.8</u>	<u>44.6</u>
<u>6.8</u>	<u>28.1</u>	<u>42.0</u>
<u>6.9</u>	<u>26.2</u>	<u>39.1</u>
<u>7.0</u>	<u>24.1</u>	<u>36.1</u>
<u>7.1</u>	<u>22.0</u>	<u>32.8</u>
<u>7.2</u>	<u>19.7</u>	<u>29.5</u>
<u>7.3</u>	<u>17.5</u>	<u>26.2</u>
<u>7.4</u>	<u>15.4</u>	<u>23.0</u>
<u>7.5</u>	<u>13.3</u>	<u>19.9</u>
<u>7.6</u>	<u>11.4</u>	<u>17.0</u>
<u>7.7</u>	<u>9.65</u>	<u>14.4</u>
<u>7.8</u>	<u>8.11</u>	<u>12.1</u>
<u>7.9</u>	<u>6.77</u>	<u>10.1</u>
<u>8.0</u>	<u>5.62</u>	<u>8.40</u>
<u>8.1</u>	<u>4.64</u>	<u>6.95</u>
<u>8.2</u>	<u>3.83</u>	<u>5.72</u>
<u>8.3</u>	<u>3.15</u>	<u>4.71</u>
<u>8.4</u>	<u>2.59</u>	<u>3.88</u>
<u>8.5</u>	<u>2.14</u>	<u>3.20</u>
<u>8.6</u>	<u>1.77</u>	<u>2.65</u>
<u>8.7</u>	<u>1.47</u>	<u>2.20</u>
<u>8.8</u>	<u>1.23</u>	<u>1.84</u>
<u>8.9</u>	<u>1.04</u>	<u>1.56</u>
<u>9.0</u>	<u>0.885</u>	<u>1.32</u>

Reference: U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia¹

¹ For freshwaters, the one-hour average concentration (Criteria Maximum Concentration or CMC) of total ammonia as nitrogen (in mg N/L) shall not exceed the values described by the following equations.

For waters designated COLD and/or MIGR:

$$\text{CMC or One-hour Average Concentration} = \frac{0.275}{1+10^{7.204-pH}} + \frac{39.0}{1+10^{pH-7.204}}$$

Or for waters not designated COLD and/or MIGR:

$$\text{CMC or One-hour Average Concentration} = \frac{0.411}{1+10^{7.204-pH}} + \frac{58.4}{1+10^{pH-7.204}}$$

Table 3-2. 30-day Average Objective for Ammonia-N for Freshwaters Designated SPWN (mg N/L)

Temperature, °C

pH	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	6.67	6.46	6.06	5.68	5.33	4.99	4.68	4.39	4.12	3.86	3.62	3.39	3.18	2.98	2.80	2.62	2.46
6.6	6.57	6.36	5.97	5.59	5.25	4.92	4.61	4.32	4.05	3.80	3.56	3.34	3.13	2.94	2.75	2.58	2.42
6.7	6.44	6.25	5.86	5.49	5.15	4.83	4.52	4.24	3.98	3.73	3.50	3.28	3.07	2.88	2.70	2.53	2.37
6.8	6.29	6.10	5.72	5.36	5.03	4.72	4.42	4.14	3.89	3.64	3.42	3.20	3.00	2.82	2.64	2.47	2.32
6.9	6.12	5.93	5.56	5.21	4.89	4.58	4.30	4.03	3.78	3.54	3.32	3.11	2.92	2.74	2.57	2.41	2.25
7.0	5.91	5.73	5.37	5.04	4.72	4.43	4.15	3.89	3.65	3.42	3.21	3.01	2.82	2.64	2.48	2.32	2.18
7.1	5.67	5.49	5.15	4.83	4.53	4.25	3.98	3.73	3.50	3.28	3.08	2.88	2.70	2.53	2.38	2.23	2.09
7.2	5.39	5.22	4.90	4.59	4.31	4.04	3.78	3.55	3.33	3.12	2.92	2.74	2.57	2.41	2.26	2.12	1.99
7.3	5.08	4.92	4.61	4.33	4.06	3.80	3.57	3.34	3.13	2.94	2.76	2.58	2.42	2.27	2.13	2.00	1.87
7.4	4.73	4.59	4.30	4.03	3.78	3.55	3.32	3.12	2.92	2.74	2.57	2.41	2.26	2.12	1.98	1.86	1.74
7.5	4.36	4.23	3.97	3.72	3.49	3.27	3.06	2.87	2.69	2.53	2.37	2.22	2.08	1.95	1.83	1.72	1.61
7.6	3.98	3.85	3.61	3.39	3.18	2.98	2.79	2.62	2.45	2.30	2.16	2.02	1.90	1.78	1.67	1.56	1.47
7.7	3.58	3.47	3.25	3.05	2.86	2.68	2.51	2.36	2.21	2.07	1.94	1.82	1.71	1.60	1.50	1.41	1.32
7.8	3.18	3.09	2.89	2.71	2.54	2.38	2.23	2.10	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	1.17
7.9	2.80	2.71	2.54	2.38	2.24	2.10	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	1.17	1.10	1.03
8.0	2.43	2.36	2.21	2.07	1.94	1.82	1.71	1.60	1.50	1.41	1.32	1.24	1.16	1.09	1.02	0.957	0.897
8.1	2.10	2.03	1.91	1.79	1.68	1.57	1.47	1.38	1.29	1.21	1.14	1.07	1.00	0.938	0.879	0.824	0.773
8.2	1.79	1.74	1.63	1.53	1.43	1.34	1.26	1.18	1.11	1.04	0.973	0.912	0.855	0.802	0.752	0.705	0.661
8.3	1.52	1.48	1.39	1.30	1.22	1.14	1.07	1.00	0.941	0.882	0.827	0.775	0.727	0.682	0.639	0.599	0.562
8.4	1.29	1.25	1.17	1.10	1.03	0.966	0.906	0.849	0.796	0.747	0.700	0.656	0.615	0.577	0.541	0.507	0.475
8.5	1.09	1.06	0.990	0.928	0.870	0.816	0.765	0.717	0.672	0.630	0.591	0.554	0.520	0.487	0.457	0.428	0.401
8.6	0.920	0.892	0.836	0.784	0.735	0.689	0.646	0.606	0.568	0.532	0.499	0.468	0.439	0.411	0.386	0.362	0.339
8.7	0.778	0.754	0.707	0.663	0.622	0.583	0.547	0.512	0.480	0.450	0.422	0.396	0.371	0.348	0.326	0.306	0.287
8.8	0.661	0.641	0.601	0.563	0.528	0.495	0.464	0.435	0.408	0.383	0.359	0.336	0.315	0.296	0.277	0.260	0.244
8.9	0.565	0.548	0.513	0.481	0.451	0.423	0.397	0.372	0.349	0.327	0.306	0.287	0.269	0.253	0.237	0.222	0.208
9.0	0.486	0.471	0.442	0.414	0.389	0.364	0.342	0.320	0.300	0.281	0.264	0.247	0.232	0.217	0.204	0.191	0.179

* At temperatures below 14 °C, the objective is the same as that shown for 14 °C.

Reference: U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia²

² For freshwaters designated SPWN, the thirty-day average concentration (Criteria Continuous Concentration or CCC) of total ammonia as nitrogen (in mg N/L) shall not exceed the values described by the following equation.

$$\text{CCC or 30-day Average Concentration} = \left(\frac{0.0577}{1 + 10^{7.688 - \text{pH}}} + \frac{2.487}{1 + 10^{\text{pH} - 7.688}} \right) * \text{MIN} \left(2.85, 1.45 * 10^{0.028 * (25 - T)} \right)$$

Where T = temperature expressed in °C.

In addition, for freshwaters, the highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average objective as calculated above.

Table 3-3. 30-day Average Objective for Ammonia-N for Freshwaters Not Designated SPWN (mg N/L)

pH	Temperature, °C									
	0-7	8	9	10	11	12	13	14	15*	
6.5	10.8	10.1	9.51	8.92	8.36	7.84	7.35	6.89	6.46	
6.6	10.7	9.99	9.37	8.79	8.24	7.72	7.24	6.79	6.36	
6.7	10.5	9.81	9.20	8.62	8.08	7.58	7.11	6.66	6.25	
6.8	10.2	9.58	8.98	8.42	7.90	7.40	6.94	6.51	6.10	
6.9	9.93	9.31	8.73	8.19	7.68	7.20	6.75	6.33	5.93	
7.0	9.60	9.00	8.43	7.91	7.41	6.95	6.52	6.11	5.73	
7.1	9.20	8.63	8.09	7.58	7.11	6.67	6.25	5.86	5.49	
7.2	8.75	8.20	7.69	7.21	6.76	6.34	5.94	5.57	5.22	
7.3	8.24	7.73	7.25	6.79	6.37	5.97	5.60	5.25	4.92	
7.4	7.69	7.21	6.76	6.33	5.94	5.57	5.22	4.89	4.59	
7.5	7.09	6.64	6.23	5.84	5.48	5.13	4.81	4.51	4.23	
7.6	6.46	6.05	5.67	5.32	4.99	4.68	4.38	4.11	3.85	
7.7	5.81	5.45	5.11	4.79	4.49	4.21	3.95	3.70	3.47	
7.8	5.17	4.84	4.54	4.26	3.99	3.74	3.51	3.29	3.09	
7.9	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89	2.71	
8.0	3.95	3.70	3.47	3.26	3.05	2.86	2.68	2.52	2.36	
8.1	3.41	3.19	2.99	2.81	2.63	2.47	2.31	2.17	2.03	
8.2	2.91	2.73	2.56	2.40	2.25	2.11	1.98	1.85	1.74	
8.3	2.47	2.32	2.18	2.04	1.91	1.79	1.68	1.58	1.48	
8.4	2.09	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	
8.5	1.77	1.66	1.55	1.46	1.37	1.28	1.20	1.13	1.06	
8.6	1.49	1.40	1.31	1.23	1.15	1.08	1.01	0.951	0.892	
8.7	1.26	1.18	1.11	1.04	0.976	0.915	0.858	0.805	0.754	
8.8	1.07	1.01	0.944	0.885	0.829	0.778	0.729	0.684	0.641	
8.9	0.917	0.86	0.806	0.756	0.709	0.664	0.623	0.584	0.548	
9.0	0.790	0.740	0.694	0.651	0.610	0.572	0.536	0.503	0.471	

* At 15 °C and above, the 30-day average objective for waters not designated SPWN is the same as that for waters designated SPWN.
Reference: U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia³

³ For freshwaters not designated SPWN, the thirty-day average concentration(Criteria Continuous Concentration or CCC) of total ammonia as nitrogen (in mg N/L) shall not exceed the values described by the following equation.

$$\text{CCC or 30-day Average Concentration} = \left(\frac{0.0577}{1 + 10^{7.688 - \text{pH}}} + \frac{2.487}{1 + 10^{\text{pH} - 7.688}} \right) * 1.45 * 10^{0.028 * (25 - \text{MAX}(T, 7))}$$

Where T = temperature expressed in °C.

In addition, for freshwaters, the highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average objective as calculated above.

**STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION**

**STANDARD PROVISIONS, GENERAL MONITORING AND
REPORTING REQUIREMENTS**

"ATTACHMENT N"

A. General Requirements

1. Neither the disposal nor any handling of wastes shall cause pollution or nuisance.
2. Wastes discharged shall not contain any substances in concentrations toxic to human, animal, plant, or aquatic life.
3. This discharge shall not cause a violation of any applicable water quality standards for receiving waters adopted by the Regional Board or the State Water Resources Control Board as required by the Federal Clean Water Act and regulations adopted thereunder. If more stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Federal Clean Water Act, and amendments thereto, the Board will revise and modify this Order in accordance with such more stringent standards.
4. Wastes discharged shall not contain visible color, oil or grease, and shall not cause the appearance of color, grease, oil or oily slick, or persistent foam in the receiving waters or on channel banks, walls, inverts or other structures.
5. Wastes discharged shall not increase the natural turbidity of the receiving waters at the time of discharge.
6. Wastes discharged shall not cause the formation of sludge deposits.
7. Wastes discharged shall not damage flood control structures or facilities.
8. Oil or oily material, chemicals, refuse, or other pollutionable materials shall not be stored or deposited in areas where they may be picked up by rainfall and carried off of the property and/or discharged to surface waters. Any spill of such materials shall be contained and removed immediately.
9. The pH of wastes discharged shall at all times be within the range 6.0 to 9.0.
10. The temperature of wastes discharged shall not exceed 100° F.
11. The discharge of any radiological, chemical, or biological warfare agent or high level radiological waste is prohibited.

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12. Effluent limitations, national standards of performance and toxic and pretreatment effluent standards established pursuant to Sections 301, 302, 303(d), 304, 306, 307, 316, 318 and 405 of the Federal Clean Water Act and amendments thereto are applicable to the discharge.

B. General Provisions

1. The requirements prescribed herein do not authorize the commission of any act causing injury to the property of another, nor protect the discharger from his liabilities under federal, state, or local laws, nor guarantee the discharger a capacity right in the receiving waters.
2. These requirements do not exempt the operator of the waste disposal facility from compliance with any other laws, regulations, or ordinances which may be applicable; they do not legalize this waste disposal facility, and they leave unaffected any further restraints on the disposal of wastes at this site which may be contained in other statutes or required by other agencies.
3. The discharger must comply with all of the terms, requirements, and conditions of this order. Any violation of this order constitutes a violation of the Clean Water Act, its regulations and the California Water Code, and is grounds for enforcement action, Order termination, Order revocation and reissuance, denial of an application for reissuance; or a combination thereof.
4. A copy of these waste discharge specifications shall be maintained at the discharge facility so as to be available at all times to operating personnel.
5. Any discharge of wastes at any point(s) other than specifically described in this Order is prohibited, and constitutes a violation of the Order.
6. The Regional Board, EPA, and other authorized representatives shall be allowed:
 - a) Entry upon premises where a regulated facility is located or conducted, or where records are kept under conditions of this Order;
 - b) Access to copy any records that are kept under the conditions of this Order;
 - c) To inspect any facility, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

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- (d) To photograph, sample, and monitor for the purpose of assuring compliance with this Order, or as otherwise authorized by the Clean Water Act and the California Water Code.
- 7. If the discharger wishes to continue an activity regulated by this Order after the expiration date of this Order, the discharger must apply for and obtain a new Order.
- 8. The discharger shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if this Order has not yet been modified to incorporate the requirement. If a toxic effluent standard or prohibition is established for toxic pollutant which is present in the discharge authorized herein and such standard or prohibition is more stringent than any limitation upon such pollutant in this Order, the Board will revise or modify this Order in accordance with such toxic effluent standard or prohibition and so notify the discharger.
- 9. After notice and opportunity for a hearing, this Order may be terminated or modified for cause, including, but not limited to:
 - (a) Violation of any term or condition contained in this Order;
 - (b) Obtaining this Order by misrepresentation, or failure to disclose all relevant facts;
 - (c) A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.
- 10. In the event the discharger is unable to comply with any of the conditions of this Order due to:
 - (a) breakdown of waste treatment equipment;
 - (b) accidents caused by human error or negligence; or
 - (c) other causes such as acts of nature,

the discharger shall notify the Executive Officer by telephone as soon as he or his agents have knowledge of the incident and confirm this notification in writing within two weeks of the telephone notification. The written notification shall include pertinent information explaining reasons for the noncompliance and shall indicate

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- what steps were taken to correct the problem and the dates thereof, and what steps are being taken to prevent the problem from recurring.
11. If there is any storage of hazardous or toxic materials or hydrocarbons at this facility and if the facility is not manned at all times, a 24-hour emergency response telephone number shall be prominently posted where it can easily be read from the outside.
 12. The discharger shall take all reasonable steps to minimize or prevent any discharge that has a reasonable likelihood of adversely affecting human health or the environment.
 13. The discharger shall at all times properly operate and maintain all facilities and systems of treatment and control including sludge use and disposal facilities (and related appurtenances) that are installed or used by the discharger to achieve compliance with this Order. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar system that are installed by a discharger only when necessary to achieve compliance with the conditions of this Order.
 14. This Order may be modified, revoked and reissued, or terminated for cause. The filing of a request by the discharger for a modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any condition of this Order.
 15. This Order does not convey any property rights of any sort, or any exclusive privilege.
 16. The discharger shall furnish, within a reasonable time, any information the Regional Board or EPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order. The discharger shall also furnish to the Regional Board, upon request, copies of records required to be kept by this Order.
 17. All applications, reports, or information submitted to the Regional Board shall be signed:
 - (a) In the case of corporations, by a principal executive officer at least of the level of vice-president or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which discharge originates;
 - (b) In the case of a partnership, by a general partner;

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- (c) In the case of a sole proprietorship, by the proprietor;
- (d) In the case of municipal, state or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.

18. The discharger shall notify the Board of:

- (a) new introduction into such works of pollutants from a source which could be a new source as defined in section 306 of the Federal Clean Water Act, or amendments thereto, if such source were discharging pollutants to the waters of the United States,
- (b) new introductions of pollutants into such works from a source which would be subject to Section 301 of the Federal Clean Water Act, or amendments thereto, if substantial change in the volume or character of pollutants being introduced into such works by a source introducing pollutants into such works at the time the waste discharge requirements were adopted.

Notice shall include a description of the quantity and quality of pollutants and the impact of such change on the quantity and quality of effluent from such publicly owned treatment works. A substantial change in volume is considered an increase of ten percent in the mean dry-weather flow rate. The discharger shall forward a copy of such notice directly to the Regional Administrator.

- 19. The discharger shall notify the Board not later than 120 days in advance of implementation of any plans to alter production capacity of the product line of the manufacturing, producing or processing facility by more than ten percent. Such notification shall include estimates of proposed production rate, the type of process, and projected effects on effluent quality. Notification shall include submittal of a new report of waste discharge appropriate filing fee.
- 20. The discharger shall give advance notice to the Regional Board as soon as possible of any planned physical alterations or additions to the facility or of any planned changes in the facility or activity that may result in noncompliance with requirements.
- 21. The discharger shall file with the Board a report of waste discharge at least 120 days before making any material change or proposed change in the character, location or volume of the discharge.
- 22. All existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Regional Board as soon as they know or have reason to believe:

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- (a) that any activity has occurred or will occur that would result in the discharge of any toxic pollutant that is not limited in this Order, if that discharge will exceed the highest of the following "notification levels:"
 - (i) One hundred micrograms per liter (100 µg/l);
 - (ii) Two hundred micrograms per liter (200 µg/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/l) for 2,4-dinitrophenol and 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;
 - (iii) Five (5) times the maximum concentration value reported for that pollutant in the permit application; or
 - (iv) The level established by the Regional Board in accordance with 40 CFR 122.44(f).
 - (b) that they have begun or expect to begin to use or manufacture intermediate or final product or byproduct of any toxic pollutant that was not reported on their application.
23. Bypass (the intentional diversion of waste streams from any portion of a treatment facility) is prohibited. The Regional Board may take enforcement action against the discharger for bypass unless:
- (a) Bypass was unavoidable to prevent loss of life, personal injury or severe property damage. (Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.);
 - (b) There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated waste, or maintenance during normal periods of equipment down time. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgement to prevent a bypass that could occur during normal periods of equipment downtime or preventive maintenance; and
 - (c) The discharger submitted a notice at least ten days in advance of the need for a bypass to the Regional Board.

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The discharger may allow a bypass to occur that does not cause effluent limitations to be exceeded, but only if it is for essential maintenance to assure efficient operation. In such a case, the above bypass conditions are not applicable. The discharger shall submit notice of an unanticipated bypass as required in E-16.

24. A discharger that wishes to establish the affirmative defense of an upset in an action brought for non-compliance shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
- (a) an upset occurred and that the discharger can identify the cause(s) of the upset;
 - (b) the permitted facility was being properly operated by the time of the upset;
 - (c) the discharger submitted notice of the upset as required in E-16; and
 - (d) the discharger complied with any remedial measures required.

No determination made before an action for noncompliance, such as during administrative review of claims that non-compliance was caused by an upset, is final administrative action subject to judicial review.

In any enforcement proceeding, the discharger seeking to establish the occurrence of an upset has the burden of proof.

25. This Order is not transferable to any person except after notice to the Regional Board. In the event of any change in name, ownership, or control of these waste disposal facilities, the discharger shall notify this Board of such change and shall notify the succeeding owner or operator of the existence of this Order by letter, copy of which shall be forwarded to the Board. The Regional Board may require modification or revocation and reissuance of the Order to change the name of the discharger and incorporate such other requirements as may be necessary under the Clean Water Act.

C. Enforcement

1. The California Water Code provides that any person who violates a waste discharge requirement or a provision of the California Water Code is subject to civil penalties of up to \$5,000 per day, \$10,000 per day, or \$25,000 per day of violation, or when the violation involves the discharge of pollutants, is subject to civil penalties of up to \$10 per gallon per day or \$25 per gallon per day of violation; or

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some combination thereof, depending on the violation, or upon the combination of violations.

Violation of any of the provisions of the NPDES program or of any of the provisions of this Order may subject the violator to any of the penalties described herein, or any combination thereof, at the discretion of the prosecuting authority; except that only one kind of penalty may be applied for each kind of violation.

2. The Federal Clean Water Act (CWA) provides that any person who violates a permit condition or any requirement imposed in a pretreatment program implementing sections 301, 302, 306, 307, 308, 318 or 405 of the CWA is subject to a civil penalty not to exceed \$25,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing these sections of the CWA is subject to a fine of not less than \$2,500 nor more than \$25,000 per day of violation, or by imprisonment for not more than 1 year, or both. Any person who knowingly violates permit conditions implementing these sections of the CWA is subject to a fine of not less than \$5,000, or more than \$50,000 per day of violation, or by imprisonment for not more than 3 years, or by both.
3. It shall not be a defense for a discharger in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Order.
4. The Clean Water Act provides that any person who knowingly makes any false material statement, representation, or certification in any application, record, report, or other document submitted or required to be maintained under this Order, or who knowingly falsifies, tampers with, or renders inaccurate any monitoring device or method required to be maintained under this act, shall upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than 2 years per violation, or by both.

D. Monitoring Requirements

1. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
2. The discharger shall retain records of all monitoring information, including all calibration and maintenance monitoring instrumentation, copies of all reports required by this Order, and records of all data used to complete the Report of Waste Discharge and application for this Order; for a period of at least five(5) years from the date of the sample, measurement, report, or application. This period may be extended by request of the Regional Board or EPA at any time and shall be extended during the course of any unresolved litigation regarding this discharge.

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3. Records of monitoring information shall include:
 - (a) The date, exact place, and time of sampling or measurements;
 - (b) The individual(s) who performed the sampling or measurements;
 - (c) The date(s) analyses were performed;
 - (d) The individual(s) who performed the analyses;
 - (e) The analytical techniques or methods used; and
 - (f) The results of such analyses.
4. All sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136, unless other test procedures have been specified in this Order.
5. All chemical, bacteriological, and bioassay analyses shall be conducted at a laboratory certified for such analyses by an appropriate governmental regulatory agency.
6. The discharger shall calibrate and perform maintenance procedures on all monitoring instruments and to insure accuracy of measurements, or shall insure that both equipment activities will be conducted.
7. The discharger shall have, and implement, an acceptable written quality assurance (QA) plan for laboratory analyses. The annual monitoring report required in E-8 shall also summarize the QA activities for the previous year. Duplicate chemical analyses must be conducted on a minimum of ten percent (10%) of the samples, or at least one sample per sampling period, whichever is greater. A similar frequency shall be maintained for analyzing spiked samples.

When requested by the Board or EPA, the discharger will participate in the NPDES discharge monitoring report QA performance study. The discharger must have a success rate equal to or greater than 80%.
8. Effluent samples shall be taken downstream of any addition to treatment works and prior to mixing with the receiving waters.
9. For parameters where both 30-day average and maximum limits are specified but

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where the monitoring frequency is less than four times a month, the following procedure shall apply:

- (a) Initially, not later than the first week of the second month after the adoption of this permit, a representative sample shall be obtained of each waste discharge at least once per week for at least four consecutive weeks and until compliance with the 30-day average limit has been demonstrated. Once compliance has been demonstrated, sampling and analyses shall revert to the frequency specified.
- (b) If future analyses of two successive samples yield results greater than 90% of the maximum limit for a parameter, the sampling frequency for that parameter shall be increased (within one week of receiving the laboratory result on the second sample) to a minimum of once weekly until at least four consecutive weekly samples have been obtained and compliance with the 30-day average limit has been demonstrated again and the discharger has set forth for the approval of the Executive Officer a program which ensures future compliance with the 30-day average limit.

E. Reporting Requirements

1. The discharger shall file with the Board technical reports on self monitoring work performed according to the detailed specifications contained in any Monitoring and Reporting Programs as directed by the Executive Officer.
2. In reporting the monitoring data, the discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernable. The data shall be summarized to demonstrate compliance with waste discharge requirements and, where applicable, shall include results of receiving water observations.
3. For every item where the requirements are not met, the discharger shall submit a statement of the actions undertaken or proposed which will bring the discharge into full compliance with requirements at the earliest time and submit a timetable for correction.
4. The discharger shall submit to the Board, together with the first monitoring report required by this permit, a list of all chemicals and proprietary additives which could affect this waste discharge, including quantities of each. Any subsequent changes in types and/or quantities shall be reported promptly.
5. The discharger shall file a technical report with this Board not later than 30 days after receipt of this Order, relative to the operation and maintenance program for this waste disposal facility. The information to be contained in that report shall

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include as a minimum, the following:

- (a) The name and address of the person or company responsible for operation and maintenance of the facility.
- (b) Type of maintenance (preventive or corrective).
- (c) Frequency of maintenance, if preventive.

If an operation and maintenance report has been supplied to the Board previously and there have been no changes, a second report need not be provided.

6. Monitoring results shall be reported at the intervals specified in the monitoring and Reporting Program.
 - (a) Monitoring results must be reported on a Discharge Monitoring Report (DMR).
 - (b) If the discharger monitors any pollutant more frequently than required by this Order using test procedures approved under 40 CFR Part 136 or as specified in this Order, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.
 - (c) Calculations for all limitations that require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this Order.
7. Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this Order shall be submitted no later than 14 days following, each schedule date.
8. By March 1 of each year, the discharger shall submit an annual report to the Board. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the discharger shall discuss the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the waste discharge requirements.
9. The discharger shall include in the annual report, an annual summary of the quantities of all chemicals, listed by both trade and chemical names, which are used for cooling and/or boiler water treatment and which are discharged.
10. Each monitoring report must affirm in writing that "all analyses were conducted at a laboratory certified for such analyses by the Department of Health Services or

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approved by the Executive Officer and in accordance with current EPA guideline procedures or as specified in this Monitoring Program".

11. Each report shall contain the following completed declaration:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted.

Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility, of a fine and imprisonment for knowing violations.

Executed on the ___ day of _____, 19__.

at _____.

_____(Signature)

_____(Title)"

12. If no flow occurred during the reporting period, the monitoring report shall so state.
13. For any analyses performed for which no procedure is specified in the EPA guidelines or in the monitoring and Reporting Program, the constituent or parameter analyzed and the method or procedure used must be specified in the monitoring report.
14. This Board requires the discharger to file with the Board, within 90 days after the effective date of this Order, a technical report on his preventive (failsafe) and contingency (cleanup) plans for controlling accidental discharges, and for minimizing the effect of such events. The technical report should:
- (a) Identify the possible sources of accidental loss, untreated waste bypass, and contaminated drainage. Loading and storage areas, power outage, waste treatment unit outage, and failure of process equipment, tanks and pipes should be considered.
 - (b) Evaluate the effectiveness of present facilities and procedures and state when they become operational.

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- (c) Describe facilities and procedures needed for effective preventive and contingency plans.
- (d) Predict the effectiveness of the proposed facilities and procedures and provide an implementation schedule contingent interim and final dates when they will be constructed, implemented, or operational.

This Board, after review of the technical report, may establish conditions which it deems necessary to control accidental discharges and to minimize the effects of such events.

Such conditions may be incorporated as part of this Order, upon notice to the discharger.

15. In the event wastes are transported to a different disposal site during the report period, the following shall be reported in the monitoring report:

- (a) Types of wastes and quantity of each type;
- (b) Name and address for each hauler of wastes (or method of transport if other than by hauling); and
- (c) Location of the final point(s) of disposal for each type of waste.

If no wastes are transported offsite during the reporting period, a statement to that effect shall be submitted.

16. The discharger shall report any noncompliance that may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the discharger becomes aware of the circumstances. A written submission shall also be provided within five days of the time the discharger becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The following shall be included as information that must be reported within 24 hours under this paragraph:

- (a) Any unanticipated bypass that exceeds any effluent limitation in the Order.
- (b) Any upset that exceeds any effluent limitation in the Order.
- (c) Violation of a maximum daily discharge limitation for any of the pollutants

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listed in this Order to be reported within 24 hours.

The Regional Board may waive the above-required written report on a case-by-case basis.

17. Should the discharger discover that it failed to submit any relevant facts or that it submitted incorrect information in a report, it shall promptly submit the missing or correct information.
18. The discharger shall report all instances of non-compliance not otherwise reported at the time monitoring reports are submitted. The reports shall contain all information listed in E-16.
19. Each monitoring report shall state whether or not there was any change in the discharge as described in the Order during the reporting period.
20. Analytical data reported as "less than" for the purpose of reporting compliance with permit limitations shall be the same or lower than the permit limit(s) established for the given parameter.
21. The discharger shall mail a copy of each monitoring report to:

INFORMATION TECHNOLOGY
CALIFORNIA REGIONAL WATER QUALITY
CONTROL BOARD - LOS ANGELES REGION
320 W. 4TH STREET, SUITE 200
LOS ANGELES, CA 90013

A copy of such monitoring report for those discharges designated as a major discharge shall also be mailed to:

REGIONAL ADMINISTRATOR
ENVIRONMENTAL PROTECTION AGENCY
REGION 9
75 Hawthorne Street
San Francisco, CA 94105

F. Publicly Owned Wastewater Treatment Plant Requirements
(Does not apply to any other type or class of discharger)

1. Publicly owned treatment works (POTWs) must provide adequate notice to the

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Regional Board of:

- (a) Any new introduction of pollutants into the POTW from an indirect discharger that would be subject to sections 301 or 306 of the Clean Water Act if it were directly discharging those pollutants.
- (b) Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the Order.

Adequate notice shall include information on the quality and quantity of effluent introduced into the POTW as well as any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

- 2. The discharger shall file a written report with the Board within 90 days after the average dry-weather waste flow for any month equals or exceeds 75 percent of the design capacity of his waste treatment and/or disposal facilities. The discharger's senior administration officer shall sign a letter which transmits that report and certifies that the policy-making body is adequately informed about it. The report shall include:
 - (a) Average daily flow for the month, the date on which the instantaneous peak flow occurred, the rate of that peak flow, and the total flow for that day.
 - (b) The discharger's best estimate of when the average daily dry weather flow rate will equal or exceed the design capacity of his facilities.
 - (c) The discharger's intended schedule for studies, design, and other steps needed to provide additional capacity for his waste treatment and/or disposal facilities before the waste flow rate equals the capacity of present units.
- 3. The flow measurement system shall be calibrated at least once per year or more frequently, to ensure continued accuracy.
- 4. The discharger shall require any industrial user of the treatment works to comply with applicable service charges and toxic pretreatment standards promulgated in accordance with Sections 204(b), 307, and 308 of the Federal Clean Water Act or amendments thereto. The discharger shall require each individual user to submit periodic notice (over intervals not to exceed nine months) of progress toward compliance with applicable toxic and pretreatment standards developed pursuant to the Federal Clean Water Act or amendments thereto. The discharger shall forward a copy of such notice to the Board and the Regional Administrator.

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5. Collected screening, sludges, and other solids removed from liquid wastes shall be disposed of at a legal point of disposal and in accordance with the provisions of Section 405(d) of the Federal Clean Water Act and Division 7 of the California Water Code. For the purpose of this requirement, a legal point of disposal is defined as one for which waste discharge requirements have been prescribed by a Regional Water Quality Control Board and which is in full compliance therewith.
6. Supervisors and operators of publicly owned wastewater treatment plants shall possess a certificate of appropriate grade in accordance with regulations adopted by the State Water Resources Control Board.

The annual report required by E-8 shall address operator certification and provide a list of current operating personnel and their grade of certification. The report shall include the date of each facility's Operation and Maintenance Manual, the date the manual was last reviewed, and whether the manual is complete and valid for the current facilities. The report shall restate, for the record, the laboratories used by the discharger to monitor compliance with this order and permit and provide a summary of performance.

G. Definitions

1. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility whose operation is necessary to maintain compliance with the terms and conditions of this Order.
2. "Composite sample" means, for flow rate measurements, the arithmetic mean of no fewer than eight individual measurements taken at equal intervals for 24 hours or for the duration of discharge, whichever is shorter.

"Composite sample" means, for other than flow rate measurement,

- (a) A combination of at least eight individual portions obtained at equal time intervals for 24 hours, or the duration of the discharge, whichever is shorter. The volume of each individual portion shall be directly proportional to the discharge flow rate at the time of sampling;

OR

- (b) A combination of at least eight individual portions of equal volume obtained over a 24-hour period. The time interval will vary such that the volume of wastewater discharged between samplings remains constant.

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The compositing period shall equal the specified sampling period; or 24 hours, if no period is specified.

3. "Daily discharge" means:
- (a) For flow rate measurements, the average flow rate measured during a calendar day or during any 24-hour period reasonably representative of the calendar day for purposes of sampling.
 - (b) For pollutant measurements, the concentration or mass emission rate measured during a calendar day or during any 24-hour period reasonably representative of the calendar day for purposes of sampling.

4. The "daily discharge rate" shall be obtained from the following calculation for any calendar day:

$$\text{Daily discharge rate} = \frac{8.34 \sum (Q_i)(C_i)}{N}$$

in which N is the number of samples analyzed in any calendar day, Q_i and C_i are the rate (MGD) and the constituent concentration (mg/l) respectively, which are associated with each of the N grab samples which may be taken in any calendar day. If a composite sample is taken, C_i is the concentration measured in the composite sample and Q_i is the average flow rate occurring during the period over which samples are composited.

5. "Daily maximum" limit means the maximum acceptable "daily discharge" for pollutant measurements. Unless otherwise specified, the results to be compared to the "daily maximum" limit are based on composite samples."
6. "Duly authorized representative" is one whose:
- (a) Authorization is made in writing by a principal executive officer or ranking elected official;
 - (b) Authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

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- (c) Written authorization is submitted to the Regional Board and EPA Region 9. If an authorization becomes no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements above must be submitted to the Regional Board and EPA Region 9 prior to or together with any reports, information, or applications to be signed by an authorized representative.
7. "Grab sample" is defined as any individual sample collected in a short period of time not exceeding 15 minutes. "Grab samples" shall be collected during normal peak loading conditions for the parameter of interest, which may or may not be during hydraulic peaks. It is used primarily in determining compliance with "daily maximum" limits and the "instantaneous maximum" limits.
 8. "Hazardous substance" means any substance designated under 40 CFR 116 pursuant to Section 311 of the Clean Water Act.
 9. "Heavy metals" are for purposes of this Order, arsenic, cadmium, chromium, copper, lead, mercury, silver, nickel, and zinc.
 10. "Instantaneous maximum" concentration is defined as the maximum value measured from any single "grab sample."
 11. "Median" of an ordered set of values is the value which the values above and below is an equal number of values, or which is the arithmetic mean of the two middle values, if there is no one middle value.
 12. "Priority pollutants" are those constituents referred to in 40 CFR 401.15 and listed in the EPA NPDES Application Form 2C, pp. V-3 through V-9.
 13. "6-month median" means a moving "median" of daily values for any 180-day period in which daily values represent flow-weighted average concentrations within a 24-hour period. For intermittent discharges, the daily value shall be considered to equal zero for days on which no discharge occurred.
 14. "7-day" and "30-day average" shall be the arithmetic average of the values of daily discharge calculated using the results of analyses of all samples collected during any 7 and 30 consecutive calendar day periods, respectively.
 15. "Toxic pollutant" means any pollutant listed as toxic under section 307(a)(1) of the Clean Water Act or under 40 CFR 122, Appendix D.

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16. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with effluent limitations because of factors beyond the reasonable control of the discharger. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper action.

Mailing List (continued)

Department of Interior, U.S. Fish and Wildlife Service
Mr. Michael Levy, State Water Resources Control Board, Office of Chief Counsel
Mr. William Paznokas, Department of Fish and Game, Region 5
Mr. Norm Riley, Department of Toxic Substances Control, Sacramento
Mr. Jim Pappas, Department of Toxic Substances Control, Sacramento
Mr. Gerard Abrams, Department of Toxic Substances Control, Sacramento
California Coastal Commission, South Coast District
Department of Health Services, Public Water Supply Branch
Los Angeles County, Department of Public Works, Environmental Programs Division
Los Angeles County, Department of Health Services
City of Los Angeles, Bureau of Engineering, Wastewater Systems Engineering Division
ULARA Watermaster
Water Replenishment District of Southern California
Ventura County Air Pollution Control District
Ventura County Public Works
Ventura County Environmental Health Division
Ms. Linda Parks, Ventura County Board of Supervisors
City Manager, City of Simi Valley
Dr. Mark Gold, Heal the Bay
Mr. David Beckman, NRDC
Mr. Mati Waiya, Wishtoyo Foundation
Friends of the Los Angeles River
Los Angeles and San Gabriel Rivers Watershed Council
Bell Creek Homeowners Association, c/o Michael Bubman
Bell Creek Homeowners Association, c/o Jerry Murphy
Ms. Carol Henderson, Office Manager, Bell Canyon Association
Ms. Barbara Johnson, Susana Knolls Homeowners, Inc.
Ms. Gayle Demirtas, Simi Valley Library
Mr. Howard Kaplan and Mr. Arthur Pinchey, Brandeis-Bardin Institute
Dr. Joseph K. Lyou, Executive Director, Committee to Bridge the Gap (CBG)
Mr. Dan Hirsch, CBG
Mr. Jerome Raskin, Pierce College
Mr. Sheldon Plotkin, SCFS
Mr. Wayne Lee
Simi Valley Library
California State University, Northridge
Mr. Evan Rose, L.A.U.S.D.
Mr. Cybil Zepieri
Mr. Lori Zinkan
Ms. Christina Walsh
Ms. Teresa Jordan
Ms. Mary Wisebrock
Masry & Vititoe Law Offices
Mr. Jonathan Parfrey, Executive Director, Physicians for Social Responsibility
Mr. Matt Hagemann, Soil/Water/Air Protection Enterprise



Mailing List (continued)

Ms. Bonnie Klea
Ms. Laura Plotkin, c/o Senator Sheila Kuehl
Mr. John Farrow, M. R. Wolfe & Associates, P.C.
Mr. Anthony Zepeda
Ms. Lorraine Scott
Florence and Dorri Raskin
Ms. Heather L. Hoecherl Esq., Director of Science and Policy, Heal the Bay
Ms. Kirsten James, MESM, Staff Scientist, Heal the Bay
Ms. Elizabeth Crawford, Senior Environmental Specialist, Physicians for Social
Responsibility
Paul Costa, Boeing
Ms. Sharon Rubalcava, Weston, Benshoof, Rochefort, Rubalcava, MacCuish, LLP
Ms. Darlene Ruiz, Hunter Ruiz Research, Consulting and Advocacy
Mr. Jack M. Wallace
Mr. Jae Kim, TetraTech



State of California
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION
320 West 4th Street, Suite 200, Los Angeles

FACT SHEET
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
FOR
THE BOEING COMPANY
(Santa Susana Field Laboratory)

NPDES PERMIT NO.: CA0001309
Public Notice No.: 07-030

FACILITY MAILING ADDRESS

The Boeing Company
5800 Woolsey Canyon Road
Canoga Park, CA 91304-1148

FACILITY LOCATION

The Boeing Company
Santa Susana Field Laboratory
Top of Woolsey Canyon
Simi Hills, CA 91311
Contact: Paul Costa
(818) 466-8778

I. Public Participation

The California Regional Water Quality Control Board, Los Angeles Region, (Regional Board) will consider, during its November 1, 2007, meeting, the reissuance of waste discharge requirements (WDRs), which serve as a National Pollutant Discharge Elimination System (NPDES) permit to the Boeing Company for the Santa Susana Field Laboratory. Modifications to the NPDES permit are being considered in response to Order WQ 2006-0012 issued by the State Water Resources Control Board (State Board) remanding the permit to the Regional Board and to an updated Report of Waste Discharge (ROWD) submitted by Boeing on February 20, 2007. As an initial step in the process, the Regional Board staff has developed tentative WDRs. The Regional Board encourages public participation in the WDR adoption process.

A. Written Comments

Interested persons are invited to submit written comments concerning the tentative WDRs. Comments should be submitted either in person, or by mail to:

California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, CA 90013

Written comments regarding the tentative Order must be received at the Regional Board office by 5:00 p.m. on September 4, 2007, in order to be evaluated by staff and included in the Board's agenda folder.

July 30, 2007
Revised: October 15, 2007

B. Public Hearing

The proposed WDRs will be considered by the Regional Board at a public hearing. The hearing is scheduled as follows:

Date: November 1, 2007
Time: 9:00 A.M.
Location: City of Simi Valley Council Chambers
2929 Tapo Canyon Road
Simi Valley, California

Please check the website address (<http://www.waterboards.ca.gov/losangeles/>) for the most up to date public hearing location as it is subject to change. Interested persons are invited to attend. At the public hearing the Regional Board will hear testimony, if any, pertinent to the discharge, WDRs and permit. Oral testimony will be heard; however, for accuracy of the record, important testimony should be in writing.

C. Waste Discharge Requirements Appeals

Any person may petition the State Water Resources Control Board to review the decision of the Regional Board regarding the final Waste Discharge Requirements. The petition must be filed within 30 days of the Regional Board's action to the following address:

State Water Resources Control Board, Office of the Chief Counsel
Attn: Elizabeth Miller Jennings, Senior Staff Counsel
1001 I Street, 22nd Floor
Sacramento, CA 95812

D. Additional Information and Copies

The proposed language and other information and documents relied upon are available for inspection and copying between the hours of 8:00 a.m. and 4:30 p.m. by appointment at the following address:

Los Angeles Regional Water Quality Control Board
320 West 4th Street, Suite 200
Los Angeles, CA 90013

Arrangements for file review and/or obtaining copies of the documents may be made by calling the Los Angeles Regional Board at (213) 576-6600.

E. Register Of Interested Persons

Persons wishing to comment on, or object to, the tentative TSO, or submit evidence for the Board to consider, are invited to submit them in writing to Cassandra Owens at the above address, or send them electronically to: cowens@waterboards.ca.gov. To be evaluated and responded to by Regional Board staff, included in the Board's agenda folder, and fully considered by the Board, written comments or testimony

regarding the tentative revisions must be received at the Regional Board office no later than close of business on **September 4, 2007**. Failure to comply with these requirements is grounds for the Regional Water Board to refuse to admit the proposed written comment or exhibit into evidence pursuant to section 648.4, title 23 of the California Code of Regulations.

Any person interested in being placed on the mailing list for information regarding the WDRs and NPDES permit should contact the Regional Board, reference this facility, and provide a name, address, and phone number.

F. Staff Contacts

If you have any question regarding this proposed action, please contact Cassandra Owens at (213) 5760-6750 or via email at cowens@waterboards.ca.gov.

II. Introduction

The Boeing Company (hereinafter Boeing or Discharger) discharged waste from its Santa Susana Field Laboratory under waste discharge requirements, which served as an NPDES permit, contained in Order No. 98-051 adopted by this Regional Board on June 29, 1998 (NPDES Permit No. CA0001309).

Boeing filed a report of waste discharge (ROWD) and applied for renewal of its WDRs and NPDES permit for discharge of wastes to surface waters. Order No. R4-2004-0111 was adopted on July 1, 2004. It incorporated effluent limitations based on the California Toxics Rule (CTR) where appropriate and added nine new compliance points.

Order R4-2006-0008 (adopted January 19, 2006), an amendment to Order No R4-2004-0111 (adopted July 1, 2004) was the result of new information incorporated into the Order after one year of compliance and routine monitoring based on Monitoring and Reporting Program (MRP) No. 6027. On March 9, 2006 Order R4-2006-0036 was adopted which incorporated total maximum daily loads (TMDLs) based effluent limitations for discharges to the Los Angeles River and to Calleguas Creek.

Subsequent to the adoption of Order R4-2004-0111, the Discharger filed a petition challenging the permit with the State Water Resources Control Board. The discharger immediately put the petition in abeyance. After the adoption of Order R4-2006-0008 in January 2006 the discharger petitioned that order, activated the previous petition and ultimately petitioned the subsequent amendment, Order R4-2006-0036. The discharger also requested that the permit be stayed pending a decision on the permit on the basis of merit.

After considering the evidence, the State Board adopted Order WQ 2006-0007 on June 21, 2006, which vacated a previous stay order issued by one of its members, and denied Boeing's request for a stay.

On December 13, 2006, the State Board held a public hearing to consider the various petitions that the discharger had filed with respect to its permit, and thereafter adopted Order WQ 2006-0012. The Order:

- Remanded the permit to the Regional Board to revise the provisions concerning Outfalls 001, 002, 011, and 018,
- Stayed the effluent limitations at Outfalls 011 and 018 pending a determination by the Regional Board to delete either Outfalls 011 and 018 or Outfalls 001 and 002 as compliance points,
- Directed the Regional Board to issue a Cease and Desist Order with the shortest possible compliance schedule and interim effluent limitations. The effective date of the CDO was to be January 19, 2006,
- Review the permit to ensure that numeric effluent limitations for different outfalls do not count the same violation twice in such a manner as to treat a single violation as multiple violations.
- In all other respects, the petitions were denied.

This Order includes the updates required by the State Board Order, updates associated with a revised Report of Waste Discharge submitted by the Discharger, and any new effluent limits that are a result of the reasonable potential analysis completed on the data obtained through May 22, 2006.

III. Facility and Waste Discharge Description

The Santa Susana Field Laboratory (SSFL) is located at the top of Woolsey Canyon, in the Simi Hills, CA (Figure 1). The developed portion of the site comprises approximately 1,500 acres. There are 1,200-acres of undeveloped property located to the south. In 1998, undeveloped land was purchased to the north of the site. SSFL is owned by both Boeing and the National Aeronautics and Space Administration (NASA). The United States Department of Energy (DOE) also owns several buildings located in Area IV, with the land being under the ownership of Boeing.

Boeing and its predecessors' operations at SSFL since 1950 include research, development, assembly, disassembly, and testing of nuclear reactors, rocket engines, and chemical lasers. DOE conducted past operations in research and development of energy related programs, and seismic testing experiments. Current DOE activities onsite are solely related to facility closure, environmental remediation, and restoration.

SSFL was permitted to discharge excess water from its groundwater treatment system, industrial activities, onsite wastewater reclamation system, and rainfall runoff that has the potential to contain pollutants from the facilities. Approximately 60% of the discharge exited the property via two southerly discharge points (Discharge Outfalls 001 and 002) to Bell Creek, a tributary to the Los Angeles River, a water of the United States, with its confluence located near the intersection of Bassett Street and Owensmouth Avenue in Canoga Park, see Figure 1).

Past operations at the SSFL that may potentially contribute contaminants to discharges from the site include:

- Nuclear Operations, decontamination and decommissioning
- Monomethyl Hydrazine Usage,
- CTL-3 Chemical Laser Testing, and

- Energy Technology Engineering Center (ETEC) Cogeneration Operations.
- Rocket Engine and Component Testing

Nuclear Operations, decontamination and decommissioning: Nuclear research and development for the U.S. Department of Energy (DOE) and its predecessors was conducted at the SSFL from 1954 – 1989. The activities included developing and operating reactors, and fabricating and disassembling nuclear fuel. The government began to phase out the program in the 1960s. The last reactor was shut down in 1980, and nuclear research was terminated in 1989. This research and the associated activities resulted in residual contamination in Area IV.

There are currently no programs at the SSFL which employ special nuclear materials. Current decommissioning activities have reduced the inventory of radioactive waste at the SSFL to approximately 5 curies. Essentially all of this material is stored in shielded vaults located at the Radioactive Materials Handling Facility (RMHF). SSFL continues to utilize radioisotopes in the form of calibration sources which are necessary to calibrate radiation detectors and counting equipment. Periodic radiological monitoring of surface waters is conducted under the existing NPDES permit. Three radiological facilities located in Area IV of the SSFL remain to be decommissioned. Storm water run-off from Area IV of the SSFL is monitored for radioactivity. The Department of Energy (DOE) is responsible for the cost of decontamination and decommissioning.

Monomethyl Hydrazine Usage: Monomethyl hydrazine (MMH), a propellant, was used for research, development, and testing of rocket engines at the SSFL since 1955. The MMH, which was generated from testing operations was captured and treated by an ozonation unit under a variance, granted by the Department of Toxic Substances Control (DTSC). MMH is no longer used at SSFL.

CTL-3 Chemical Laser Testing: CTL-3 Chemical Laser Testing was not operational in 2004. In 2005, limited operations resumed at the facility. There is no discharge to surface waters from this area.

Energy Technology Engineering Center (ETEC) Cogeneration Operations: The Sodium Component Testing Installation (SCTI) (cogeneration) unit of ETEC utilized two cooling tower operations, Power Pac and E-5. Both systems were shut down and will not be reactivated. The facility has been decommissioned and was demolished in July 2003.

Rocket Engine and Component Testing: An engine test consisted of a cycle of one to three engine runs lasting one to three minutes each. A test cycle may take one to two weeks to complete. Each engine run results in the use of 50,000 to 200,000 gallons of deluge/cooling water that may come in contact with fuels such as LOX or kerosene and associated combustion products. The frequency of testing historically varied depending on production requirements. In July 2004 the frequency of testing was one test cycle every one to two months. In January 2006 the Discharger indicated that the frequency of testing had significantly decreased over the past year and was likely to shut down completely during the life of this permit (expiration date June 10, 2009). The updated ROWD submitted February 2007 provided documentation that rocket engine and component testing operations at the facility had terminated.

Current and Future Operations: Since the SSFL is a test facility, it is difficult to anticipate future test projects and possible wastewater generation. Following are descriptions of expected operations:

1. Treatment Under Tiered Permitting Rules. Boeing may explore the feasibility of treating certain waste streams by either a mobile or fixed hazardous waste treatment unit operating under DTSC Permit-by-Rule requirements. Treated effluent would then be released into the ponds.
2. Unspecified waste streams generated during remediation, cleaning, assembly, testing and support operations at the facility.

Groundwater Remediation: During the early 1950s to the mid-1970s, volatile organic compounds were utilized for the cleaning of hardware and rocket engine thrust chambers, and for the cleaning of other equipment. These solvents migrated into the subsurface, contaminating groundwater primarily with trichloroethylene (TCE) and 1,2-dichloroethylene (1,2-DCE).

As a result, in July 2004 there was an extensive groundwater remediation/investigation program in progress at the SSFL, which included pumping, treating and storing groundwater at the facility. The system was composed of eight treatment systems, five being active (two currently in use) and three being inactive (standby status), which had the capability of producing up to 578 million gallons per year of groundwater treated to remove the volatile organic compounds. The treatment system was not designed to treat other pollutants such as perchlorate or metals. The chemical treatments used in groundwater treatment operations consisted of ultraviolet light and hydrogen peroxide oxidation, carbon adsorption, and the physical treatment consisted of air stripping towers. These treatment systems were regulated under Resource Conservation and Recovery Act (RCRA) part A and part B hazardous waste permits by DTSC, and various air quality control permits issued by Ventura County. Boeing plans to treat effluent from the SSFL groundwater remediation operation in either a mobile or fixed hazardous waste treatment unit operating under DTSC Permit-By-Rule requirements. The waste stream to be treated would be classified under these regulations as non-RCRA or RCRA exempt hazardous waste. In addition, there will also be intermittent pilot projects where test wells will be drilled and groundwater treated to determine optimum locations for future wells. Effluent from the groundwater remediation operations will be discharged to a separate outfall (Outfall 019).

Sewage Treatment Plants: Historically, two package-type activated sludge sewage treatment plants (STP1 and STP3) provide secondary and tertiary treatment for the sewage. Disinfected sewage effluent from the activated sludge facilities was directed to the ponds. A third activated sludge sewage treatment plant (STP2) was available, but was used only as a pump station to STP-3 and as temporary storage of excess sewage. There were no discharges to receiving waters from STP-2.

Operations terminated at STP3 in October 2001 and at STP1 in December 2001. Recently, domestic sewage that had previously been treated at STP1 and STP3 has been diverted offsite. The STP1 and STP3 basins are used as collection points. Every few days, vacuum trucks transport the accumulated waste offsite for treatment. In July 2004, the Discharger requested that the permit continue to cover potential discharges from these plants, as it may be necessary to bring them back on line in the future.

The ROWD submitted in February 2007 indicated that discharges from the sewage treatment plants would not be resumed. Waste water collected would continue to be shipped offsite for disposal at one of the Los Angeles County Sanitation District's publicly owned treatment wastewater (POTW) facilities. The Discharger also requested that the compliance locations be deleted from this order (R4-2007-0055).

Water Reclamation System and Discharges: When in operation, effluent discharges from STP1 and STP3, the two sewage treatment plants, subsequently enter an onsite water retention system. Historically, SSFL utilized a system of natural, unlined and man-made ponds and channels to collect water from onsite operations. Water supplied to the retention system came from any one or a combination of the following sources: storm water, treated groundwater, treated sanitary sewage, rocket engine test cooling water, or domestic water purchased from an established purveyor. The water was stored in a series of 100,000-gallon steel tanks located in Area 2 called Skyline. Water from Perimeter and R-1 ponds may be pumped to the Skyline tanks where it can be transferred to Silvernale Pond. Water purchased from the Calleguas Water District was also stored at Skyline where it was used to cool test stands during engine testing and discharges to Silvernale Pond.

The water reclamation system consisted of five ponds.

R-1 Pond	capacity 3.7 million gallons
Perimeter Pond	capacity 1.3 million gallons
Silvernale Pond	capacity 6.0 million gallons
R2-B Pond	capacity 200,000 gallons
R2-A Pond	capacity 2.5 million gallons

The Coca Pond was previously used as a retention basin to collect water from the space shuttle main engine testing area. When Coca Pond was filled to capacity, it discharged to the R-2 Pond. The pond was used to collect water that leaked from the fire suppression system located in the former test area. If sufficient leaks occurred, the pond discharged to R-2.

Area I utilized the R-1 Pond as a reservoir. Water retained in the R-1 Pond was primarily comprised of storm water. Other sources included effluent from Sewage Treatment Plant 1 and treated groundwater. While this was a water reclamation system in the past, it is currently used as a retention system to minimize discharges.

Storm water collected at the facility is primarily stored at Silvernale Pond and R-2A Pond. As in Area I, the primary source of water stored in the ponds comes from storm water. Other sources included effluent from Sewage Treatment Plant 3, cooling water runoff from test operations and treated groundwater. While this was a water reclamation system in the past, it is currently used as a retention system to minimize discharges. Historically, if the supply of reclaimed water exceeded requirements, the water was discharged to the south through R-2A Pond, and then to Bell Creek through Outfall 002.

The SSFL is underlain by alluvium, weathered bedrock and unweathered bedrock. The alluvium occurs in narrow drainages and alluvial valleys and is underlain by the Chatsworth Formation. The Chatsworth Formation consists of fractured sandstone with interbeds of siltstone and claystone, which can transmit water as well as contaminants.

The groundwater system at the SSFL is divided into two aquifers; the shallow and the deep. The alluvium and weathered bedrock comprise the shallow aquifer, and the unweathered and fractured Chatsworth Formation comprise the deep aquifer.

The groundwater in the shallow aquifer generally reflects surface topography. In April 2002, groundwater depths in the shallow aquifer ranged from approximately 6 feet to 40 feet below grade. Wells in the deeper aquifer, contained groundwater between approximately 23 feet to approximately 520 feet below grade.

In dry weather, ongoing activities were normally sufficient to use the water generated from onsite groundwater treatment systems. However, in recent years this water balance has changed. In July 2004, the Discharger indicated that water added into the system from the Calleguas Water District, plus the reduction of testing activities, had caused releases from R-2A Pond (located upstream from Outfall 002) to become intermittent. During hot weather, the water released either evaporated or percolated into the ground before reaching Discharge Outfall 002. Thus, no offsite discharge of water occurred.

In July 2004, the discharges from Outfalls 001 and 002 which were characterized in the permit application are as follows:

Constituents	Units	30-Day Average¹	Daily Maximum
Flow	MGD	1.5	20
Temperature			
Winter (Oct. – April)	°F	57	59.2
Summer (May – September)	°F	71	76.2
pH	pH Units	7.9	8.41
BOD ₅ 20°C	mg/L	6	15
Total suspended solids	mg/L	15	62
Total organic carbon	µg/L	7.4	18
Total residual chlorine	mg/L	ND	ND
Fluoride	mg/L	0.4	0.7
Nitrate	mg/L	0.42	1.1
Oil and grease	mg/L	ND	ND
Radioactivity			
Total Alpha	pCi/L	----	8.9+/-5
Total Beta	pCi/L	----	20+/-9.1
Total Radium	pCi/L	----	3.54+/-1
Sulfate as SO ₄	mg/L	120	173
Surfactants	mg/L	0.1	0.1
Barium	mg/L	17	90
Boron	mg/L	0.11	0.36
Iron	mg/L	0.09	0.22
Manganese	mg/L	51.6	170
Antimony	mg/L	2.8	5.7

¹ The maximum of the value presented for Discharge No. 001 or Discharge No. 002.

<u>Constituents</u>	<u>Units</u>	<u>30-Day Average¹</u>	<u>Daily Maximum</u>
Arsenic	mg/L	6.5	11
Beryllium	mg/L	ND	ND
Cadmium	mg/L	ND	ND
Chromium, Total	mg/L	7.7	10
Copper, Total	mg/L	5.2	15
Lead, Total	mg/L	1.6	3.5
Mercury, Total	mg/L	ND	ND
Nickel	mg/L	2	2
Selenium ²	mg/L	2.1	2.1
Silver ²	mg/L	1.2	1.4
Zinc	mg/L	28	80

Other priority pollutants were reported as not detected or not believed to be present in the discharge in the application.

Discharges from the groundwater treatment systems, the engine test stands and the water reclamation ponds located onsite in most cases enter naturally occurring drainage channels. Some of these channels are unlined, but portions of many of them have been lined or the flow is transported using piping to a natural drainage channel. Since the wastewater enters natural water transport channels onsite, these channels are considered waters of the United States and are thus subject to the Clean Water Act. These onsite natural drainage channels are tributaries to Bell Creek, hence limits for discharges to them must protect the beneficial uses for discharges to Bell Creek and the downstream reaches of the Los Angeles River. Similarly, because certain natural drainage channels are unlined and groundwater recharge is a designated beneficial use in Bell Creek and its tributaries, limits for discharges to the channels must protect the underlying beneficial uses of the groundwater.

Many of the areas that discharged wastewater to the drainage areas and streambeds were associated with RCRA activities that are being directed by DTSC. The RCRA activities at the site include Post Closure Permits and investigation and corrective action oversight of contaminated areas. The Post Closure Permits cover the operation of the groundwater treatment systems. The investigation and corrective action oversight includes the site characterization and delineation of areas of contamination as well as subsequent cleanup operations at areas of concern onsite.

The 1995 Final SB 1082 Framework which was issued on December 14, 1995 documents the framework for implementing Health and Safety Code Section 25204.6(b) dealing with jurisdictional overlap between DTSC and the Regional Water Quality Control Boards (RWQCBs). SB 1082 requires that "sole jurisdiction over the supervision of that action [meaning oversight of those corrective action activities] is vested in either the department or the State Water Resources Control Board and the California Regional Water Quality Control Boards." Since many of the identified wastewater sources are currently involved in the RCRA corrective action or the Post Closure Permits with DTSC as the oversight agency, consistent with RCRA, DTSC will ensure that the discharges from these operations

² This analyte was reported ND at Discharge No. 001. The values reported were for Discharge No. 002.

through the RCRA permitting process meet the substantive Clean Water Act requirements. Regional Board staff will provide appropriate comments during the revision of RCRA permits to ensure the Clean Water Act, Porter-Cologne Act, and the Basin Plan requirements are met. However, at all times, the final downstream Outfalls 001 and 002 will be regulated by the accompanying NPDES permit and will implement relevant water quality standards.

There were several other operations that discharged wastewater to the onsite drainageways and streambeds which were not included in the RCRA corrective action. Order R4-2004-0111 covered these activities.

The operations evaluated at SSFL, the agency (Regional Board or DTSC) with primary oversight authority, and the NPDES outfall number associated with the operation if the Regional Board has oversight are listed below and in Figure 2.

Operation	NPDES Outfall No.	Agency
1. Wastewater and Storm water runoff	001	RWQCB
2. Wastewater and Storm water runoff	002	RWQCB
3. Storm water Radioactive Material Handling Facility	003	RWQCB
4. Storm water Sodium Reactor Exp.	004	RWQCB
5. Storm water Sodium Burn Pit 1	005	RWQCB
6. Storm water Sodium Burn Pit 2	006	RWQCB
7. Storm water Building 100	007	RWQCB
8. Storm water Happy Valley	008	RWQCB
9. Storm water WS-13 Drainage	009	RWQCB
10. Storm water Building 203	010	RWQCB
11. R-1 Pond	----	DTSC
12. Perimeter Pond	011	RWQCB
13. R-2 Ponds (R-2A and R-2B)	----	DTSC
14. R-2 Spillway	018	RWQCB
15. Silvernale Pond	----	DTSC
16. Alfa Test Stand	012	RWQCB
17. Bravo Test Stand	013	RWQCB
18. WS-5 Groundwater Treatment System (GWTS)	----	DTSC
19. RD-9 GWTS	----	DTSC
20. Alfa GWTS	----	DTSC
21. Delta GWTS	----	DTSC
22. STLV-IV GWTS	----	DTSC
23. Area 1 Road GWTS/AST	----	DTSC
24. Bravo GWTS/AST	----	DTSC
25. Canyon GWTS/AST	----	DTSC
26. Interim GWTS near FSDF*	----	DTSC
27. Interim GWTS near Bldg 59*	----	DTSC
28. Interim GWTS near RMHF*	----	DTSC

	Operation	NPDES Outfall No.	Agency
29.	APTF	014	RWQCB
30.	STP-1 – effluent	015	RWQCB
31.	STP-2 – effluent	016	RWQCB
32.	STP-3 – effluent	017	RWQCB
33.	Groundwater Treatment System	019	RWQCB

* Implemented in Interim Measures at the site. If the systems continue they will be included in the revised Post Closure Permit.

Operations enumerated in items 1 through 32 were included in Order R4-2004-0111 and subsequent revisions (Orders R4-2006-0008 and R4-2006-0036). Item 33 identifies a new outfall that is added in this Order (R4-2007-0055). The updated ROWD submitted on February 20, 2007, included a request to discharge treated groundwater from a new groundwater treatment system, operating under Permit-By-Rule requirements, to the streambed downstream of Outfall 011 and upstream of Outfall 001. The treated groundwater is a wastewater discharged from a point source. The discharge will be regulated by the RWQCB in this permit. Order R4-2004-0111 and subsequent revisions did not regulate treated groundwater at the point of discharge. However, once the treated groundwater was mixed with wastewater from the sewage treatment plants, rocket engine test operations, and storm water runoff in the onsite water reclamation/retention system and was subsequently discharged via Outfalls 011, 018, 001, and 002 it was regulated as a component of the mixed wastewater. The new compliance point (Outfall 019) will be the compliance point for the treated groundwater only. The groundwater treatment systems listed in the table above will be taken off line and the new groundwater treatment system operating under Permit-By-Rule requirements are permitted in Order R4-2007-0055. The new compliance point is included in the previous table.

Operations at the test stands (Outfalls 012 -014) and the sewage treatment plants (Outfalls 015 – 017) have ceased. No further process waste discharges are expected from these areas.

Storm Water Discharges

In 1989, EPA conducted an investigation and submitted a report on SSFL environmental issues. The report specified under the recommended and planned actions that the Regional Board was to use the Clean Water Act to ensure run-off from the northwest side of Area IV was not contaminated. In response to the request, Boeing developed a surface water monitoring program for the northwest slope area that was subsequently approved by EPA and implemented.

The topography of the SSFL is such that approximately 70% of rainfall runoff is routed to one of the two southerly-located retention ponds and is discharged from the site via Discharge Outfalls 001 or 002. Storm water runoff from the northwest slope of the facility is monitored at Discharge Outfalls 003, 004, 005, 006, 007, 009, AND 010 which discharge towards the Arroyo Simi. The outfall locations near the Northwest slope are located such that they capture runoff from past and existing radiological facilities.

<u>Discharge Outfall</u>	<u>Latitude (North)</u>	<u>Longitude (West)</u>	<u>Vicinity</u>
003 (RMHF)	34° 14' 4.0"	118° 42' 38.4"	Radioactive Materials Handling Facility
004 (SRE)	34° 14' 9.1"	118° 42' 23.9"	Sodium Reactor Experiment
005 (SBP-1)	34° 13' 48.1"	118° 43' 3.9"	Sodium Burn Pit 1
006 (SBP 2)	34° 13' 50.7"	118° 42' 59.9"	Sodium Burn Pit 2
007 (B100)	34° 13' 50.2"	118° 42' 52.5"	Building 100

The samples collected are analyzed for radioactivity and for a number of other priority pollutants that may be present.

There is one more storm water monitoring location Discharge Outfall 008 (formerly referred to as Happy Valley and Happy Valley 1). This outfall captures runoff from an area that has previously been used for operations that involved perchlorate and monitoring events have yielded detections of perchlorate in the storm water runoff. Storm water from Happy Valley flows to Dayton Canyon Creek. The flow from Dayton Canyon Creek joins Chatsworth Creek, which flows south to Bell Creek southwest of the intersection of Shoup Avenue and Sherman Way. Bell Creek flows east to the Los Angeles River. Order R4-2004-0111 implements effluent limits for conventional pollutants and perchlorate at Outfall 008. Monitoring for the emergent chemicals and EPA priority pollutants except asbestos was also required in that Order.

A second Happy Valley sample location (referred to as Happy Valley 2) was monitored during the 2002-2003 rainy season. The samples in most cases yielded nondetect at Happy Valley 2 while samples collected during the same rain event yielded detections of perchlorate. However on May 3, 2003 samples collected from Happy Valley 1 (Discharge Outfall 008) were nondetect for perchlorate. The sample collected from Happy Valley 2 collected on that date resulted in a perchlorate concentration of 4.6 µg/L. The nondetect at 4 µg/L and the detected concentration of 4.6 µg/L may represent very similar concentrations.

The objective of this Order is to protect the beneficial uses of receiving waters. To meet this objective, storm water runoff discharges from the SSFL are subject to requirements stipulated in this NPDES permit and the Discharger will be required to comply with all applicable provisions of the Storm Water Pollution Prevention Plan (Attachment A of the Order). This plan includes requirements to develop, implement, and when appropriate update a Storm Water Pollution Prevention Plan (SWPPP) along with Best Management Practices (BMPs) that will prevent all pollutants from contacting storm water and with the intent of keeping all contaminants of concern from moving into receiving waters.

Storm water sampling events during 1999, 2000 and 2001 yielded exceedances of existing effluent limitations for several contaminants of concern. These effluent violations indicate that the implementation of best management practices (BMPs) to control the transport of contaminants off site were not effective. Previous attempts to utilize BMPs to control the transport of contaminants offsite have proven ineffective as is demonstrated by the effluent limitation exceedances noted from Outfalls 003 through 007 on page 11 of the Fact Sheet (in the Compliance History Section). Storm water runoff exiting the northern boundary of the site travels via Meir and Runkle Canyons to the Arroyo Simi, a tributary of Calleguas Creek. Hence, this Order includes effluent limits for the storm water discharges from the site for priority pollutants with reasonable potential.

In 2004, site inspections resulted in the identification of two other storm water monitoring locations:

- WS-13 Drainage Area Discharge Outfall 009
- Building 203 Discharge Outfall 010

Storm water runoff from the area that drains to discharge points 001, and 002 is estimated at 34 and 51 million gallons per day (MGD) (based on a 24-hour duration, 10-year return storm). This runoff is mixed with industrial waste collected in the ponds prior to discharge. Discharges from Outfall 008 are composed solely of storm water runoff.

The estimated flow from the area that drains storm water only from the northwest slope and discharges it via discharge points 003, 004, 005, 006, 007, 009 and 010 and via various drainage channels into Meir, Runkle and Woolsey Canyons is 35 MGD. (Figure 2).

The locations and the associated drainage areas are listed below for each of the seven storm water only discharge locations:

<u>Discharge Outfall</u>	<u>Latitude (North)</u>	<u>Longitude (West)</u>	<u>Vicinity</u>
003 (RMHF)	34° 14' 4.0"	118° 42' 38.4"	Radioactive Materials Handling Facility
004 (SRE)	34° 14' 9.1"	118° 42' 23.9"	Former Sodium Reactor Experiment
005 (SBP-1)	34° 13' 48.1"	118° 43' 3.9"	Former Sodium Burn Pit 1
006 (SBP 2)	34° 13' 50.7"	118° 42' 59.9"	Former Sodium Burn Pit 2
007 (B100)	34° 13' 50.2"	118° 42' 52.5"	Building 100
009(WS-13)	34° 14' 17"	118° 41' 38"	WS-13 Drainage Area
010(Bldg. 203)	34° 14' 17"	118° 41' 56"	Building 203

There is no flow from these locations except during heavy rainfall. For purposes of access and safety, these sampling stations have been established inside the SSFL northwest property boundary. The stations are located in close proximity to past and/or existing radiological facilities or other operations, as noted in the vicinity column above.

Storm water from APTF flows toward Bell Creek and the Los Angeles River. Current operations at the facility have shut down. Past operations included small engine testing using kerosene (RP-1), hydrogen, potentially alcohol, methanol, peroxide, and liquid oxygen (LOX). Nitrogen was also used for purge gas. After testing the staging areas were not routinely washed down to remove residual contaminants from the test operations. During normal operations testing may have occurred during storm events.

It is likely that contaminants associated with the engine test material would be present in the storm water runoff from the area. Hence, this permit requires that the storm water runoff from the area be monitored. If the monitoring data indicates reasonable potential, the permit will be reopened and effluent limitations will be implemented. In July 2004, the Discharger indicated that the standard operating procedures for the area in the future would include washdowns of the staging areas after engine tests. The water associated with the washdown would be collected and disposed of offsite. If testing operations occurred during

storm events, the Discharger would collect the storm water runoff from the staging area for offsite disposal. If washdowns did not occur after test operations or if testing occurs during storm events and the water is not collected for offsite disposal, the Discharger would be required to sample it as stipulated for other storm water monitoring locations.

Historical engine testing in the area has likely resulted in residual contamination. Therefore, this permit (Order R4-2007-0055) includes requirements to monitor storm water runoff from the area.

Compliance History

An audit of the file revealed several exceedances of the effluent limits prescribed in Order No. 98-051. The Table below lists the exceedances and/or potential exceedances noted in the self-monitoring reports submitted by the Discharger. The contaminant, effluent limit, detected value and date of detection is recorded for each exceedance in the table that follows. The Table also includes footnote references to describe the disposition of each violation.

Footnote	Outfall Number	Contaminant	Effluent Limit (units)	Detected Value	Date of Exceedance
1	002	Total Suspended Solids	15 mg/L	21	08/31/1998
2	005	Mercury	0.012 µg/L	0.2	11/30/1998
10	STP1	Turbidity	2 NTU	3.1	10/13/1998
3	STP1	Turbidity	2 NTU	2.2	10/14/1998
3	STP1	Turbidity	2 NTU	2.3	11/10/1998
3	STP1	Turbidity	2 NTU	2.3	11/11/1998
3	STP1	Turbidity	2 NTU	2.4	11/24/1998
4	001	Manganese	50 µg/L	120	05/11/1999
4	001	Manganese	50 µg/L	60	05/20/1999
4	001	Manganese	50 µg/L	90	05/21/1999
4	001	Manganese	50 µg/L	110	05/24/1999
4	001	Manganese	50 µg/L	70	05/25/1999
2	004	Mercury	0.012 µg/L	0.26	02/09/1999
10	005	Antimony	6 µg/L	8	02/08/1999
10	005	Antimony	6 µg/L	7	02/09/1999
10	005	Antimony	6 µg/L	7	01/20/1999
5	005	Mercury	0.012 µg/L	8.04	11/08/1999
10	005	Copper	11 µg/L	14	11/08/1999
2	006	Mercury	0.012 µg/L	0.45	02/09/1999
10	007	Antimony	6 µg/L	8	02/09/1999
10	007	Antimony	6 µg/L	11	03/25/1999
10	007	Cadmium	3.7 µg/L	4	03/25/1999
9	003	Mercury	0.012 µg/L	0.025	2/00
9	004	Mercury	0.012 µg/L	2.3	2/00
9	005	Mercury	0.012 µg/L	0.87	2/00
9	006	Mercury	0.012 µg/L	0.17	2/00
9	007	Copper	11 µg/L	13	2/00
9	007	Mercury	0.012 µg/L	0.055	2/00

Footnote	Outfall Number	Contaminant	Effluent Limit (units)	Detected Value	Date of Exceedance
9	STP III	BOD ₅	>85 % removal	71.6	2/00
9	STP III	Total coliform	2.2 MPN/100 mL	60	2/00
9	STP III	Total coliform	2.2 MPN/100 mL	60	2/00
9	002	TSS	15 mg/L	20	6/00
9	007	Mercury	0.012 µg/L	0.055	2/00
9	STP III	BOD ₅	>85 % removal	71.6	2/00
9	STP III	Total coliform	2.2 MPN/100 mL	60	2/00
9	STP III	Total coliform	2.2 MPN/100 mL	60	2/00
9	002	TSS	15 mg/L	20	6/00
9	002	TSS	15 mg/L	16	9/00
9	005	Mercury	2.1 µg/L	3.6	1/25/00
9	005	Thallium	2.0 µg/L	3.2	3/5/00
9	006	Oil and Grease	15 mg/L	30.5	3/8/00
9	002	Thallium	2.0 µg/L	4.1	2/8/01
9	005	(NO ₂ + NO ₃) as N	8.0 µg/L	14	2/27/01
9	005	(NO ₂ + NO ₃) as N	8.0 µg/L	8.4	3/7/01
6	STP III	Turbidity	2 NTU	2.6	8/14/98
6	STP III	Turbidity	2 NTU	2.6	8/17/98
6	STP III	Turbidity	2 NTU	3.0	8/18/98
6	STP III	Turbidity	2 NTU	2.6	8/20/98
6	STP III	Turbidity	2 NTU	2.8	8/21/98
6	STP III	Turbidity	2 NTU	3.0	8/24/98
6	STP III	Turbidity	2 NTU	3.0	8/25/98
6	STP III	Turbidity	2 NTU	3.0	9/04/98
6	STP III	Turbidity	2 NTU	3.2	9/22/98
6	STP III	Turbidity	2 NTU	2.8	9/23/98
6	STP III	Turbidity	2 NTU	2.8	9/24/98
6	STP III	Turbidity	2 NTU	3.3	10/01/98
6	STP III	Turbidity	2 NTU	2.8	10/02/98
6	STP III	Turbidity	2 NTU	2.8	11/23/98
6	STP III	Turbidity	2 NTU	3.9	11/24/98
6	STP III	Turbidity	2 NTU	2.9	11/25/98
6	STP III	Turbidity	2 NTU	5.5	12/05/98
6	STP III	Turbidity	2 NTU	7.5	12/06/98
6	STP III	Turbidity	2 NTU	3.3	12/07/98
6	007	Cadmium	1	4	03/31/99
7	001	Iron	0.3 mg/L	0.67	2/12/03
7	002	Iron	0.3 mg/L	0.7	2/12/03
8	001	MBAS	0.5 mg/L	2	5/03/03

1. **The detected value should be adjusted** - Discharger sampled seven additional days during the month for a monthly average of 21 mg/L. The value of 16 mg/L on 08/06/98 was only one sample.
2. **These violations should not be included** - The method detection limit (MDL) used by the discharger is higher than the permit limit, the permit allows for the use of a PQL in

place of the permitted monthly average limit. Per the permit the PQL for this limits was calculated by taking the Permittees' MDL (0.2 µg/L) and multiplying by a factor of 10 (due to the fact that Hg is a non-carcinogen).

3. **These violations should not be included** - The daily average permit limit for turbidity is 2 NTUs. For consistency purposes the Enforcement Unit uses the following guideline: since the permit limit is only shown with one significant figure, the Permittees' results are rounded to one significant figure.
4. **These identified violations should not be included** - The Permittee stated that no flow occurred from Outfall 001 during the month of May. The Permittee took samples although no wastewater was discharged from Outfall 001.
5. **This violation should not be included** - Additional analyses were performed on the same sample within the holding time for Hg. The results varied from 8.04 µg/L to 0.2 µg/L.
6. **These identified violations should be included** - Additional violations identified by the Enforcement Unit.
7. **This violation should not be included** - Additional analyses were performed on the same samples, which yielded results consistent with historical findings and below the specified limit.
8. **This violation should not be included** - The discharger has a letter from the laboratory indicating that an inappropriate method was used to analyze the sample. A subsequent analysis of the sample yielded a nondetect result at 0.1 mg/L.
9. **This violation was included** - The NOV issued June 27, 2001 included this violation.
10. **This violation was included** - The NOV issued February 6, 2004 included this violation.

A Notice of Violation (NOV) was issued for exceedances occurring after January 2000 on June 27, 2001 and SSFL provided additional information. A revised NOV was issued on October 19, 2001 and the Administrative Civil Liability complaint was issued on April 29, 2002. The Discharger completed the stipulated requirements on October 9, 2002.

On February 6, 2004 a NOV was issued for the violations identified in the Table that occurred prior to January 2000, and subsequent to the previously mentioned NOV that have not been adequately addressed by the Discharger.

Order No. R4-2004-0111 was adopted on July 1, 2004 and implemented effluent limits that are more stringent than those from Order 98-051. That Order was updated in January 2006 and in March 2006. The discharger has reported numerous violations of the effluent limits included in these orders. Notices of Violation were issued on February 6, 2004, March 14, 2005, October 7, 2005, April 20, 2006, and November 7, 2006, for violations included in self monitoring reports submitted through May 31, 2006.

The Regional Board on July 25, 2007, issued Complaint No. R4-2007-0035 for Administrative Civil Liability against the Boeing Company in the amount of \$471,190. On August 27, 2007, Boeing waived its right to a hearing and submitted full payment of the civil liability. A Notice of Conclusion of Enforcement Action was issued referencing this case on September 11, 2007.

IV. Applicable Statutes, Plans, Policies, and Regulations

- A. *Clean Water Act (CWA)*. The federal CWA requires that any point source discharge of pollutants to a water of the United States must be done in conformance with an NPDES permit. NPDES permits establish effluent limitations that incorporate various requirements of the CWA designed to protect water quality.
- B. *Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (Basin Plan)*. The Basin Plan contains water quality objectives and beneficial uses for inland surface waters and for the Pacific Ocean. The receiving water for storm water runoff from Outfall 008 (Happy Valley) is Dayton Canyon Creek which flows to Chatsworth Creek. Chatsworth Creek merges with Bell Creek and Bell Creek flows into the Los Angeles River. The receiving water for the permitted discharge of the treated effluent via Outfalls 001, 002, 011 and 018 is Bell Creek a tributary to the Los Angeles River. The beneficial uses of the Dayton Canyon Creek, Bell Creek and the Los Angeles River are:

Dayton Canyon Creek – Hydrologic Unit 405.21

Existing: wildlife habitat
Intermittent: groundwater recharge, contact and non-contact water recreation; warm freshwater habitat.

Bell Creek – Hydrologic Unit 405.21

Existing: wildlife habitat
Intermittent: groundwater recharge, contact and non-contact water recreation; warm freshwater habitat.

The Los Angeles River upstream of Figueroa Street – Hydrologic Unit 405.21:

Existing: groundwater recharge; contact and non-contact water recreation, warm freshwater habitat; wildlife habitat; and wetland habitat.
Potential: industrial service supply.

Los Angeles River downstream of Figueroa Street – Hydrologic Unit 405.15

Existing: groundwater recharge, contact and non-contact water recreation, and warm freshwater habitat.
Potential: industrial service supply and wildlife habitat.

Los Angeles River downstream of Figueroa Street – Hydrologic Unit 405.12

- Existing: groundwater recharge; contact and noncontact water recreation; warm freshwater habitat; marine habitat; wildlife habitat; and rare, threatened, or endangered species.
- Potential: industrial service supply; industrial process supply; migration of aquatic organisms; spawning, reproduction, and/or early development; and shellfish harvesting.

Los Angeles River Estuary – Hydrologic Unit 405.12

- Existing: industrial service supply; navigation; contact and non-contact water recreation; commercial and sport fishing; estuarine habitat; marine habitat; wildlife habitat; rare, threatened, or endangered species; migration of aquatic organisms; spawning, reproduction, and/or early development; and wetland habitat.
- Potential: shellfish harvesting.

Dayton Canyon Creek, Bell Creek and all of the reaches of the Los Angeles River listed except for the estuary also have municipal and domestic supply (MUN) listed as a potential beneficial use with an asterisk in the Basin Plan. This is consistent with Regional Board Resolution 89-03; however the Regional Board has only conditionally designated the MUN beneficial uses and at this time cannot establish effluent limitations designed to protect the conditional designation.

The storm water runoff from Outfalls 003 through 007, 009 and 010 discharges from the SSFL exit the site to the northwest and flows down the Meier and Runkle Canyons toward the Arroyo Simi. The Arroyo Simi is tributary to the Calleguas Creek. The beneficial uses for the receiving water are listed below.

Arroyo Simi – Hydrologic Unit 403.62

- Existing: wildlife habitat, rare, threatened, or endangered species habitat,
- Intermittent: industrial process supply, groundwater recharge, freshwater replenishment, contact and non-contact water recreation, warm freshwater habitat;

Arroyo Las Posas – Hydrologic Unit 403.62

- Existing: groundwater recharge, freshwater replenishment, contact and non-contact water recreation, warm freshwater habitat, wildlife habitat,
- Potential: industrial process supply, industrial service supply, agricultural supply, and cold freshwater habitat.

Calleguas Creek – Hydrologic Unit 403.12

Existing: industrial service supply, industrial process supply, agricultural supply, groundwater recharge, contact and non-contact water recreation, warm freshwater habitat, and wildlife habitat,

Calleguas Creek – Hydrologic Unit 403.11

Existing: agricultural supply, groundwater recharge, freshwater replenishment; contact and non-contact water recreation, warm freshwater habitat, cold freshwater habitat, wildlife habitat, rare, threatened or endangered species, and wetland habitat,

Calleguas Creek Estuary – Hydrologic Unit 403.11

Existing: noncontact water recreation, commercial and sport fishing, estuarine habitat, wildlife habitat, rare, threatened or endangered species, migration of aquatic organisms, spawning, reproduction, and/or early development, and wetland habitat;
Potential: navigation and water contact recreation.

Mugu Lagoon – Hydrologic Unit 403.11

Existing: navigation, non-contact water recreation, commercial and sport fishing, estuarine habitat, marine habitat, preservation of biological habitats, wildlife habitat, rare, threatened or endangered species, migration of aquatic organisms, spawning, reproduction, and/or early development, shellfish harvesting, and wetland habitat,
Potential: water contact recreation.

All of the reaches of Calleguas Creek except the estuary also include conditional municipal and domestic supply designations as an intermittent or potential beneficial use in the Basin Plan.

- C. **Ammonia Basin Plan Amendment.** The 1994 Basin Plan provided water quality objectives for ammonia to protect aquatic life, in Tables 3-1 through Tables 3-4. However, those ammonia objectives were revised on April 25, 2002, by the Regional Board with the adoption of Resolution No. 2002-011, *Amendment to the Water Quality Control Plan for the Los Angeles Region to Update the Ammonia Objectives for Inland Surface Waters (including enclosed bays, estuaries and wetlands) with Beneficial Use designations for protection of Aquatic Life*. The ammonia Basin Plan amendment was approved by the State Board, the Office of Administrative Law, and USEPA on April 30, 2003, June 5, 2003, and June 19, 2003, respectively. Although the revised ammonia water quality objectives may be less stringent than those contained in the 1994 Basin Plan, they are protective of aquatic life and are consistent with USEPA's 1999 ammonia criteria update.
- D. **Title 22 of the California Code of Regulations.** The California Department of Health Services established primary and secondary maximum contaminant levels (MCLs) for a number of chemical and radioactive contaminants. These MCLs can

be found in Title 22, California Code of Regulations (Title 22). Chapter 3 of the Basin Plan incorporates portions of Title 22 by reference. In addition, narrative objectives require the ground waters shall not contain taste or odor-producing substances in concentrations that affect beneficial uses. The secondary MCLs in Title 22 are designed to ensure that the water's taste and odor does not affect its suitability as drinking water. Title 22 MCLs have been incorporated into NPDES permits and Non-Chapter 15 WDRs to protect the municipal and domestic supply (MUN) and groundwater recharge (GWR), where the underlying groundwater has a designated MUN beneficial use.

Groundwater Recharge. Sections of Bell Creek and Arroyo Simi, near the SSFL discharge points, are designated as GWR indicating that groundwater recharge is a beneficial use. Surface water from the Bell Creek enter the Los Angeles River Watershed. The headwaters of the Los Angeles River originate in the Santa Monica, Santa Susana, and San Gabriel Mountains. Four basins in the San Fernando Valley area contain substantial deep groundwater reserves and are recharged mainly through runoff and infiltration.

Surface water discharges from the north west edge of the SSFL are directed to Arroyo Simi, a tributary located in the Calleguas Creek Watershed. Supplies of groundwater are critical to agricultural operations and industry (sand and gravel mining) in this watershed.

Moreover, much of the population in the watershed relies upon groundwater for drinking. Since groundwater from these basins is used to provide drinking water to a large portion of the population, Title 22-based limits are needed to protect that drinking water supply. By limiting the contaminants in the SSFL discharges, the amount of pollutants entering the surface waters and groundwater basins are correspondingly reduced. Once groundwater basins are contaminated, it may take years to clean up, depending on the pollutant. Compared to surface water pollution, investigations and remediation of groundwater are often more difficult, costly, and extremely slow. For these reasons Title 22-based limits will remain in the NPDES permit where there is reasonable potential.

On December 17, 2003, the Regional Board received the December 2003 *Technical Memorandum Analysis of Groundwater Recharge, Santa Susana Field Laboratory, Ventura County, California*, prepared by Montgomery Watson Harza on behalf of the Boeing Company. This document was submitted to DTSC in order to present a qualitative and quantitative analysis of groundwater recharge at the Santa Susana Field Laboratory. Regional Board staff have also reviewed this document and find that a reasonable conclusion for the amount of rainfall that infiltrates soil using a water balance method is between 23% to 26%. Using a chloride mass balance method resulted in a range of 1% to 12% rainfall infiltration. As these calculations by different methodologies differ significantly and are inconclusive, Regional Board staff find that there is insufficient data to suggest that rainfall will not significantly recharge groundwater in the underlying surficial soils, weathered and fractured bedrock. In addition, there has been no site-specific soil attenuation factor/model submitted for Regional Board staff review. Inasmuch, those limits placed in this Order to protect groundwater recharge beneficial uses and beneficial uses of underlying groundwater apply at end-of-pipe.

Notification Levels. California Department of Health Services (DHS) establishes Notification Levels (NLs), or health based advisory levels, for chemicals in drinking water that lack MCLs. Through 2004, the Notification Levels were referred to as Action Levels (ALs). An AL is the concentration of a chemical in drinking water that is considered not to pose a significant risk to people ingesting that water on a daily basis. ALs may be established by DHS for non-regulated chemical contaminants when one of the following occurs:

1. A chemical is found in an actual or proposed drinking water source, or
2. A chemical is in proximity to a drinking water source, and guidance is needed, should it reach the source.

An AL is calculated using standard risk assessment methods for non-cancer and cancer endpoints, and typical exposure assumptions, including a 2-liter per day ingestion rate, a 70-kilogram adult body weight, and a 70-year lifetime. For chemicals that are considered carcinogens, the AL is considered to pose "de minimus" risk, i.e., a theoretical lifetime risk of up to one excess case of cancer in a population of 1,000,000 people – the 10^{-6} risk level. (In that population, approximately 250,000 – 300,000 cases of cancer would be anticipated to occur naturally.) ALs may be revised from time to time to reflect new risk assessment information. Chemicals for which ALs are established may eventually be regulated by MCLs, depending on the extent of contamination, the levels observed, and the risk to human health. A number of the contaminants for which action levels were originally established now have MCLs.

In 1997, DHS established an 18 $\mu\text{g/L}$ AL for perchlorate. DHS used the upper value of the 4 to 18 $\mu\text{g/L}$ range that resulted from the "provisional" reference dose that USEPA prepared in support of its Superfund activities. A revised external review draft perchlorate reference dose corresponding to a drinking water concentration of 1 $\mu\text{g/L}$ was released in 2002. DHS concluded that the AL needed to be revised downward. On January 18, 2002, DHS reduced the perchlorate AL to 4 $\mu\text{g/L}$. The revised AL coincided with the analytical detection limit for purposes of reporting and was at the lower end of the 4 to 18 $\mu\text{g/L}$ range from the USEPA 1992-1995 assessment. The Public Health Goal (PHG) for perchlorate was developed by Office of Environmental Health Hazard Assessment based on a contemporary health risk assessment. This new information was provided to DHS and on March 11, 2004, the AL for perchlorate was revised to 6 $\mu\text{g/L}$, a value identical to the PHG that will be used by DHS to develop the MCL for perchlorate. The effluent limit for perchlorate included in this Fact Sheet and in the revised-tentative WDR (dated March 25, 2004) has been updated to reflect the change in the NL by DHS (from 4 $\mu\text{g/L}$ to 6 $\mu\text{g/L}$).

Perchlorate and its salts are used in, but not limited to, solid propellant for rockets, missiles, and fireworks. The defense and aerospace industries purchase more than 90 percent of all the perchlorate manufactured. Perchlorate has historically been used at SSFL and thus is considered a chemical of concern at the site. Monitoring data collected during the tenure of the current permit indicates that perchlorate was present in the storm water runoff in Happy Valley and it has been detected in some

of the groundwater wells utilized in the cleanup operations ongoing with DTSC oversight.

Perchlorate can interfere with iodide uptake by the thyroid gland; this can result in a decrease in the production of thyroid hormones, which are needed for prenatal and postnatal growth and development, as well as for normal body metabolism. Neither, the CTR, NTR or the Basin Plan has requirements stipulated for perchlorate. Since there is no drinking water standard, or maximum contaminant level (MCL), the DHS uses the AL as an advisory level. The Regional Board, exercising its best professional judgement, in the review of the "best available science" has in the past considered and used ALs when deemed appropriate to establish final effluent limitations in WDRs and NPDES permits adopted by this Board, to implement the Basin Plan narrative WQO, "*all waters shall be maintained free of toxic substance that produce detrimental physiological responses in human, plant, animal, or aquatic life,*" and to prevent degradation of valuable groundwater sources of drinking water.

- E. Under title 40 Code of Federal Regulations (40 CFR) section 122.44(d), *Water Quality Standards and State Requirements*, "Limitations must control all pollutants or pollutant parameters (either conventional, non-conventional, or toxic pollutants), which the Director determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any State water quality standard, including State narrative criteria for water quality." Where numeric effluent limitations for a pollutant or pollutant parameter have not been established in the applicable state water quality control plan, 40 CFR section 122.44(d)(1)(vi) specifies that water quality-based effluent limitations (WQBELs) may be set based on United States Environmental Protection Agency (USEPA) criteria, and may be supplemented where necessary by other relevant information to attain and maintain narrative water quality criteria, and to fully protect designated beneficial uses.
- F. In July 2004 the influent to the package type sewage treatment plants located at SSFL meet the requirements for the special consideration for less concentrated influent wastewaters. Section 133.103 of 40 CFR provides guidance on special considerations for secondary treated effluent. Paragraph (d) address less concentrated influent wastewater for separate sewers. The regulation states that:

"The Regional Administrator or, if appropriate, State Director is authorized to substitute either a lower percent removal requirement or a mass loading limit for the percent removal requirements set forth in sections 133.102 (a) (3), 133.102 (a) (4) (iii), 133.102 (b) (3), 102.105 (a) (3), 133.105(b) (3) and 133.105(e) (1) (iii) provided that the permittee satisfactorily demonstrates that: (1) The treatment works is consistently meeting, or will consistently meet, its permit effluent concentration limits but its percent removal requirements cannot be due to less concentrated influent wastewater (2) to meet the percent removal requirements, the treatment works would have to achieve significantly more stringent limitations than would otherwise be required by the concentration-based standard, and (3) the less concentrated influent wastewater is not the result of excessive infiltration/inflow."

Consequently, this permit has substituted the mass loading limit for the percent removal requirement. However, there is a requirement that the influent monitoring be completed at least annually such that the per cent removal can be calculated.

- G. Section 402(p) of the federal Clean Water Act (CWA), as amended by the Water Quality Act of 1987, requires NPDES permits for storm water discharges. The Discharger in addition to meeting the effluent limits included in this permit for storm water discharges only will be required to develop and implement a SWPPP as stipulated in Finding 27 of the Waste Discharge Requirements. These requirements as they are met will protect and maintain existing beneficial uses of the receiving water.
- H. On May 18, 2000, the USEPA promulgated numeric criteria for priority pollutants for the State of California [known as the *California Toxics Rule* (CTR) and codified as 40 CFR section 131.38]. On March 2, 2000, the State Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Implementation Policy or SIP). The SIP was effective on April 28, 2000 with respect to the priority pollutant criteria promulgated for California by the USEPA through National Toxics Rule (NTR) and to the priority pollutant objectives established by the Regional Boards in their Basin Plans, with the exception of the provision on alternate test procedures for individual discharges that have been approved by the USEPA Regional Administrator. The alternate test procedures provision was effective on May 22, 2000. The SIP was effective on May 18, 2000, with respect to the priority pollutant criteria promulgated by the USEPA through the CTR. The State Board adopted an amendment to the SIP on February 24, 2005, that became effective on July 13, 2005. The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for chronic toxicity control.
- I. Section 402(o) of the Clean Water Act and 40 CFR section 122.44(l) require that water-quality based effluent limits in re-issued permits must be at least as stringent as in the existing permit (anti-backsliding). There are, however, exceptions to the prohibition which are codified in sections 303(d)(4) and/or 402(o)(2) of the Clean Water Act. Hence, many of the limits from the existing waste discharge requirements contained in Regional Board Order No. 98-051, adopted by the Regional Board on June 29, 1998 have been included in this Order. For those limits carried forward, the Regional Board has determined that there is reasonable potential for the pollutant to cause or contribute to an exceedance of water quality standards in accordance with State Board Order No. WQ2003-0009. Reasonable potential is determined using the procedures established in the SIP, informed by professional judgment.
- J. Antidegradation. On October 28, 1968, the State Board adopted Resolution No. 68-16, Maintaining High Quality Water, which established an antidegradation policy for State and Regional Boards. Similarly, the CWA (section 304(d)(4)(B)) and USEPA regulations (40 CFR section 131.12) require that all NPDES permitting actions be consistent with the federal antidegradation policy. Specifically, waters that are of a higher quality than needed to maintain designated beneficial uses shall be maintained at the higher water quality unless specific findings are made.

- K. *Watershed Management Approach.* The Regional Board has implemented a Watershed Management Approach, in accordance with *Watershed Protection: A Project Focus* (EPA841-R-95-003, August 1995), to address water quality protection in the Los Angeles Region. Programs covered under the Watershed Management Approach include regulatory (e.g., NPDES), monitoring and assessment, basin planning and water quality standards, watershed management, wetlands, TMDLs, 401 certifications, groundwater (as appropriate), and nonpoint source management activities. The Watershed Management Approach integrates the Regional Board's many diverse programs, particularly, permitting, planning, and other surface-water oriented programs. It emphasizes cooperative relationships between regulatory agencies, the regulated community, environmental groups, and other stakeholders in the watershed to achieve the greatest environmental improvements with the resources available. This approach facilitates a more accurate assessment of cumulative impacts of pollutants from both point and nonpoint sources.

The Los Angeles River watershed is one of the largest in the Region. The headwaters of the Los Angeles River originate in the Santa Monica, Santa Susana, and San Gabriel Mountains. The river flows through industrial and commercial areas and is bordered by rail yards, freeways, and major commercial and government buildings. The Los Angeles River tidal prism/estuary begins in Long Beach at Willow Street and runs approximately three miles before joining with Queensway Bay located between the Port of Long Beach and the city of Long Beach.

The wastewater discharge from Outfalls 001 and 002 at the SSFL enters Bell Creek near the headwaters of the Los Angeles River. The storm water runoff from Happy Valley (Outfall 008) exits the site via Dayton Canyon Creek which flows to Bell Creek and subsequently the Los Angeles River.

The other storm water runoff exiting the SSFL site does so near the northwest site boundary from Outfalls 003 through 007, 009 and 010. The receiving water for the storm water runoff from these locations is the Arroyo Simi, a tributary of Calleguas Creek. The Calleguas Creek Watershed extends from the Santa Monica Mountains and Simi Hills in the south, to the Santa Susana Mountains, South Mountain, and Oak Ridge in the north. Land uses vary throughout the watershed. Urban developments are generally restricted to the city limits of Simi Valley, Moorpark, Thousand Oaks, and Camarillo. Agricultural activities are spread out along valleys and on the Oxnard Plain.

The storm water discharge exits the site and travels down Meier and Runkle Canyons towards the Arroyo Simi. Most of the land use around the facility is open area. Overall the Calleguas Creek Watershed is considered an impaired watershed. It appears that the sources of many of these pollutants are agricultural activities. Approximately fifty percent of the watershed is still open space although there is a severe lack of benthic and riparian habitat present. The discharge, when it is sufficient to reach the Arroyo Simi, enters it in Reach 1 – Hydrological Unit 403.62.

- L. *303(d) Listing of Impaired Waterways.* Bell Creek, which is the receiving water for the wastewater discharge from Outfalls 001, and 002 is on the 2002 303(d) list with high coliform count as the stressor.

The storm water runoff discharge from Outfalls 003 through 007, 009 and 010, when it is sufficient to reach the Arroyo Simi, enters it in Reach 1 – Hydrological Unit 403.62. The stressors listed in the 2002 State Board's California 303(d) list for this reach of Arroyo Simi are ammonia, boron, chloride, sulfates, fecal coliform, organophosphorous pesticides, sediment/siltation, and total dissolved solids.

M. **Total Maximum Daily Load (TMDL)**

The TMDL development for the Los Angeles River watershed and for Calleguas Creek has been developed for a number of the constituents on the California State Water Board 2002 303(d) list. The WQBELS in this permit have been analyzed to ensure they are consistent with the assumptions and requirements of the WLAs in those TMDLS. The TMDLS, which are not scheduled for completion within the lifetime of this permit, will include WLAs for the 303(d) listed pollutants. When each TMDL is complete, the Regional Board will adopt WQBELs consistent with the corresponding WLAs. If authorized, a time schedule may be included in a revised permit to require compliance with the final WQBELs.

N. **LA River Nitrogen (Nutrients) TMDL**. The TMDL for Nitrogen (nutrients) in the Los Angeles River received Regional Board approval on July 10, 2003 (Resolution No. 03-009) and State Board approval with adoption of Order 2003-0074 on November 19, 2003. Office of Administrative Law (OAL) and USEPA approval dates were February 27, 2003 and March 18, 2003, respectively. The Regional Board filed a Notice of Decision with the California Resources Agency on March 23, 2004 and the TMDL was effective as of that date. The Los Angeles River Nutrient TMDL revision with Interim WLAs was approved by the Regional Board on December 4, 2003 (Resolution No. 2003-016). The State Board approved the TMDL with Resolution 2004-0014 on March 24, 2004. OAL approved it on September 27, 2004, and the effective date for the Order was September 27, 2004.

The TMDL includes numeric targets for ammonia as nitrogen (NH₃-N), Nitrate-nitrogen and nitrite-Nitrogen within Reach 5 (within Sepulveda Basin), Reach 3 (Riverside Drive to Figueroa Street), and the Burbank Western Channel. Waste loads are allocated to minor point sources in these reaches that are enrolled in industrial and construction storm water permits.

O. **LA River Metals TMDL**. The TMDL for metals in the Los Angeles River was approved by the Regional Board during the June 2, 2005 hearing (Resolution No. 2005-006). State Board approved the TMDL on October 20, 2005. OAL approved the TMDL on December 9, 2005 and EPA approved it on December 22, 2005. The TMDL for metals in storm water is in effect for discharges to the specified reaches of the Los Angeles River.

The metals TMDL implements numeric water quality targets that are based on objectives established by USEPA in the CTR. Targets for copper, lead, zinc and/or selenium (total recoverable) are established in designated reaches of the Los Angeles River. Separate water quality targets are established for dry and wet weather discharges.

The TMDL for metals in the Los Angeles River includes an implementation schedule for non-storm water NPDES permits (including POTWs, other major, minor, and general permits). SSFL is included in this group of permittees. The implementation schedule states that NPDES permits shall achieve waste load allocations, which shall be expressed as NPDES water quality-based effluent limitations. Compliance schedules may allow up to five years in individual NPDES permits to meet permit requirements.

Discharges from SSFL, of wastewater and of storm water runoff only, exiting the site enter Bell Creek or Dayton Canyon Creek. Dry weather numeric water quality targets for copper, lead, and selenium are established for Bell Creek in the TMDL. WLAs are assigned to all point source discharges to Bell Creek and tributaries to Bell Creek. Wet-weather numeric targets for cadmium, copper lead and zinc are established for Los Angeles (LA) River Reach 1 in the TMDL. WLAs are assigned to all point source discharges to LA River Reach 1 and all upstream reaches and tributaries to Reach 1 (including Bell Creek and tributaries to Bell Creek). Hence, effluent limits for cadmium, copper, lead, zinc, and selenium in discharges to Bell Creek, Dayton Canyon Creek, or any tributaries of the LA River will be based on WLAs established by the TMDL or existing permit limits, whichever are more protective.

- P. LA River Trash TMDL. The Los Angeles River Trash TMDL was adopted by the Regional Board on September 19, 2001. The TMDL established a numeric target of zero trash in the river. The TMDL was to be implemented via storm water permits in a phased reduction for a period of ten years. The LA River Trash TMDL was approved by the State Water Resources Control Board on February 19, 2002, Office of Administrative Law on July 16, 2002 and by the US EPA on August 1, 2002. The TMDL became effective on August 28, 2002.

There were a number of challenges to the LA River Trash TMDL. The consideration of the challenges resulted in a requirement that the TMDL be set aside and not implemented until the California Environmental Quality Act (CEQA) requirements have been satisfied. On June 8, 2006, the Los Angeles Regional Water Quality Control Board adopted a resolution to set aside the adopted TMDL. On July 17, 2006, the State Board adopted Resolution 2006-0051, setting the TMDL aside.

The Regional Board on August 9, 2007, adopted a new TMDL for trash in the Los Angeles River Watershed that includes WLAs of zero for trash. This TMDL will become effective after approval from the State Board, OAL, and EPA. When the TMDL is effective, the WLA for trash will be incorporated in this permit.

- Q. Calleguas Creek Chloride (Salts) TMDL. On March 22, 2002, the consent decree deadline for the establishment of a chloride TMDL, USEPA Region 9 established the Calleguas Creek Total Maximum Daily Load for chloride. The TMDL adopted by USEPA was based largely on the technical efforts produced by the Regional Board staff.

The Calleguas Creek Watershed Group in collaboration with USEPA Region 9 and the Regional Board is developing the *Calleguas Creek Watershed Salts TMDL Work Plan*. The work plan addresses chloride, TDS, sulfate and boron in the watershed.

The Regional Board and USEPA may use the work product from the Calleguas Creek Watershed Group to establish a subsequent TMDL for chloride in the Calleguas Creek Watershed.

Discharges from SSFL enter the Calleguas Creek Watershed in Arroyo Simi Reach 7, which is included on the 303 (d) list as a chloride water quality limited segment in the Calleguas Creek Watershed. There are no waste load allocations (WLAs) for point source discharges or load allocations (LAs) for nonpoint sources in effect under storm conditions in the TMDL. Since all discharges from the SSFL to the Arroyo Simi occur as a result of storm water runoff, no chloride WLAs will be included in this Order for discharges from Outfalls 003 through 007, 009 and 010 to Arroyo Simi. Based on existing data, SSFL does not appear to contribute chloride loading to the watershed at levels that would alter the assumptions of the TMDL or contribute to further impairment.

- R. Calleguas Creek Nitrogen Compounds and Related Effects TMDL. On October 24, 2002, the Regional Board adopted Resolution No. 2002-017, Amendment to the *Basin Plan for the Los Angeles Region* to Include a TMDL for Nitrogen Compounds and Related Effects in Calleguas Creek (*Nitrogen Compounds and Related Effects TMDL*). The State Board approved the Nitrogen Compounds and Related Effects TMDL on March 19, 2003. The Office of Administrative Law approved the TMDL on June 5, 2003 and USEPA approved it on June 20, 2003.

The *Nitrogen Compounds and Related Effects TMDL* includes waste load allocations for ammonia (NH_3), nitrite as nitrogen ($\text{NO}_2\text{-N}$), nitrate as nitrogen ($\text{NO}_3\text{-N}$), and nitrate plus nitrite as nitrogen ($\text{NO}_2\text{-N} + \text{NO}_3\text{-N}$). The TMDL authorizes interim limits (expressed as interim waste allocations) for total nitrogen ($\text{NO}_3\text{-N} + \text{NO}_2\text{-N}$). The WLA applied to the publicly owned treatment works (POTW) in the watershed and the LAs are specified for agricultural discharges. Hence, this Order does not include the TMDL limits for ammonia, nitrate as nitrogen, nitrite as nitrogen, or nitrate plus nitrite as nitrogen for discharges of storm water only from the SSFL to Arroyo Simi and Calleguas Creek. However, based on existing data, SSFL does not appear to contribute nitrogen loading to the watershed at levels that would alter the assumptions of the TMDL or contribute to further impairment.

- S. Calleguas Creek Toxicity, Chlorpyrifos, Diazinon TMDL. The Regional Board approved the Basin Plan amendment to incorporate the TMDL for toxicity, chlorpyrifos, and diazinon in the Calleguas Creek, its tributaries and Mugu Lagoon (Resolution No. R4-2005-009) on July 7, 2005. The TMDL addresses impairment to water quality due to elevated levels of chlorpyrifos, diazinon, other pesticides and/or other toxicants. The amendment includes numeric targets, WLAs, and load allocations for Toxicity Unit Chronic, chlorpyrifos, and diazinon. It also includes a compliance schedule of two years from the effective date of the TMDL to meet the final WLAs and ten years to meet the LAs applied to nonpoint sources.

State Board approved the TMDL on September 22, 2005 (Resolution No. 2005-0067). OAL and EPA approvals were effective on November 27, 2005, and March 14, 2006, respectively. The TMDL became effective on March 24, 2006. A wasteload of 1.0 TUC is allocated to the major point sources (POTWs) and minor port sources discharging to the Calleguas Creek Watershed. Interim and final

waste load allocations and were also established for chlorpyrifos and diazinon. The implementation schedule specifies that the interim limits for chlorpyrifos and diazinon in storm water NPDES permits be in stream limits. The appropriate waste load allocations will be translated into permit limits and included in this Order (R4-2007-0055).

- T. Calleguas Creek and Mugu Lagoon OC Pesticides, PCBs, and Siltation TMDL Resolution No. R4-2005-0010, a TMDL for organochlorine (OC) pesticides, polychlorinated biphenyl (PCBs) and siltation in Calleguas Creek, its tributaries, and Mugu Lagoon, was also approved by the Regional Board on July 7, 2005. The TMDL addresses impairment to water quality due to elevated concentrations of OC pesticides and PCBs, which can bioaccumulate in fish tissue and cause toxicity to aquatic life in estuarine and inland waters. Siltation may transport these contaminants to surface waters and impair aquatic life and wildlife habitats. The TMDL establishes water column targets, fish tissue targets, and sediment targets to ensure the protection of beneficial uses. The TMDL establishes a twenty-year compliance plan for reducing OC pesticides, PCBs and siltation loads from point sources and nonpoint sources.

State Board approved the TMDL on September 22, 2005 (Resolution No. 2005-0068). OAL and EPA approvals followed on January 20, 2006, and March 14, 2006, respectively. The TMDL was effective on March 24, 2006. The appropriate targets will apply to discharges from Outfalls 003 through 007, 009, and 010 which enter Arroyo Simi, a tributary of Calleguas Creek.

The TMDL also includes waste load allocations for OC pesticides and PCBs in sediment in Calleguas Creek and its tributaries. The waste load allocations have been translated directly into ambient contaminant concentrations in the sediment of Arroyo Simi. Those ambient contaminant concentrations will be compared directly to sediment concentrations measured in the samples collected to determine compliance with the interim or final waste load allocations stipulated.

The Calleguas Creek OC Pesticides and PCBs TMDL includes a compliance schedule of twenty years. As per the May 10, 2007, memorandum with the subject "Compliance Schedules for Water Quality-Based Effluent limitations in NPDES Permits" from James A. Hanlon, Director of Wastewater Management to Alexis Strauss, Director of the Water Division at USEPA Region 9, this permit includes both the final and interim WLAs with a compliance schedule providing a maximum of five years of operation utilizing the interim WLAs. The permit includes a provision to reopen the permit to implement the final WLAs if the data collected supports implementation of the final WLAs prior to the renewal of the permit.

The waste load allocations in the water column will be translated into effluent limitations utilizing the steady state model from the SIP. The calculated effluent limits will be included in the permit as receiving water effluent limits. Since the discharge is storm water and it is near the top of the watershed, the Discharger may utilize the option of sampling the discharge for the OC pesticides and PCBs or sampling the receiving water. The Discharger may also choose to join the Calleguas Creek Watershed TMDL Monitoring Program (CCWTMP) and monitor at an established compliance sampling location in Arroyo Simi.

- U. Calleguas Creek and Mugu Lagoon Metals and Selenium TMDL. Resolution R4-2006-012, the TMDL for metals and selenium for Calleguas Creek, its tributaries and Mugu Lagoon was adopted by the Los Angeles Regional Board on June 8, 2006. The TMDL establishes numeric targets for dissolved copper, nickel, and zinc, and in total recoverable mercury and selenium. It also includes fish tissue targets for mercury, bird egg targets for mercury and selenium and sediment quality guidelines for copper, nickel, and zinc.

State Board approved the TMDL on October 25, 2006 (Resolution No. 2006-0078). OAL and EPA approval the TMDL on February 6, 2007, and March 26, 2007, respectively. The TMDL became effective on March 26, 2007. The TMDL includes final waste load allocations for wet weather total recoverable copper and nickel. A concentration-based waste load allocation applied during both wet and dry weather was also included in the TMDL for mercury.

Discharges from the Boeing SSFL site (Outfalls 003 through 007, 009, and 010) enter Calleguas Creek in Reach 7, which was noted as Arroyo Simi Reaches 1 and 2 in the 1998 303(d) List. Dry weather discharges from this area do not reach Calleguas Creek and Mugu Lagoon. Therefore, no dry weather waste load allocations are established for the constituents in the water column. Selenium waste load allocations have not been developed for this reach as it is not on the 303 (d) list. The final waste load allocation developed for mercury was 0.051 µg/L based on CTR. The mercury waste load allocation was used to develop a daily maximum effluent limit, implemented at Outfalls 003 through 007, 009, and 010.

Final waste load allocations for wet daily maximum concentrations of copper and nickel are stipulated as 31.0 and 958 µg/L, respectively. The daily maximum limit for copper is included in the permit. The TMDL-based daily maximum for nickel (958 µg/L), which was developed to protect aquatic life in the lower Calleguas Creek and Mugu Lagoon, is greater than the Title 22-based MCL limit of 100 µg/L. Since the groundwater basin below the Arroyo Simi has the municipal and domestic supply as an existing beneficial use and Arroyo Simi has groundwater recharge as an intermittent beneficial use, the effluent limitation implemented must be protective of both groundwater recharge and of the downstream aquatic life beneficial uses. Therefore, the 100 µg/L effluent limitation, which is protective of the beneficial uses of Arroyo Simi and the groundwater basin below it, has been implemented for nickel.

V. Regulatory Basis for Effluent Limitations

A. General Basis for Effluent Limits

Effluent limitations established pursuant to Sections 301 (Effluent Limitations), 302 (Water Quality-Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 304 (Information and Guidelines), and 402 (NPDES) of the Federal Clean Water Act and amendments thereto, are applicable to the discharges covered by the tentative order.

B. Water Quality Based Effluent Limitations (WQBELs)

The WQBELs are based on the Basin Plan, other State plans and policies, or USEPA water quality criteria. These requirements, as they are met will protect and maintain existing beneficial uses of the receiving water. Where numeric water quality objectives have not been established in the Basin Plan, 40 CFR section 122.44(d) specifies that WQBELs may be set based on USEPA criteria and supplemented, where necessary by, other relevant information to attain and maintain narrative water quality criteria to fully protect designated beneficial uses. The previous NPDES permit for SSFL (Order No. 98-051) included monthly averages for chemicals of concern discharged from Outfalls 003 through 008. The discharges from these outfalls consist solely of storm water runoff. These discharges are seasonal and infrequent. Individual NPDES permits that regulate storm water runoff only discharges issued recently by the Regional Board do not contain monthly average limitations. Hence, this Order does not contain monthly average limitations for the storm water runoff only discharges from these outfalls.

C. Reasonable Potential Analysis

Discharges from the engine test stands had not been previously regulated independently. These discharges did not have specific monitoring requirements or effluent limits. This permit includes effluent limits for conventional pollutants and requires monitoring for the EPA priority pollutants excluding asbestos from the engine test areas.

In accordance with Section 1.3 of the SIP, the Regional Board will conduct a reasonable potential analysis (RPA) for each priority pollutant with an applicable criterion or objective to determine if a WQBEL is required in the permit. The Regional Board will analyze effluent data to determine if a pollutant in a discharge has a reasonable potential to cause or contribute to an excursion above a state water quality standard. For all parameters that have a reasonable potential, numeric WQBELs are required. The RPA considers water quality objectives outlined in the CTR, NTR, as well as the Basin Plan. To conduct the RPA, the Regional Board must identify the maximum observed effluent concentration (MEC) for each constituent, based on data provided by the Discharger.

Section 1.3 of the SIP provides the procedures for determining reasonable potential to exceed water applicable water quality criteria and objectives. The preliminary steps involve the following:

- Identifying the lowest or most stringent criterion or water quality objective for the pollutant "(C)";
- Adjusting the selected criterion/objective, when appropriate, for hardness, pH, and translators of the receiving water (C_a). There is no hardness data available for Arroyo Simi. For the storm water only discharges to Arroyo Simi, the hardness used was 100 mg/L as CaCO_3 , which is the default value. Consequently, the default value was used to complete the calculation of the final effluent limits. The acute and chronic dilution factors utilized to complete the calculation are zero since Arroyo Simi, which is a tributary to

Calleguas Creek, has intermittent flows and many of the beneficial uses specified for Arroyo Simi are intermittent. A site-specific study would need to be completed to determine if seasonal dilution factors would be appropriate.

Wastewater discharges from industrial process and storm water from Happy Valley exit the site and flow into Bell Creek, a tributary to the Los Angeles River. The hardness data submitted by the Discharger for the receiving water provided hardness values less than the 100 mg/L as CaCO_3 default.

In fact, the hardness data was very similar for the discharge and the receiving water, indicating that the discharge was a primary contributing flow to the receiving water. The default value of 100 mg/L for hardness was used to adjust the selected criteria.

- Collating the appropriate effluent data for the pollutant;
- Determining the observed maximum concentration in the effluent (MEC) from the effluent data; and
- Determining the observed maximum ambient background concentration of the pollutant (B). Ambient data was submitted for Bell Creek upstream of Discharge Serial 001 and 002. This ambient data was included in the calculation of effluent limits for the wastewater discharges from these two locations. Ambient data was not available for Arroyo Simi and was not included in the analysis of the discharges from Outfalls 003 through 007.

The SIP specifies three triggers to complete a RPA:

1. Trigger 1 – If the MEC is greater than or equal to the CTR water quality criteria or applicable objective (C), a limitation is needed. For certain constituents present in this discharge that were nondetect, the MEC was set at the method detection limit consistent with section 1.3 of the SIP.
2. Trigger 2 – If $\text{MEC} < \text{C}$ and background water quality (B) $> \text{C}$, a limitation is needed.
3. Trigger 3 – If other related information such as CWA 303(d) listing for a pollutant, discharge type, compliance history, etc. indicates that a WQBEL is required.

The first two triggers were evaluated using the California Permit Writers Training Tool (CAPWTT). While on contract with the State Board, Scientific Applications International Corporation (SAIC) developed this software to determine RPAs and, when reasonable potential exists, calculate the WQBELs, following procedures in SIP. The third trigger is evaluated by the permit writer utilizing all other information available to determine if a water quality-based effluent limitation is required to protect beneficial uses.

The results of the RPA for each analyte evaluated is presented in Attachment 1 for discharges from Outfall 001 and 002 and in Attachment 2 for the storm water only discharges (Outfalls 003 – 007) of Order No. R4-2004-0111. Most of the targeted analytes evaluated have a response of (Best Professional Judgement) BPJ or No Criteria required. The BPJ response requires the permit writer use all other available information to determine if a limit should be stipulated and if necessary to determine the applicable limit. The No Criteria result indicated that CTR does not include criteria to evaluate this analyte.

A numeric limit has not been prescribed for a toxic constituent if it has been determined that it has no reasonable potential to cause or contribute to excursions of water quality standards. However, if the constituent had a limit in the previous permit, and if none of the Antibacksliding exceptions apply, then the limit will be retained if the Regional Board concludes there is reasonable potential. For those pollutants with existing effluent limitations where the CAPWTT did not statistically determine reasonable potential, the Regional Board staff conducted a further analysis under Trigger 3 of the SIP. If reasonable potential was found based on Trigger 3, the basis for that decision is articulated in this fact sheet. A narrative limit to comply with all water quality objectives is provided in *Standard Provisions* for the priority pollutants, which have no available numeric criteria.

Sufficient effluent and ambient data are needed to conduct a complete RPA. If data are not sufficient, the Discharger will be required to gather the appropriate data for the Regional Board to conduct the RPA. Upon review of the data, and if the Regional Board determines that WQBELs are needed to protect the beneficial uses, the permit will be reopened for appropriate modification.

D. Calculating WQBELs

If a reasonable potential exists to exceed applicable water quality criteria or objectives, then a WQBEL must be established in accordance with one of three procedures contained in Section 1.4 of the SIP. These procedures include:

- 1) If applicable and available, use of the wasteload allocation (WLA) established as part of a total maximum daily load (TMDL).
- 2) Use of a steady-state model to derive maximum daily effluent limitations (MDELs) and average monthly effluent limitations (AMELs).
- 3) Where sufficient effluent and receiving water data exist, use of a dynamic model, which has been approved by the Regional Board.
- 4) WQBELs Calculation Example

Using Copper as an example, the following demonstrates how WQBELs were established for this Order.

Concentration-Based Effluent Limitations

A set of AMEL and MDEL values are calculated separately, one set for the protection of aquatic life and the other for the protection of human health. The AMEL and MDEL limitations for aquatic life and human health are compared, and the most restrictive AMEL and the most restrictive MDEL are selected as the WQBEL.

Calculation of aquatic life AMEL and MDEL:

Step 1: For each constituent requiring an effluent limit, identify the applicable water quality criteria or objective. For each criterion determine the effluent concentration allowance (ECA) using the following steady state equation:

$$\begin{array}{ll} \text{ECA} = C + D(C-B) & \text{when } C > B, \text{ and} \\ \text{ECA} = C & \text{when } C \leq B, \end{array}$$

Where C = The priority pollutant criterion/objective, adjusted if necessary for hardness, pH and translators. In this Order a hardness value of 100 mg/L (as CaCO_3) was used for development of hardness-dependant criteria, and a pH of 8.1 was used for pH-dependant criteria.
 D = The dilution credit, and
 B = The ambient background concentration

As discussed above, for this Order, dilution was not allowed; therefore:

$$\text{ECA} = C$$

For copper the applicable water quality criteria are (reference Table F-5):

$$\begin{array}{ll} \text{ECA}_{\text{acute}} = & 14.00 \text{ } \mu\text{g/L} \\ \text{ECA}_{\text{chronic}} = & 9.33 \text{ } \mu\text{g/L} \end{array}$$

Step 2: For each ECA based on aquatic life criterion/objective, determine the long-term average discharge condition (LTA) by multiplying the ECA by a factor (multiplier). The multiplier is a statistically based factor that adjusts the ECA to account for effluent variability. The value of the multiplier varies depending on the coefficient of variation (CV) of the data set and whether it is an acute or chronic criterion/objective. Table 1 of the SIP provides pre-calculated values for the multipliers based on the value of the CV. Equations to develop the multipliers in place of using values in the tables are provided in Section 1.4, Step 3 of the SIP and will not be repeated here.

$$\text{LTA}_{\text{acute}} = \text{ECA}_{\text{acute}} \times \text{Multiplier}_{\text{acute } 99}$$

$$\text{LTA}_{\text{chronic}} = \text{ECA}_{\text{chronic}} \times \text{Multiplier}_{\text{chronic } 99}$$

The CV for the data set must be determined before the multipliers can be selected and will vary depending on the number of samples and the standard deviation of a

data set. If the data set is less than 10 samples, or at least 80% of the samples in the data set are reported as non-detect, the CV shall be set equal to 0.6.

For copper, the following data were used to develop the acute and chronic LTA using equations provided in Section 1.4, Step 3 of the SIP (Table 1 of the SIP also provides this data up to three decimals):

CV	ECA Multiplier _{acute.99}	ECA Multiplier _{chronic.99}
0.581	0.32	0.53

$$LTA_{acute} = 14.00 \mu\text{g/L} \times 0.33 = 4.48 \mu\text{g/L}$$

$$LTA_{chronic} = 9.33 \mu\text{g/L} \times 0.54 = 4.94 \mu\text{g/L}$$

Step 3: Select the most limiting (lowest) of the LTA.

$$LTA = \text{most limiting of } LTA_{acute} \text{ or } LTA_{chronic}$$

For Copper, the most limiting LTA was the $LTA_{chronic}$

$$LTA = 4.48 \mu\text{g/L}$$

Step 4: Calculate the WQBELs by multiplying the LTA by a factor (multiplier). WQBELs are expressed as Average Monthly Effluent Limitations (AMEL) and Maximum Daily Effluent Limitation (MDEL). The multiplier is a statistically based factor that adjusts the LTA for the averaging periods and exceedance frequencies of the criteria/objectives and the effluent limitations. The value of the multiplier varies depending on the probability basis, the coefficient of variation (CV) of the data set, the number of samples (for AMEL) and whether it is a monthly or daily limit. Table 2 of the SIP provides pre-calculated values for the multipliers based on the value of the CV and the number of samples. Equations to develop the multipliers in place of using values in the tables are provided in Section 1.4, Step 5 of the SIP and will not be repeated here.

$$AMEL_{aquatic\ life} = LTA \times AMEL_{multiplier\ 95}$$

$$MDEL_{aquatic\ life} = LTA \times MDEL_{multiplier\ 99}$$

AMEL multipliers are based on a 95th percentile occurrence probability, and the MDEL multipliers are based on the 99th percentile occurrence probability. If the number of samples is less than four (4), the default number of samples to be used is four (4).

For copper, the following data were used to develop the AMEL and MDEL for aquatic life using equations provided in Section 1.4, Step 5 of the SIP (Table 2 of the SIP also provides this data up to two decimals):

No. of Samples Per Month	CV	Multiplier _{MDEL 99}	Multiplier _{AMEL 95}
4	0.6	3.11	1.55

$$AMEL_{\text{aquatic life}} = 4.48 \times 1.55 = 6.94 \text{ } \mu\text{g/L}$$

$$MDEL_{\text{aquatic life}} = 4.48 \times 3.11 = 13.9 \text{ } \mu\text{g/L}$$

Calculation of human health AMEL and MDEL:

Step 5: For the ECA based on human health, set the AMEL equal to the $ECA_{\text{human health}}$

However, for copper, the $ECA_{\text{human health}} = \text{Not Available}$. The CTR does not contain a numeric copper criterion protective of human health; therefore, it was not possible to develop a copper AMEL based on human health criteria.

Step 6: Calculate the MDEL for human health by multiplying the AMEL by the ratio of the $\text{Multiplier}_{\text{MDEL}}$ to the $\text{Multiplier}_{\text{AMEL}}$. Table 2 of the SIP provides pre-calculated ratios to be used in this calculation based on the CV and the number of samples.

A copper $MDEL_{\text{human health}}$ could not be calculated because a copper $AMEL_{\text{human health}}$ was not available. There are no criteria protective of human health for copper; therefore, none of the limitations for copper are based on human health criteria.

Step 7: Select the lower of the AMEL and MDEL based on aquatic life and human health as the WQBEL for the Order.

For copper:

$AMEL_{\text{aquatic life}}$	$MDEL_{\text{aquatic life}}$	$AMEL_{\text{human health}}$	$MDEL_{\text{human health}}$
7.0 $\mu\text{g/L}$	14 $\mu\text{g/L}$	Not Applicable	Not Applicable

The lowest (most restrictive) effluent limits are based on aquatic toxicity and were incorporated into this Order. For copper, there are no human health criteria; therefore, the AMEL and MDEL based on aquatic life criteria are considered for WQBELs.

E. Impaired Water Bodies in 303 (d) List

Section 303(d) of the CWA requires states to identify specific water bodies where water quality standards are not expected to be met after implementation of technology-based effluent limitations on point sources. For all 303(d) listed water bodies and pollutants, the Regional Board plans to develop and adopt TMDLs that will specify WLAs for point sources and load allocations (LAs) for non-point sources, as appropriate.

The USEPA has approved the State's 303(d) list of impaired water bodies. Certain receiving waters in the Los Angeles and Ventura County watersheds do not fully support beneficial uses and therefore have been classified as impaired on the 2002 303(d) list and have been scheduled for TMDL development.

The Los Angeles River flows for 55 miles from the Santa Monica Mountains at the western end of the San Fernando Valley to the Pacific Ocean. The Los Angeles River drains an area of about 825 square miles. Approximately 324 square miles of the watershed are covered by forest or open space land. The rest of the watershed is highly developed. The river flows through industrial, residential, and commercial areas, including major refineries and petroleum products storage facilities, major freeways, rail lines, and rail yards serving the Ports of Los Angeles and Long Beach.

The majority of the Los Angeles River watershed is considered impaired due to a variety of point and nonpoint sources. The 2002 303(d) list includes total aluminum, dissolved cadmium, dissolved copper, dissolved zinc, high coliform count, pH, ammonia, nutrients (algae), odors, lead, coliform, trash, scum, oil, dichloroethylene, tetrachloroethylene, and trichloroethylene. High coliform count is a pollutant stressor for Bell Creek. The pollutant stressors listed for the Los Angeles River estuary include chlordane, DDT, lead, PCBs and zinc in sediment. The beneficial uses potentially threatened or impaired by degraded water quality are aquatic life, recreation, groundwater recharge, and municipal water supply.

Calleguas Creek Watershed and its major tributaries, Revlon Slough, Conejo Creek, Arroyo Conejo, Arroyo Santa Rosa, and Arroyo Simi drain an area of 343 square miles in southern Ventura and a small portion of western Los Angeles County. The northern boundary of the watershed is formed by the Santa Susana Mountains, South Mountain, and Oak Ridge; the southern boundary is formed by the Simi Hills and Santa Monica Mountains.

Urban developments within the watershed are generally restricted to the city limits of Simi Valley, Moorpark, Thousand Oaks, and Camarillo. Agricultural activities, primarily cultivation of orchards and row crops, are spread out along valleys and on the Oxnard Plain.

The Watershed Management Initiative characterizes the Calleguas Creek Watershed as a very impaired watershed. Calleguas Creek Reach 7 (the Arroyo Simi) is on the 2002 303 (d) list for ammonia, chloride, boron, sulfates, total dissolved solids, fecal coliform, organophosphorus pesticides, and sedimentation/siltation. The 2006 303(d) list includes the constituents listed on the 2002 303 (d) list except ammonia, organophosphorous pesticides and sedimentation/siltation. The beneficial uses potentially threatened or impaired by degraded water quality are wildlife habitat, and rare, threatened or endangered species habitat. The intermittent beneficial uses potentially impacted include industrial process supply, groundwater recharge, freshwater replenishment, contact and non-contact water recreation, and warm freshwater habitat.

F. Whole Effluent Toxicity

Whole Effluent Toxicity (WET) protects the receiving water quality from the aggregate toxic effect of a mixture of pollutants in the effluent. WET tests measure the degree of response of exposed aquatic test organisms to an effluent. The WET approach allows for protection of the narrative "no toxics in toxic amounts" criterion while implementing numeric criteria for toxicity. There are two types of WET tests: acute and chronic. An acute toxicity test is conducted over a short time period and

measures mortality. A chronic toxicity test is conducted over a longer period of time and measures mortality, reproduction, and growth.

The Basin Plan specifies a narrative objective for toxicity, requiring that all waters be maintained free of toxic substances in concentrations that are lethal to or produce other detrimental response on aquatic organisms. Detrimental response includes but is not limited to decreased growth rate, decreased reproductive success of resident or indicator species, and/or significant alterations in population, community ecology, or receiving water biota. The existing permit does not contain toxicity limitations or monitoring requirements.

In accordance with the Basin Plan, acute toxicity limitations dictate that the average survival in undiluted effluent for any three consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, with no single test having less than 70% survival. Consistent with Basin Plan requirements, this Order includes acute toxicity limitations.

In addition to the Basin Plan requirements, Section 4 of the SIP states that a chronic toxicity effluent limitation is required in permits for all discharges that will cause, have the reasonable potential to cause, or contribute to chronic toxicity in receiving waters.

The Discharger will be required to conduct chronic toxicity testing. The Order includes a chronic testing trigger hereby defined as an exceedance of 1.0 toxic units chronic (TUC) in a critical life stage test for 100% effluent. (The monthly median for chronic toxicity of 100% effluent shall not exceed 1.0 TUC in a critical life stage test.) If the chronic toxicity of the effluent exceeds 1.0 TUC, the Discharger will be required to immediately implement accelerated chronic toxicity testing according to Monitoring and Reporting Program, Item IV.D.1. If the results of two of the six accelerated tests exceed 1.0 TUC, the Discharger shall initiate a toxicity identification evaluation (TIE).

G. Specific Rationale for Each Numerical Effluent Limitation

Section 402(o) of the Clean Water Act and 40 CFR 122.44(l) require that effluent limitations standards or conditions in re-issued permits are at least as stringent as in the existing permit unless an antibacksliding exception applies. The Regional Board has determined that reasonable potential exists for all pollutants that are regulated under the current permit; therefore effluent limitations have been established for these pollutants. Furthermore, effluent limitations for several contaminants have been included based on BPJ with the CTR WQBELs or with effluent limits from the current Order.

In compliance with 40 CFR 122.45(f), mass-based limitations have also been established in the proposed Order for conventional and priority pollutants. The mass for both the maximum and the monthly or 30-day average limits and when appropriate the 7-day average effluent limits were calculated using the flow for the associated operation, which was provided by the Discharger.

When calculating the mass for discharges, the maximum permitted flow rate was used to calculate the daily maximum, the monthly average, or 7-day average mass. When calculating the appropriate mass for the discharge event or events evaluated the actual flow rate should be substituted in the following equation. The daily maximum flow will be used to calculate the daily maximum, the monthly average, 30-day average or 7-day average flows will be used to calculate the respective mass discharge limit.

Mass (lbs/day) = flow rate (MGD) X 8.34 X effluent limitation (mg/L):
where: mass = mass limit for a pollutant in lbs/day
effluent limitation = concentration limit for a pollutant, mg/L
flow rate = discharge flow rate in MGD

Order R4-2004-0111

Outfalls 001 and 002. RPAs were performed using CAPWTT for each of 126 priority pollutants for which effluent data were available. The input data for the RPAs were provided in the Self-Monitoring Reports submitted by the Discharger. One RPA was performed for discharges from Outfalls 001 and 002, which are composed of treated wastewater, water from the groundwater treatment systems, excess reclaimed water, water from the engine test stands, and storm water. Four analytes had reasonable potential to exceed WQBELs: copper, lead, mercury, and TCDD. Three of these analytes (copper, lead, and mercury) had effluent limitations in the previous order (Order No. 98-051).

The Discharger also submitted data for the receiving water associated with discharges from Outfalls 001 and 002. This data was collected using elevated detection limits and hence several other constituents had reasonable potential. The constituents are 2,4,6-trichlorophenol, 2,4-dinitrotoluene, alpha-BHC, bis(2-ethylhexyl)phthalate, N-nitrosodimethylamine and pentachlorophenol. Effluent limits for these constituents have also been included in this Order.

Since perchlorate has been detected above the Department of Health Services action level in storm water runoff from the facility and it has been detected in the influent to some of the groundwater treatment systems, BPJ has been used to establish reasonable potential for it to be present in discharges from the site via Outfalls 001 and 002. Consequently an effluent limit for perchlorate has been included in this Order for these discharges. Since perchlorate is typically not a naturally occurring pollutant and its presence in the receiving waters is the result of operations at the facility, the effluent limitation was developed based on anti-degradation grounds (State Board Res. No. 68-16 and 40 CFR § 131.12). The effluent limitation was therefore set at 6 µg/L, which would prevent the degradation of receiving waters and maintain and protect receiving water quality.

Several volatile organic compounds (VOCs) had effluent limits in Order No. 98-051 for discharges from Outfalls 001 and 002. The number of samples evaluated for each contaminant ranged from 19 to 60, and none of the contaminants were detected. The CTR based effluent limits for all of the VOCs except 1,1-dichloroethylene, were less stringent than the limits in Order No. 98-051. Since none of the contaminants were detected during numerous sampling events and the

limits in the tentative Order would be the same as those from the previous Order, the limits for these analytes were not included. The only VOC that has limits in the tentative Order is 1,1-dichloroethylene. The limit is included since the CTR based limit for this analyte is more stringent than the limit included in the previous Order.

As set forth above, Section 1.3 of the State Board's State Implementation Plan (SIP) establishes a stepwise procedure for determining which toxic pollutants require water quality-based effluent limitations in conformance with 40 C.F.R. § 122.44(d). This stepwise procedure for toxic pollutants is called a reasonable potential analysis. The SIP's reasonable potential analysis applies to water quality standards for priority pollutants, whether promulgated by USEPA or established as water quality objectives by the Regional Board. Steps 1 through 6 establish an analytical procedure for requiring water quality-based limitations based solely on discharge and ambient receiving water data. Except as noted in the preceding paragraph, reasonable potential for toxic pollutants regulated by this Order was determined using the analytical procedure in Steps 1 through 6 of SIP section 1.3 as explained above.

Step 7 of SIP Section 1.3 recognizes that in certain instances a rote, mathematical analysis of the data will not be sufficient to protect beneficial uses. Step 7 therefore reserves for the Regional Board the obligation to "review other available information to determine if a water quality-based effluent limitation is required, notwithstanding the above analysis in Steps 1 through 6, to protect beneficial uses." Among the factors the State Board identifies as relevant to the Step 7 analysis are: the facility type, discharge type, and potential toxic impact of the discharge. With respect to the Facility, the Regional Board finds sufficient, unusual circumstances to require a water quality-based effluent limitation for trichloroethylene (TCE). Data and testimony indicate that approximately 530,000 gallons of TCE were released to the soil and groundwater at the Facility. The tremendous volume of TCE released at the site warrants significant scrutiny. While recent monitoring data do not show TCE in surface water discharges, scouring from large storm events may release soils with adsorbed TCE. The large volumes of TCE in scoured soils may become chemically available in the surface water runoff and cause or contribute to an exceedance of the water quality standard. In addition, the existing monitoring data has been collected far downstream from on-site sources. The data may not reliably indicate the presence of TCE in waters of the United States because the turbid conditions may have volatilized the TCE before it reached existing monitoring points. Further, contamination is spotty and not completely characterized; pathways are not always predictable and are not fully characterized; and the site is in a hilly environment with uncertain pathways and seeps which could possibly lead to surfacing of water with contamination that cannot be predicted. Finally, TCE is a probable carcinogen that can cause skin rashes on contact, and when ingested has been associated with liver and kidney damage, impaired immune system function, and in large volumes unconsciousness, impaired heart function, or death. Considering the toxic nature of TCE and that past practices at the site released extraordinary volumes of TCE into the environment that can continue to leach into surface water through the scouring from storm events, and further considering that the existing monitoring data may not be representative of direct discharges to waters of the United States since the data were collected downstream of the initial discharge, the Regional Board has determined that a water quality-based effluent limitation for TCE is necessary to protect beneficial uses.

Outfalls 003 through 007. Discharges from Outfall 003 through 007 are storm water runoff only. Daily maximum and monthly average limits for storm water were included in Order No. 98-051. This Order does not include monthly average limits for priority pollutants in storm water only discharges since storm events are infrequent and often occur less than once per month during the rainy season. This change in the limits is consistent with permits adopted by the Regional Board for storm water discharges only.

The storm water only discharges from Discharge Outfalls 003 through 007 were also evaluated using CAPWTT (Attachment 2 of Order No. R4-2004-0111). The analytes with statistical reasonable potential are cadmium, copper, cyanide, mercury, and TCDD (Attachment 2 page 1). Cyanide was detected only once during the period evaluated at a concentration of 5.8 micrograms/liter. That detection triggered the reasonable potential since it exceeds that calculated average monthly effluent limit (AMEL). However, the discharges evaluated are storm water only discharges, which do not have monthly average limits. When the maximum effluent concentration (MEC) of 5.8 µg/L is compared to the maximum daily effluent limit (MDEL) the MEC is less than the MDEL. Consequently, this permit does not include an effluent limit for cyanide in the storm water only discharges. CTR-WQBELs for cadmium copper, mercury and TCDD have been included in this Order. The previous order included effluent limits for all of these analytes except TCDD. The effluent limits for the analytes with a positive RPA are the most stringent of the limit included in Order 98-051, and the applicable CTR criteria which include the freshwater aquatic life criteria, and the human health criteria for consumption of organisms only. The previous permit included limits for these analytes from Title 22, which are more stringent than the CTR limits. The compliance history reveals that the effluent limit for antimony (6 µg/L) was exceeded at Outfalls 005 and 007 in 1999 and the limit for thallium (2 µg/L) was exceeded at Outfall 005 on March 8, 2000. Therefore, limits for antimony and thallium were established using best professional judgement.

The monthly average effluent limit for mercury included in Order No. 98-051 (0.012 µg/L) was based on freshwater continuous criteria from 40 CFR 131.36. This limit is based on a fish consumption advisory, which appeared in the July 1, 1998 edition but was subsequently withdrawn. CTR included criteria for mercury, which was used to develop the WQBEL for mercury that is included in Order R4-2004-0111.

The CTR-WQBELs for cadmium in the tentative Order is greater than the limit stipulated in Order 98-051 (previous order). The daily maximum concentrations for cadmium from the previous order were taken directly from NTR and were expressed as dissolved criteria. The daily maximum limits for all metals included in this order were calculated based on criteria that appears in CTR when they were the most protective criteria available. The dissolved criteria were adjusted using conversion factors to total recoverable. Since the effluent limit for cadmium in the Order R4-2004-0111 is total cadmium it is slightly higher than the limit included in the Order 98-051.

The criteria stipulated for TDS, sulfate, chloride, and nitrogen also changed for storm water discharges to the Arroyo Simi, a tributary of Calleguas Creek. The criteria listed previously were the stipulated criteria for the Los Angeles River Watershed. The criteria stipulated for Calleguas Creek above Potrero Road are 850, 250, 150, 1.0, and 10 mg/L for TDS, sulfate, chloride, boron and nitrogen respectively.

Outfall 008. The area commonly referred to as Happy Valley receives storm water runoff from the former solid propellant testing area. Operations at the former solid propellant testing area ended in 1994. A major component of the propellant was perchlorate. Since the propellant has been used in the area and it has been detected in the storm water runoff at concentrations exceeding the Department of Health Services action level of 4 µg/L (which was changed to 6 µg/L on March 11, 2004), an effluent limit for perchlorate has been included in this Order. The effluent limitation for perchlorate is established based on antidegradation as explained for Outfalls 001 and 002. A requirement for sampling of the storm water runoff all other constituents tested for at Outfalls 003 through 007, has also been included in this Order. The new storm water monitoring location is Discharge Outfall 008. Storm water from Happy Valley flows to Dayton Canyon Creek. Dayton Canyon Creek merges with flows from Chatsworth Creek, which flows south to Bell Creek southwest of the intersection of Shoup Avenue and Sherman Way. Bell Creek subsequently flows east to the Los Angeles River.

This area has since undergone an interim measure cleanup, with final excavation occurring in September 2004, under the direction of DTSC.

Outfalls 009. The WS-13 Drainage area begins near the entrance to the property and traverses several potential areas of concern. The WS-13 drainage area collects storm water runoff from the Area 1 and Area 2 Landfills, and the former LOX plant located on NASA owned property. In addition, WS-13 picks up storm water run on from Sage Ranch where agricultural operations took place and a gun shooting range is located. Prior to Order R4-2004-0111, this drainage had only been sampled once. Additional data would provide information regarding the transport of contaminants in these areas offsite by storm water runoff. The WS-13 Drainage area will become Discharge Outfall 009; this outfall drains to Arroyo Simi.

Outfall 010. Building 203 was formally used as an instrumentation laboratory where various types of instrumentation were repaired and calibrated. The instrumentation included but was not limited to, thermometers and manometers that contained mercury. Currently the building houses operations related to laser research. Operations include polishing fibers, hand wipe solvent and chemical cleaning, assembly and test of various components in both open warehouse and clean room environments. All wastes are currently containerized and transported off site for disposal. An interim measures cleanup was completed in this area during the summer of 2004. With DTSC oversight, soil containing mercury and trichloroethylene was removed, hauled offsite and disposed of at a permitted disposal facility.

Outfall 011. The Perimeter Pond collects wastewater generated from Area 1. The discharges from groundwater treatment systems located in Area 1, discharges from Sewage Treatment Plant 1 and storm water runoff from the vicinity is discharged initially to R-1 Pond which flows to the Perimeter Pond. Discharges from the Perimeter Pond exit the site via Outfall 001. The Perimeter Pond is the final step in the storage of water. Consequently, this Order includes effluent limits and requirements for monitoring of the effluent from the pond for the priority pollutants and for other targeted chemicals of concern at the site.

Outfalls 012 – 014. The various test stands are used to test fire rocket engines built onsite. The fire suppression water used during testing may contain residual fuels and solvents. This wastewater is directed via lined and unlined channels to the reclamation ponds, which are used to store wastewater collected from the various onsite operations along with any storm water runoff for reuse onsite.

The Regional Board will have oversight of the discharges from the engine test stands. R4-2004-0111 included requirements for monitoring of the discharges. The data collected will be used to evaluate reasonable potential of the discharge to exceed applicable requirements and if warranted; effluent limits will be implemented for the discharges.

Outfalls 015 – 017. In July 2004 the two operational plants (STP-1 and STP-3) were activated sludge sewage treatment plants that provided secondary and tertiary treatment for the domestic sewage from the facility. The disinfected sewage effluent was subsequently directed to the reclaimed water system reservoir. The two plants which are currently being used as collection reservoirs only, previously had effluent limits for BOD₅20°C, coliform, and turbidity on discharges from the facilities. Sewage sludge was hauled offsite to the one of the facilities operated by Los Angeles County Sanitation Districts. The monitoring program for the sewage treatment plants included requirements for the previously mentioned constituents as well as pH, oil and grease and suspended solids. Order R4-2004-0111 included requirements to monitor for priority pollutants except asbestos, perchlorate, N-nitrosodimethylamine, 1,4-dioxane, and 1,2,3-trichloropropane to provide the data required to evaluate reasonable potential. If reasonable potential exists, effluent limits will be implemented.

Outfall 018. The R-2A and R-2B Ponds are used to collect wastewater from Areas II and III. R-2A Ponds collect wastewater from the Delta Groundwater Treatment System and storm water runoff from the location of the former Delta Test Stand. The R-2B Ponds receive overflow from the Silvernale Pond which includes discharges from the Bravo, Alpha and RD-9 Groundwater Treatment Systems and storm water runoff from the Alpha and Bravo Engine Test Stands. The R-2B Pond also receives wastewater discharges and storm water runoff from the STL-IV Test Stand area. The R-2 Spillway is an overflow area used to allow the wastewater from the two ponds to flow via a drainageway to Outfall 002. Wastewater released from the R-2 Spillway travels approximately 4,500 feet prior to reaching Outfall 002. Hence, this permit includes a monitoring requirement for discharges from the R-2 Spillway.

Data collected from August 20, 2004 (the effective date of Order R4-2004-0111) through May 5, 2005 was used to evaluate reasonable potential at the compliance points enumerated in that Order. This analysis has been completed to supplement the initial results presented in Order R4-2004-0111.

R4-2006-0008

Outfalls 001 002, 011, and 018 discharge wastewater and storm water runoff from SSFL to Bell Creek at the south. Outfalls 011, the Perimeter Pond, and 018, the R-2 Pond Spillway, are located directly upstream of Outfalls 001 and 002 respectively.

Discharges from Outfalls 011 and 018 receive no additional treatment prior to exiting Outfalls 001 and 002. However, storm water runoff traversing other RCRA areas of concern may pick up other contaminants and subsequently enter the streambed between the upstream outfalls (Outfalls 011 and 018) and the corresponding downstream outfalls (Outfalls 001 and 002). Since there was no additional treatment, the discharges from these outfalls were evaluated together.

The statistical analysis yielded reasonable potential for copper, lead, mercury, and TCDD. The data, site history, and other information available were incorporated into the BPJ analysis. This analysis supported the retention of effluent limits established at Outfalls 001 and 002 in Order No. R4-2004-0111 and it supported the inclusion of those effluent limits for discharges from Outfalls 011 and 018.

Outfalls 008, 009 and 010 are storm water only outfalls. Data collected at these locations since the adoption of Order No. R4-2004-011 indicated that the discharges from these locations are very similar to those from the other storm water only discharge locations. The statistical RPA of the data collected from all of the storm water locations resulted in Tier 1 RPA for copper, lead, mercury and TCDD. Since the discharges from Outfalls 008, 009 and 010 are very similar to those from Outfalls 003 through 007, BPJ was used to establish effluent limits for other priority pollutants and other chemicals of concern (i.e. perchlorate) at all of the storm water only outfalls.

Outfalls 012-014 (Rocket Engine Test Stands) Data collected at Outfall 012 resulted in Tier 1 reasonable potential using the method specified in the SIP for copper, lead, mercury, TCDD. Additional constituents including settleable solids, total suspended solids, 1,4-dioxane, total petroleum hydrocarbons, naphthalene, oil and grease, tertiary-butyl alcohol, and ethylene dibromide demonstrated RP utilizing the TSD method. RP was established for total dissolved solids and perchlorate based on BPJ. These constituents as well as other applicable Basin Plan constituents have been included in this addendum.

During the development and adoption of Order R4-2004-0111, Regional Board staff was informed that Boeing was not utilizing the three package type sewage treatment plants located onsite (STP1, STP2, STP-3), which are NPDES Outfalls 15-17. A rain event on January 11, 2005, resulted in the discharge of partially treated wastewater from Outfalls 015 and 017. The evaluation of the data collected resulted in Tier 1 reasonable potential for cadmium, chromium III, copper, mercury, nickel, TCDD. Other constituents of concern that demonstrate reasonable potential include MBAS, TSS, BOD, perchlorate, total coliform oil and grease, total residual chlorine, and nitrate as nitrogen. The BPJ analysis resulted in reasonable potential for total dissolved solids, chloride, sulfate, fluoride, nitrate + nitrite as nitrogen, and barium. Effluent limitations for these constituents were included in Order R4-2006-0008.

R4-2006-0036

Discharges from Outfalls 001, 002, 011 and 018 flow to Bell Creek a tributary of the LA River. The TMDL for metals in the Los Angeles River assigned WLAs to all point source discharges to LA River and all upstream reaches and tributaries to (including Bell Creek and tributaries to Bell Creek). Effluent limits for cadmium, copper, lead,

zinc, and selenium at the aforementioned outfalls were based on WLAs established by the TMDL or existing effluent limits, whichever were more protective. The LA River Nutrient TMDL requires WLAs for ammonia-N, nitrate-N, and nitrite-N, which are included for these outfalls.

Outfalls 003 through 010 are storm water only outfalls. Outfall 008 is the only storm water only compliance point that discharges to Dayton Canyon Creek which flows to Bell Creek, a tributary of the Los Angeles River. The storm water only discharges do not have statistical reasonable potential for zinc. However, discharges from Outfall 008 flow to the LA River, which has a TMDL that provides a WLA for zinc. That WLA will also be incorporated as an effluent limitation at Outfall 008 only. The LA River Nutrient TMDL requires WLAs for ammonia-N, nitrate-N, and nitrite-N, which are also included for this outfall.

Discharges from Outfalls 012 through 014 (rocket engine test stands) exit the site via tributaries to Bell Creek. The metals that have TMDL WLAs that do not have reasonable potential at these outfalls are cadmium, selenium and zinc. Effluent limits for these constituents are included based on the TMDL. The Los Angeles River Nutrient TMDL developed WLAs for ammonia-N, nitrate-N, and nitrite-N. Daily maximum effluent limitations for these constituent were also applicable and included for discharges from these locations. The LA River Nutrient TMDL requires WLAs for ammonia-N, nitrate-N, and nitrite-N.

Discharges from Outfalls 015 through 017 exited the site via tributaries to Bell Creek. The Metals TMDL resulted in new WLAs for lead and selenium and a wet weather discharge WLA for cadmium. The LA River Nutrient TMDL requires WLAs for ammonia-N, nitrate-N, and nitrite-N. TMDL based effluent limitations were included in the order for the noted metals and nutrients.

R4-2007-0055

On February 21, 2007, the discharger submitted a new ROWD that requested that outfalls 012, 013, and 014 be removed from the permit. Since discharges from the rocket engine test stands have terminated, wastewater will no longer be discharged. However, years of using the rocket engine test stands have resulted in contamination in the immediate vicinity of the test stands. RCRA investigations have resulted in the delineation of areas surrounding the test stands as RCRA Facility Investigation (RFI) sites. Chemicals of concern identified at these sites include TPH-gasoline, TPH-diesel, TPH-kerosene, oil and grease, trichloroethene and 1,2-dichloroethene. Since these contaminants are documented as present in these locations the discharger will be required to monitor during storm events for chemicals of concern. The effluent limits included in Orders R4-2006-0008 and R4-2006-0036 for the rocket engine test stands will be included as "benchmarks".

A "benchmark" is a water quality based effluent limit or a performance based limit that is used to evaluate the performance of BMPs with regard to the removal of contaminants present in the discharge. In this permit, the benchmarks are established based on water quality based effluent limits. Exceedance of a benchmark two times consecutively at the same location triggers an evaluation of the BMPs implemented at the site. The evaluation may determine that the BMPs

require augmentation, upgrading, or replacement. If so, the Discharger must develop a plan to implement the required upgrades and report to the Regional Board staff within 60 days of the second reported exceedance. The Discharger will continue monitoring as directed in the Monitoring and Reporting Program and the Basin Management Practices Compliance Plan.

The Topanga Fire occurred on September 28, 2005. The fire resulted in significant alterations to the site. Over 70 percent of the SSFL burned with significant areas denuded of vegetation, making much of the steep terrain highly erodible. The exposure of the surface soils with no vegetative cover to runoff has increased the potential for the transport of those surface soils and associated contaminants offsite as a result of the fire. All of the BMPs in place onsite were destroyed.

After the fire Boeing immediately began efforts to replace the BMPs that were destroyed. Many of the drainage areas were vacuumed to remove accumulated ash. The Discharger hydromulched in excess of 800 acres onsite and installed erosion control devices throughout much of the SSFL site prior to the January 19, 2006 Board Meeting. BMPs implemented prior to the fire were typical of those routinely used at construction sites to retard the transport of sediment (silt fences, plastic sheeting, etc). In most cases, the BMPs implemented after the fire were designed to slow flows (i.e. using underdrain systems) and to treat specific contaminant groups (i.e. metals) using bags filled with carbon or vermiculite.

During the Regional Board hearing on the 2005-07 Triennial Review of the Basin Plan, many stakeholders raised the issue of compliance with water quality standards and TMDLs during wet weather as a significant challenge and suggested that the formation of a Wet Weather Task Force to discuss and identify potential solutions to the challenges involved in complying with water quality standards during wet weather would be helpful. The Regional Board requested that staff convene a task force to identify project ideas that would address these wet weather concerns. The task force identified as a top priority a project to evaluate alternative design storm criteria. A design storm is a specific size storm event used to plan for and design storm water controls. Specifically, a design storm would assist in determining the scale and treatment capacity of controls such as BMPs. The Regional design storm issue arose again as a high priority for stakeholders as well as the Board at the hearing on the Los Angeles River Metals TMDL. During the TMDL hearing, the Executive Officer, Jonathan Bishop, committed Regional Board resources to fund an initial 2-year contract with Southern California Coastal Water Research Project (SCCWRP) to begin an evaluation of potential design storms that could be used by responsible agencies when implementing TMDLs.

Over the last two years, Regional Board staff has been working with SCCWRP, GeoSyntec, and a cross-section of stakeholders in the region known as the Design Storm Project Steering Committee on this project to evaluate potential design storms in terms of capturing storm water runoff, achieving water quality standards and implementability. A draft report is scheduled for circulation in early September 2007, which will summarize the results of the first two years of the project; discuss the complexities of establishing a regional design storm; and set forth recommendations for additional technical studies, sensitivity analysis and modeling.

Regional Board staff recognizes that while there are an infinite number of site specific considerations and permutations that could be considered in evaluating potential design storms (e.g. different land uses, different pollutants, different inter-event times, different levels of effluent quality, etc.), it was necessary to make many assumptions and generalizations during this initial evaluation of regional design storms.

Therefore, Regional Board staff anticipates that further work will be needed before proposing a regional design storm policy or any site-specific design storm in order to further explore these assumptions and generalizations; evaluate the efficacy of the design storm for different pollutants and land uses; refine the data used in modeling the water quality outcomes of potential design storms and consider policy with regard to incorporating design storms into permits. It is therefore premature to establish a regional design storm or site-specific design storm at this time prior to this additional technical work and prior to a full consideration of the policy considerations of adopting a regional design storm policy.

On February 23, 2007, Boeing submitted to the Regional Board a memo entitled Outfall BMP Capacity Evaluation – 1 year storm 1 hour time of concentration. The memo evaluated the capacity of onsite structural best management practices. The memo also documented discussions with Regional Board staff which introduced the possibility of the use of the design storm size used for the trash TMDL in the Los Angeles River. The site specific storm proposed by Boeing utilized the same approach as was utilized in the Los Angeles River Trash TMDL, with some modifications. Boeing's concluded that a storm that generated a flow of 2.3 inches depth could be considered the "site specific design storm" and it was used to design the structural BMPs.

On April 3, 2007, Boeing submitted to the Regional Board a letter entitled Boeing SSFL Best Management Practice Rainfall Capacity Submittal. The letter included a summary of the site specific storm analysis and an evaluation of the BMPs in place. The analysis of the BMPs in place concluded that BMPs at Outfalls 003 and 004 required upgrades to capture and treat the 2.3 inches of rainfall. All other storm water only outfalls had best management practices capable of treating the storm depth of 2.3 inches, except Outfalls 008 and 009. The Discharger proposed the implementation of natural BMPs to treat the 2.3 inches of rainfall at Outfalls 008 and 009. The Discharger indicated that the location, terrain, and size of these outfalls make the implementation of structural BMPs to treat that volume of water (2.3 inches) much more difficult at these locations. The modeling and the structural BMP upgrades required to treat the site specific storm have been implemented at Outfalls 003 through 007.

The assumptions and generalizations utilized to develop the site specific storm have not been enumerated by the Discharger. The Regional Board has not developed a regional design storm policy or a policy for the consideration and evaluation of site specific storms developed for individual discharges. Therefore, this permit does not implement the 2.3 inches as the upper bound of the runoff that the discharger must treat for compliance with the final effluent limitations. When the Regional Board Design Storm Project, and associated policy considerations, are further developed

along with an evaluation of acceptable assumptions and generalizations, the storm size developed by the Discharger may be considered by the Regional Board.

On May 24, 2007, Boeing submitted to the Regional Board the *Phase 2 Post-Fire Vegetation Recovery Assessment Report* prepared for Geosyntech Consultants by Western Botanical Services, Inc. The report assessed the status of and time to recovery of chaparral and scrub at the project site subsequent to the Topanga Fire which began on September 28, 2005. The executive summary of the report asserts that chaparral and scrub represent the dominant vegetation types at SSFL and that these plant communities represent an important natural vegetation-based means of erosion control at the site. It further states that the "perennial plant cover differed by significantly more than 30 percent between burned and unburned transects, total vegetative cover differed by significantly greater than 20 percent cover and ground cover differed by significantly more than 30 percent cover." The executive summary also states that the burned chaparral and scrub vegetation will likely recover to previous conditions within five to ten years.

The report also includes a section titled *Chaparral Recovery after Fire*. The section includes summaries of other studies completed on chaparral. Several studies (Guo 2001, Grace & Keeley 2006, Keeley & Keeley 1981, Horton & Kraebel 1955, Robi chaud et al 2000) concluded that the total vegetative cover is generally high in the first two years following a fire: reported values are from 11 to 85 percent. The report estimates that between March 26 and April 12, 2007, the mean total vegetative cover within the burned areas on the SSFL site is 46.6 percent.

Soil infiltration capacity is sometimes reduced after a fire. This reduction in soil infiltration capacity is due to an increase in soil water repellency (hydrophobicity) which is caused by waxy residues that are deposited on the soils during the burning of vegetation. On July 17, 2007, Boeing submitted the "Post Fire Soil Hydrophobicity and Recovery of Infiltration Capacity Report". The report documented an investigation of the pre-fire and post fire hydrophobicity conditions in four onsite target soil groups. The analysis was completed in April 2007. The conclusion suggests no statistical difference in the hydrophobicity of the soils between the burned and unburned tested areas onsite other than a portion of watershed 002 (west of Outfall 018). (Based on a confidence level of $\alpha=0.05$.) The report included the statement that case studies indicate that the recovery time ranged from one to three years. The study at SSFL was completed nineteen months after the fire which began on September 28, 2005.

Outfalls 015 through 017 will be deleted. The discharger currently trucks the wastewater offsite for disposal at one of the County Sanitation Districts of Los Angeles facilities and there are no plans to initiate discharges from the treatment plants in the future. Therefore, the updated ROWD included a request that Outfalls 015 through 017 be removed from the permit.

A reasonable potential analysis was completed for data collected through May 22, 2006. The analysis did not result in the inclusion of any new constituents with effluent limitations in this Order.

To prevent further degradation of the water quality of the Los Angeles River and Calleguas Creek and to protect their beneficial uses, mixing zones and dilution credits are not allowed in this Order. This determination is based on:

- Many of the beneficial uses stipulated are intermittent for Dayton Canyon Creek, Bell Creek and the Arroyo Simi. The discharges from SSFL in many cases provide a significant portion of the headwaters for these waterbodies. Since there is little assimilative capacity of the receiving water, a dilution factor is not appropriate and the final WQBEL should be a numeric objective applied end-of-pipe.
- The discharge may contain the 303(d) listed pollutants that are bioaccumulative such as metals. These pollutants, when exceeding water quality criteria within the mixing zone, can potentially result in tissue contamination of an organism directly or indirectly through contamination of bed sediments with subsequent incorporation into the food chain. The SIP, section 1.4.2.2.B. states that the "Regional Board shall deny or significantly limit a mixing zone and dilution credit as necessary to protect beneficial uses..." It continues that "such situations may exist based upon the quality of the discharge... or the overall discharge environment (including ... potential for bioaccumulation)."

For some pollutants, including aldrin, alpha-BHC, chlordane, DDT, dieldrin, heptachlor, heptachlor epoxide, several PAHs, PCBs, TCDD equivalents, and toxaphene the applicable water quality objectives are below the levels that current analytical techniques can measure. Reasonable potential analyses have been completed on each of these constituents and two of them had reasonable potential: alpha-BHC and TCDD equivalents. The MEC detected for TCDD exceeded the CTR criterion and the detection limits for alpha-BHC in the receiving water and the effluent exceeded the criterion.

VI. MODIFICATIONS ASSOCIATED WITH STATE BOARD ORDER WQ 2006-0012 AND WITH THE REVISED REPORT OF WASTE DISCHARGE SUBMITTED BY BOEING ON FEBRUARY 20, 2007

The State Board Order included the following provisions:

- Remanded the permit to the Regional Board to revise the provisions concerning Outfalls 001, 002, 011, and 018,
- Stayed the effluent limitations at Outfalls 011 and 018 pending a determination by the Regional Board deleting either Outfalls 011 and 018 or Outfalls 001 and 002,
- Directed the Regional Board to issue a Cease and Desist Order with the shortest possible compliance schedule and interim effluent limitations. The effective date of the CDO was to be January 19, 2006,
- Review the permit to ensure that numeric effluent limitations for different outfalls do not count the same violation twice in such a manner as to treat a single violation as multiple violations.
- In all other respects, the petitions were denied.

Orders R4-2006-0008 and R4-2006-0036 included numeric effluent limits for discharges from Outfalls 001, 002, 011, and 018. Outfall 018 is located upstream of Outfall 002 and Outfall 011 is upstream of Outfall 001. The same effluent limits were applicable to all four outfalls. The State Board Order concluded that Outfalls 001 and 002 were duplicative of Outfalls 011 and 018 and directed the Regional Board to retain only two of the four compliance points with numeric effluent limits. Since Outfalls 011 and 018 are closer to the developed portion of the site, this Order (Order R4-2007-0055) retains the numeric effluent limits. Outfall 011 will transport effluent from the groundwater treatment unit and storm water runoff. Therefore, the effluent limits at Outfall 011 will include daily maximum and monthly average concentrations. Outfall 018 will transport storm water runoff from the site, therefore this location will be regulated with daily maximum limitations only since storm water only discharges from this region typically have daily maximum effluent limitations only for the priority pollutants.

Outfalls 001 and 002 will have monitoring requirements with benchmarks and a requirement for the Discharger to implement BMPs that will be upgraded based on the monitoring data relative to the benchmark. The benchmarks for Outfall 001 will include daily maximum and monthly average limits since the discharge from Outfall 011 and Outfall 001 will include treated groundwater from Outfall 019 and storm water runoff. Since the discharge at Outfall 001 will be composed of both storm water runoff and treated groundwater both the daily maximum and monthly average benchmarks are applicable. The benchmarks for Outfall 002 are the daily maximum effluent limits stipulated for Outfalls 011 and 018, since Outfall 002 will transport storm water runoff only.

The State Board Order concluded that the discharge from Outfall 018 was duplicative of the discharge from Outfall 002 and that the discharge from Outfall 011 was duplicative of the Outfall 001. Discharges from Outfalls 018 only occur during storm events. Outfall 018 is located in the same subwatershed with several solid waste management units (SWMU). Flow leaving the R-2 Pond travels 4,500 feet prior to reaching Outfall 002. Prior to the discharge reaching Outfall 002 storm water from STL-IV and from various regions of the buffer zone will also enter the drainage. Storm water from the buffer zone will provide dilution for the contaminants in the discharge. However, storm water from STL-IV may contain elevated levels of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, chromium, copper, lead, and zinc, all chemicals of concern associated with this SWMU. Therefore, discharges from Outfall 018 may pick up additional contaminants from storm water runoff traversing contaminated areas at STL-IV and entering the drainage prior to the water exiting Outfall 002.

Discharges from Outfall 011, Perimeter Pond, travel along the southeastern edge of Area 1 Burn Pit (A1BP) prior to entering the buffer zone. A partial list of the chemicals of concern in soil associated with the A1BP include perchlorate, dioxins, metals (including cadmium, chromium, selenium, copper, mercury, boron, etc.) total petroleum hydrocarbons, and pentachlorophenol. Downstream in the buffer zone discharges from the Perimeter Pond also join with storm water runoff from the southeastern portion of the COCA area of concern (AOC) and the Component Test Laboratory V (CTL V) AOC. Additional runoff from the buffer zone is added to the drainage prior to the flow reaching Outfall 001. Discharges from Outfall 011 may pick up additional contaminants from storm water runoff from the COCA and CTL V AOCs prior to being discharged offsite at Outfall 001.

Outfalls 001 and 002, are downstream from Outfalls 011 and 018. Outfall 001 includes storm water runoff from the southern portion of STL IV and the buffer zone south of Outfall 018. Outfall 002 includes storm water runoff from CTL V the COCA area, A1BP and the buffer zone south of Outfall 011. The discharger will be required to continue to monitor at Outfalls 001 and 002 while implementing BMPs to ensure that contaminants associated with site activities are not transported offsite by storm water runoff.

Based on the State Board Order, a Cease and Desist Order will also be developed to address new effluent limits included in Order R4-2006-0008.

VII. SPECIFIC RATIONALES FOR EACH OF THE NUMERICAL EFFLUENT LIMITATIONS

- A. The following table presents the effluent limitations and the specific rationales for pollutants that are expected to be present in the discharge from Outfalls 011, 018 and 019. The daily maximum effluent limitations are applicable for discharges of storm water runoff from Outfall 018. The daily maximum and monthly average effluent limitations are applicable for discharges from Outfalls 011 and 019(the groundwater treatment unit).

These effluent limitations will also be used as benchmarks when evaluating the performance of BMPs implemented at Outfalls 001 (daily maximum and monthly average) and Outfall 002 (daily maximum discharge limitations only).

Constituents	Units	Discharge Limitations		Rationale¹
		Monthly Average	Daily Maximum	
pH	pH Units	---	6.5-8.5	Basin Plan
Temperature	°F	---	86	BPJ/Thermal Plan
Total suspended solids	mg/L	15	45	BPJ-Previous Order
BOD ₅ 20°C	mg/L	20	30	BPJ - Previous Order
Oil and grease	mg/L	10	15	BPJ - Previous Order
Settleable solids	ml/L	0.1	0.3	BPJ - Previous Order
Total residual chlorine	mg/L	----	0.1	Basin Plan
Total dissolved solids	mg/L	----	950	Basin Plan
Chloride	mg/L	----	150	Basin Plan
Sulfate	mg/L	----	300	Basin Plan
Barium	mg/L	----	1.0	BPJ-Previous Order
Iron	mg/L	----	0.3	BPJ-Previous Order
Fluoride	mg/L	----	1.6	Basin Plan
Detergents (as MBAS)	mg/L	----	0.5	Basin Plan
Nitrate + Nitrate-N	mg/L	----	8.0	Basin Plan
Ammonia-N	mg/L	1.96©	10.1®	LA River Nutrients TMDL
Nitrate-N	mg/L	----	8.0	LA River Nutrients TMDL

¹ The rationale includes plans, policies, regulations, and other sources of effluent limitations. Basin Plan is Water Quality Control Plan Los Angeles Region, BPJ is Best Professional Judgement, TMDL is Total Maximum Daily Load, CTR is California Toxics Rule (40 CFR Part 131).

Constituents	Units	Discharge Limitations		Rationale¹
		Monthly Average	Daily Maximum	
Nitrite-N	mg/L	----	1.0	LA River Nutrients TMDL
Manganese	µg/L	----	50	BPJ-Previous Order
Cyanide	µg/L	4.3	8.5	CTR
Antimony	µg/L	----	6.0	Basin Plan-Title 22
Arsenic	µg/L	----	10	USEPA MCL
Beryllium	µg/L	----	4.0	Basin Plan-Title 22
Cadmium	µg/L	2.0	4.0/3.1* ^β	CTR/TLA River Metals TMDL
Chromium (VI)	µg/L	8.1	16.3	CTR
Copper	µg/L	7.1	14.0	CTR
Lead	µg/L	2.6	5.2	CTR
Mercury	µg/L	0.05	0.1	CTR
Nickel	µg/L	35	96	CTR
Selenium	µg/L	4.1	8.2/5* ^β	CTR/LA River Metals TMDL
Silver	µg/L	2.0	4.1	CTR
Thallium	µg/L	----	2.0	Basin Plan
Zinc	µg/L	53.6	119	CTR
1,1-Dichloroethylene	µg/L	3.2	6.0	CTR/BPJ-Title 22
Trichloroethylene	µg/L	----	5.0	BPJ/Basin Plan-Title 22
Perchlorate	µg/L	----	6.0	BPJ/DHS Action Level
2,4,6-Trichlorophenol	µg/L	6.5	13.0	CTR
2,4-Dinitrotoluene	µg/L	9.1	18.3	CTR
Alpha-BHC	µg/L	0.01	0.03	CTR
Bis(2-ethylhexyl)phthalate	µg/L	----	4.0	Basin Plan/Title 22
N-Nitrosodimethylamine	µg/L	8.1	16.3	CTR
Pentachlorophenol	µg/L	8.2	16.5	CTR
TCDD	µg/L	1.4E-08	2.8E-08	CTR
Radioactivity				
Gross Alpha	pCi/L	----	15	BPJ/Basin Plan
Gross Beta	pCi/L	----	50	BPJ/Basin Plan
Combined Radium-226 & Radium-228	pCi/L	----	5	BPJ/Basin Plan
Tritium	pCi/L	----	20,000	BPJ/Basin Plan
Strontium-90	pCi/L	----	8	BPJ/Basin Plan

* Effluent limit applies only during wet weather discharges.

^β This effluent limit shall be deemed vacated at such time as Regional Board Resolutions R05-006 and R05-007 are vacated in compliance with a writ of mandate in the matter of Cities of Bellflower et al v. State Water Resources Control Board et al, Los Angeles Superior Court # BS101732. The Regional Board shall provide notice to the discharger of any such action.

Effluent limit applies only during dry weather discharges.

© Thirty day average at pH = 7.9 and 20°C, when hourly samples are collected and composited or only one grab sample is collected.

® One hour average WLA at 7.9 pH and 20°C, applies if hourly samples are taken throughout the storm and each is analyzed. No single sample may exceed the 10.1 mg/L limit.

- B. Following are the effluent limitations and the specific rationales for pollutants discharged from Outfalls 003 through 010. The effluent limits are effective on the effective date of the permit for Outfalls 003 through 007 and 010. Discharges from Outfalls 008 and 009 must demonstrate compliance with the effluent limits after September 28, 2008.

The effluent limits also serve as benchmarks effective from the effective date of the permit through September 28, 2008, for Outfalls 008 and 009.

Constituents	Units	Discharge Limitations		Rationale
		Monthly Average	Daily Maximum	
pH	pH Units	----	6.5-8.5	Basin Plan
Oil and grease	mg/L	----	15	BPJ
Chloride	mg/L	----	150	Basin Plan
Sulfate	mg/L	----	250 ^{2a}	Basin Plan
Sulfate	mg/L	----	300 ^{2b}	Basin Plan
Boron ¹	mg/L	----	1.0	Basin Plan
Fluoride	mg/L	----	1.6	Basin Plan
Nitrate + Nitrate-N	mg/L	----	10.0 ^{2a}	Basin Plan
Nitrate + Nitrate-N	mg/L	----	8 ^{2b}	Basin Plan
Total dissolved solids	mg/L	----	850 ^{2a}	Basin Plan
Total dissolved solids	mg/L	----	950 ^{2b}	Basin Plan
Ammonia-N ^(Outfall 008 only)	mg/L	----	10.1®	LA River Nutrients TMDL
Nitrate-N ^(Outfall 008 only)	mg/L	----	8.0	LA River Nutrients TMDL
Nitrite-N ^(Outfall 008 only)	mg/L	----	1.0	LA River Nutrients TMDL
Selenium ^(Outfall 008 only)	µg/L	----	5 ^{#B}	LA River Metals TMDL
Zinc ^(Outfall 008 only)	µg/L	----	159* ^B	LA River Metals TMDL
Antimony	µg/L	----	6.0	Basin Plan/Title 22
Cadmium	µg/L	----	4.0/3.1* ^B	CTR/LA River Metals TMDL
Copper	µg/L	----	14.0	CTR
Mercury	µg/L	----	0.13	Calleguas Creek Metals TMDL
Nickel	µg/L	----	100	Calleguas Creek Metals TMDL/Basin Plan (Title 22)
Thallium	µg/L	----	2.0	Basin Plan
Lead	µg/L	----	5.2	CTR
TCDD	µg/L	----	2.8E-08	CTR
Perchlorate	µg/L	----	6.0	BPJ/ DHS Notification Level
Radioactivity				
Gross Alpha	pci/L	----	15	Basin Plan/Title 22
Gross Beta	pci/L	----	50	Basin Plan/Title 22
Combined Radium-226 & Radium-228	pci/L	----	5	Basin Plan/Title 22
Tritium	pci/L	----	20,000	Basin Plan/Title 22

¹ Limit is for discharges for Outfalls 003 through 007, 009, and 010 which flows to Calleguas Creek. It is not applicable to discharges from Outfall 008 to Dayton Canyon Creek.

^{2a} This limit is for discharges which flow to Calleguas Creek from Outfalls 003 through 007, 009, and 010.

Constituents	Units	Discharge Limitations		Rationale
		Monthly Average	Daily Maximum	
Strontium-90	pci/L	----	8	Basin Plan/Title 22

C. Following are the benchmarks and the specific rationales for pollutants discharged in storm water runoff from Outfalls 012 through 014.

Constituents	Units	Discharge Limitations		Rationale
		Monthly Average	Daily Maximum	
pH	pH Units	----	6.5-8.5	Basin Plan
Oil and grease	mg/L	----	15	BPJ
Chloride	mg/L	----	150	Basin Plan
Sulfate	mg/L	----	300	Basin Plan
Fluoride	mg/L	----	1.6	Basin Plan
Nitrate + Nitrate-N	mg/L	----	8	Basin Plan
Total dissolved solids	mg/L	----	950	Basin Plan
Settleable solids	ml/L	----	0.3	Basin Plan
Total suspended solids	mg/L	----	45	BPJ
Ammonia-N	mg/L	----	10.1®	LA River Nitrogen TMDL
Nitrate-N	mg/L	----	8.0	LA River Nitrogen TMDL
Nitrite-N	mg/L	----	1.0	LA River Nitrogen TMDL
Cadmium	µg/L	----	3.1* ^β	LA River Metals TMDL
Selenium	µg/L	----	5* ^β	LA River Metals TMDL
Zinc	µg/L	----	159* ^β	LA River Metals TMDL
Copper	µg/L	----	13.5	CTR
Mercury	µg/L	----	0.10	CTR
Lead	µg/L	----	5.2	CTR
TCDD	µg/L	----	2.8E-08	CTR
Naphthalene	µg/L	----	21	BPJ
Total Petroleum Hydrocarbons	µg/L	----	100	BPJ
Ethylene dibromide	µg/L	----	50	BPJ
Tertiary butyl alcohol	µg/L	----	12	BPJ
1,4-dioxane	µg/L	----	3	BPJ
Perchlorate	µg/L	----	6.0	BPJ/ DHS Notification Level

VIII. Receiving Water Limitations

- A. The discharge shall not cause the concentration of constituents in Arroyo Simi, a tributary of Calleguas Creek, in excess of the following limits.

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>	<u>Rationale</u>
Chlorpyrifos	µg/L	--	0.02 ¹	Toxicity TMDL
Diazinon	µg/L	--	0.16 ¹	Toxicity TMDL
Chlordane	µg/L	--	0.001	OC Pest & PCBs TMDL
4,4-DDD	µg/L	--	0.0014	OC Pest & PCBs TMDL
4,4-DDE	µg/L	--	0.001	OC Pest & PCBs TMDL
4,4-DDT	µg/L	--	0.001	OC Pest & PCBs TMDL
Dieldrin	µg/L	--	0.0002	OC Pest & PCBs TMDL
PCBs	µg/L	--	0.0003	OC Pest & PCBs TMDL
Toxaphene	µg/L	--	0.0003	OC Pest & PCBs TMDL

¹ Limit effective March 24, 2008, through June 10, 2009. The TMDL specifies interim limits which are effective from March 24, 2006, through March 23, 2008.

- B. Interim effluent limitations effective for Arroyo Simi from the effective date of the permit through March 23, 2008. The final effluent limitations in Table A for these constituents are effective from March 24, 2008, through the term of the permit.

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>	<u>Rationale</u>
Chlorpyrifos	µg/L	--	0.74	Toxicity TMDL
Diazinon	µg/L	--	0.91	Toxicity TMDL

IX. Receiving Water Sediment Effluent Limitations

- A. Final Ambient WLAs for Pollutants in Sediment for Storm Water Dischargers

The following are the final ambient WLAs for storm water permittees that were established in the Calleguas Creek OC Pesticides & PCBs TMDL. They are measured as in-stream annual averages at the base of each subwatershed where the discharges are located.

The final WLAs must be achieved and become sediment limits after the sampling indicates that the Discharger is able to comply with the final WLAs or at the end of the 20-year compliance schedule specified in the TMDL (March 24, 2026), which ever occurs first. In either event, the permit will be reopened at that time to include appropriate sediment limits.

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>	<u>Rationale</u>
Chlordane	µg/g	--	0.0033	OC Pest & PCBs TMDL
4,4-DDD	µg/g	--	0.002	OC Pest & PCBs TMDL
4,4-DDE	µg/g	--	0.0014	OC Pest & PCBs TMDL
4,4-DDT	µg/g	--	0.0003	OC Pest & PCBs TMDL
Dieldrin	µg/g	--	0.0002	OC Pest & PCBs TMDL
PCBs	µg/g	--	0.12	OC Pest & PCBs TMDL
Toxaphene	µg/g	--	0.0006	OC Pest & PCBs TMDL

B. Interim Ambient WLAs for Pollutants in Sediment for Storm Water Dischargers

The following sediment interim WLAs are effective from November 23, 2007, through June 10, 2009. If the permit is administratively extended, these WLAs will continue to be in effect up to November 23, 2012 (five years from the effective date of this permit).

<u>Constituents</u>	<u>Units</u>	<u>Discharge</u> <u>Monthly Average</u>	<u>Limitations</u> <u>Daily Maximum</u>	<u>Rationale</u>
Chlordane	µg/g	--	0.0033	OC Pest & PCBs TMDL
4,4-DDD	µg/g	--	0.014	OC Pest & PCBs TMDL
4,4-DDE	µg/g	--	0.17	OC Pest & PCBs TMDL
4,4-DDT	µg/g	--	0.025	OC Pest & PCBs TMDL
Dieldrin	µg/g	--	0.0011	OC Pest & PCBs TMDL
PCBs	µg/g	--	25.7	OC Pest & PCBs TMDL
Toxaphene	µg/g	--	0.23	OC Pest & PCBs TMDL

X. Monitoring Requirements

A. Effluent Monitoring

To assess the impact of the discharge to the beneficial uses of the receiving waters, the Discharger is required to monitor the conventional and priority pollutants and other identified parameters.

B. Storm Water Monitoring and Reporting

Storm water runoff discharges from the SSFL are subject to requirements stipulated in this NPDES permit and the Discharger is required to comply with all applicable provisions of the Storm Water Pollution Prevention Plan (Attachment A of the Order). This plan includes requirements to develop, implement, and when appropriate update a Storm Water Pollution Prevention Plan (SWPPP) along with Best Management Practices (BMPs) with the goal of preventing all pollutants from contacting storm water and with the intent of keeping all contaminants of concern from moving into receiving waters. The BMPs are designed to treat flows generated by storm water runoff from a storm depth up to 2.3 inches to meet the final effluent limits.

C. Receiving Water Monitoring and Reporting

The Calleguas Creek Toxicity TMDL and the Calleguas Creek OC Pesticides & PCBs TMDL include receiving water concentrations that are to be accomplished utilizing BMPs. The OC Pesticides & PCBs TMDL includes sediment contaminant concentrations for tributaries of Calleguas Creek as well. This permit includes monitoring requirements to demonstrate compliance with the stipulated effluent limits.

A requirement has also been included to require priority pollutant monitoring in the Arroyo Simi and in Bell Creek once during the five year permit term.

D. Sediment Monitoring and Reporting

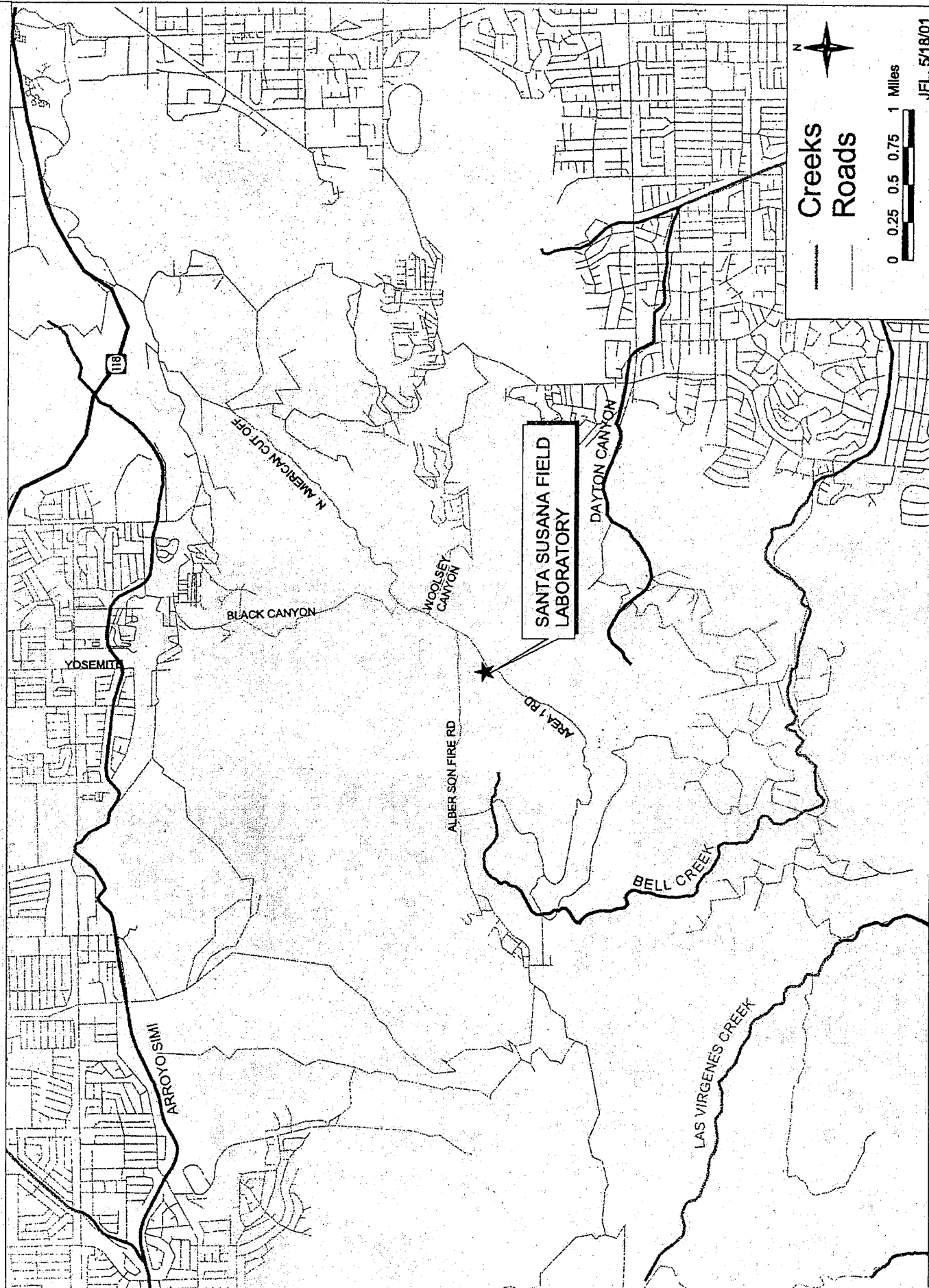
The Calleguas Creek OC Pesticides & PCBs TMDL includes waste load allocations and a requirement for monitoring of the sediment. The TMDL stipulates that compliance with the sediment based WLAs is measured as an in-stream annual average at the base of each subwatershed where the discharges are located.

E. Bioassessment Monitoring

The goals of the bioassessment monitoring for the Arroyo Simi and Los Angeles River are to:

- Determine compliance with receiving water limits;
- Monitor trends in surface water quality;
- Ensure protection of beneficial uses;
- Provide data for modeling contaminants of concern;
- Characterize water quality including seasonal variation of surface waters within the watershed;
- Assess the health of the biological community; and
- Determine mixing dynamics of effluent and receiving waters in the estuary.

SANTA SUSANA FIELD LABORATORY AND VICINTY - FIGURE 1



**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION**

MONITORING AND REPORTING PROGRAM NO. 6027

**for
THE BOEING COMPANY
SANTA SUSANA FIELD LABORATORY
(CA0001309)**

I. Reporting Requirements

- A. The Boeing Company (Discharger) shall implement this monitoring program on the effective date of this Order. All monitoring reports shall be submitted quarterly and must be received by the Regional Board by the dates in the following schedule. All monitoring reports should be addressed to the Regional Board, Attention: Information Technology Unit. The first monitoring report under this Program is due by February 15, 2007.

<u>Reporting Period</u>	<u>Report Due</u>
January – March	May 15
April – June	August 15
July – September	November 15
October – December	February 15

- B. If there is no discharge during any reporting period, the report shall so state. The Discharger shall submit an annual summary report (for both dry and wet weather discharges), containing a discussion of the previous year's effluent and receiving water monitoring data, as well as graphical and tabular summaries of the data. The data shall be submitted to the Regional Board on hard copy and CD or electronically. Submitted data must be IBM compatible, preferably using EXCEL software. This annual report is to be received by the Regional Board by March 1 of each year following the calendar year of data collection.
- C. Each monitoring report shall contain a separate section titled "Summary of Non-Compliance" which discusses the compliance record and corrective actions taken or planned that may be needed to bring the discharge into full compliance with waste discharge requirements. This section shall clearly list all non-compliance with waste discharge requirements, as well as all excursions of effluent limitations.
- D. Each quarterly report shall contain a separate section titled "Reasonable Potential Analysis" which discusses whether or not reasonable potential was triggered for

pollutants which do not have a final effluent limitation in the NPDES permit. This section shall contain the following statement, "The analytical results for this

sampling period did/did not trigger reasonable potential." If reasonable potential was triggered, then the following information should be provided:

- a. A list of the pollutant(s) that triggered reasonable potential;
 - b. The Basin Plan or CTR criteria that was exceeded for each given pollutant;
 - c. The concentration of the pollutant(s);
 - d. The test method used to analyze the sample; and
 - e. The data and time of sample collection.
- E. The Discharger shall inform the Regional Board well in advance of any proposed construction activity that could potentially affect compliance with applicable requirements.
- F. Any mitigation/remedial activity including any pre-discharge treatment conducted at the site must be reported in the quarterly monitoring report.
- G. Database Management System – The Regional Board is developing a compliance monitoring database management system that may require the Discharger to submit the monitoring and annual reports electronically when it becomes fully operational.

II. Effluent Monitoring Requirements

- A. Sampling station(s) shall be established for the point of discharge and shall be located where representative samples of that effluent can be obtained. Provisions shall be made to enable visual inspection of the discharge. All visual observations shall be included in the monitoring report.
- B. This Regional Board shall be notified in writing of any change in the sampling stations once established, or in the methods for determining the quantities of pollutants in the individual waste streams.
- C. Pollutants shall be analyzed using the methods described in 40 CFR 136.3, 136.4, and 136.5 (revised March 12, 2007); or where no methods are specified for a given pollutant, methods approved by Regional Board or State Board. Laboratories analyzing monitoring samples shall be certified by the California Department of Health Services and must include quality assurance/quality control (QA/QC) data with their report. For the purpose of monitoring pH, dissolved oxygen, residual chlorine, and temperature, tests may be conducted at the field sampling location provided that all requirements of the approved analytical methods for NPDES use in 40 CFR 136 are met.

The monitoring report shall specify the USEPA analytical method used, the Method Detection Limit (MDL) and the Minimum Level (ML) for each pollutant. For the purpose of reporting compliance with numerical limitations, performance goals, and receiving water limitations, analytical data shall be reported by one of the following methods, as appropriate:

1. An actual numerical value for sample results greater than, or equal to, the ML; or,
2. "Detected, but Not Quantified (DNQ)" if results are greater than or equal to the laboratory's MDL but less than the ML; or,
3. "Not-Detected (ND)" for sample results less than the laboratory's MDL with MDL indicated for the analytical method used.

Current MLs (Attachment T-A) are those published by the State Water Resources Control Board (State Board) in the *Policy for the Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (SIP), March 2, 2000.

- D. Where possible, the MLs employed for effluent analyses shall be lower than the permit limits established for a given parameter. If the ML value is not below the effluent limitation, then the lowest ML value and its associated analytical method shall be selected for compliance purposes. At least once a year (in the annual report), the Discharger shall submit a list of the analytical methods employed for each test and associated laboratory quality assurance/quality control (QA/QC) procedures.

The Regional Board, in consultation with the State Board Quality Assurance Program, shall establish a ML that is not contained in Attachment T-A to be included in the Discharger's permit in any of the following situations:

1. When the pollutant under consideration is not included in Attachment T-A;
2. When the Discharger and Regional Board agree to include in the permit a test method that is more sensitive than those specified in 40 CFR 136 (revised May 14, 1999);
3. When the Discharger agrees to use an ML that is lower than that listed in Attachment T-A;
4. When a Discharger demonstrates that the calibration standard matrix is sufficiently different from that used to establish the ML in Attachment T-A and proposes an appropriate ML for their matrix; or,

5. When the Discharger uses a method whose quantification practices are not consistent with the definition of an ML. Examples of such methods are the USEPA-approved Method 1613 for dioxins and furans, Method 1624 for volatile organic substances, and Method 1625 for semi-volatile organic substances. In such cases, the Discharger, the Regional Board, and the State Board shall agree on a lowest quantifiable limit, and that limit will substitute for the ML for reporting and compliance determination purposes.
- E. Laboratory analyses – all chemical, bacteriological, and toxicity analyses shall be conducted at a laboratory certified for such analyses by the California Department of Health Services Environmental Laboratory Accreditation Program (ELAP). A copy of the laboratory certification shall be submitted with the Annual Report.
- F. Water/wastewater samples must be analyzed within allowable holding time limits as specified in 40 CFR section 136.3. All QA/QC samples must be run as specified by the EPA methodology and the results must be reported in the Regional Board format if available, and submitted with the laboratory reports.
- G. All analyses shall be accompanied by the chain of custody, including but not limited to data and time of sampling, sample identification, and name of person who performed sampling, date of analysis, name of person who performed analysis, QA/QC data, method detection limits, analytical methods, copy of laboratory certification, and a perjury statement executed by the person responsible for the laboratory.
- H. Quarterly effluent analyses are typically performed during the months of February, May, August and November. Annual effluent analyses shall be performed during the month of February. Due to the intermittent nature and unpredictable frequency of discharges from SSFL, periodic sampling should be conducted during the first opportunity presented during the prescribed monitoring period.
- J. In coordination with interested stakeholders in the Calleguas Creek Watershed and within the Los Angeles River Watershed, the Discharger shall conduct instream bioassessment monitoring once a year, during the spring/summer period (unless an alternate sampling period is approved by the Executive Officer). Over time, bioassessment monitoring will provide a measure of the physical condition of the waterbody and the integrity of its biological communities.
 1. The bioassessment program shall include an analysis of the community structure of the in stream macroinvertebrate assemblages and physical habitat assessment at the monitoring stations RSW-001U and RSW-002D.

This program shall be implemented by appropriately trained staff. Alternatively, a professional subcontractor qualified to conduct bioassessments may be selected to perform the bioassessment work for the Discharger. Analyses of the results of the bioassessment monitoring program, along with photographs of the monitoring site locations taken during sample collection, shall be submitted in the corresponding annual report. If another stakeholder, or interested party in the watershed subcontracts a qualified professional to conduct bioassessment monitoring during the same season and at the same location as specified in the MRP, then the Discharger may, in lieu of duplicative sampling, submit the data, a report interpreting the data, photographs of the site, and related QA/QC documentation in the corresponding annual report.

2. The Discharger must provide a copy of their Standard Operation Procedures (SOPs) for the Bioassessment Monitoring Program to the Regional Board upon request. The document must contain step-by-step field, laboratory and data entry procedures, as well as, related QA/QC procedures. The SOP must also include specific information about each bioassessment program including: assessment program description, its organization and the responsibilities of all its personnel; assessment project description and objectives; qualifications of all personnel; and the type of training each member has received.
3. Field sampling must conform to the SOP established for the California Stream Bioassessment Procedure (CSBP) or more recently established sampling protocols, such as used by the Surface Water Ambient Monitoring Program (SWAMP). Field crews shall be trained on aspects of the protocol and appropriate safety issues. All field data and sample Chain of Custody (COC) forms must be examined for completion and gross errors. Field inspections shall be planned with random visits and shall be performed by the Discharger or an independent auditor. These visits shall report on all aspects of the field procedure with corrective action occurring immediately.
4. A taxonomic identification laboratory shall process the biological samples that usually consist of subsampling organisms, enumerating and identifying taxonomic groups and entering the information into an electronic format. The Regional Board may require QA/QC documents from the taxonomic laboratories and examine their records regularly. Intra-laboratory QA/QC for subsampling, taxonomic validation and corrective actions shall be conducted and documented. Biological laboratories shall also maintain reference collections, vouchered specimens (the Discharger may request the return of their sample voucher collections) and remnant collections. The laboratory should participate in an (external) laboratory taxonomic validation program at

a recommended level of 10% or 20%. External QA/QC may be arranged through the California Department of Fish and Game's Aquatic Bioassessment Laboratory located in Rancho Cordova, California:

5. The Executive Officer of the Regional Water Board may modify the Monitoring and Reporting Program to accommodate the watershed-wide monitoring.

- I. For parameters that both monthly average and daily maximum limits are specified and the monitoring frequency is less than four times a month, the following shall apply. If an analytical result is greater than the monthly average limit, the sampling frequency shall be increased (within one week of receiving the test results) to a minimum of once weekly at equal intervals, until at least four consecutive weekly samples have been obtained, and compliance with the monthly average limit has been demonstrated.

III. Effluent Monitoring Program

- A. The rainfall in inches is recorded at the time the sample is collected. Daily rainfall measurements in inches per day are recorded and reported.
- B. The following shall constitute the effluent monitoring program for the final effluent at Discharge Nos. 001, 002, 011, 018, and 019.

Constituent	Units	Type of Sample	Minimum Frequency of Analysis¹
Total waste flow	gal/day	----	once per discharge event
Temperature	°F	grab	once per discharge event
pH	pH Units	grab	once per discharge event
Rainfall	Inches	continuous	continuous
Hardness as CaCO ₃	mg/L	grab	annually
Conductivity at 25°C	µmhos/cm	grab	once per discharge event
Total suspended solids	mg/L	grab	once per discharge event
Settleable solids	ml/L	grab	once per discharge event
BOD ₅ (20°C)	mg/L	grab	once per discharge event
Oil and grease	mg/L	grab	once per discharge event
Ammonia-N	mg/L	grab	once per discharge event
Turbidity	NTU	grab	once per discharge event
Total residual chlorine	mg/L	grab	annually
Total organic carbon	mg/L	grab	annually
Total dissolved solids	mg/L	grab	once per discharge event
Chloride	mg/L	grab	once per discharge event
Sulfate	mg/L	grab	once per discharge event
Detergents (as MBAS)	mg/L	grab	once per discharge event
Nitrate + Nitrate-N	mg/L	grab	once per discharge event
Ammonia-N	mg/L	grab	once per discharge event [©]
Nitrate-N	mg/L	grab	once per discharge event
Nitrite-N	mg/L	grab	once per discharge event
Cyanide ²	µg/L	grab	once per discharge event
Copper ²	µg/L	grab	once per discharge event
Lead ²	µg/L	grab	once per discharge event
Mercury ²	µg/L	grab	once per discharge event
1,1-Dichloroethylene	µg/L	grab	once per discharge event

¹ During wet weather flow, a discharge event is greater than 0.1 inch of rainfall in a 24-hour period. No more than one sample per week need be obtained during extended periods of rainfall and a storm must be preceded by at least 72 hours of dry weather. Sampling shall be during the first hour of discharge or at the first safe opportunity. The reason for delay shall be included in the report. If the rain event is not sufficient to produce flow from the area, the observation must be documented with date, time condition and rainfall amount. During dry weather flow, whenever Outfalls 001, 002, 011, 018, or 019 is discharging, minimum sampling frequency during operations generating discharges shall be once per month. © The thirty day average at pH = 7.9 and 20°C, when hourly samples are collected and composited or only one grab sample is collected. The one hour average WLA at 7.9 pH and 20°C, applies if hourly samples are taken throughout the storm and each is analyzed. No single sample may exceed the 10.1 mg/L limit. Analysis for the temperature and pH of the receiving water at the same time as the discharge would provide data for a site-specific determination of the ammonia limit using Attachment H to the WDR. Shall there be no receiving water present, the pH and temperature of the effluent at the monitoring location shall be determined and reported.

Constituent	Units	Type of Sample	Minimum Frequency of Analysis¹
Perchlorate	µg/L	grab	once per discharge event
2,4,6-Trichlorophenol	µg/L	grab	once per discharge event
2,4-Dinitrotoluene	µg/L	grab	once per discharge event
Alpha-BHC	µg/L	grab	once per discharge event
Bis(2-ethylhexyl)phthalate	µg/L	grab	once per discharge event
N-Nitrosodimethylamine	µg/L	grab	once per discharge event
Pentachlorophenol	µg/L	grab	once per discharge event
Trichloroethylene	µg/L	grab	once per discharge event
TCDD*	µg/L	grab	once per discharge event
Volatile organic compounds	µg/L	grab	once per discharge event**
Boron	mg/L	grab	annually ⁶
Fluoride	mg/L	grab	annually ⁶
Barium	mg/L	grab	annually ⁶
Iron	mg/L	grab	annually ⁶
Manganese ²	µg/L	grab	annually ⁶
Antimony ²	µg/L	grab	annually ⁶
Arsenic ²	µg/L	grab	annually ⁶
Beryllium ²	µg/L	grab	annually ⁶
Cadmium ²	µg/L	grab	once per discharge event
Chromium (VI) ^{2,3}	µg/L	grab	annually ⁶
Nickel ²	µg/L	grab	annually ⁶
Selenium ²	µg/L	grab	once per discharge event
Silver ²	µg/L	grab	annually ⁶
Thallium ²	µg/L	grab	annually ⁶
Zinc ²	µg/L	grab	once per discharge event
Cobalt	µg/L	grab	annually
Vanadium	µg/L	grab	annually

* Analysis must be completed for TCDD and all congeners. After four consecutive samples are reported as nondetect the sampling frequency may be decreased to quarterly. If detected subsequently, the frequency reverts back to once per discharge event.

** Analyses must include benzene, carbon tetrachloride, chloroform, 1,1-dichloroethane, 1,2-dichloroethane, ethylbenzene, tetrachloroethylene, toluene, xylenes, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichlorofluoromethane, and vinyl chloride. Analyses shall be performed once per discharge event for two years, if all results are nondetect the frequency of monitoring is decreased to quarterly.

² Total recoverable results are required.

³ The Discharger has the option to meet the hexavalent chromium limitations with a total chromium analysis. However, if the total chromium level exceeds the hexavalent chromium limitation, it will be considered a violation unless an analysis has been made for hexavalent chromium in replicate sample and the result is reported within the hexavalent chromium limits.

Constituent	Units	Type of Sample	Minimum Frequency of Analysis¹
Radioactivity-			
Gross Alpha	pCi/L	grab	once per discharge event
Gross Beta ⁴	pCi/L	grab	once per discharge event
Combined Radium 226 & Radium 228 ⁵	pCi/L	grab	once per discharge event
Tritium ⁴	pCi/L	grab	once per discharge event
Strontium-90 ⁴	pCi/L	grab	once per discharge event
H-3 (Radioactive Hydrogen) (Tritium)	pCi/L	grab	once per discharge event
K-40 (Potassium-40)	pCi/L	grab	once per discharge event
Cs-137	pCi/L	grab	once per discharge event
Uranium	pCi/L	grab	once per discharge event
PCBs	µg/L	grab	annually
TPH ¹⁰	µg/L	grab	annually
Monomethylhydrazine	µg/L	grab	annually
cis-1,2-Dichloroethene	µg/L	grab	annually
1,4-Dioxane	µg/L	grab	annually
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	grab	quarterly
1,2-Dichloro-1,1,2-trifluoroethane	µg/L	grab	annually
Cyclohexane	µg/L	grab	annually
Remaining USEPA priority pollutants excluding asbestos ¹¹	µg/L	grab	annually ⁶
Acute toxicity	% survival	grab	annually
Chronic toxicity	TU _c	grab	First and second rain events of each year

⁴ Analyze these radiochemicals by the following USEPA testing methods: method 900.0 for gross alpha and gross beta, method 903.0 or 903.1 for radium-226, method 904.0 for radium-228, method 906.0 for tritium, method 908.0 for uranium, method 901.0 or 901.1 for Cesium, and method 905.0 for strontium-90.

⁵ Gross alpha and gross beta analysis must be performed. Gross alpha analysis must be <15 pCi/L. If gross alpha is >15 pCi/L, uranium analysis must be performed and must be less than 30 µg/L (20 pCi/L). Radium-228 analysis must be performed, and combined Radium-226 and Ra-228 activity must be < 5pCi/L. Radium 226 analysis can be performed, or if gross alpha is <5 pCi/L, one can assume Ra-226 activity = gross alpha activity for purposes of meeting the 5 pCi/L limit.

Gross Beta, H-3, K-40, and Sr-90 analyses must be performed. The gross beta limit is 15 pCi/L, after subtraction of K-40 activity. The K-40 is assumed to be all natural. H-3 limit is 20,000 pCi/L, and the Sr-90 limit is 8 pCi/L. If gross beta >15 pCi/L (after subtracting K-40 activity) gamma isotopic analysis must be performed for Cs-137 (the most likely emitter associated with the site). The sum of the fractions technique must be used to demonstrate that the gamma emitters don't exceed 4 mrem/year (200 pCi/L for Cs 137). The sum of the fractions must include H-3 and Sr-90. If the limit is exceeded, which is an annual average, the frequency of the sampling is increased to once per discharge event until the annual average is below the specified limit. If the analyses of these constituents demonstrates exceedances, of the annual average effluent limitations (determined at each sampling point) the monitoring frequency is increased to once per discharge until four consecutive analyses demonstrates compliance with the effluent limitations.

- C. The following shall constitute the storm water monitoring program for Outfalls 003, through 010.

Constituent	Units	Type of Sample	Minimum Frequency of Analysis¹
Rainfall	inches	continuous	continuous
pH	pH Units	grab	once per discharge event
Oil and grease	mg/L	grab	once per discharge event
Total dissolved solids	mg/L	grab	once per discharge event
Chloride	mg/L	grab	once per discharge event
Sulfate	mg/L	grab	once per discharge event
Nitrate + Nitrate-N	mg/L	grab	once per discharge event
Ammonia-N ^(Outfall 008 only)	mg/L	grab	once per discharge event ⁶
Nitrate-N ^(Outfall 008 only)	mg/L	grab	once per discharge event
Nitrite-N ^(Outfall 008 only)	mg/L	grab	once per discharge event
Total suspended solids	mg/L	grab	annually
Boron ²	mg/L	grab	annually ⁶
Fluoride	mg/L	grab	annually
Iron	mg/L	grab	annually
Antimony ²	µg/L	grab	once per discharge event
Cadmium ²	µg/L	grab	once per discharge event
Copper ²	µg/L	grab	once per discharge event
Lead ²	µg/L	grab	once per discharge event
Mercury ²	µg/L	grab	once per discharge event
Thallium	µg/L	grab	once per discharge event
Selenium ^(Outfall 008 only)	µg/L	grab	once per discharge event
Zinc ^(Outfall 008 only)	µg/L	grab	once per discharge event
Vanadium ²	µg/L	grab	annually
Aluminum ²	µg/L	grab	annually
TCDD ⁹	µg/L	grab	once per discharge event
Perchlorate	µg/L	grab	once per discharge event ⁷
Remaining USEPA priority pollutants excluding asbestos ¹¹	µg/L	grab	annually ⁶
Chlorpyrifos	µg/L	grab	annually ⁶
Diazinon	µg/L	grab	annually ⁶
Radioactivity ⁵			
Gross Alpha	pCi/L	grab	once per discharge event
Gross Beta	pCi/L	grab	once per discharge event

⁷ Monitor once per discharge at Happy Valley (Outfall 008). Monitor semiannually at all other storm water only outfalls. If the results are nondetect for two years the Discharger may submit a request for the monitoring frequency to be decreased to annually with Executive Officer approval.

Constituent	Units	Type of Sample	Minimum Frequency of Analysis¹
Combined Radium 226 & Radium 228 ⁴	pCi/L	grab	once per discharge event
Tritium ⁴	pCi/L	grab	once per discharge event
Strontium-90 ⁴	pCi/L	grab	once per discharge event
H-3 (Radioactive Hydrogen)	pCi/L	grab	once per discharge event
K-40 (Potassium-40)	pCi/L	grab	once per discharge event
Cs-137	pCi/L	grab	once per discharge event
Uranium	pCi/L	grab	once per discharge event
Hardness as CaCO ₃	mg/L	grab	annually
Acute toxicity	% survival	grab	annually
Chronic toxicity	TU _c	grab	First and second rain events of each year

- D. The following shall constitute the effluent monitoring program from Outfalls 012 through 014 during engine test operations.

Constituent	Units	Type of Sample	Minimum Frequency of Analysis¹
Rainfall	inches	continuous	continuous
Hardness as CaCO ₃	mg/L	grab	annually
pH	pH units	grab	once per discharge event ¹²
Temperature	°F	grab	once per discharge event ¹²
Suspended solids	mg/L	grab	once per discharge event ¹²
BOD ₅ 20°C	mg/L	grab	once per discharge event ¹²
Settleable solids	mg/L	grab	once per discharge event ¹²
Oil and grease	mg/L	grab	once per discharge event ¹²
Ammonia-N	mg/L	grab	once per discharge event ¹²
Nitrate-N	mg/L	grab	once per discharge event ¹²
Nitrite-N	mg/L	grab	once per discharge event ¹²
Turbidity	NTU	grab	once per discharge event ¹²
Total dissolved solids	mg/L	grab	once per discharge event ¹²

Constituent	Units	Type of Sample	Minimum Frequency of Analysis¹
Total petroleum hydrocarbons ¹⁰	µg/L	grab	once per discharge event ¹²
Perchlorate	µg/L	grab	once per discharge event ¹²
N-Nitrosodimethylamine	µg/L	grab	once per discharge event ¹²
1,4-Dioxane	µg/L	grab	once per discharge event ¹²
1,2,3-Trichloropropane	µg/L	grab	once per discharge event ¹²
Ethylene dibromide	µg/L	grab	once per discharge event ¹²
Methyl tertiary butyl ether (MTBE)	µg/L	grab	once per discharge event ¹²
Naphthalene	µg/L	grab	once per discharge event ¹²
Di-isopropyl Ether (DIPE)	µg/L	grab	once per discharge event ¹²
Tertiary Butyl Alcohol (TBA)	µg/L	grab	once per discharge event ¹²
Monomethyl hydrazine**	µg/L	grab	once per discharge event ¹²
Chloride	µg/L	grab	once per discharge event ¹²
Boron	µg/L	grab	once per discharge event ¹²
Sulfate	µg/L	grab	once per discharge event ¹²
Fluoride	µg/L	grab	once per discharge event ¹²
Nitrate + Nitrite-N	µg/L	grab	once per discharge event ¹²
Copper ²	µg/L	grab	once per discharge event ¹²
Lead ²	µg/L	grab	once per discharge event ¹²
Mercury ²	µg/L	grab	once per discharge event ¹²
Cadmium	µg/L	grab	once per discharge event ¹²
Selenium	µg/L	grab	once per discharge event ¹²
Zinc	µg/L	grab	once per discharge event ¹²
TCDD ⁹	µg/L	grab	once per discharge event ¹²
Acute toxicity	% survival	grab	annually
Remaining USEPA priority pollutants excluding asbestos ¹¹	µg/L	grab	annually

¹⁰ Total petroleum hydrocarbons includes all fuels, gasoline, diesel and jet fuel. Analysis should be completed using EPA 8015 (modified) methods.

¹¹ Analysis shall include xylenes and trichlorofluoromethane. Analysis at Outfalls 008 and 009 shall include asbestos.

** This analysis is completed only for discharges from APTF.

¹² Monitoring shall occur once per discharge event for a minimum of eight discharge events or for each discharge event that occurs from December 20, 2007, through June 10, 2009. If the concentrations of the detected analytes do not exceed water quality based effluent limits established at downstream outfalls, the monitoring frequency may be decreased to annually.

IV. Toxicity Monitoring Requirements

A. Acute Toxicity Monitoring Program

1. The Discharger shall conduct acute toxicity tests on effluent grab samples by methods specified in 40 CFR Part 136 which cites USEPA's *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms*, Fifth Edition, October 2002 (EPA/821-R-012) or a more recent edition to ensure compliance in 100 % effluent.
2. The fathead minnow, *Pimephales promelas*, shall be used as the test species for fresh water discharges and the topsmelt, *Atherinops affinis*, shall be used as the test species for brackish effluent. The method for topsmelt is found in USEPA's *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition, October 2002 (EPA/821-R-02-013).
3. In lieu of conducting the standard acute toxicity testing with the fathead minnow, the Discharger may elect to report the results or endpoint from the first 48 hours of the chronic toxicity test as the results of the acute toxicity test.

B. Chronic Toxicity Effluent Monitoring Program

1. The Discharger shall conduct critical life stage chronic toxicity tests on effluent samples (24-hour composite) or receiving water samples in accordance with EPA's Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition, October 2002 (EPA/821-R-02-013) or EPA's Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, Third Edition, October 2002, (EPA/821-R-02-014).
2. Effluent samples shall be collected after all treatment processes and before discharge to the receiving water.
3. Test Species and Methods:
 - a. The Discharger shall conduct tests as follows: with a vertebrate, an invertebrate, and an alga for the first three suites of tests. After the screening period, monitoring shall be conducted using the most sensitive species.

- b. Re-screening is required every 15 months. The Discharger shall re-screen with the three species listed above and continue to monitor with the most sensitive species. If the first suite of re-screening tests demonstrates that the same species is the most sensitive than the re-screening does not need to include more than one suite of tests. If a different species is the most sensitive or if there is ambiguity then the Discharger shall proceed with suites of screening tests for a minimum of three, but not to exceed five suites.
- c. The presence of chronic toxicity shall be estimated as specified using West Coast marine organisms according to EPA's Short-Term Methods for Estimating Chronic Toxicity of Effluent and Receiving Waters to Freshwater Organisms, Fourth Edition, October 2002 (EPA/821-R-02-013).

C. Quality Assurance

1. Concurrent testing with a reference toxicant shall be conducted. Reference toxicant tests shall be conducted using the same test conditions as the effluent toxicity tests (e.g., same test duration, etc).
2. If either the reference toxicant test or effluent test does not meet all test acceptability criteria (TAC) as specified in the test methods manuals (EPA/600/4-91/002 and EPA/821-R-02-013), then the Discharger must re-sample and re-test within 14 days of notification by the laboratory of an invalid test.
3. Control and dilution water shall be receiving water or laboratory water as described in the manual. If the dilution water used is different from the culture water, a second control using culture water shall be used.

D. Accelerated Monitoring

1. If toxicity exceeds the limitations (as defined in Order No. R4-2007-0055, Section I.D.4.a.1. and 1.D.4.b.1), then the Discharger shall immediately implement accelerated testing, as specified at Section I.D.4.a.2 and 1.D.4.b.2. The discharger shall ensure that they receive results of a failing toxicity test within 24 hours of the completion of the test and the additional tests shall begin within 3 business days of receipt of the results or at the first opportunity of discharge. If the accelerated testing shows consistent toxicity, the discharger shall immediately implement the Initial Investigation of the TRE Workplan.

2. If implementation of the initial investigation TRE workplan indicates the source of toxicity (e.g., a temporary plant upset, etc.), then the Discharger may discontinue the TIE.
3. The first step in the initial Investigation TRE Workplan for downstream receiving water toxicity can be a toxicity test protocol designed to determine if the effluent causes or contributes to the measured downstream chronic toxicity. If this first step TRE testing shows that the outfall effluent does not cause or contribute to downstream chronic toxicity, using EPA's Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition, October 2002(EPA/821-R-02-013). Then a report on this testing shall be submitted to the Board and the TRE will be considered to be completed. Routine testing in accordance with MRP No. 6027 shall be continued thereafter.

E. Steps in Toxicity Reduction Evaluation (TRE) and Toxicity Identification Evaluation (TIE)

1. Following a TRE trigger, the Discharger shall initiate a TRE in accordance with the facility's initial investigation TRE workplan. At a minimum, the Discharger shall use EPA manuals EPA/600/2-88/070 (industrial) or EPA/833B-99/002 (municipal) as guidance. The Discharger shall expeditiously develop a more detailed TRE workplan for submittal to the Executive Officer within 30 days of the trigger, which will include, but not be limited to:
 - a. Further actions to investigate and identify the cause of toxicity;
 - b. Actions the Discharger will take to mitigate the impact of the discharge and prevent the recurrence of toxicity;
 - c. Standards the Discharger will apply to consider the TRE complete and to return to normal sampling frequency; and,
 - d. A schedule for these actions
2. The following is a stepwise approach in conducting the TRE:
 - a. Step 1 - Basic data collection. Data collected for the accelerated monitoring requirements may be used to conduct the TRE;

- b. Step 2 - Evaluates optimization of the treatment system operation, facility housekeeping, and the selection and use of in-plant process chemicals;
- c. If Steps 1 and 2 are unsuccessful, Step 3 implements a Toxicity Identification Evaluation (TIE) and employment of all reasonable efforts and using currently available TIE methodologies. The objective of the TIE is to identify the substance or combination of substances causing the observed toxicity;
- d. Assuming successful identification or characterization of the toxicant(s), Step 4 evaluates final effluent treatment options;
- e. Step 5 evaluates in-plant treatment options; and,
- f. Step 6 consists of confirmation once a toxicity control method has been implemented.

Many recommended TRE elements parallel source control, pollution prevention, and storm water control program best management practices (BMPs). To prevent duplication of efforts, evidence of implementation of these control measures may be sufficient to comply with TRE requirements. By requiring the first steps of a TRE to be accelerated testing and review of the facility's TRE workplan, a TRE may be ended in its early stages. All reasonable steps shall be taken to reduce toxicity to the required level. The TRE may be ended at any stage if monitoring indicates there is no longer toxicity (or six consecutive chronic toxicity results are less than or equal to 1.0 TU_c).

- 3. The Discharger may initiate a TIE as part of the TRE process to identify the cause(s) of toxicity. The Discharger shall use the EPA acute and chronic manuals, EPA/600/6-91/005F (Phase I)/EPA/600/R-96-054 (for marine), EPA/600/R-92/080 (Phase II), and EPA-600/R-92/081 (Phase III) as guidance.
- 4. If a TRE/TIE is initiated prior to completion of the accelerated testing schedule required by Part I.C.4.a.2 and Part I.C.4.b.2 of this permit, then the accelerated testing schedule may be terminated, or used as necessary in performing the TRE/TIE, as determined by the Executive Officer.
- 5. Toxicity tests conducted as part of a TRE/TIE may also be used for compliance, if appropriate.

6. The Board recognizes that toxicity may be episodic and identification of causes of and reduction of sources of toxicity may not be successful in all cases. Consideration of enforcement action by the Board will be based in part on the Discharger's actions and efforts to identify and control or reduce sources of consistent toxicity.

F. Reporting

1. The Discharger shall submit a full report of the toxicity test results, including any accelerated testing conducted during the month as required by this permit. Test results shall be reported in Toxicity Units (percent survival or TU_c) with the discharge monitoring reports (DMR) for the month in which the test is conducted.

If an initial investigation indicates the source of toxicity and accelerated testing is unnecessary, pursuant to Section IV.C.1., those results shall also be submitted with the DMR for the period in which the investigation occurred.
2. The full report shall be submitted on or before the end of the month in which the DMR is submitted.
3. The full report shall consist of (1) the results; (2) the dates of sample collection, initiation, and completion of each toxicity tests; (3) the acute toxicity limit or chronic toxicity limit or trigger as described in Order No. R4-2004-0111 sections I.C.4.a.1. and I.C.4.b.1; and (4) printout of the ToxCalc or CETIS program results.
4. Test results for toxicity tests also shall be reported according to the appropriate manual chapter on Report Preparation and shall be attached to the DMR. Routine reporting shall include, at a minimum, as applicable, for each test:
 5. sample date(s);
 6. test initiation date;
 7. test species;
 8. end point values for each dilution (e.g., number of young, growth rate, percent survival);
 9. NOEC value(s) in percent effluent;

10. IC_{15} , IC_{25} , IC_{40} and IC_{50} values in percent effluent;
11. TU_c values $\left(TU_c = \frac{100}{NOEC}\right)$;
12. Mean percent mortality ($\pm$ standard deviation) after 96 hours in 100% effluent (if applicable);
13. NOEC and LOEC values for reference toxicant test(s);
14. IC_{25} value for reference toxicant test(s);
15. Any applicable control charts; and
16. Available water quality measurements for each test (e.g., pH, D.O., temperature, conductivity, hardness, salinity, ammonia).
17. The Discharger shall provide a compliance summary, which includes a summary table of toxicity data from at least eleven of the most recent samples.

The Discharger shall notify, by telephone or electronically, this Regional Board of any toxicity exceedance of the limit or trigger within 24 hours of receipt of the results followed by a written report within 14 calendar days of receipt of the results. The verbal or electronic notification shall include the exceedance and the plan the Discharger will pursue. The written report shall describe actions the Discharger has taken or will take to investigate and correct the cause(s) of toxicity. It may also include a status report on any actions required by the permit, with a schedule for actions not yet completed. If no actions have been taken, the reasons shall be given.

V. Receiving Water Monitoring Requirements

- A. Receiving Water Monitoring for TMDL based effluent limitations established for Calleguas Creek and its tributaries and for priority pollutants in both Arroyo Simi and Bell Creek. Monitoring will occur in Arroyo Simi in the area where storm water runoff discharges enters the receiving water and where storm water discharges enter Bell Creek (downstream of the SSFL facility).

Constituent	Units	Type of Sample	Minimum Frequency of Analysis
Water velocity	Ft/second	recorder ⁸	quarterly ^{1,2}
Hardness as CaCO ₃	mg/L	grab	quarterly ^{1,2}
pH	pH units	grab	quarterly ^{1,2}
Temperature	°F	grab	quarterly ^{1,2}
Chlorpyrifos	µg/L	grab	quarterly ^{1,2}
Diazinon	µg/L	grab	quarterly ^{1,2}
Chlordane	µg/L	grab	quarterly ^{1,2}
4,4-DDD	µg/L	grab	quarterly ^{1,2}
4,4-DDE	µg/L	grab	quarterly ^{1,2}
4,4-DDT	µg/L	grab	quarterly ^{1,2}
Dieldrin	µg/L	grab	quarterly ^{1,2}
PCBs	µg/L	grab	quarterly ^{1,2}
Toxaphene	µg/L	grab	quarterly ^{1,2}
Priority pollutants	µg/L	grab	once every five years ^{2,3}

¹ Samples collected quarterly. Compliance is determined by comparing the final concentration to the limits listed in Finding I.C.1. and I.C.2. of Order R4-2007-0055. The final concentration is the average of the samples collected over one year.

² Sampling should occur where discharges from SSFL enter Arroyo Simi.

³ Sampling should occur where discharges from SSFL enter Bell Creek.

B. The receiving water monitoring program shall include periodic surveys of receiving water and shall include studies of those physical-chemical characteristics of the receiving water that may be impacted by the discharge.

1. Receiving Water Observations. General observations of the receiving water shall be made at each discharge point on a monthly basis and shall be reported in the quarterly monitoring report. If no discharge occurred during the observation period, this shall be reported.

Observations shall be descriptive where applicable, such that colors, approximate amounts, or types of materials that are apparent. The following observations shall be made where appropriate:

⁸ The Discharger will use the flow of the process water used for quenching with the time of the test to calculate the total volume of water used.

⁹ All seventeen congeners of TCDD must be analyzed as stipulated in State Implementation Policy. After four consecutive samples are reported as nondetect the sampling frequency may be decreased to quarterly. If detected subsequently, the frequency reverts back to once per discharge event.

- a. Tidal stage, time, and date of monitoring
- b. Weather conditions
- c. Color of water
- d. Appearance of oil films or grease, or floatable materials
- e. Extent of visible turbidity or color patches
- f. Direction of tidal flow
- g. Description of odor, if any, of the receiving water
- h. Presence and activity of California Least Tern and California Brown Pelican.

VI. Sediment Sampling

The Calleguas Creek OC Pesticides and PCBs TMDL includes requirements for the concentrations of several pesticides and PCBs in sediment. Therefore this permit includes requirements to monitor sediment for these constituents. The Discharger may choose to join the Calleguas Creek Watershed TMDL Monitoring Program (CCWTMP) and collect the required sediment samples along with a host of other stakeholders in the watershed. This facility is located in Arroyo Simi and the Compliance Sampling Site locations stipulated in the TMDL documentation are Arroyo Simi East of Hitch Boulevard (07_HITCH) or Simi Valley Water Quality Control Plant (07D_SIMI). As an alternative the Discharger may choose to collect the sediment samples at the base of the subwatershed where the discharge occurs. The exact location of the sampling point must be stipulated in the initial self-monitoring report.

The in-stream sediment sampling shall be conducted according to methods developed by the USGS and outlined in *Guidelines for Collecting and Processing Samples of Stream Bed Sediment for Analysis of Trace Elements and Organic Contaminants for the National Water Quality Assessment Program* (1994). A brief description of the protocol also appears in the *Draft Calleguas Creek Watershed Management Plan Quality Assurance Project Plan (QAPP) Monitoring and Reporting Program Plan for Nitrogen, OC and PCBs, and Toxicity Total Maximum Daily Loads* dated September 26, 2006, beginning on page 38. Discussions include field measurements and observations, sample handling and custody, sample handling and shipping, and analytical methods.

Constituent	Units	Type of Sample	Minimum Frequency of Analysis
Sediment toxicity (chronic 10-day eohaustorius estuarius toxicity)	NA	grab	annually
48-hour Bivalve Embryo toxicity (Mytilus edulis or Crassostrea gigas)	NA	grab	annually
Total ammonia	mg/wet kg	grab	annually
% Moisture	%	grab	annually
Particle Size Distribution	um	grab	annually

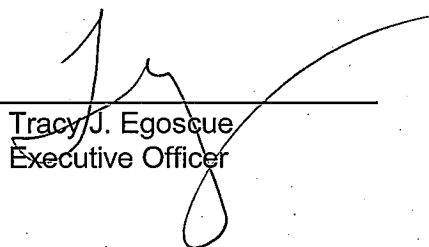
<u>Constituent</u>	<u>Units</u>	<u>Type of Sample</u>	<u>Minimum Frequency of Analysis</u>
Total Organic Carbon	% dry weight	grab	annually
Water velocity	ft/sec	grab	annually
pH	pH Units	grab	annually
Temperature	°C	grab	annually
Dissolved Oxygen	mg/L	grab	annually
Conductivity	umhos/cm	grab	annually
Chlordane	ng/g	grab	annually
4,4-DDD	ng/g	grab	annually
4,4-DDE	ng/g	grab	annually
4,4-DDT	ng/g	grab	annually
Dieldrin	ng/g	grab	annually
PCBs	ng/g	grab	annually
Toxaphene	ng/g	grab	annually

VIII. Bioassessment Monitoring

The goals of the bioassessment monitoring for the Arroyo Simi and Los Angeles River are to:

- Determine compliance with receiving water limits;
- Monitor trends in surface water quality;
- Ensure protection of beneficial uses;
- Provide data for modeling contaminants of concern;
- Characterize water quality including seasonal variation of surface waters within the watershed;
- Assess the health of the biological community; and
- Determine mixing dynamics of effluent and receiving waters in the estuary.

Ordered by:


Tracy J. Egoscue
Executive Officer

Date: November 1, 2007

/CDO

SWRCB Minimum Levels in ppb ($\mu\text{g/L}$)

The Minimum Levels (MLs) in this appendix are for use in reporting and compliance determination purposes in accordance with section 2.4 of the State Implementation Policy. These MLs were derived from data for priority pollutants provided by State certified analytical laboratories in 1997 and 1998. These MLs shall be used until new values are adopted by the SWRCB and become effective. The following tables (Tables 2a - 2d) present MLs for four major chemical groupings: volatile substances, semi-volatile substances, inorganics, and pesticides and PCBs.

Table 2a - VOLATILE SUBSTANCES*	GC	GCMS
1,1 Dichloroethane	0.5	1
1,1 Dichloroethylene	0.5	2
1,1,1 Trichloroethane	0.5	2
1,1,2 Trichloroethane	0.5	2
1,1,2,2 Tetrachloroethane	0.5	1
1,2 Dichlorobenzene (volatile)	0.5	2
1,2 Dichloroethane	0.5	2
1,2 Dichloropropane	0.5	1
1,3 Dichlorobenzene (volatile)	0.5	2
1,3 Dichloropropene (volatile)	0.5	2
1,4 Dichlorobenzene (volatile)	0.5	2
Acrolein	2.0	5
Acrylonitrile	2.0	2
Benzene	0.5	2
Bromoform	0.5	2
Methyl Bromide	1.0	2
Carbon Tetrachloride	0.5	2
Chlorobenzene	0.5	2
Chlorodibromo-methane	0.5	2
Chloroethane	0.5	2
Chloroform	0.5	2
Chloromethane	0.5	2
Dichlorobromo-methane	0.5	2
Dichloromethane	0.5	2
Ethylbenzene	0.5	2
Tetrachloroethylene	0.5	2
Toluene	0.5	2
Trans-1,2 Dichloroethylene	0.5	1
Trichloroethene	0.5	2
Vinyl Chloride	0.5	2

*The normal method-specific factor for these substances is 1; therefore, the lowest standard concentration in the calibration curve is equal to the above ML value for each substance.

Table 2b - SEMI-VOLATILE SUBSTANCES*	GC	GCMS	LC	COLOR
Benzo (a) Anthracene	10	5		
1,2 Dichlorobenzene (semivolatile)	2	2		
1,2 Diphenylhydrazine		1		
1,2,4 Trichlorobenzene	1	5		
1,3 Dichlorobenzene (semivolatile)	2	1		
1,4 Dichlorobenzene (semivolatile)	2	1		
2 Chlorophenol	2	5		
2,4 Dichlorophenol	1	5		
2,4 Dimethylphenol	1	2		
2,4 Dinitrophenol	5	5		
2,4 Dinitrotoluene	10	5		
2,4,6 Trichlorophenol	10	10		
2,6 Dinitrotoluene		5		
2- Nitrophenol		10		
2-Chloroethyl vinyl ether	1	1		
2-Chloronaphthalene		10		
3,3' Dichlorobenzidine		5		
Benzo (b) Fluoranthene		10	10	
3-Methyl-Chlorophenol	5	1		
4,6 Dinitro-2-methylphenol	10	5		
4- Nitrophenol	5	10		
4-Bromophenyl phenyl ether	10	5		
4-Chlorophenyl phenyl ether		5		
Acenaphthene	1	1	0.5	
Acenaphthylene		10	0.2	
Anthracene		10	2	
Benidine		5		
Benzo(a) pyrene		10	2	
Benzo(g,h,i)perylene		5	0.1	
Benzo(k)fluoranthene		10	2	
bis 2-(1-Chloroethoxyl) methane		5		
bis(2-chloroethyl) ether	10	1		
bis(2-Chloroisopropyl) ether	10	2		
bis(2-Ethylhexyl) phthalate	10	5		
Butyl benzyl phthalate	10	10		
Chrysene		10	5	
di-n-Butyl phthalate		10		
di-n-Octyl phthalate		10		
Dibenzo(a,h)-anthracene		10	0.1	
Diethyl phthalate	10	2		
Dimethyl phthalate	10	2		
Fluoranthene	10	1	0.05	
Fluorene		10	0.1	

Table 2b - SEMI-VOLATILE SUBSTANCES*	GC	GCMS	LC	COLOR
Hexachloro-cyclopentadiene	5	5		
Hexachlorobenzene	5	1		
Hexachlorobutadiene	5	1		
Hexachloroethane	5	1		
Indeno(1,2,3,cd)-pyrene		10	0.05	
Isophorone	10	1		
N-Nitroso diphenyl amine	10	1		
N-Nitroso-dimethyl amine	10	5		
N-Nitroso -di n-propyl amine	10	5		
Naphthalene	10	1	0.2	
Nitrobenzene	10	1		
Pentachlorophenol	1	5		
Phenanthrene		5	0.05	
Phenol **	1	1		50
Pyrene		10	0.05	

* With the exception of phenol by colorimetric technique, the normal method-specific factor for these substances is 1,000; therefore, the lowest standard concentration in the calibration curve is equal to the above ML value for each substance multiplied by 1,000.

** Phenol by colorimetric technique has a factor of 1.

Table 2c – INORGANICS*	FAA	GFAA	ICP	ICPMS	SPGFAA	HYDRIDE	CVAA	COLOR	DCP
Antimony	10	5	50	0.5	5	0.5			1,000
Arsenic		2	10	2	2	1		20	1,000
Beryllium	20	0.5	2	0.5	1				1,000
Cadmium	10	0.5	10	0.25	0.5				1,000
Chromium (total)	50	2	10	0.5	1				1,000
Chromium VI	5							10	
Copper	25	5	10	0.5	2				1,000
Cyanide								5	
Lead	20	5	5	0.5	2				10,000
Mercury				0.5			0.2		
Nickel	50	5	20	1	5				1,000
Selenium		5	10	2	5	1			1,000
Silver	10	1	10	0.25	2				1,000
Thallium	10	2	10	1	5				1,000
Zinc	20		20	1	10				1,000

* The normal method-specific factor for these substances is 1; therefore, the lowest standard concentration in the calibration curve is equal to the above ML value for each substance.

Table 2d – PESTICIDES – PCBs*	GC
4,4'-DDD	0.05
4,4'-DDE	0.05
4,4'-DDT	0.01
a-Endosulfan	0.02
alpha-BHC	0.01
Aldrin	0.005
b-Endosulfan	0.01
Beta-BHC	0.005
Chlordane	0.1
Delta-BHC	0.005
Dieldrin	0.01
Endosulfan Sulfate	0.05
Endrin	0.01
Endrin Aldehyde	0.01
Heptachlor	0.01
Heptachlor Epoxide	0.01
Gamma-BHC (Lindane)	0.02
PCB 1016	0.5
PCB 1221	0.5
PCB 1232	0.5
PCB 1242	0.5
PCB 1248	0.5
PCB 1254	0.5
PCB 1260	0.5
Toxaphene	0.5

* The normal method-specific factor for these substances is 100; therefore, the lowest standard concentration in the calibration curve is equal to the above ML value for each substance multiplied by 100.

Techniques:

GC - Gas Chromatography

GCMS - Gas Chromatography/Mass Spectrometry

HRGCMS - High Resolution Gas Chromatography/Mass Spectrometry (i.e., EPA 1613, 1624, or 1625)

LC - High Pressure Liquid Chromatography

FAA - Flame Atomic Absorption

GFAA - Graphite Furnace Atomic Absorption

HYDRIDE - Gaseous Hydride Atomic Absorption

CVAA - Cold Vapor Atomic Absorption

ICP - Inductively Coupled Plasma

ICPMS - Inductively Coupled Plasma/Mass Spectrometry

SPGFAA - Stabilized Platform Graphite Furnace Atomic Absorption (i.e., EPA 200.9)

DCP - Direct Current Plasma

COLOR - Colorimetric

**STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION**

CEASE AND DESIST ORDER NO. R4-2007-0056

**REQUIRING THE BOEING COMPANY, SANTA SUSANA FIELD LABORATORY
TO CEASE AND DESIST DISCHARGES OF CONTAMINANT CONCENTRATIONS IN EXCESS
OF APPLICABLE WATER QUALITY STANDARDS TO WATERS OF THE UNITED STATES**

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) finds:

BACKGROUND

1. The Boeing Company (Permittee), Santa Susana Field Laboratory (SSFL) is located at the top of Woolsey Canyon Road in the Simi Hills, Ventura County, California. The site includes 2,800 acres of land; the developed portion of the site comprises approximately 1,500 acres. There is 1,200-acres of undeveloped land located to the south and additional 150-acres of undeveloped land to the north of the developed portion of the site. SSFL is owned by both the Permittee and the National Aeronautics and Space Administration (NASA). The United States Department of Energy (DOE) also owns several buildings located in Area IV, with the land being under the ownership of Boeing.
2. The Permittee and its predecessors' operations at SSFL since 1950 include research, development, assembly, disassembly, and testing of rocket engines, and chemical lasers. DOE conducted past operations in research and development of energy related programs, including nuclear reactors, and seismic testing experiments. Current DOE activities onsite are solely related to facility closure, environmental remediation, and restoration.
3. Nuclear research and development for the DOE and its predecessors was conducted at the SSFL from 1954 – 1989. The activities included developing and operating reactors, and fabricating and disassembling nuclear fuel. The government began to phase out the program in the 1960s. The last reactor was shut down in 1980, and nuclear research was terminated in 1989. This research and the associated activities resulted in contamination in Area IV.

There are currently no programs at the SSFL which employ special nuclear materials. Current decommissioning activities have reduced the inventory of radioactive waste at the SSFL to approximately 5 curies. Essentially all of this material is stored in shielded vaults located at the Radioactive Materials Handling Facility (RMHF). SSFL continues to utilize radioisotopes in the form of calibration sources which are necessary to calibrate radiation detectors and counting equipment. Three radiological facilities located in Area IV of the SSFL remain to be decommissioned. Storm water run-off from Area IV of the SSFL is monitored for radioactivity. The DOE is responsible for the cost of decontamination and decommissioning, the California Department of Health Services (Radiological Health Branch) has radiological oversight responsibilities at Area IV of the SSFL.

July 30, 2007
Revised: October 15, 2007
Revised: November 1, 2007

4. Historical activities at SSFL that contributed to discharges from the site included rocket engine testing cooling water, operation of fire suppression equipment, and pressure testing of equipment used to support rocket engine testing. Other facility support activities such as cooling, heating, domestic waste treatment, and groundwater treatment also contributed to discharges from the site.
5. During the early 1950s to the mid-1970s, volatile organic compounds were utilized for the cleaning of hardware and rocket engine thrust chambers as well as other equipment. These solvents migrated into the subsurface, contaminating groundwater primarily with trichloroethylene (TCE) and 1, 2-dichloroethylene (1, 2-DCE). There is an extensive groundwater remediation/investigation program in progress at the SSFL, which historically included pumping, treating, and storing groundwater at the facility. This system was composed of eight treatment systems. These systems had the capability of producing up to 578 million gallons of treated groundwater per year. The groundwater was treated to remove volatile, and in some cases semi-volatile, organic compounds. The system was not designed to treat perchlorate or metals. Historically, treated groundwater was discharged directly into one of five water reclamation ponds via naturally occurring streambeds and in some cases man made watercourses present onsite. These treatment systems were regulated under Resource Conservation Recovery Act (RCRA) hazardous waste permits or administrative orders issued by Department of Toxic Substances Control (DTSC), and various air quality control permits issued by Ventura County.

The groundwater treatment system is being reconfigured. The plan is for one system that will be located in Area 1, near CTL-V. The groundwater from all over the site will be pumped to this location for treatment. After treatment the effluent will be tested and discharged to the streambed at Outfall 019. Outfall 019 is a new compliance point located downstream of Outfall 011 and upstream of Outfall 001. The new groundwater treatment system is scheduled to begin operation in August 2007.

6. SSFL has the potential to discharge a total of approximately 272 million gallons per day (MGD) of storm water runoff and wastewater that has the potential to contain pollutants from the facilities. Approximately 60% of the discharge exits the property via southerly discharge points (Discharge Outfalls 001, 002, 011, and 018) to Bell Creek, a tributary to the Los Angeles River, a navigable water of the United States, with its confluence located near the intersection of Bassett Street and Owensmouth Avenue in Canoga Park, above the estuary.

The remaining storm water is discharged offsite via Outfalls 003 through 007, 009, and 010 to the northwest toward the Arroyo Simi, a tributary of Calleguas Creek. Discharges from Outfall 008 in Happy Valley flows via Dayton Canyon Creek to Chatsworth Creek. Chatsworth Creek flows south to Bell Creek southwest of the intersection of Shoup Avenue and Sherman Way. Bell Creek subsequently flows southeast to the Los Angeles River.

DISCHARGE HISTORY

7. Discharges from the SSFL have been covered by a National Pollutant Discharge Elimination System (NPDES) permit since 1976.
8. On June 29, 1998, the Regional Board adopted Order No. 98-051 which prescribed waste discharge requirements to the Permittee for the discharge of storm water runoff and wastewater from the SSFL.

9. On June 27, 2001, the Regional Board issued a Notice of Violation (NOV) to the Permittee for violations of the effluent limits and monitoring and reporting requirements set forth in Board Order No. 98-051. The Permittee's effluent discharges exceeded the limits for mercury (Hg), copper (Cu), BOD, total coliform, total suspended solids (TSS), cadmium (Cd), thallium (Tl), oil and grease, antimony (Sb), and $\text{NO}_2 + \text{NO}_3$ as Nitrogen (N) from January 2000 through March 2001 from various discharge outfalls at the SSFL site.
10. On October 19, 2001, the Regional Board issued a Revised NOV to the Permittee, which resulted in rescinding seven (7) effluent limit violations and two (2) monitoring and reporting violations noted in the June 27, 2001, NOV.
11. On April 29, 2002, the Regional Board issued Complaint No. R4-2002-0084 for Mandatory Minimum Penalty to the Permittee in the amount of \$39,000 which was paid by the Permittee for effluent limit violations of Hg, Tl, oil and grease, total coliform, settleable solids, $\text{NO}_2 + \text{NO}_3$ as N, and fluoride from January 2000 through April 2001. Boeing waived a hearing and paid \$33,000 to the State Board Cleanup and Abatement Account. The remaining \$6,000 was used to fund a Regional Board approved Supplemental Environmental Project.
12. On February 6, 2004, the Regional Board issued a NOV to the Permittee for violations of effluent limits set forth in Board Order No. 98-051. The Permittee's effluent exceeded the limits for Sb, Cd, Cu, TSS, and turbidity from August 1998 through November 2003. The NOV required submittal of a report detailing the corrective actions taken by the Permittee to achieve compliance with Board Order No. 98-051.
13. In a letter dated March 8, 2004, the Permittee responded to the February 6, 2004, NOV by listing all the corrective actions taken at the site.
14. On July 1, 2004, the Regional Board adopted Order No. R4-2004-0111 replacing Order No. 98-051, which prescribes waste discharge requirements to the Permittee for the discharge of storm water runoff and wastewater from SSFL. This order added eleven new compliance points and incorporated requirements based on the California Toxics Rule (CTR).
15. On July 30, 2004, a Petition from Committee to Bridge the Gap for Review of Regional Board Order No R4-2004-0111 was filed. The petition requested a stay of the requirements included in Order R4-2004-0111 to the extent it would remove water quality based effluent limitations for certain metals and volatile organic compounds applicable to seven outfalls at the site. On September 17, 2004, the State Board adopted Order WQO 2004-0014, which denied the petitioners request..
16. Subsequent to the adoption of Order R4-2004-0111, on August 2, 2004, the Permittee filed a petition of the permit with the State Water Resources Control Board. The permittee immediately put the petition in abeyance.
17. On March 14, 2005, the Regional Board issued a NOV to the Permittee for violations of the effluent limits set forth in Board Order No. R4-2004-0111. The Permittee's effluent exceeded the limits for Cu, Hg, 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), and pH during the 4th Quarter 2004. The NOV required submittal of a report detailing the corrective actions taken by the Permittee to achieve compliance with Board Order No. R4-2004-0111.

18. In a letter dated April 14, 2005, the Permittee, in response to the March 14, 2005 NOV, submitted a report detailing corrective actions taken. The Permittee asserted that most of the exceedances are the result of natural causes and/or new constituents, effluent limits or methodologies in the renewed permit. The Permittee also asserted that they planned to request that the permit be modified to remove permitted discharges that were generated by operations that have been terminated (sewage treatment plants).
19. By a letter to the Regional Board dated July 15, 2005, the Permittee requested that the Regional Board reopen and revise the NPDES permit issued in July 2004 to provide a compliance schedule for all outfalls where the Regional Board adopted more stringent numerical standards or analytical procedures that are different than the previous permit ("1998 permit").
20. On October 7, 2005, the Regional Board issued a NOV to the Permittee for violations of effluent limits set forth in Board Order No. R4-2004-0111. The Permittee's effluent exceeded the limits for Hg, TCDD, residual chlorine, oil and grease, sulfate, MBAS, chromium (Cr), iron (Fe), lead (Pb), manganese (Mn), total dissolved solids (TDS), and chronic toxicity from 1st Quarter 2005 through 2nd Quarter 2005. The NOV required a report detailing the corrective actions taken by the Permittee to achieve compliance with Board Order No. R4-2004-0111.
21. In a letter dated November 4, 2005, the Permittee, in response to the October 7, 2005, NOV, again asserted that the permit exceedances were consistent with the presence of naturally occurring constituents in site soils or in ash from area wildfires, rather than a result of site operations. The Permittee asserted that significant upgrades to the Best Management Practices (BMPs), to control runoff and to attempt to bring their discharge into full compliance with the waste discharge requirements had been implemented. However, due to the Topanga Wildfire on September 28, 2005, most of the BMPs were destroyed.
22. On November 22, 2005, pursuant to section 13267 of the California Water Code, the Regional Board issued a letter and directed the Permittee to submit a technical report including a workplan outlining how and when the Permittee proposed to meet the final effluent limitations of Board Order No. R4-2004-0111. The technical report was submitted to the Regional Board on December 16, 2005.
23. On November 30, 2005, a Cleanup and Abatement Order (CAO) No. R4-2005-0077 was issued to the Permittee. The CAO was issued in response to chronic exceedances of effluent limits contained in Regional Board Order Nos. 98-051 and R4-2004-0111 as well as the increased threat of erosion of soil and ash resulting from the Topanga wildfire. The CAO ordered the Permittee to: (i) initiate a cleanup and abatement program including the implementation of all BMPs necessary to abate impacts of any erosion and ash deposition to navigable waters of the United States; (ii) implement corrective and preventative actions to bring the Permittee's discharge into full compliance with Effluent Limitations and Receiving Water Requirements contained in Regional Board Order No. R4-2004-0111; and (iii) prepare a technical report summarizing the efforts being made to cleanup and abate the condition of pollution.
24. On November 30, 2005, tentative Order No. R4-2006-0XXX Amending Order No. R4-2004-0111 was issued for public comment. The tentative Order would incorporate new effluent limits based on the reasonable potential analysis of data collected since August 20, 2004, the effective date of Order No. R4-2004-0111. The tentative order was considered at the January 19, 2006, Board Meeting, updated by the Board and adopted as Order R4-2006-0008.

25. On January 24, 2006, tentative Order R4-2006-00XX, which incorporated updates associated with the metals and nutrients TMDLs for Los Angeles River was issued for public comment. During the March 9, 2006, Board Meeting the item was considered and the proposed amendment adopted as Order No. R4-2006-0036.
26. After the adoption of Order R4-2006-0008 in January 2006 the Permittee petitioned that order, activated the previous petition and petitioned the pending amendment, Order R4-2006-0036. The permittee also requested that the permit be stayed pending a decision on the permit on the basis of merit.
27. On April 3, 2006, there was a State Board Hearing on the Permittee's request for a stay. Order WQ 2006-0002, which was adopted on April 7, 2006, from the State Board stayed effluent limitations for specified constituents at various outfalls. Subsequently, the State Board met en banc. After considering the evidence, the Board adopted Order WQ 2006-0007 on June 21, 2006, which vacated the previous Order and denied the request for a stay.
28. On December 13, 2006, after issuing a draft Order, the State Board held a public hearing to discuss issues related to the petition of the permit on the basis of merit. On that day, Order WQ 2006-0012 was issued by State Board. The Order:
 - Remanded the permit to the Regional Board to revise the provisions concerning Outfalls 001, 002, 011, and 018,
 - Stayed the effluent limitations at Outfalls 011 and 018 pending a determination by the Regional Board deleting either Outfalls 011 and 018 or Outfalls 001 and 002,
 - Directed the Regional Board to issue a Cease and Desist Order with the shortest possible compliance schedule and interim effluent limitations, based on the effects of the Topanga Fire. The effective date of the CDO was to be January 19, 2006, and
 - Review the permit to ensure that numeric effluent limitations for different outfalls do not count the same violation twice in such a manner as to treat a single violation as multiple violations.

In all other respects, the petitions were denied.

29. On February 21, 2007, the Permittee submitted the first of a number of deliverables with the final document delivered on May 24, 2007, which included a revised ROWD and other supplemental information considered during the update of the permit. The revised permit and this CDO will be considered by the Regional Board at the August 9, 2007 Board Meeting.
30. The Regional Board issued Complaint No. R4-2007-0035 for Administrative Civil Liability against the Boeing Company in the amount of \$471,190. On August 27, 2007, Boeing waived its right to a hearing and submitted full payment of the civil liability. A Notice of Conclusion of Enforcement Action was issued referencing this case on September 11, 2007.

EVIDENCE OF CONTAMINATION AND BASIS FOR SECTION 13301 ORDER

31. On July 1, 2004, the Regional Board, adopted Order No. R4-2004-0111 (NPDES Permit No. CA0001309), containing Waste Discharge Requirements for the Boeing Santa Susana Field Laboratory including requirements as follows:

- a) "Standard Provision A1: Neither the disposal nor any handling of wastes shall cause pollution or nuisance."
 - b) "Standard Provision A2: The discharge shall not cause a violation of any applicable water quality standards for receiving waters adopted by the Regional Board or the State Water Resources Control Board as required by the Federal Clean Water Act and regulations adopted there under...."
 - c) "Standard Provision B3: The discharger must comply with all of the terms, requirements, and conditions of this order. Any violation of this order constitutes a violation of the Clean Water Act, its regulations and the California Water Code, and is grounds for enforcement action, Order termination, Order revocation and reissuance, denial of an application for reissuance; or a combination thereof."
32. The Permittee, in self-monitoring reports submitted to the Regional Board, has reported violations of the waste discharge requirements contained in Order No. R4-2004-0111, R4-2006-0008, and R4-2006-0036. The Permittee has been discharging effluent that has chronically exceeded the effluent limits for TCDD, heavy metals and other pollutants from 1998 through 2006.

CONCLUSION

33. The unauthorized discharge of wastes by the Permittee was not permitted and is in violation of water quality objectives established in the *1994 Water Quality Control Plan for the Los Angeles Region*, as amended, and other applicable State and Federal Water Quality Standards.
34. The Permittee has upgraded and implemented a number of new BMPs onsite since the adoption of Order R4-2004-0111. However, discharges from the facility continue to have contaminant concentrations in excess of established effluent limitations even after the implementation of the new BMPs. This indicates that efforts to control the transport of contaminants to waters of the United States have been ineffective.
35. On September 28, 2005, the Topanga Fire resulted in damage to much of the facility. Approximately 70% of the site was burned; leaving the hills denuded of vegetation and covered in ash.
36. Immediately after the Topanga Fire, the Discharger began cleanup operations. Activities undertaken to control the transport of contaminants and BMPs that have been implemented since the Topanga Fire include:
- Cleared and repaired fire damaged access roads.
 - Repaired flow meter and telemetry systems.
 - Removed burned debris.
 - Installed new silt fencing, straw bales and/or straw waddles at various discharge locations.
 - Graveled access roads in certain areas to prevent soil migration.
 - Implemented daily irrigation to promote the vegetation growth in areas where it was destroyed.
 - Installed new plastic tarp using new and improved techniques for anchoring and to prevent undermining at Outfall 004.
 - Designed and started construction of sand/carbon under drain filter systems at a number of Outfalls.

- Where required the area was re-graded to improve surface flow path.
- Rip rap was installed across the access road at Outfall 006.
- Implemented upgraded structural BMPs at all outfall locations in the developed portion of the site by May 2006. The upgraded BMPs in several instances included course and fine gravel beds to slow the flow of the runoff and filter bags filled with activated carbon and vermiculite, as well as silt fencing, fiber rolls, and in some cases course rip-rap.

Many of the upgraded BMPs were implemented prior to May 2006, which was reported in the *Best Management Practices Effectiveness Sampling Workplan for Santa Susana Field Laboratory* submitted to the Regional Board on October 2, 2006. However, the Permittee has continued to evaluate and upgrade the BMPs.

37. Section 13301 of the California Water Code states, in part, that:

“When a regional board finds that a discharge of waste is taking place or threatening to take place in violation of requirements or discharge prohibitions prescribed by the regional board or the state board, the board may issue an order to cease and desist and direct that those persons not complying with the requirements or discharge prohibitions (a) comply forthwith, (b) comply in accordance with a time schedule set by the board, or (c) in the event of a threatened violation, take appropriate remedial or preventive action....”

This Cease and Desist Order (CDO) requires the Permittee to comply with established requirements or prohibitions, to comply with a time schedule, or, if the violation is threatening, to take appropriate remedial or preventative action.

38. 40 CFR Part 122.44(l)(1) requires that when a permit is renewed or reissued, interim effluent limitations, standards or conditions must be at least as stringent as the final effluent limitations, standards or conditions in the previous permit (unless the circumstances on which the previous permit was based have materially and substantially changed since the time the permit was issued and would constitute cause for permit modification or revocation and reissuance under §122.62).
39. The data collected since the adoption of Order R4-2006-0008 and R4-2006-0036 provide new information about the discharge including the concentrations of contaminants in the discharge.
40. Review of the petition by the State Board resulted in a remand of the permit to the Regional Board with a directive to issue a CDO with the shortest possible compliance schedule and interim effluent limitations. The effective date of the CDO was stipulated as January 19, 2006.
41. The Topanga Fire resulted in significant alterations to the site. The exposure of the surface soils with no vegetative cover to retard runoff has increased the potential for the transport of those surface soils and associated contaminants offsite as a result of the fire. The fire created runoff conditions at SSFL over which the Permittee has limited control. Over 70 percent of the SSFL burnt with significant areas denuded of vegetation, making much of the steep terrain highly erodible. Boeing hydromulched upwards of 800 acres and installed erosion control devices throughout much of the SSFL after the fire which occurred on September 28, 2005, and prior to January 19, 2006.

After the fire Boeing immediately began efforts to replace the BMPs that were destroyed. Many of the drainage areas were vacuumed to remove accumulated ash. The Discharger hydromulched in excess of 800 acres onsite and installed erosion control devices throughout much of the SSFL site

prior to the January 19, 2006 Board Meeting. BMPs implemented prior to the fire were typical of those routinely used at construction sites to retard the transport of sediment (silt fences, plastic sheeting, etc). In most cases, the BMPs implemented after the fire were designed to slow flows (i.e. using underdrain systems) and to treat specific contaminant groups (i.e. metals) using bags filled with carbon or vermiculite.

On May 24, 2007, Boeing submitted to the Regional Board the *Phase 2 Post-Fire Vegetation Recovery Assessment Report* prepared for Geosyntech Consultants by Western Botanical Services, Inc. The report assessed the status of and time to recovery of chaparral and scrub at the project site subsequent to the Topanga Fire. The executive summary of the report asserts that chaparral and scrub represent the dominant vegetation types at SSFL and that these plant communities represent an important natural vegetation-based means of erosion control at the site. It further states that the "perennial plant cover differed by significantly more than 30 percent between burned and unburned transects, total vegetative cover differed by significantly greater than 20 percent cover and ground cover differed by significantly more than 30 percent cover." The executive summary also states that the burned chaparral and scrub vegetation will likely recover within five to ten years.

The report also includes a section titled *Chaparral Recovery after Fire*. The section includes summaries of other studies completed on chaparral. Several studies (Guo 2001, Grace & Keeley 2006, Keeley & Keeley 1981, Horton & Kraebel 1955, Robi Chaud et al 2000) concluded that the total vegetative cover is generally high in the first two years following a fire: reported values are from 11 to 85 percent. The report estimates that between March 26 and April 12, 2007, the mean total vegetative cover within the burned areas is 46.6 percent.

42. The discharge from SSFL is currently primarily storm water runoff. The size of the site and the volume of storm water runoff generated presents challenges with treating the entire volume of rainfall. An estimate of the 85th percentile of the 1-year 24-hour storm event, the site specific "design storm" for the site resulted in a storm depth of 2.3 inches using the Los Angeles County Department of Public Works (LADWP) estimation models. The new BMPs implemented were designed to treat the storm water runoff generated by a storm depth of that size.
43. During discussions with the Permittee on February 23, 2007, there was a request to treat the discharges from Outfalls 008 and 009 differently from the other storm water only outfalls. Outfalls 008 and 009 are located in jurisdictional drainages where engineered BMP installation may be impractical. Historical data confirms that treatment is required to meet the effluent limitations included in the NPDES permit. The Permittee has proposed a conceptual natural BMP design study as the mechanism to meet the final effluent limitations proposed for discharges from these locations. The natural BMPs will be strategically located to control erosion and sediment from specific source areas, and RCRA RFI Sites throughout the subwatershed. The natural BMPs will include erosion and sediment controls (such as surface roughening and use of soil binders) and structural treatment devices (such as treatment wetlands and bioretention areas). An independent team of experts will be convened to evaluate site conditions including contaminants in the vicinity, evaluate the natural BMPs, their documented effectiveness and their performance under site conditions, to select the appropriate BMPs, the design and implementation. The goal of the natural BMPs implemented is to meet the final effluent limitations included in Order R4-2007-0055.
44. This CDO is an action taken for the protection of the environment and, as such, is exempt from the provisions of the California Environmental Quality Act in accordance with California Code of Regulations, title 14, section 15321.

The Regional Board notified Boeing, interested agencies, and parties of its intent to issue a CDO. The Regional Board heard and considered all testimony pertinent to this matter in a public hearing. All Orders referred to above and records of hearings and testimony therein are included herein by reference.

IT IS HEREBY ORDERED that, in accordance with section 13301 of the California Water Code, the Boeing Company shall cease and desist all discharges of contaminants in excess of the effluent limits stipulated in Order No. R4-2007-0055 and this CDO, by complying with the following:

1. Interim effluent concentrations specified in Tables 1 and 2, which shall be deemed effective from January 19, 2006, through August 31, 2006.

Table 1: Outfalls 001, 002, 011, and 018:

<u>Constituent</u>	<u>Daily Maximum</u>		<u>Basis</u>
	<u>Concentration</u>	<u>Mass¹</u>	
Chromium	100µg/L	--	MEC
Copper	55 µg/L	--	MEC
Lead	160 µg/L	--	MEC
Mercury	0.13 µg/L	--	MEC
Manganese	120 µg/L	--	MEC
TCDD	4.6E-06 µg/L	--	MEC
Iron	92 mg/l	--	MEC

Table 2: Outfalls 003 through Outfall 010:

<u>Constituent</u>	<u>Daily Maximum</u>		<u>Basis</u>
	<u>Concentration</u>	<u>Mass¹</u>	
Antimony	35µg/L	--	MEC
Copper	39 µg/L	--	MEC
Lead	260 µg/L	--	MEC
Mercury	0.89 µg/L	--	MEC
TCDD	9.1 E-04 µg/L	--	MEC
Thallium	3.1 µg/L	--	MEC

2. Discharges from Outfalls 001 through 011, and 018 after August 31, 2006, shall comply with the limitations specified in Order R4-2006-0036 until the effective date of Order R4-2007-0055.

¹ The permitted mass is calculated using the following formula:

$$\text{Mass (lbs/day)} = 8.34 * \text{Flow (MGD)} * \text{Concentration (mg/L)}$$

where the flow is the actual recorded flow for that discharge event.

3. Submit for approval to the Executive Officer by December 15, 2007, a workplan to evaluate, select and implement natural BMPs for Outfalls 008 and 009. The workplan shall contain the following components:
 - a. A time schedule that begins on November 1, 2007, and ends on June 10, 2009.
 - b. Assembly of a panel to review site conditions, modeled flow, contaminants of concern, and evaluate the BMPs capable of providing the required treatment to meet the final effluent limits.
 - c. A description of the BMPs to be utilized. Design the BMPs and develop a plan for BMP implementation. Purchase required materials.
 - d. A schedule for the installation of the BMPs at Outfalls 008 and 009.
 - e. A schedule to evaluate the BMPs' performance.
4. Discharges from Outfalls 008 and 009 on June 10, 2009, and thereafter, shall comply with the final effluent limits that appear in I.B.4. of Order R4-2007-0055.
5. Submit a final report on the results of the BMP implementation and evaluation and final recommended BMPs by August 15, 2009. The report should include a description of the new BMPs considered and/or evaluated, any sample data collected during the evaluation of BMPs, and the results of BMP effectiveness evaluations with quality assurance results.

The Permittee shall immediately comply with all other effluent limitations and requirements contained in Order R4-2007-0055.

This CDO is not intended to permit or allow the Permittee to cease any work required by any other order issued by the Regional Board, nor shall it be used as a reason to stop or redirect any investigation or cleanup or remediation programs ordered by the Regional Board or any other agency. Furthermore, this CDO does not exempt the Permittee from compliance with any other laws, regulations, or ordinances which may be applicable, and it leaves unaffected any further restrictions which may be contained in other statutes or required by other agencies.

This CDO does not preclude the Regional Board from taking any enforcement action, including but not limited to complaints for administrative civil liability for the discharge of effluent concentrations exceeding the effluent limitations specified in Order R4-2004-0111, R4-2006-0008, R4-2006-0036, or subsequent Orders.

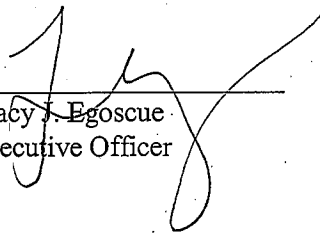
The action taken by this Regional Board does not preclude the possibility of actions to enforce this CDO by third parties pursuant to Section 505 of the Federal Clean Water Act.

Should Permittee fail to comply with any provision of this CDO, the Executive Officer is authorized to request the Attorney General to take appropriate action against the Permittee, including injunction and civil monetary remedies, pursuant to appropriate California Water Code sections, including but not limited to, sections 13331, 13350, 13385 and 13386.

RESCISSION

Cleanup and Abatement Order No. R4-2005-0077, adopted by this Regional Board November 30, 2005, is hereby rescinded except for enforcement purposes.

I, Tracy J. Egoscue, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Los Angeles Region, on November 1, 2007.



Tracy J. Egoscue
Executive Officer

#107188



Ventura County
Air Pollution
Control District

669 County Square Drive
Ventura, California 93003

tel 805/645-1400
fax 805/645-1444
www.vcapcd.org

Michael Villegas
Air Pollution Control Officer

April 2, 2008

Mr. Paul Costa
The Boeing Company
5800 Wolsey Canyon Road – MS T487
Canoga Park, CA 91304

Subject: Authority to Construct No. 00232-390

Dear Mr. Costa:

Your Authority to Construct is enclosed. Pursuant to Rule 19, this Authority to Construct, or a copy, shall be posted reasonably close to the equipment and shall be readily accessible to inspection personnel.

Also enclosed is a revised version of Emission Reduction Credit (ERC) Certificate No. 1119 that was used to provide ROC offsets for this Authority to Construct.

In your facsimile (dated March 26, 2008) to the APCD, you requested that a correction be made to Condition No. 2 of draft Authority to Construct No. 00232-390 pertaining to the correct outfall (i.e. Outfall 019), and that Condition No. 4.b of Authority to Construct No. 00232-390 be modified to allow weekly instead of daily monitoring. **The change to Condition No. 2 has been made, however, the changes to Condition No. 4.b cannot be made until a Permit to Operate is obtained and a history of compliance has been established.**

The granting of this Authority to Construct signifies that the subject equipment has been evaluated based on the information provided with your application. It does not, however, either grant or imply an APCD endorsement of the equipment; nor does it guarantee compliance with APCD Rules and Regulations. Prior to operating the equipment, an application for an APCD Permit to Operate must be submitted with a \$450.00 filing fee.

If you have any questions on this matter in, please contact me at 805/645-1418.

Sincerely,


Ali Lakhdar-Hamina
Engineering Division

Enclosure

c: Barry Mamaghany, VCAPCD Compliance Division



Ventura County
Air Pollution
Control District

669 County Square Drive
Ventura, California 93003

tel 805/645-1400
fax 805/645-1444
www.vcapcd.org

Michael Villegas
Air Pollution Control Officer

AUTHORITY TO CONSTRUCT
Number 00232-390

Valid April 2, 2008 to April 01, 2010

This Permit Has Been Issued To The Following:

Company Name / Address:

The Boeing Company
5800 Woolsey Canyon Rd. - MS T487
Canoga Park, CA 91304

Facility Name / Address:

Santa Susana Field Laboratory
Facility FESOP Permit
Simi Valley, CA 93065

Permission Is Hereby Granted To Construct The Following:

Ground Water Remediation Operations

At Area I - CarbonAir Stripping System, Model STAT 80, 100 gallon per minute capacity, consisting of:

- 1 - 600 Cubic Feet Per Minute Air Stripper Tower, 4 feet (L) x 2 feet (W) x 7'-10.25" (H)
- 1 - Siemens Model VSC-2000 Carbon Adsorption System, consisting of two (2) Carbon Adsorbers, 2,000 Pound Capacity Each, Operated in Series, Controlling the Exhaust from the Stripper Tower

This Permit Has Been Issued Subject To The Following Conditions:

1. Permitted Emissions

	Tons/Year	Pounds/Hour
Reactive Organics	0.01	0.00
2. This Authority to Construct authorizes the installation of a groundwater remediation system for treatment of groundwater, purge water generated during quarterly sampling events, and water from well pump tests at the Santa Susana Field Laboratory (SSFL). The remediation system shall utilize a transfer system that routes all extracted vapors to a carbon adsorption system as described above. The control system shall be designed to operate effectively at the maximum flow rate at which the corresponding blowers or fans operate. Treated groundwater shall be discharged to Outfall 019. The spraying of contaminated (treated or untreated) groundwater is prohibited.
3. The Air Stripper Tower shall be vented at all times to the carbon adsorption system. This condition has been applied as Best Available Control Technology (BACT) pursuant to Rule 26.2, "New Source Review - Requirements", and pursuant to Rule 51, "Nuisance".
4. The Ground Water Remediation Operations shall be operated in compliance with the following conditions:

- a) The combined Reactive Organic Compound (ROC) and total non-methane organic compound (NMOC) concentration in the exhaust from the stripping tower carbon adsorption system shall not exceed 1 ppmv, as methane. Additional controls or operation modifications will be required if this concentration is exceeded.
 - b) ROC and total non-methane organic compound (NMOC) concentration measurements shall be conducted and recorded once per day of operation at the exhaust of each carbon adsorber. The frequency of sampling may be adjusted based on review of the required sampling records and determination of the carbon adsorption system breakthrough periods. Written approval from the District in the form of a permit application, and approved permit modification, shall be obtained prior to modifying the sampling frequency. Tests shall be conducted using a portable analyzer approved by the District.
 - c) The maximum exhaust flow rate from the stripping tower shall not exceed 600 cubic feet per minute, which is the value specified in the above equipment description. The exhaust flow rate in cubic feet per minute from the stripping tower shall be determined based on velocity pressure measurements. The measurements shall be recorded from a Pitot tube magnehelix gauge in inches of water. The permittee shall establish and maintain data relating the velocity pressure measurements to flow rate.
 - d) All spent carbon shall be disposed at a Class I Hazardous Waste Facility or reclaimed by a certified regeneration facility.
 - e) Samples shall be taken on a monthly basis of the influent groundwater and the effluent water from the air stripping system. These samples shall be analyzed by a certified independent laboratory for ROC and total non-methane organic compounds.
 - f) The permittee shall maintain records of sample analyses, results of ROC and total non-methane organic compound (NMOC) exhaust concentrations, and air and water flow rates for the air stripping system. These records shall be maintained for a period of five years and be made available to District personnel upon request.
5. Stack sampling ports shall be installed at the inlet and exhaust duct of each carbon adsorber.
6. All waste water collected from the remediation system shall be collected and stored in a covered container, and shall be treated or disposed of in accordance with applicable hazardous waste regulations. This permit does not grant permission for the storage, treatment or disposal of such waste water.

VCAPCD Permit To Operate Number 00232
Issued To Santa Susana Field Laboratory
Valid April 2, 2008 to April 01, 2010

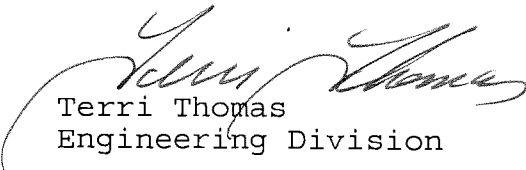
7. The blowers or fans shall be powered with an electric motor that receives its electrical power from the local utility grid. Electricity generating engines shall not be used as the source of electrical power. This condition has been applied as best available control technology (BACT) pursuant to Rule 26.2, "New Source Review - Requirements".

Prior to operation of equipment listed on this Authority to Construct, the permittee shall submit a Permit to Operate application (Rule 10).

This Authority to Construct shall expire and shall be cancelled two years from the date of issuance unless an extension has been approved in writing by the District (Rule 10).

Within 30 days after receipt of this permit, the permittee may petition the Hearing Board to review any new or modified condition (Rule 22). This permit, or a copy, shall be posted reasonably close to the subject equipment and shall be accessible to inspection personnel (Rule 19).

The granting of this Authority to Construct shall not be construed as an endorsement by the District and shall not guarantee compliance with the rules of the District.



Terri Thomas
Engineering Division

For:

Michael Villegas
Air Pollution Control Officer

APPENDIX B

EQUIPMENT CUTSHEETS – CONTROL SYSTEM

AUGUST 23, 2007

INVITATION TO BID
FABRICATION AND START-UP OF CONTROL SYSTEM
FOR GROUNDWATER EXTRACTION
AND TREATMENT SYSTEM
SANTA SUSANA FIELD LABORATORY
5800 WOOLSEY CANYON ROAD
SIMI VALLEY, CALIFORNIA

EXHIBIT 1

INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

This Request for Proposal (RFP) is being made based on the information noted and in accordance with all of the data provided in the referenced/attached enclosures. Bids will not be considered responsive unless there is compliance with the following paragraphs:

A. ACKNOWLEDGEMENT OF RECEIPT OF RFP

The Contractor shall acknowledge receipt of this RFP and notify Envirosolve, Inc. or Hargis + Associates, Inc. (H+A) of the intent to meet the proposal due date. Please reply via e-mail within two (2) days of your receipt of this RFP to Mr. Ralph Schmitt and Mr. Chris Liles. Mailing and contact information for Mr. Schmitt and Mr. Liles is as follows:

Contract Representative
ENVIROSOLVE CORPORATION
28215 Agoura Road, Suite 200
Agoura Hills, CA 91301
Attn: Mr. Ralph Schmitt
Telephone: (818) 879-5870
Facsimile: (818) 889-6973
E-mail: rjschmitt@envirosolve.com

Technical Representative
HARGIS + ASSOCIATES, INC
2365 Northside Dr. Suite C-100
San Diego, CA 92108
Attn: Mr. Chris Liles
Telephone: (619) 521-0165
Facsimile: (619) 521-8580
E-mail: cliles@hargis.com

If the prospective Contractor declines to provide a proposal, H+A requests that the Contractor return all materials and documents supplied by H+A to the technical representative listed above, and include a brief statement of Contractor's reason(s) for declining.

B. ACCEPTANCE

The response to this RFP shall be accompanied by a cover letter stating whether or not the quotation includes acceptance of the proposed General Terms and Conditions, and if not, note exceptions and submit with quote.

C. AUDIT RIGHTS

N/A

D. JOB WALK

N/A

E. BID DUE DATE

Bid shall be received no later than 4:00 pm Friday August 31, 2007.

INSTRUCTIONS TO BIDDERS

NOTE: Bids received later than the date/time indicated will be stamped as "Late Bids" unless the bid date is officially extended by the Buyer. "Late Bids" may or may not be considered at the Buyer's discretion in accordance with the then current Company Policies and Procedures.

Submit electronically: *rjschmitt@envirosolve.com* and *cliles@hargis.com*

F. RETURN ADDRESS

N/A

G. BID PERIOD

All bids submitted shall be considered firm for ninety (90) days or the period otherwise stated to support quotation pricing.

H. EXCEPTIONS

Exceptions taken to any portion of this RFP are taken at the bidder's risk and should be cited in a special section entitled "**Exceptions**" in the appropriate section of your quotation and in your letter of transmittal. Such exceptions must reference the particular paragraph or item number and page number of the document to which they pertain, stating in detail the reason(s) for the exception and specifying a proposed alternate solution. If no exceptions are to be taken to the RFP, it should be so stated in the response.

I. FORMAT OF BIDDER'S RESPONSE

The proposal shall include the following sections, at a minimum, and be organized as outlined below. All claimed technical, management, performance, and schedule capabilities to meet the requirements shall be realistic and are subject to verification by H+A. The proposal shall be clear, concise, and focused.

Section 1: Introduction

A statement of the Contractor's general scope of available services, highlighting any special strength in performing the required tasks (**two pages maximum**).

Section 2: Project Approach

The Contractor must provide a description of how they will deliver a successful project. At a minimum, the following items should be addressed:

- Project Management

INSTRUCTIONS TO BIDDERS

- Quality Assurance/Quality Control
- Field Implementation
- Data Management and Documentation
- Communications
- Project Tracking
- Invoicing
- Measures of Success

The description of project approach to supply a functioning control system shall be presented (**six pages maximum**).

Section 3: Qualifying Experience

The Contractor will provide the name, resume, experience, and respective project responsibilities for all project management and field staff personnel.

1. Experience in design, construction, and installation of similar control systems.
2. Years employed with the firm.
3. Office location for each project team member.
4. Percent availability for the project on a yearly basis.

Include names for a minimum of three (3) similar projects completed or in progress within the last five (5) years of clients or agencies served, along with the name and phone number of the contact person. Contractors may provide other information as appropriate to further support their company's ability and expertise to perform the requested work (**four pages maximum plus qualified personnel resumes**). ***The Contractor will also provide a statement that none of the proposed project team can be replaced on the job without prior authorization from H+A.***

The Contractor shall identify the resources to be used for the project and their proximity to the project location. The Contractor shall identify the proximity of field technicians, and trouble-shooting personnel that will be utilized during checkout and start-up operation.

In addition, Contractor shall identify capability with regard to utility feeder design.

Section 4: Subcontractors

Names and experience of all subcontractors, if any, who would be part of the Contractor's team. Indicate the proposed role of each subcontractor and provide the same level of detail as presented in Section 3.

Section 5: Quotation Summary Sheet

The Contractor will submit a completed Quotation Summary Sheet (Attachment 3). The costs must include all "fully loaded" unit costs for project management, field personnel, and any subcontractors required to complete the scope of work. For bid evaluation

INSTRUCTIONS TO BIDDERS

purposes, the Contractor must provide a copy of the current Rate Sheets and detailed backup showing the derivation of the costs presented on the Quotation Summary Sheet. Prices and rates will be fixed for the first two years of the contract and may be adjusted based on the Consumer Price Index.

Section 6: Alternative Costing Proposals, Discounts, and Incentive Award Programs

H+A strongly encourages alternative costing proposals, discount programs, and incentive award programs. For consideration as part of this bid, any such proposed alternative must be complete, specific, and detailed. Alternate value added approaches will be considered as part of the proposal evaluation process. At a minimum, the Contractor must specify whether there are any discounts or premiums to be provided to account for the following: not meeting/or exceeding operational goals; or addition or removal of active systems.

J. GENERAL

This RFP is not a commitment to purchase, and any expenditure experienced by the bidder in preparation and submission of a response to this quotation shall not be reimbursed by EnviroSolve, nor does EnviroSolve obligate itself with any actions taken or costs incurred by a bidder responding to this RFP. EnviroSolve reserves the right to reject any bids submitted in response to this request without any explanation.

K. LICENSE

Responses to this RFP shall include evidence of the firm's current "Business License" and all applicable "Contractor Licenses" issued by the applicable State(s).

L. OPTIONS

Bidder is requested to respond to the options noted herein and the attached documents. Acceptance of the bidder's offer may be predicated upon the bidder's response to the noted options.

M. PAYMENT TERMS

The Buyers' standard payment terms are Net 30 days unless favorable discount payment terms are offered.

INSTRUCTIONS TO BIDDERS

N. PRICING

1. Published Price/Rate List/Catalog Pricing

If any of the quoted prices/rates are taken from a published price/rate list/catalog, please identify the specific price/rate list/catalog, date, and furnish a copy of the page(s) where each item is listed with your quotation. Identify any discounts that are applicable and that will be allowed Envirosolve at time of award.

2. Discounts/Non-discountable Items

The amount and terms of any prompt payment discount that may be taken or when payment is made proposed in the Supplier's offer will be a factor in Buyer's evaluation of the offer.

3. Protect Pricing

In the event the bidder's proposed pricing/rate(s) are subject to subsequent industry wide price increases, Envirosolve reserves the right to accept the increase(s), to terminate the procurement at the cost schedule provided in the termination liability, to cancel at the cost incurred to date, or to cancel at no cost (as may apply). In any case, if the situation exists, it shall be noted in the Supplier's response.

O. PROPERTY (H+A Supplied)

All materials, specifications, and/or drawings supplied to the offeror shall remain the property of H+A and shall be returned upon request or destroyed locally as per H+A's instructions.

P. TECHNICAL DATA

H+A will assume unlimited rights to all technical data submitted unless otherwise specifically identified and reserved by the bidder. Specifications and other material furnished to the bidder shall remain the property of H+A and shall be destroyed or returned upon request. Alternate technical approaches and/or technical deviations should be addressed as a separate item to the requested requirement. While in the possession of H+A, your response will be handled in confidence. The information contained herein will not be disclosed to any person not directly involved with the proposal effort.

Q. PROPOSAL EVALUATION CRITERIA

Selection criteria for the award of the contract will be based on the following:

1. Project team. 20%
2. Project approach. 10%

INSTRUCTIONS TO BIDDERS

3. Related experience. 20%
4. Cost. 40%
5. The extent to which the proposal is clear, concise, and focused. 10%

EXHIBIT 2

SCOPE OF WORK



ENGINEERING SPECIFICATION

FABRICATION AND START-UP
CONTROL SYSTEM
SECTION 16400

Project: 597.183
Revision: 0
Date: August 1, 2007
Page 1 of 32

PART 1 GENERAL

1.01 SCOPE

- A. This specification identifies the minimum requirements for the following: design, fabrication, programming, inspection, documentation, functional testing, identification, shipment, and start-up of a control and shutdown system (Control System) for the Area 1 Groundwater Extraction and Treatment Facility (Area 1 GET) at Santa Susana Field Laboratory (SSFL), Simi Valley, California. It is the intent of this specification to provide a fully operational and ready-to-use system. In addition, this specification outlines design, fabrication, and field wiring required for integration of main panel motor control, and local control panels. The vendor will integrate the local control panels to a central control station via radio communication (Drawings 1 and 2).

The complete control system will consist of a series of satellite control systems and a central control station with an operator interface. The vendor will provide power distribution panel at the Area 1 GET, and instrumentation outlined in this specification. Construction of the complete groundwater containment systems will occur over the next 2 to 3 months. The Control System must allow for future expansion of the groundwater containment systems.

- B. Entities identified in this specification are defined as follows:

Purchaser: EnviroSolve Corporation.

Vendor: Supplier of the Control System.

- C. The Vendor shall provide all materials, labor, fabrication and testing of the Control System. The Vendor is responsible for the functional operation of panel wiring from the panel terminal blocks to the programmable logic controller (PLC) modules and panel instruments. Follow the manufactures written requirements and recommendations for mounting and space allocation, wiring and grounding of the PLC and panel instruments.
- D. The Control System shall be designed in accordance with the requirements of this specification, and the attached design drawings. These drawings are for conceptual use only and are not equipment specific. No change orders will be accepted unless a specific change of scope is requested in writing by the Purchaser, fully approved and executed.
- E. This specification describes the requirements for providing the PLC, all associated racks, power supplies and input/output (I/O) modules and performing the PLC ladder logic programming necessary to provide a complete and operating system.



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- F. The Vendor shall provide overall system integration of Purchaser-provided equipment with the Control System at remote wells WS-9A and RD-2.
- G. The Vendor will provide well controls in a climate controlled, secure panel enclosure at each of the well sites and/or wellhead treatment systems. In addition, the Vendor will repackage the existing variable frequency drive (VFD) and control equipment at the WS-9A well site in a climate controlled enclosure.
- H. The Vendor shall provide instrumentation as specified in the attached instrument data sheets.

1.02 ALTERNATES

Alternate designs will be considered, provided they meet the intent of this specification and result in performance that is equivalent to and otherwise in accordance with this specification. All proposed alternates or deviations from this specification shall be described by the Vendor separately and may not be substituted until mutually agreed upon in writing by the Purchaser and the Vendor.

1.03 REFERENCES

The enclosures, wiring, and component parts of this system shall conform to the latest revision of the following codes and regulations.

1. National Electric Code (NEC), ANSI/NFPA 70.
2. National Electric Safety Code (NESC), ANSI C2.
3. American National Standards Institute (ANSI).
4. National Electrical Manufacturing Association (NEMA).
5. Electronics Industry Association / Telecommunications Industry Association (EIA/TIA).
6. ANSI/NEMA ICS 1 General Standards for Industrial Control and Systems.
7. NEMA 250 Enclosures for Electrical Equipment (1,000 Volts Maximum).
8. ISA RP60.8 Recommended Practice Electrical Guide for Control Centers.
9. ANSI X3.64 Additional Controls for Use with American National Standard Code for Information Interchange (ASCII).
10. All applicable federal, state, and local codes.



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1.04 SUBMITTALS

A. General

1. Review of submittals by the Purchaser shall not relieve the Vendor of the responsibility to meet all requirements of this specification.
2. The design drawings included with the Invitation to Bid may include certain hold areas awaiting additional design data or information or may contain certain conflicts. The hold areas and conflicts are considered to be non-critical with respect to your ability to prepare an accurate bid.
3. Hold areas and conflicts will be resolved and appropriate revisions will be included with revised "Approved for Construction" issue of design drawings. Revisions will be specifically identified.
4. Revised "Approved for Construction" issue design drawings may not be completed until after bid award. If completed after bid award, a Change Order may be issued to either increase or decrease the scope of work based on the revisions.
5. The design drawings included with this Invitation to Bid are "B" size and are considered to be adequate to prepare an accurate bid. Access to "D" size design drawings will be available on request.
6. All post-award drawing submittals shall include three sets of standard "B" size 11-inch x 17-inch and one soft copy submitted on AutoCAD Release 2004 on CD-ROM.
7. All post-award submittals will be reviewed by the Purchaser and returned to the Vendor within 5 working days of receipt unless otherwise agreed to by the Purchaser and Vendor.
8. All post-award submittals shall be revised and resubmitted by the Vendor until identified as "APPROVED" by the Purchaser.
9. Submittals identified in this specification represent minimum or special requirements identified by the Purchaser. The Vendor shall be responsible for identification and preparation of all other design work and submittals to meet the requirements of this specification.
10. Post-award drawings shall include parts lists referencing the components identified on the drawings.



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B. Pre-Award Submittals

Three copies of the following information shall be included with the Vendor quotation for the Control System to supplement the response required in the instructions to bidders:

1. Brief written description of proposed Control System.
2. Preliminary or conceptual design drawings and vendor data for the proposed Control System including:
 - a. Control System schematic indicating the basic interconnections between the major components or panels.
 - b. Interior and exterior layout drawings and descriptions for the Control Panel.
 - c. A detailed materials list for all major components.
 - d. A detailed material list for components to be reused from the existing control panels.
 - e. Vendor data and/or data sheets for major components materials supplied by the Vendor.
 - f. Specifications regarding the overall Control System scan rate and minimum communications rate for the proposed Control System.
 - g. Specifications for the electronic equipment including the mean time between failures for primary components.
 - h. Instrument data sheets and instrument lists for instrumentation provided by the Vendor.
 - i. Vendor cut sheet(s) and material list for power distribution panel, transformer, and subpanel.
3. Brief description of proposed functional testing procedures.
4. Representative examples of display screen graphics.
5. Proposed schedule for design, fabrication, testing, and delivery of the Control System.
6. Brief description of design capabilities and fabrication facilities.



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7. Résumés of key personnel.
8. References for a minimum of three control systems of similar point count or complexity designed and fabricated by the Vendor and currently in service.
9. Statement of warranty.
10. Written alternates in accordance with the requirements of Paragraph 1.02.
11. Written exceptions, if any. Exceptions should be carefully considered and held to a minimum.

C. Bid Presentation

1. Prior to award, a short list of prospective bidders may be required to present their bid to representatives of the Purchaser.
2. The bid presentation should include key members of the project team and describe the capabilities of the bidder and the overall project approach.

D. Post-Award Submittals

Three copies of the following information shall be submitted for Purchaser review and approval:

1. Within 5 working days of contract award, the Vendor shall provide and present a detailed project schedule for the design, fabrication, testing, and delivery of the Control System at a project kick-off meeting. The detailed project schedule will include the following:
 - a. Design coordination meetings.
 - b. Design.
 - c. Programming.
 - d. Design drawing preparation and submittal.
 - e. Construction drawing preparation and submittal.
 - f. Material and component procurement.
 - g. Fabrication.
 - h. Testing.
 - i. Delivery and Installation.
2. Within three weeks of contract award, the Vendor shall provide design drawings including the following:
 - a. Control system schematic indicating basic interconnections between the Control System and the local control panels provided by the Purchaser.



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- b. Interior and exterior panel layout diagrams and descriptions for the Control Panel including at a minimum: mechanical layout detailing the external dimensions of enclosure and location of components; interior layout detailing layout of terminal blocks, wireways, I/O racks, processors, disconnect switches, and fuse blocks.
 - c. Point-to-point wiring diagrams for the Control Panel including field wiring to instrumentation and external power. The wiring diagrams shall include individual wire and terminal block numbers and relay contact cross-reference designations.
 - d. A detailed bill of materials for all components and materials with reference to applicable drawings.
 - e. Vendor data and/or data sheets for major components.
 - f. A preliminary detailed functional test procedure.
 - g. A list of recommended spare components with prices.
 3. The following information shall be delivered 1 week prior to the functional test of the Control System:
 - a. Three copies of the final functional test procedure and documentation forms.
 - b. Two copies of a draft operating and maintenance manual (Operating Manual) shall be submitted to the Purchaser. The Operating Manual shall be compiled in separate nominal 8-1/2 by 11-inch, 3-ring binders and Adobe Acrobat PDF electronic format. The Operating Manual shall include the following information at a minimum:
 1. Description of the Control System.
 2. Description of all control programs, algorithms, mathematical equations, variables, set points, time periods, messages, passwords, and other information necessary to load alter, test, and execute the Control System.
 3. Instructions on modifying control algorithms or parameters, verifying errors, point status, changing passwords, and initiating or disabling control programs.
 4. Complete point identification, including terminal number, symbol, engineering units, and control program reference number.
 5. Field information, including location, device, and device type and function, electrical parameters, and installation drawing number.



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6. Location and identification of Control System hardware.
 7. Instructions on the proper assembly, installation, and maintenance of the Control System.
 8. Start-up instructions.
 9. Shutdown and safety procedures.
 10. Maintenance and troubleshooting guidelines.
 11. Drawings, materials lists, vendor literature, and other information provided with previous submittals.
 12. Any limitations or warnings on the installation, operation, or maintenance of the Control System.
4. The following information shall be delivered two weeks prior to the delivery of the Control System to the site:
 - a. One copy of all working programs on CD-ROM and a printed program listing.
 - b. The Vendor shall submit documented Ladder Logic Diagrams (LLD) for this application prior to installation and start-up of the main control panel.
 5. The following information shall be delivered no later than 2 weeks after final acceptance of the Control System:
 - a. The as-built drawings for the Control System.
 - b. Three copies of any revisions to the Operating Manual compiled in separate nominal 8-1/2 by 11-inch, 3-ring binders and Adobe Acrobat PDF electronic format.

E. Record Submittals

1. After the Vendor has successfully commissioned the PLC System, the PLC programming software will be transferred to Purchaser for ownership. In addition, a "hard copy" of the documented LLD and electronic file copy on CD ROM will be submitted to Purchaser as a record copy.
2. Clearly documented LLD will be prepared for the Control System. Every element will have a tag number and/or descriptor. Rung comments shall be used to describe logic for control of specific equipment.



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3. A complete commented LLD Report will be provided by the Vendor at the completion of commissioning to include:
 - Program Listing;
 - Cross Reference;
 - Processor Configuration; and
 - Data Tables.
4. The Vendor shall submit all manuals, maintenance instructions, and spare parts data for installed equipment.
5. The Vendor shall submit two weeks prior to shipment to the site three copies and one reproducible set of the Control System Operating Manual that will include:
 - a. All control system drawings;
 - b. LLD report;
 - c. Start-up instructions;
 - d. Shutdown and safety procedures; and
 - e. Maintenance and troubleshooting guidelines.

1.05 CONTROL SYSTEM AND PROCESS DESCRIPTION

See Attachment A.

PART 2 PRODUCTS

2.01 GENERAL

- A. All products provided by the Vendor for the Control System shall be new, and UL-listed. Materials that are not covered by UL testing standards shall be tested and approved by an independent testing laboratory or a governmental agency, which laboratory shall be acceptable to the Purchaser.
- B. The Vendor shall provide an Allen Bradley PLC complete with all PLC hardware and software necessary for installing, maintaining, and programming LLD in Allen Bradley SLC 500-based system or Purchaser approved equal.
- C. The Vendor shall provide Human Machine Interface (HMI) computer and HMI software.



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- D. All software shall be commercially available and not proprietary. No custom software or drivers will be acceptable.
- E. Grounding in Vendor-supplied equipment shall be provided by the Vendor. External grounding requirements for the Control System and Motor Control Center shall be identified and transmitted on the drawings by the Vendor to the Purchaser.
- F. All analog I/O modules shall be individually and fully isolated to 1,000 volts. Output modules shall not have a common power supply.
- G. All Control System components shall be capable of operating at an ambient temperature of 0 to 60 degrees Centigrade (°C), with an ambient temperature rating for storage of -40 to +85 degrees °C.
- H. All Control System components shall be capable of functioning continuously in a relative humidity range of 5 percent to 95 percent with no condensation.

2.02 PANEL COMPONENTS

A. Enclosures

- 1. Panel enclosures shall be manufactured by Hoffman or Purchaser-approved equal and provided as specified on the contract drawings.
- 2. Control panel shall be painted manufacturers standard.
- 3. Control panel shall be enclosed in a NEMA 3R gasketed enclosure that is also dust tight.
- 4. The Control Panels will be mounted on nominal 4-inch reinforced concrete pads provided by others.
- 5. All enclosures shall be provided with sun shielding on exterior surfaces.
- 6. Control panels with utility metering sections shall be constructed with metering and pull sections in accordance with Southern California Edison requirements and SSFL facility requirements.
- 7. Electrical distribution panels shall be provided with 600-ampere, 480-VAC, 3 phase, 4-wire, copper bussing rated at 65 KAIC Symmetrical RMS.
- 8. Panels exterior sections shall be constructed from 12 gauge galvanized steel.
- 9. All nuts, bolts, screws, hinges shall be stainless steel.



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10. Exterior color will be grey and interior color shall be white.
11. Doors shall be secured by a heavy duty, three-point padlockable latch and hold open rods.

B. Panel Wiring

1. The Vendor shall provide all wiring from PLC inputs and outputs to terminal blocks for field wiring connection except as indicated below.
2. Power to each device shall be provided via DIN rail mounted circuit breaker Terminal Block. Provide internal panel wiring as follows:
 - 120 VAC Power wiring will be 14 AWG, 600 Volt, MTW, stranded;
 - 120 VAC Control wiring will be 16 AWG, 600 Volt, MTW, stranded;
 - Analog signal wiring (from panel terminal blocks to panel device) shall be 18 AWG, 600 Volt, MTW, stranded, and twisted; and
 - 120 VAC 15-amp GFI type duplex receptacle will use 12 AWG, 600 MTW stranded.
3. Color code internal panel wiring as follows:
 - 120 VAC Control Wiring: Control = Red
 - 120 VAC Power Wiring: HOT = Black
Neutral = White
Ground = Green
 - Analog Signal Wiring: Blue
 - RTD Wire direct to panel device
 - Thermocouple Wire direct to panel device
 - Communication Wire direct to panel device
 - Fiber Optic cable Orange

C. Wireway

1. The Vendor shall provide ventilated plastic wireways for separating and organizing the wiring. Size the wireways so that no more than 20 percent of the cross-sectional area is filled with conductors (NEC 362-19). Wireways shall be Panduit or Purchaser-approved equal.
2. Electric signals carried in one Wireway will be of similar types and voltage levels. Provide separate wireways for AC and DC wiring. Route internal wiring in separate wireway from space allowed for external field wiring. Provide each signal type with its own terminal strip.



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D. Terminal Blocks

The Vendor shall provide DIN rail mounted terminal blocks for termination of internal and field wiring. Provide power to each device via DIN rail mounted circuit breaker terminals. Terminate no more than two wires per side of each terminal. All Vendor wiring shall be limited to one side of the terminal strips. The other side of the terminal is reserved for field wiring connections. Terminal blocks shall be Allen-Bradley or Purchaser-approved equal.

E. Wire Marking

Permanently identify each wire at both ends with heat shrink tubing. Brady Hot-Stamped characters 3/32 x 3/32 inch or equal. Identify wiring according to wire identifiers provided on the elementary and loop diagrams. Wire from terminal block to terminal block without splicing. Wire each spare input or output channel from the module wiring arm to the panel field terminal block.

2.03 PLC PROCESSOR

The Vendor shall provide an Allen-Bradley SLC 500 series processor SLC 5/03 or higher, complete with chassis, power supplies, interconnecting cabling, and all necessary mounting hardware or Purchaser approved equal. The PLC processor shall be provided with battery backup that will allow continued operation of the Control System for a minimum of 30 minutes in the event of power loss.

2.04 PLC PROGRAMMING SOFTWARE

The Vendor shall provide the following programming software and appurtenances necessary to program the PLC. At a minimum one copy of Windows based RSLogix 500 (most current Version) or Purchaser-approved equal.

2.05 PLC INPUTS AND OUTPUTS

I/O modules shall be Allen-Bradley SLC 500 series or Purchaser-approved equal. The Vendor shall identify type and number of I/O modules based on Control System requirements and installed spare requirements.

2.06 HMI INTERFACE COMPUTER

- A. The computer shall at a minimum be a Dell Intel Pentium® 4 Processor at 3.0Ghz, and have 500 gigabyte hard disk drive, compact disk drive read and write capabilities and digital video disk (DVD) 16X DVD+/-RW, 4 GB RAM, Windows™ XP Professional capable on HMI software selection, keyboard, and 2-button mouse with roller wheel. Computer 128 MB graphics card compatible with monitor. The Computer shall be supplied with a minimum 19-inch viewable area flat screen monitor. Computer shall be provided with sound card and speakers. The computer shall have a Modem and



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software for phone modem. The computer shall have necessary Ethernet card for local network. The computer shall be equipped with all necessary communication cards and cabling necessary to interface with the Control Panel. Computer shall be provided with uninterruptible power supply to operate computer and monitor for up to 15 minutes in the event of a power failure.

- B. The computer shall have one licensed copy of Microsoft Office Professional 2007 latest compatible version installed.
- C. The computer shall have one licensed copy of Symantec PCAnywere™ latest compatible version installed.
- D. The computer will be located in a climate controlled office.

2.07 HMI INTERFACE SOFTWARE

HMI software shall be Wonderware™ or Intellution™ or Purchaser-approved equal. The HMI software shall be provided with 200 percent spare tags to allow for future expansion. The HMI software shall be scalable to allow the addition of tags up to an additional 30 extraction wells and associated controls.

2.08 AUTODIALER

The autodialer shall have the following features:

- A. Power failure sensing in addition to four alarm conditions.
- B. Upon detection of alarm condition or power failure:
 - 1. Commences dialing first of eight user-selected phone numbers;
 - 2. Delivers message describing alarm condition; and
 - 3. Continues calling phone numbers in succession until acknowledged.
- C. Standard telephone lines communication.
- D. Ability to receive incoming phone calls.
- E. Minimum 1-hour of battery back-up.
- F. Nonvolatile read only memory (ROM) circuitry so that no memory loss shall occur when power (including battery power) is lost.



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2.09 END DEVICES

- A. All end devices will be provided and installed by the Vendor.
- B. Preliminary vendor data and preliminary instrument data sheets have been provided with this specification (Attachment B). Final vendor data and completed instrument data sheets will be provided by the Vendor after contract has been awarded.
- C. Interconnecting wiring between Control Panel and end devices will be provided by the Purchaser.

2.10 MOTOR AND HEATER CONTROL COMPONENTS

- A. The Vendor shall provide all necessary motor control components and internal power distribution wiring for motor starting and control equipment for transfer pump PC-200, transfer pump PC-201, future green sand filter PA-200, air stripping tower PA-2002, ultraviolet/peroxide system PA-2005, and sump pump PS-200.
- B. The Vendor shall provide all necessary panel disconnects, and circuit breakers for system and motor control.

2.11 VARIABLE FREQUENCY DRIVES

- A. The Vendor shall supply VFDs for use with NEMA B design AC squirrel cage induction motors. The VFDs and all associated optional equipment shall be UL listed according to Power Conversion Equipment UL 508C. A UL label shall be attached inside each enclosure as verification. The VFDs shall use pulse width modulation (PWM) control technique.
- B. The VFDs shall be enclosed in a NEMA 4 enclosure with an external operated disconnect device. A mechanical interlock shall prevent an operator from opening the VFD door when the disconnect is in the "ON" position. Another mechanical interlock shall prevent an operator from placing the disconnect in the "ON" position while the VFD is open. It shall be possible for authorized personnel to defeat these interlocks. Provisions shall be provided for locking all disconnects in the "OFF" position with up to three padlocks.
- C. Circuit breaker or current limiting fuses shall be installed and wired to the VFD input. The Vendor shall provide three spare fuses, if fuses are provided.
- D. The Vendor shall ultimately be responsible for obtaining all necessary motor technical data from the motor or equipment manufacturer to properly size the VFDs. The VFDs shall be provided with an integral bypass. The VFDs selected to be compatible with submersible pump and motor service. The VFDs shall be sized per the motor's maximum current requirements under breakaway torque requirements, not per the motor horsepower rating. The VFDs will be sized to operate the AC motor of the following equipment.



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1. Motor for Extraction Pump PC-200, Motor Model to be provided: Motor Horsepower 7.5 hp constant torque, Motor full load amperes 11 Amps; Motor RPM 3450 at 60 Hertz; Motor voltage 460 V; Motor Service Factor 1.15.

- E. The Vendor shall provide input line reactors of minimum 3 percent per unit impedance and output line reactors of minimum 1.5 percent impedance per unit. All line reactors, integral or external type, shall be provided by the VFD manufacturer as part of the VFD package.
- F. The VFDs shall be manufactured by Allen-Bradley, ABB, Square D or an approved equal.
- G. The VFDs shall be ABB Model ACS 600 or approved equal by an approved manufacturer listed in Item F.
- H. The Vendor shall provide necessary climate control for VFD enclosures to ensure that the VFDs operate at the manufactures recommended operating temperature.

2.12 Radio Communication

- A. The Vendor shall supply a complete radio communication system to link the local control panel PLCs with the HMI. The radio communication system will include, but is not limited to radios, antennas, antenna wiring, interconnecting wiring between the PLCs and the radios, all mounting towers and/or poles, and mounting hardware.
- B. Radios shall be manufactured by Microwave Data Systems and shall be MDS Transnet 900™. The results of a radio survey for the project have been included to aid in design (Attachment C).
- C. Antennas shall be manufactured by Microwave Data Systems.
- D. Alternatives will be considered only for radio systems that have had a radio survey performed and an on-site field test performed by the Vendor at no cost to the Purchaser.

2.13 Power Distribution Panel and Transformer with Subpanel

- A. The Vendor shall supply a power distribution panel as outlined in Drawing E-1. The panel shall include a watt-hour meter to allow tracking power consumption by the Area 1 GET from the facility electrical distribution system. The main panel shall be Square D QMB Panelboard Series or Purchaser-approved equal with a 400 ampere main switch, and the branch switches and fuses as indicated on Drawing E-1. The panel shall be NEMA 3R and suitable for outdoor installation at the project location.
- B. The Vendor shall supply a transformer and subpanel as outlined on Drawing E-1. The transformer and subpanel shall be NEMA 3R and suitable for installation outdoors at the project location. The equipment shall be Square D or purchaser approved equal.

PART 3 EXECUTION



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3.01 GENERAL

- A. The Control System shall provide system control for the proposed system as depicted on the design drawings. The design drawings are conceptual in nature and the Vendor shall be responsible for identifying additional equipment and programming not identified on the drawings and Contract Documents to result in a functioning ready to use Control System.
- B. The Control System shall include an auto dialer that will call-out to a programmable list of phone numbers based on alarm and/or shutdown conditions.
- C. The Control System shall data log all analog channels. The data shall be stored in a manner to allow remote dial-up and/or internet access to logged data and downloading. The Control System shall record all channel values once every 5 minutes, and be capable of storing logged data for a minimum of 31 days. Logged data shall be in an ASCII format or in a format downloadable into Microsoft Excel.
- D. The Control System shall accept phone dial-in and/or internet access to allow remote inquiry of Control System using the most current commercially available version of PCAnywhere.
- E. The Vendor shall prewire all spare inputs and outputs from the PLC to the terminal block(s) in the Control Panel.
- F. The Vendor shall install and pre-wire to the terminal block a minimum of 100 percent spare discreet inputs, 50 percent spare analog inputs, 50 percent discreet outputs, and 25 percent analog outputs. All spare I/O channels shall be wired to the terminal blocks.
- G. The Vendor shall select and size all hardware and enclosures to allow for future expansion by approximately 100 percent.

3.02 PROGRAM DEVELOPMENT

- A. The Vendor shall be responsible for preparing all PLC configuration and ladder logic programming, installation, testing, debugging, and documentation for the Control System.
- B. The narrative description for the Control System operation and interlocks is provided in Attachment A.

3.03 CONTROL SYSTEM CAPABILITIES

A. General

The minimum capabilities for the Control System shall be in accordance with the requirements of this specification and include normal start-up, normal operation,



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normal shutdown, and emergency shutdown of the remediation system. Descriptions of each of these capabilities are provided herein and specified on the applicable design drawings. The descriptions are for clarification only and not intended to describe all aspects of the Control System specified on the applicable design drawings.

B. Normal Start-Up Sequence

Normal start-up sequence applies to remediation system start-up after a normal shutdown, or a shutdown caused by an alarm condition after the alarm condition has been cleared. Normal operation assumes that all hand switches are in the auto position, and hand selector switches are in flow or speed control position. Normal start-up shall be initiated by a "Remediation System Start" command at the main operator interface at which time the following sequence shall be followed:

The Control System shall survey all inputs for alarm conditions prior to actual start-up sequence. The inputs that result in equipment or remediation system shutdowns shall have timers to disable the shutdowns initially during start-up. The equipment and remediation system inputs shall become enabled as the timers time out. The timers shall be adjustable using the main operator interface from 0 to 240 minutes. Inputs that do not cause equipment or system shutdowns shall be active and displayed during start-up for operator information. Alarms shall clear as the process requirements are satisfied.

C. Normal Operation

Normal operation shall consist of operations after start-up under design load conditions. Set points adjustments for treatment system controllers and alarms shall be possible during normal operation. During normal operation, alarm points for switches shall be adjustable without a system shutdown; the proportional integrative derivative (PID) loops shall be tunable.

Normal operation shall be as specified on the applicable design drawings and in accordance with the requirements of Attachment A.

D. Normal Shutdown

Normal shutdown shall consist of a shutdown resulting from a "Remediation System Stop" command executed from the HMI. The local control panels for WS-9A and RD-2 will each be capable of performing a normal start and stop of the WS-9A and RD-2 well sites, respectively. A normal shutdown shall be an orderly shutdown of equipment.

E. Emergency Shutdown



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Emergency shutdown shall consist of a shutdown resulting from an "Emergency System Stop" command executed from the local control panel cabinet. The emergency stop is intended to immediately stop all rotating equipment and other electrical and mechanical components to protect operating personnel. An emergency shutdown procedure shall be defined during final design.

F. Interlocks

Interlocks have been provided to minimize the potential for release of untreated water and to prevent damage to remediation system equipment. Malfunctions or abnormal conditions that would damage equipment shall shut down the affected equipment. Malfunctions, abnormal conditions, or equipment shutdowns that prevent continued operation of the remediation system shall shut down the remediation system. Any malfunction or abnormal condition for the remediation system that requires operator attention to initiate corrective measures shall initiate an alarm.

G. Failure Modes

1. Power failure at the HMI at the Treatment System shall result in an immediate shutdown of extraction wells WS-9A and RD-2. Upon restoring power, the Control System shall indicate power failure with an alarm. The Control System shall not restart until the alarm is acknowledged by an operator at the HMI.
2. All sensors that fail shall result in an alarm condition.

H. Alarm System

1. Time verification delays shall be used to ensure it is a true alarm.
2. All alarms shall be logged on the HMI computer hard-disk.
3. All alarm messages shall have a time and date stamp.
4. Alarm messages shall be sent to remote locations via the autodialer.
5. The Control System shall be able to send messages to different phone numbers based on type of message, time of day, or if the previous dialed number did not answer.
6. The autodialer shall be able to dial eight phone numbers and shall be able to rotate through numbers until contact is made or an alarm is acknowledged.
7. Alarms shall be displayed as they occur on the color-graphics display screen. Trouble alarms shall be represented by the "graphic target" flashing on and



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off (blinking). It shall be possible to determine the specific details of an alarm condition, including point name, alarm value, and current value using a mouse without leaving the color-graphics display screen.

8. The system shall include an alarm log that will store all acknowledged and unacknowledged alarms to disk with date and time stamp, name of point, and alarm condition.
9. A feature shall be provided to force operator acknowledgement of alarms prior to the system being reset to resting state. The Control System shall log the name of the operator and time of alarm acknowledgement.
10. All current and historical alarm data from disk shall be available through an operator-selectable report that can be read on the color-graphics display screen or sent to a printer. Reports shall be definable as to specific date and time period.
11. All points, reports, parameters, control/monitoring strategies, and routines shall be definable by the operator through the operator's terminal. It shall be possible for the operator to modify the system functions independently after receiving the training from the Vendor. Through the operator terminal, any trained operator with security access shall be able to:
 - a. Read the value of a measured variable (i.e., temperature, level);
 - b. Stop or start equipment;
 - c. Monitor the status of equipment being controlled and/or monitored;
 - d. Read the set point of a control/monitoring loop;
 - e. Determine the control signal to an actuator;
 - f. Set or change alarm limits;
 - g. Determine the control/monitoring strategies that have been defined for a specific piece of equipment; and
 - h. Generate displays of control/monitoring strategies.
12. The Control System shall provide a qualified programmer with the ability to:
 - a. Add control/monitoring loops to the system;
 - b. Add points and color graphics to the system;



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- c. Create, modify, or delete control strategies;
- d. Assign sensors and/or actuators to a control/monitoring strategy;
- e. Tune control/monitoring loops by adjusting loop parameters;
- f. Enable or disable control/monitoring strategies;
- g. Generate hard-copy records of control/monitoring strategies on a printer;
- h. Select points to be alarmed and define the alarm state(s);
- i. Select points to be trended over a period of time and initiate the recording of values; and
- j. Add, Change, Modify, or Delete control strategies while "on-line."

I. Reports

- 1. The operator interface software shall be capable of producing reports with the following:
 - a. User-definable selection criteria;
 - b. Generated periodically (period to be user-definable) or as requested; and
 - c. Generated and printed on the local terminal or to a file.
- 2. Status reports shall contain current status of all controlled equipment and current values of all sensors.
- 3. Runtime reports shall contain the runtime of all equipment controlled and monitored.
- 4. Summary reports shall be able to contain any of the following information for any point in the Control System if requested by the operator:
 - a. Flowrate, temperatures; and
 - b. High, low, average, and calculated values.
- 5. History reports shall be selectable for any point in the Control System and for any time and/or date period. The system shall be able to use actual,



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average, or minimum and maximum values. Minimum display options shall be:

- a. Color bar chart with auto-scaling and time and date stamps;
- b. Tabular report with time and date stamps per sample; and
- c. Disk file ExcelTM-compatible format.

6. Alarm and logging reports shall be available and definable by the user. Alarms shall cause a visual and audible notification to the user upon occurrence. Visual notification shall continue until acknowledged. Alarm and logging options shall be as follows:

- a. User-definable, low and high limits;
- b. User adjustment directly from a graphics screen;
- c. User-selectable event logging to disk, printer, or screen with time and date stamp:
 - user log on/log off;
 - alarms;
 - manual controls;
 - automatic controls;
 - communication failures; and
 - power failures and system reboots.
- d. Up to 31 days of data logs and 365 days per year history file;
- e. Return from alarm tolerance setting; and
- f. Data logging for all analog channels. The process value, time and date will be recorded at a frequency of once a minute.

3.04 DISPLAY SCREENS

A. The Vendor shall create a minimum of 30 detailed color graphics screens for the entire remediation system. The color graphics screens must be able to be modified by the Purchaser. The Purchaser must approve the color graphics screens submitted by the Vendor prior to their use. Twenty color graphics screens of the 30 required shall be as follows:

- 1. Operator Log On/Off.
- 2. Overview screen, list type, with major operating parameters for the treatment system and extraction wells WS-9A and RD-2.



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3. Process & Instrumentation Diagram type, with controller faceplates for each PID loop and Hand-Off-Automatics (HOAs), depicting major equipment, wells, and all analog values.
 4. Individual well screen for each extraction well to allow observation of flows, pressure, and level. Allow modification of set points from this screen (7 screens).
 5. Setup screen, text type for establishment of alarm values, setpoints for control loops.
 6. Trending.
 7. Alarm log. The Vendor shall prepare an alarm summary color graphics screen that will display current and acknowledged alarms. In addition, alarms that have been cleared and acknowledged during the past 24 hours shall be displayed.
 8. Event log.
- B. The color graphics screens shall be dynamic, with a refresh rate of 60 times/second. The Vendor shall supply graphics sufficient to display all monitored points incorporated in the associated points lists.
- C. Color graphics screens shall allow display of data as numerical, horizontal or vertical analog fill, or digital change-of-state. When monitored equipment goes into alarm, the data display shall flash on the screen to draw the operator's attention. Change-of-state signals shall cause the display to change color for that device. Status display colors shall be user-definable. Alarm conditions shall cause the displayed point to blink and generate an audible alarm buzzer.
- D. It shall be possible to perform automatic and manual controls and monitoring directly from the color graphics screen using a mouse or track-ball. The operator shall be able to activate automatic controls from a graphics target, or manually adjust a digital or analog point by "clicking" on that particular object and selecting the desired control/monitoring option from a menu with "Help" text. The system shall require proper security level and shall prompt the user for verification prior to actuating control.
- E. The color graphics screens shall provide change-of-state displays, graphics displays, information summaries, control system malfunction advisories, and operator input advisories. Furthermore, all software and program editing shall be capable of being performed either at the color graphics screen or from a remote terminal (direct connect or via modem).
- F. Operator communications with the system shall be performed at the main operator interface (or via remote terminal) and shall be in full English language. Complete access to controls, on-line monitoring, and all other operator interface functions shall be available remotely (via telephone and/or hard-wire) assuming the operator has the proper password access code.

3.05 COORDINATION



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A. General Requirements

1. The Vendor shall coordinate with the Purchaser the following activities, at a minimum:
 - a. Control and remediation system design, fabrication, and shop testing;
 - b. Control system installation;
 - c. Control system check-out;
 - d. Control and remediation system start-up; and
 - e. Operator training.
2. Coordination requirements identified in this specification shall not be construed to limit the amount of professional time or other resources provided by the Vendor to resolve deficiencies or other problems.

B. Design, Fabrication, and Shop Testing Coordination

1. During design, fabrication, and shop testing of the Control System, the Vendor shall coordinate activities and requirements with the Purchaser.
2. Design coordination shall include review of instrumentation and other interconnected devices selected by the Purchaser for compatibility with the design of the Control System.
3. Coordination shall include biweekly design review meetings and periodic shop inspections by the Purchaser during fabrication and testing.
4. The agenda for the design meetings shall include the following:
 - a. Status report, including progress made during the previous two weeks;
 - b. Updated schedule;
 - c. Problems identified or resolved; and
 - d. Progress expected to be made during the coming week.
5. The meeting schedule and agenda may be modified by the Purchaser as required.



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6. Fabrication coordination shall include inspection in accordance with the requirements of Paragraph 3.07.
7. Shop-testing coordination shall include completion of the Functional Test in accordance with the requirements of Paragraph 3.07.

C. Check-out Coordination

1. During check-out of the Control System, the Vendor shall work with the Purchaser to ensure that the Control System is ready for operation and installed in accordance with the Vendor's design requirements.
2. Check-out is expected to require full-time Vendor support for a minimum of 5 days.
3. Check-out is expected to include a detailed, point-by-point, inspection of the Control System to verify installation in accordance with the Vendor's design requirements. The inspection shall include field functional testing of each Control System function in accordance with the requirements of this specification and Paragraph 3.07.

D. Start-up Coordination

1. During start-up of the remediation system, the Vendor shall provide full-time assistance to verify Control System operation in accordance with the requirements of this specification and the final approved design.
2. Start-up is expected to require full-time Vendor support for a minimum period of 7 days. Additional part-time Vendor support to resolve Vendor deficiencies shall be provided as required at no additional cost to the Purchaser.
3. Start-up shall be deemed complete when the Control System demonstrates, to the satisfaction of the Purchaser, its ability to achieve normal start-up, operation, and shutdown and emergency shutdown of the remediation system on a routine basis. Control System functions shall be retested during start-up.

E. Operator Training Coordination

Coordination of operator training shall be in accordance with the requirements of Paragraph 3.09.

3.06 REPORTING



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The Vendor shall prepare and submit a biweekly status report to the Purchaser. The biweekly status report shall briefly describe the status of work completed, problems encountered, proposed resolution of problems, and schedule updates.

3.07 INSPECTIONS AND TESTS

A. General

1. The inspections and tests identified in this specification represent minimum or special requirements identified by the Purchaser. The Vendor shall be required to identify and implement all other inspections and tests to meet the requirements of this specification.
2. The Vendor shall perform the following Observed inspections on the Control System:
 - a. Installation inspection; and
 - b. Control system check-out.
3. The following witnessed tests shall be performed on the Control System:
 - a. Functional Test; and
 - b. Acceptance Test.
4. After advance notification to the Vendor by the Purchaser, the Purchaser or Purchaser's representative shall have access to all Vendor and subvendor facilities where fabrication, testing, or inspection of the Control System is in progress.
5. The Vendor shall notify subvendors of the Purchaser's inspection and testing requirements.
6. The Vendor shall provide a minimum of 7 days advanced notice to the Purchaser before conducting any inspection or test that the Purchaser has specified to be witnessed or observed.
7. "Witnessed" means that a hold shall be applied to the production schedule and that the inspection and/or test shall be carried out with Purchaser and or the Purchaser's representative in attendance.
8. "Observed" means that the Purchaser shall be notified to the timing of the inspection and/or test; however, the inspection and/or test is performed as scheduled, and if the Purchaser and/or the Purchaser's representative is not present, the Vendor shall proceed to the next step.



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9. Equipment and materials for the specified inspections and tests shall be provided by the Vendor.
10. The responsibility for inspection and testing rests with the Vendor; however, the Purchaser and/or the Purchaser's representative reserve the right to inspect the Control System at any time during fabrication to ensure that materials and workmanship are in accordance with the requirements of this specification.
11. The Purchaser's approval of any work and release of the Control System for shipment shall in no way relieve the Vendor of any responsibility for carrying out the requirements of this specification.

B. Inspections

1. The Purchaser may perform random inspections with advanced notice in accordance with the requirements of Paragraph 3.07 A.
2. The Purchaser may perform in-progress or final inspection of the Control System prior to the release of shipment.
3. Control System installation inspection shall be performed in accordance with the requirements of Paragraph 3.05 C.
4. Control System check-out shall be performed in accordance with the requirements of Paragraph 3.05 D and shall include the following:
 - a. Voltage check of all circuits;
 - b. Phase sequence check;
 - c. Calibration of all safety equipment;
 - d. Verification of proper instrumentation and control signal generation, transmission, reception, and response; and
 - e. Checking that identification of all enclosures, components, and wiring is completed in accordance with the requirements of Paragraph 3.08.

C. Functional Test

1. The Functional Test shall be conducted prior to shipment to the site to demonstrate that the Control System was fabricated and functions in accordance with the approved design.



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2. The Functional Test shall be performed in accordance with a test procedure prepared by the Vendor after review and approval of the procedure by the Purchaser.
3. At a minimum, the Functional Test shall simulate normal start-up, normal operation, normal shutdown, and emergency shutdown.
4. During the Functional Test, inputs and outputs to the Control System will be simulated. The simulations will demonstrate the functionality of each loop. Each I/O loop shall be tested to verify operation.
5. The Vendor shall correct any fault, malfunction, or deficiency found during the Functional Test at the Vendor's expense. The particular function corrected shall be retested and witnessed by the Purchaser to verify that the control and shutdown system fault, malfunction, or deficiency has been corrected.
6. Testing will generally be limited to 8 hours per day. The Purchaser's representative will conduct a meeting each day to review the test results and upcoming test schedule. The Vendor will be allowed to correct deficiencies as the test progresses, as long as the corrective work does not delay the ongoing testing.
7. At the completion of the test, the Purchaser's representative will review the list of deficiencies and determine if the system is acceptable for shipment or if major deficiencies must be corrected and re-tested prior to shipment. If the system test of a portion of the test fails, the Vendor will correct the deficiencies and pay any travel and living expenses incurred to complete the re-testing of the corrected equipment at the same rates as initially incurred.

D. Acceptance Tests

1. Acceptance testing is intended to demonstrate the reliability of performance of the Control System under operational conditions.
2. Acceptance testing shall be performed by the Purchaser. The Vendor shall remain on-call and participate in the Acceptance Test to resolve deficiencies identified in the Control System.
3. Any deficiencies identified in the Control System during this period shall be resolved by the Vendor in a timely fashion to the Purchaser's satisfaction.
4. Acceptance testing shall be deemed complete when the Control System demonstrates its ability to operate in accordance with the approved design during 30 consecutive days of operation after completion of start-up.



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5. The Purchaser may simulate shutdown or other emergency conditions during the Acceptance Tests.

E. Test Equipment

The Vendor will provide the following equipment for the Purchaser's representative while testing the System:

1. Adequate Physical Space and Electrical Power to perform the test.
2. Documentation on all equipment to be tested including:
 - a. Configuration, panel layout, and connection diagrams;
 - b. Hardware manuals on Purchaser-furnished equipment; and
 - c. Any Vendor-developed shop drawings and documents.
3. Test equipment for the Purchaser's use during functional testing including:
 - a. One 4-20 milliamp signal generator;
 - b. Two multimeters; and
 - c. A supply of electrical jumpers to fully test the I/O equipment.

3.08 IDENTIFICATION

The Vendor shall propose an identification system for the approval of the Purchaser.

3.09 OPERATOR TRAINING

A. General

1. The Vendor shall provide training for designated operations personnel. Operator training shall be conducted in three phases:
 - a. Classroom training;
 - b. Initial site training; and
 - c. Follow-up site training.
2. All operator training sessions will be attended by a maximum of six operating personnel.
3. The Vendor shall coordinate the schedule for all training with the Purchaser.
4. A detailed plan for operator training, including course content and agendas, shall be prepared by the Vendor for Purchaser review and approval.



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5. For guidance in planning the required instruction, the Vendor should assume that attendees have a high school education or equivalent and have a technical background, but are not otherwise familiar with control systems.

B. Classroom Training

1. Classroom training shall be conducted in Simi Valley, California, in facilities provided by the Purchaser.
2. Classroom training shall be conducted a minimum of 1 week prior to scheduled Control System check-out.
3. Classroom training shall include a review of the content of the Operating Manual prepared by the Vendor. The draft Operating Manual shall be reviewed and approved by the Purchaser prior to the classroom training session.
4. Classroom training is expected to consist of a minimum of 4- to 6-hours of instruction.
5. Classroom training shall include discussion of the following topics, at a minimum:
 - a. Operation of Control System equipment;
 - b. Programming procedures;
 - c. Diagnostic procedures;
 - d. Failure recovery procedures;
 - e. Alarm formats;
 - f. Maintenance and calibration procedures;
 - g. Trouble shooting, diagnostics, and repair instructions;
 - h. Report generation procedures and capabilities;
 - i. Data base entry;
 - j. Reports and logs;
 - k. Color graphics generation; and



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I. Preventive maintenance procedures and schedules.

C. Initial Site Training

1. Initial site training shall be conducted at the job site.
2. Initial site training shall be conducted within 2 weeks of completion of start-up activities in accordance with the requirements of Paragraph 3.05.
3. Initial site training shall include a review of the revised Operating Manual. The revised Operating Manual shall incorporate revisions that include changes identified during start-up activities. The revised Operating Manual shall be reviewed and approved by the Purchaser prior to the initial site training.
4. Initial site training is expected to include a minimum of one 8-hour day of instruction.
5. Initial site training shall include the following items, at a minimum:
 - a. A review of Control System and Operating Manual revisions;
 - b. A walk-through and description of the Control System;
 - c. Demonstration of normal start-up, operation, and shutdown procedures, emergency shutdown procedures, diagnostic procedures, failure recovery procedures, and basic calibration and maintenance procedures. The demonstration shall include instruction on graphics manipulation and capabilities;
 - d. Report generation; and
 - e. Observed, hands-on start-up and shut-down by each attendee.
6. Upon completing this training, each attendee should be able to perform basic operations by using appropriate documentation and be able to describe the general architecture and functionality of the Control System.

D. Follow-up Site Training

1. Follow-up site training shall be conducted at the job site.
2. Follow-up site training shall be conducted within 60 days after completion of the Acceptance Test in accordance with the requirements of Paragraph 3.07 D. The date to be determined by the Purchaser in coordination with the Vendor.



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3. Follow-up site training shall include a review of all items included with classroom and initial site training, and a question and answer session.
4. Follow-up site training is expected to consist of a minimum of 8 hours of instruction.
5. Upon completion of the follow-up training, the attendees should be fully proficient in the operation and basic maintenance of the Control System.

3.10 DELIVERY, STORAGE, AND HANDLING

- A. The Control System shall be dry, thoroughly cleaned inside and outside, and free of all loose foreign materials.
- B. The Control System shall be stored at the Vendor's facility upon completion until ready for installation at the site. The ship date shall be provided by the Purchaser.
- C. The Vendor shall prepare the Control System for shipment to the site.
- D. Lifting points for enclosure shall be clearly identified.
- E. Each container shall be marked with the address, Purchaser's job number, purchase order number, equipment tag number, and equipment serial number. Crated equipment shall be shipped with duplicate packing lists, one inside and one outside of the shipping container.
- F. The Vendor shall furnish recommendations for protective measures to be applied to the Control System after its delivery to the site.

3.11 WARRANTY

The Vendor shall provide a written statement of warranty with the Vendor quotation.

END OF TEXT



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TABLES

<u>Table Number</u>	<u>Description</u>
1	Area 1 GET System Input and Output Summary
2	Area 1 GET System Shutdown and Warning Alarms

DESIGN DRAWINGS

<u>Drawing Number</u>	<u>Description</u>
1	Site Location
2	Control Layout
G-2	Piping and Instrumentation Diagram, Symbols and Legends
P-1	Process Flow Diagram
P-2	Piping and Instrumentation Diagram, Pre-Treatment Systems
P-3	Piping and Instrumentation Diagram, IX/Air Stripping Systems
P-4	Piping and Instrumentation Diagram, Carbon Adsorption Systems
P-5	Piping and Instrumentation Diagram, Ultraviolet/Peroxide System
P-6	Piping and Instrumentation Diagram, Utility Systems
P-7	Piping and Instrumentation Diagram, WS-9A and RD-2
E-1	Area 1 GET System, One-Line Diagram



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ATTACHMENTS

<u>Attachment</u>	<u>Description</u>
A	Control System Description Area 1 Groundwater Extraction And Treatment System, The Boeing Company, Santa Susana Field Laboratory, Simi Valley, California
B	Instrumentation Data Sheets
C	Radio Survey Results

TABLE 1

AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM INPUT AND OUTPUT SUMMARY

Tag No.	Description	Location	Range	Unit of Measure	Power Type	Load
DISCRETE INPUTS						
FSH 100	High Flow Switch on Pressure Relief Line to WS-9A Well	WS-9A Well head	On-Off	None	120 VAC	Transistor
FSH 101	High Flow Switch on Pressure Relief Line to RD-2 Well	RD-2 Well head	On-Off	None	120 VAC	Transistor
LSH 201	High Level Switch at Pump PS-200	PS-200	On-Off	None	120 VAC	Transistor
LSL 203	Low Level Switch at Pump PS-200	PS-200	On-Off	None	120 VAC	Transistor
LSHH 201	High Level Switch at Treatment System Containment Pad	Treatment System	On-Off	None	120 VAC	Transistor
DPS 200	Differential Pressure Switch at F-200/F-201	Treatment System	On-Off	None	120 VAC	Transistor
YI 200	Status Transfer Pump PC-200	SIC-200	On-Off	None	120 VAC	Transistor
YI 201	Status Transfer Pump PC-201	Motor Starter PC-201	On-Off	None	120 VAC	Transistor
YI-100	VFD for Extraction Pump PS-100 Status	SIC-100	On-Off	None	120 VAC	Transistor
YI-101	Extraction Pump PS-101 Status	RD-2 Motor Starter	On-Off	None	120 VAC	Relay
FSH-200	High flow relief line from PA-201 (future)	PA-201	On-Off	None	120 VAC	Transistor
YI-208	Run Status Air Stripping Tower PA-202	PA-202	On-Off	None	120 VAC	Transistor
YI-233	Alarm Status Air Stripping Tower PA-202	PA-202	On-Off	None	120 VAC	Transistor
FSH-201	High flow relief line from PA-203	PA-203	On-Off	None	120 VAC	Transistor
YI-204	Alarm Status Ultraviolet/Peroxide System PA-205	PA-205	On-Off	None	120 VAC	Transistor
YI-213	Run Status Ultraviolet/Peroxide System PA-205	PA-205	On-Off	None	120 VAC	Transistor
YI-215	Shutdown Status Ultraviolet/Peroxide System PA-205	PA-205	On-Off	None	120 VAC	Transistor
YI-230	Alarm Status Green Sand Filter System PA-200 (Future)	PA-200	On-Off	None	120 VAC	Transistor
YI-231	Run Status Green Sand Filter System PA-200 (Future)	PA-200	On-Off	None	120 VAC	Transistor
HS-210	Status Sump Pump PS-200	HS-210	On-Off	None	120 VAC	Relay
YI-110	Control Panel Door Open WS-9A	WS-9A Well head	On-Off	None	120 VAC	Transistor
YI-111	Control Panel Door Open RD-2	RD-2 Well head	On-Off	None	120 VAC	Transistor
YI-220	Control Panel Door Open Area 1 Main Control Panel	Treatment System	On-Off	None	120 VAC	Transistor
YI-112	AC-Power Failure WS-9A	WS-9A Well head	On-Off	None	120 VAC	Relay
YI-113	AC-Power Failure RD-2	RD-2 Well head	On-Off	None	120 VAC	Relay
YI-221	AC-Power Failure Area 1 Main Control Panel	Treatment System	On-Off	None	120 VAC	Relay
YI-114	Battery Failure WS-9A	WS-9A Well head	On-Off	None	120 VAC	Relay
YI-115	Battery Failure RD-2	RD-2 Well head	On-Off	None	120 VAC	Relay
YI-222	Battery Failure Area 1 Main Control Panel	Treatment System	On-Off	None	120 VAC	Relay
TSH-100	High Temperature Switch in Control Panel WS-9A	WS-9A Well head	On-Off	None	120 VAC	Transistor
TSH-101	High Temperature Switch in Control Panel RD-2	RD-2 Well head	On-Off	None	120 VAC	Transistor
TSH-200	High Temperature Switch in Control Panel Area 1 Main Control Panel	Treatment System	On-Off	None	120 VAC	Transistor
HS-100	Emergency Stop Control Panel WS-9A	WS-9A Well head	On-Off	None	120 VAC	Transistor
HS-110	Emergency Stop Control Panel RD-2	RD-2 Well head	On-Off	None	120 VAC	Transistor
HS-220	Emergency Stop Control Panel Area 1 Treatment System	Treatment System	On-Off	None	120 VAC	Transistor

Total Discrete Input Points

35

TABLE 1

AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM INPUT AND OUTPUT SUMMARY

Tag No.	Description	Location	Range	Unit of Measure	Power Type	Load
ANALOG INPUTS						
FQIT 100	WS-9A Groundwater Flow Quantity Indicating Transmitter	WS-9A Well head	0-60	gpm	24 VDC	4-20 milliamp
PT 100	WS-9A Wellhead Pressure Transmitter	WS-9A Well head	0- 160	psig	24 VDC	4-20 milliamp
FQIT 101	RD-2 Groundwater Flow Quantity Indicating Transmitter	RD-2 Well head	0-60	gpm	24 VDC	4-20 milliamp
PT 101	RD-2 Wellhead Pressure Transmitter	RD-2 Well head	0- 160	psig	24 VDC	4-20 milliamp
LT 200	Level Transmitter at T-200	T-200	0-13	feet	24 VDC	4-20 milliamp
LT 201	Level Transmitter at T-201	T-201	0-17	feet	24 VDC	4-20 milliamp
FIT 200	Treatment System Flow Indicating Transmitter	FIT-200	0-100	gpm	24 VDC	4-20 milliamp
DPIT 200	Differential Pressure Indicating Transmitter	F-202/F-203	0-60	psid	24 VDC	4-20 milliamp

Total Analog Input Points

8

DISCRETE OUTPUTS

HS-101	PS-100 VFD Start Stop Signal	SIC-100	On-Off	None	120 VAC	Relay
HS-111	PS-101 Motor Starter Stop Signal	RD-2 Motor Starter	On-Off	None	120 VAC	Relay
DPAH-203	Differential Pressure Alarm High at F-200/F201	F-200/F-201	On-Off	None	120 VAC	Relay
HS-200	PC-200 VFD Start Stop Signal	SIC-200	On-Off	None	120 VAC	Relay
HS-201	PC-201 Start Stop Signal	HS-201	On-Off	None	120 VAC	Relay
HS-210	PS-200 Start Stop Signal	HS-210	On-Off	None	120 VAC	Relay
HS-230	PA-200 Start Stop Signal (Future)	PA-200	On-Off	None	120 VAC	Relay
HS-231	PA-202 Start Stop Signal	PA-202	On-Off	None	120 VAC	Relay
HS-211	PA-205 Start Stop Signal	PA-205	On-Off	None	120 VAC	Relay

Total Discrete Output Points

9

ANALOG OUTPUTS

FIC-100	Speed Signal to SIC-100 for Extraction Pump PS-100	SIC-100	0-100	Percent	24 VDC	4-20 milliamp
FIT-200	Flow Signal to PA-200 from FIT-200 (Future)	PA-200	0-100	gpm	24 VDC	4-20 milliamp
FIT-200	Flow Signal to PA-205 from FIT-200	PA-205	0-100	gpm	24 VDC	4-20 milliamp
LIC-200	Speed Signal to SIC-1001 for Extraction Pump PS-1001	SIC-200	0-100	Percent	24 VDC	4-20 milliamp

Total Analog Output Points

4

Total Points

56



TABLE 2

AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM SHUTDOWN AND WARNING ALARMS

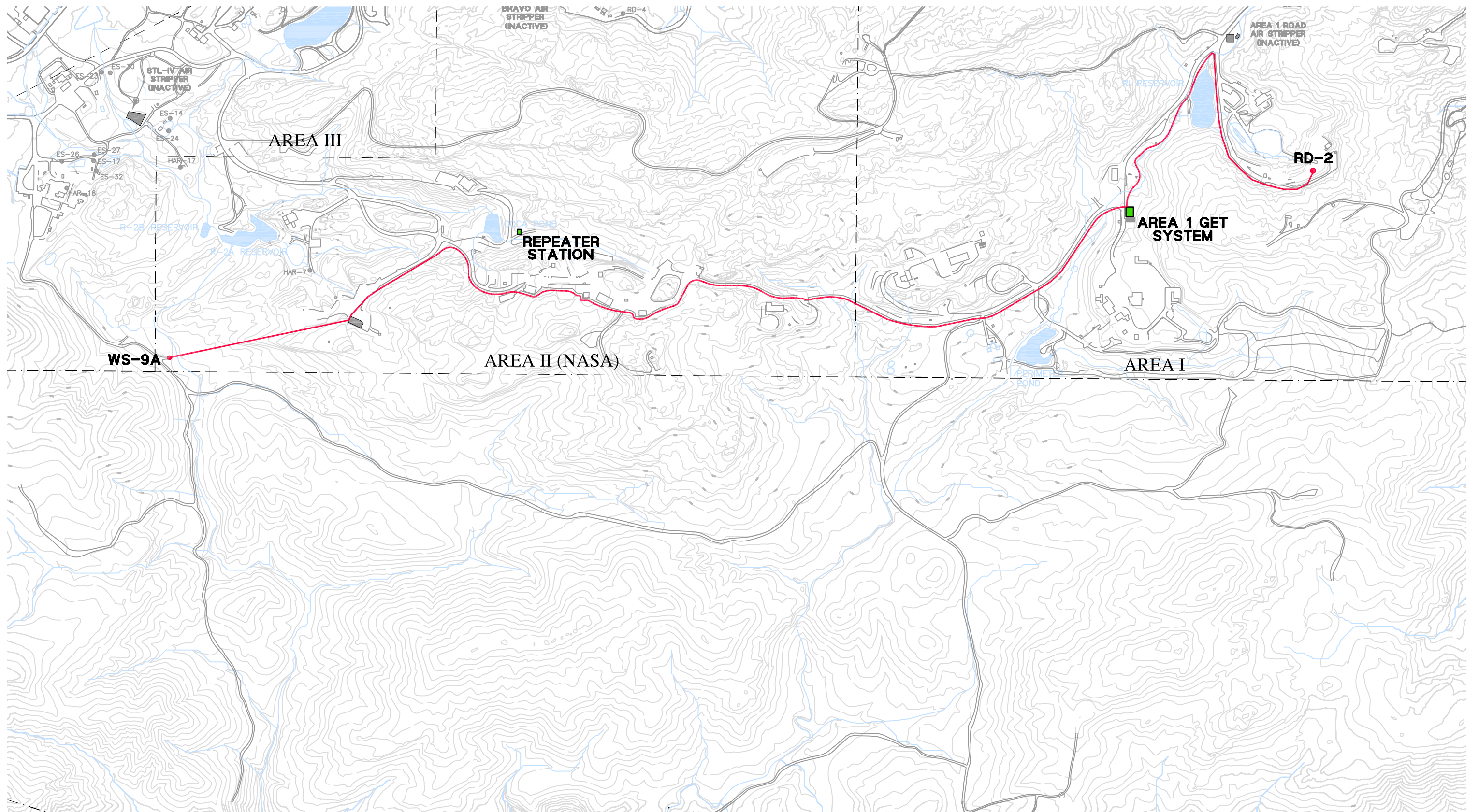
TAG NUMBER	DESCRIPTION	SET POINT	SET POINT RANGE	UNITS
Shut Down Alarms				
FSH-100	High flow in WS-9A relief line at FSH-100.	fixed	fixed	gpm
FSH-101	High flow in RD-2 relief line at FSH-101.	fixed	fixed	gpm
PAH-100	High pressure at extraction well WS-9A measured by PT-100.	120	110 to 160	psig
PAL-100	Low pressure at extraction well WS-9A measured by PT-100.	50	25 to 75	psig
PAH-101	High pressure at extraction well RD-2 measured by PT-101.	120	110 to 160	psig
PAL-101	Low pressure at extraction well RD-2 measured by PT-101.	50	25 to 75	psig
LAHH-200	High water level in Storage Tank T-200 measured at LT-200	11	10.5 to 11.5	feet
LAL-200	Low water level in Storage Tank T-200 measured at LT-200	3	2.5 to 3.5	feet
LAHH-201	High water level in Storage Tank T-201 measured at LT-201	14	13 to 15	feet
YA-200	Transfer Pump PC-200 failure measured at YA-200	fixed	fixed	event
FAL-200	Low water flow measured at FIT-200	10	5 to 15	gpm
LAHH-203	High water level in treatment system containment pad at LSHH-201.	9	3 to 12	inches
YI-211	Equipment failure from Air Stripping Tower PA-202	fixed	fixed	event
FAH-200	High flow burst plate relief line from ion exchange vessels PA-201 at FSH-200. (future)	fixed	fixed	gpm
HS-100	Emergency stop at the control panel WS-9A.	fixed	fixed	event
HS-110	Emergency stop at the control panel RD-2.	fixed	fixed	event
HS-220	Emergency stop at the control panel Area 1 GET main control panel. Communication loss between	fixed	fixed	event
YA-230	Communication loss between radio repeater and Area 1 GET main control panel.	fixed	fixed	event
YA-231	Power loss at radio repeater.	fixed	fixed	event
YA-232	Power loss at Area 1 GET main control panel.	fixed	fixed	event
YA-233	Communication loss between WS-9A and Area 1 GET main control panel	fixed	fixed	event
FAH-201	High flow burst plate relief line from carbon adsorbers PA-203 at FSH-201.	fixed	fixed	event
YA-204	Ultraviolet/Peroxide System PA-205 failure measured at PA-205	fixed	fixed	event



TABLE 2

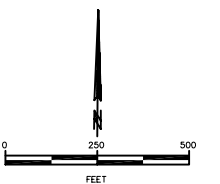
AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM SHUTDOWN AND WARNING ALARMS

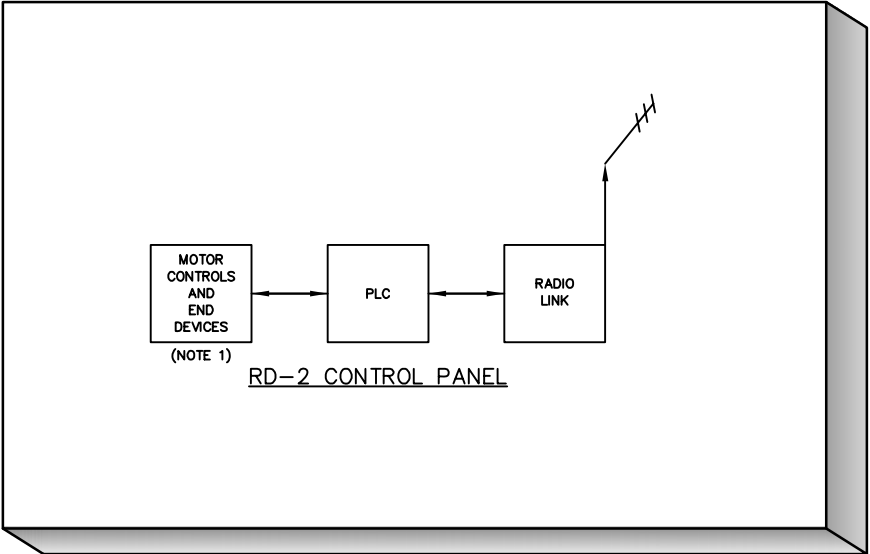
TAG NUMBER	DESCRIPTION	SET POINT	SET POINT RANGE	UNITS
TSH-100	High Temperature Switch in Control Panel WS-9A	125	115 to 130	degrees F
TSH-101	High Temperature Switch in Control Panel RD-2	125	115 to 130	degrees F
TSH-200	High Temperature Switch in Control Panel Area 1 Main Control Panel	125	115 to 130	degrees F
WS-9A Shut Down Alarms				
FAL-100	VFD failure for PS-100 at WS-9A	fixed	fixed	event
RD-2 Shut Down Alarms				
FAL-101	Motor starter failure at RD-2.	fixed	fixed	event



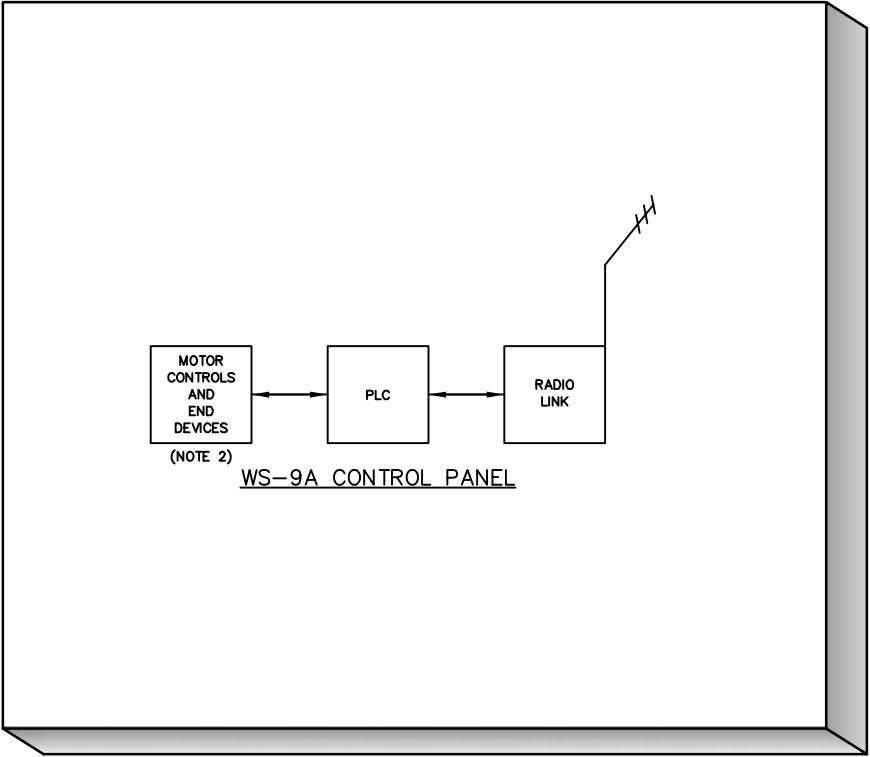
EXPLANATION

- PROPOSED DOUBLE CONTAINED EXTRACTION PIPELINE
- PROPOSED AREA I GROUNDWATER EXTRACTION AND TREATMENT SYSTEM LOCATION
- GET – GROUNDWATER EXTRACTION AND TREATMENT
- NOTE: INTERIM GROUNDWATER SYSTEM AND WELL LOCATION ARE APPROXIMATE

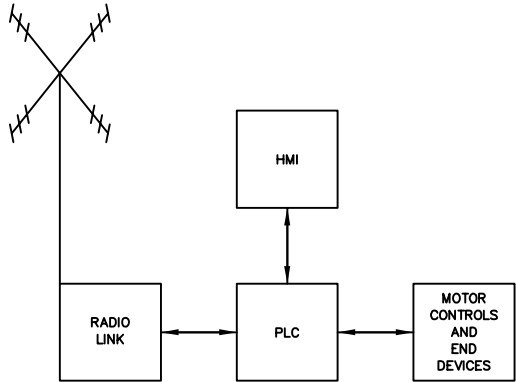




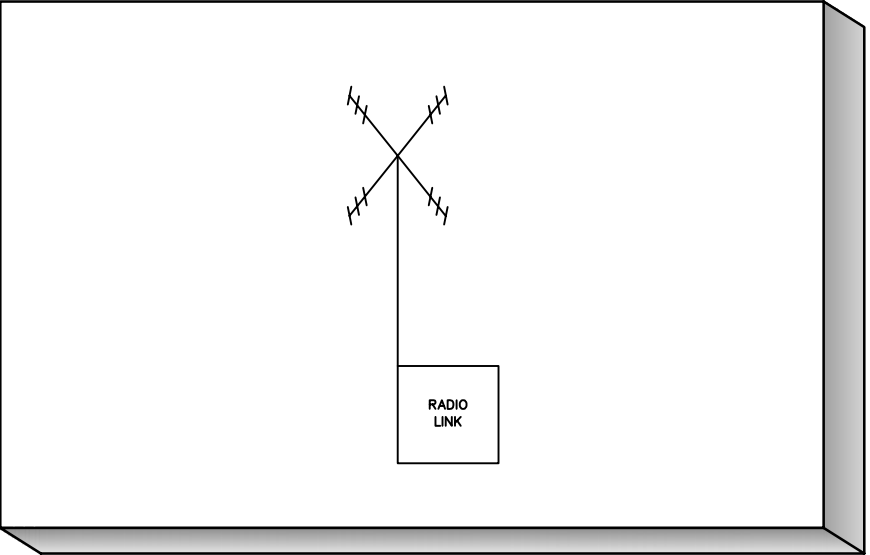
EXTRACTION WELL RD-2 WELL SITE



EXTRACTION WELL WS-9A WELL SITE



AREA 1 GROUNDWATER TREATMENT SYSTEM

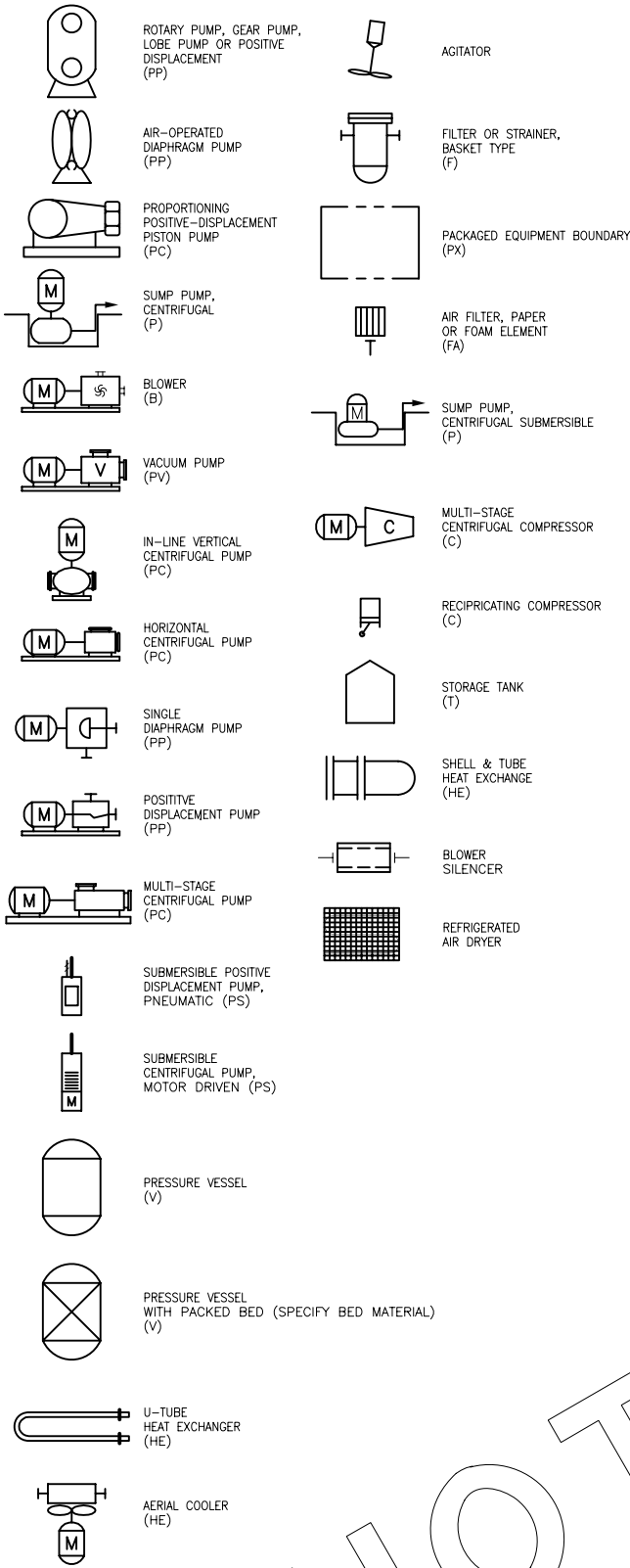


REPEATER STATION

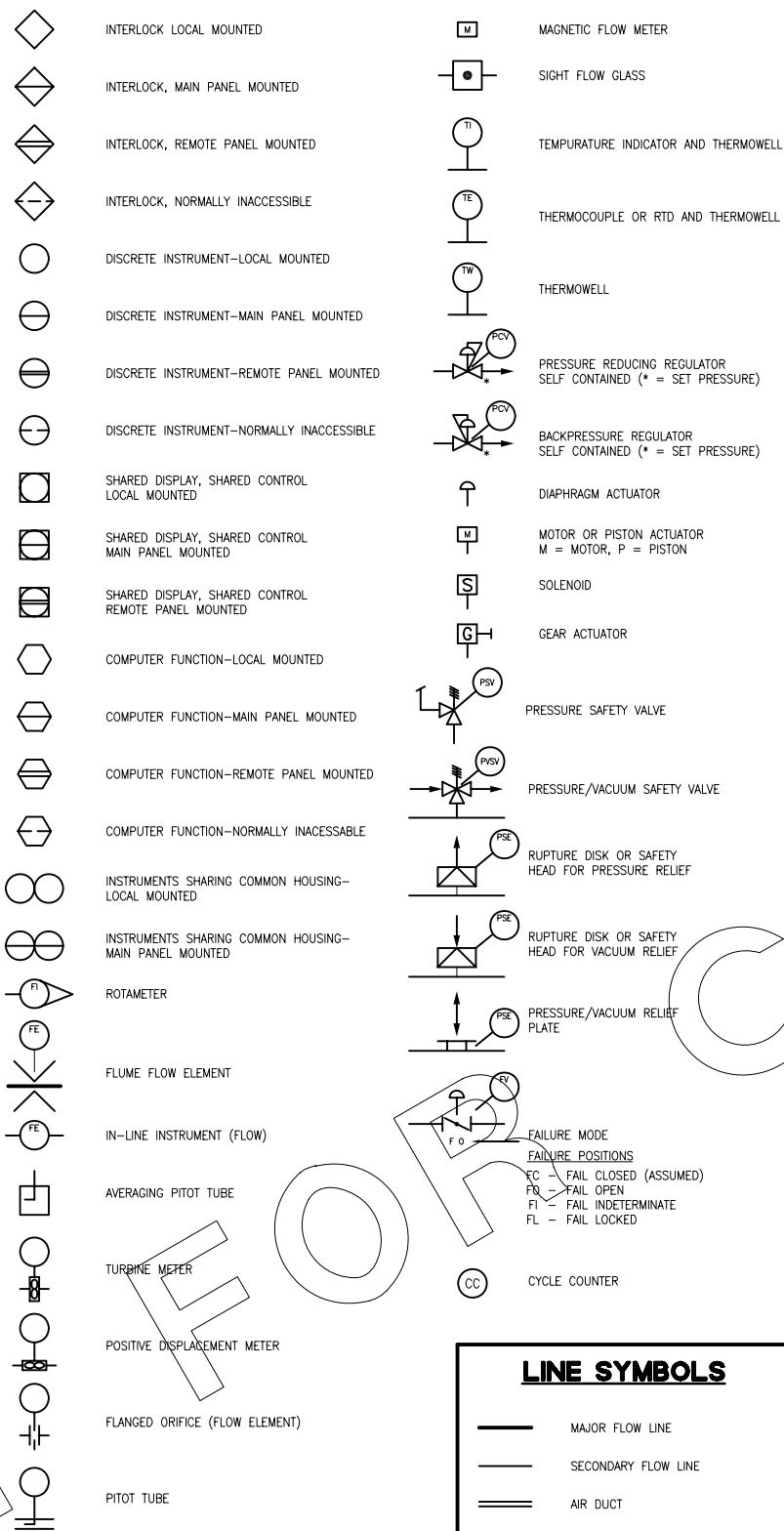
NOTES: 1. MOTOR CONTROL PANEL FOR RD-2 IS EXISTING. VENDOR TO INTEGRATE EXISTING PANEL INTO CONTROL SYSTEM
2. MOTOR CONTROL PANEL FOR WS-9A
3. VENDER TO INTEGRATE EXISTING VARIABLE FREQUENCY DRIVE INTO CONTROL SYSTEM

								THE BOEING COMPANY			
								SANTA SUSANA FIELD LABORATORY			
								SIMI VALLEY, CALIFORNIA			
								AREA 1			
								GROUNDWATER EXTRACTION TREATMENT SYSTEM			
								CONTROL LAYOUT			
0	APPROVED FOR BID						 HARGIS+ASSOCIATES, INC.				2
REV	ISSUE	CL	EM	PM	DE	DATE	RPT NO. 597.183	DATE 7/27/07	DWG BY ADE	DWG NO. 521-0116	0

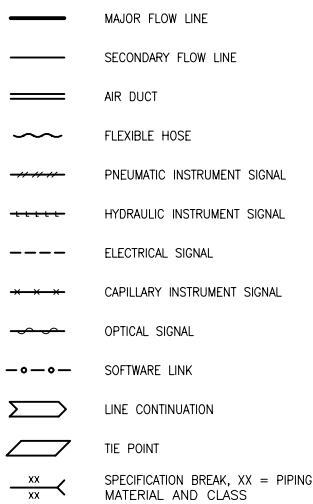
EQUIPMENT IDENTIFICATION



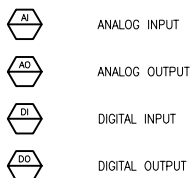
INSTRUMENTS



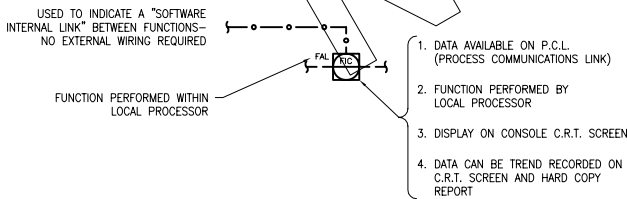
LINE SYMBOLS



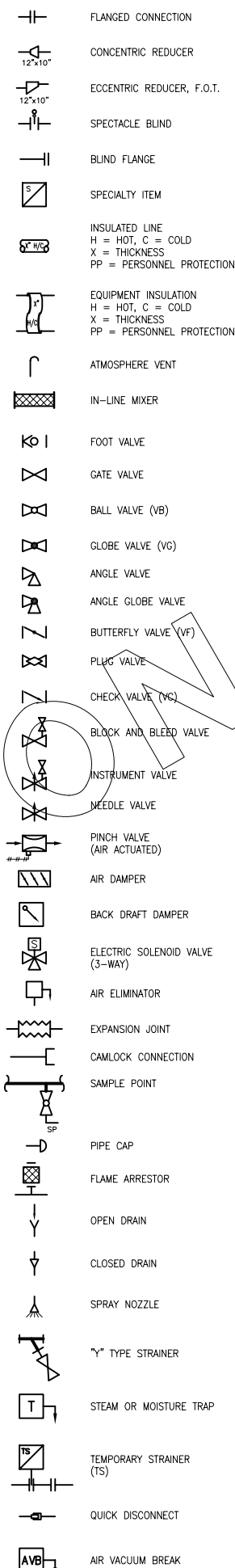
COMPUTER INTERFACE SYMBOLS



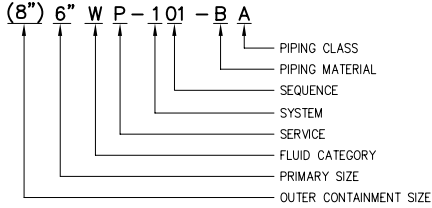
SHARED DISPLAY EXPLANATION



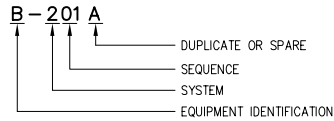
PIPING SYMBOLS



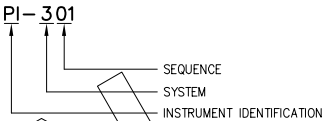
LINE NUMBERS



EQUIPMENT TAG NUMBERS



INSTRUMENT TAG NUMBERS



EQUIPMENT IDENTIFICATION

- A - AGITATOR
- B - BLOWER
- C - COLUMN
- D - DRIVE
- HE - HEAT EXCHANGER
- F - FILTER
- FX - FIRED EQUIPMENT
- G - FLUID MIXING NOZZLE
- H - SOLIDS HANDLING EQUIPMENT
- M - MIXER
- P - PUMP
- PS - PUMP (SUBMERSIBLE)
- PX - VENDOR PACKAGE SYSTEM
- S - SEPARATOR
- T - TANK
- U - LUBRICATION PACKAGE
- V - VESSEL
- W - COOLING TOWER
- WX - WEIRS
- X - VENT STACKS
- Y - MISCELLANEOUS
- Z - MISCELLANEOUS EQUIPMENT

PIPING MATERIAL

- A - CARBON STEEL, A53 Gr. B, GALVANIZED
- B - HIGH DENSITY POLYETHYLENE
- C - POLYVINYL CHLORIDE
- D - STAINLESS STEEL
- E - COPPER
- F - HOSE
- G - DURAPLUS PLASTIC AIR PIPE
- H - DOUBLE CONTAINED HIGH DENSITY POLYETHYLENE

FLUID CATEGORIES

- A - AIR
- W - WATER
- G - GAS
- C - CHEMICAL

SYSTEM

- 0 - UNCLASSIFIED
- 1 - GROUNDWATER EXTRACTION
- 2 - GROUNDWATER TREATMENT/DISPOSAL

PIPING CLASS

- A - ANSI CLASS 150
- B - SCHEDULE 80
- C - SDR11
- D - SDR17
- E - TYPE M

SERVICE

- P - PROCESS
- R - RELIEF
- U - UTILITY

DEFINITIONS

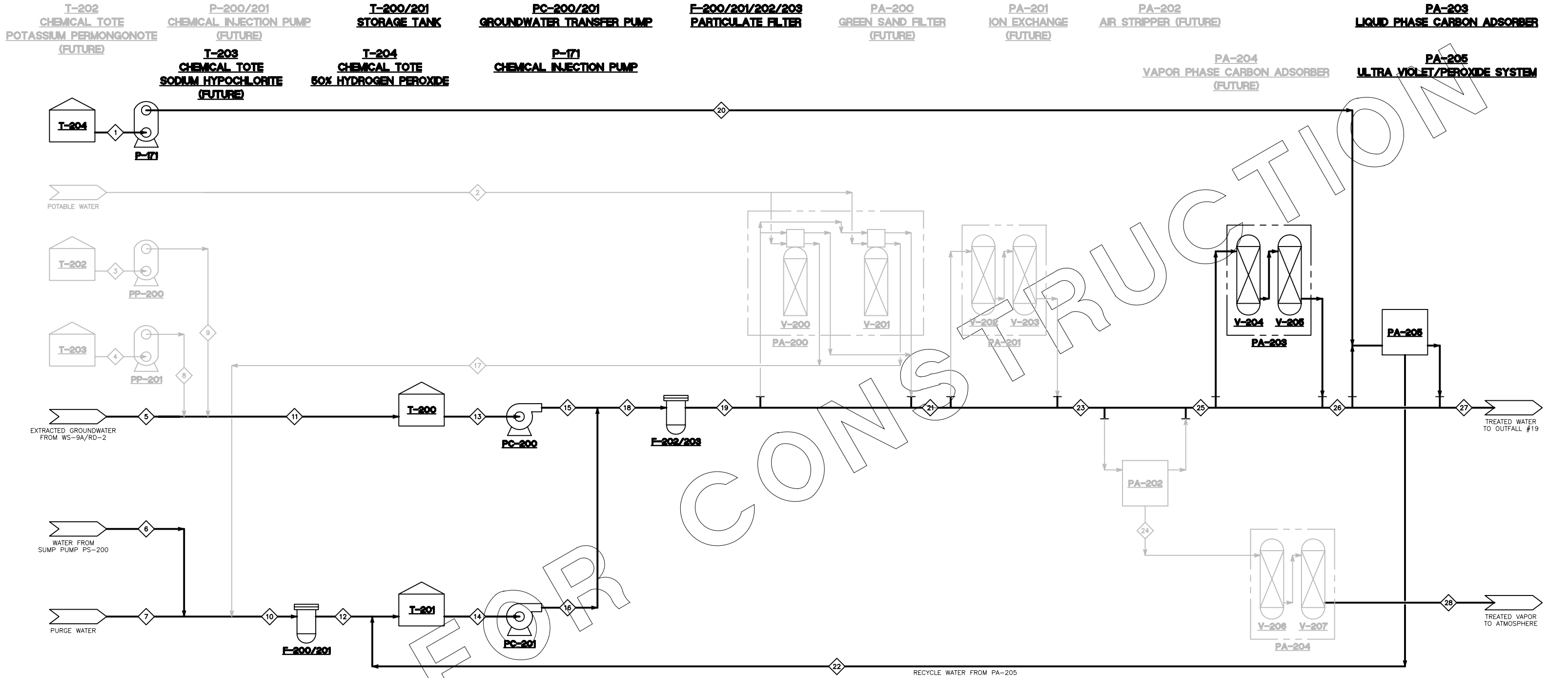
- GAP - CAPACITY
- C.S. - CARBON STEEL
- D.I. - DUCTILE IRON
- EGW - EXTRACTED GROUNDWATER
- F - DEGREES FAHRENHEIT
- F.O.T. - FLAT ON TOP
- FRP - FIBERGLASS REINFORCED PLASTIC
- gal - GALLON
- GRC - GALVANIZED RIGID CONDUIT
- gpm - GALLONS PER MINUTE
- HLL - HIGH LIQUID LEVEL
- HP - HORSEPOWER
- IAS - INSTRUMENT AIR SUPPLY
- LLL - LOW LIQUID LEVEL
- mA - MILLIAMPERE
- MW - MANWAY
- NLL - NORMAL LIQUID LEVEL
- NPT - NATIONAL PIPE THREAD
- O.D. - OUTSIDE DIAMETER
- PRESS. - PRESSURE
- POTW - PUBLICLY OWNED TREATMENT WORKS
- psig - POUNDS PER SQUARE INCH GAUGE
- REF. - REFERENCE
- RPM - REVOLUTIONS PER MINUTE
- RTD - RESISTANCE TEMPERATURE DETECTOR
- SCFM - STANDARD CUBIC FEET PER MINUTE
- SP - SAMPLE PORT
- S.S. - STAINLESS STEEL
- TDH - TOTAL DYNAMIC HEAD
- TEMP. - TEMPERATURE
- T.H. - TOTAL HEIGHT
- T.L. - TANGENT TO TANGENT
- V - VOLTS
- VES - VAPOR EXTRACTION SYSTEM
- VEW - VAPOR EXTRACTION WELL
- WC - WATER COLUMN

INSTRUMENT IDENTIFICATION

FIRST LETTERS	INITIATING OR MEASURED VARIABLE	CONTROLLERS				READOUT DEVICES		SWITCHES AND ALARM DEVICES (a)			TRANSMITTERS			SOLENOIDS, RELAYS, COMPUTING DEVICES	PRIMARY ELEMENTS	DATA INPUT	WELL OR PROBE	VIEWING DEVICE, GLASS	FINAL ELEMENT
		RECORDING	INDICATING	BLIND	SELF-ACTUATED CONTROL VALVES	RECORDING	INDICATING	HIGH	LOW	COMB	RECORDING	INDICATING	BLIND						
A	ANALYSIS	ARC	AIC	AC		AR	AI	ASH	ASL	ASHL	ART	AIT	AT	AV	AE		AW	BG	AV
B	BURNER/COMBUSTION	BR	BC	BC															
C	USER'S CHOICE																		
D	VOLTA																		
E																			
F	FLOW RATE	FRC	FIC	FC	FCV, FICV	FR	FI	FSH	FSL	FSHL	FRT	FIT	FT	FY	FE			FG	FV
FO	FLOW QUANTITY	FORC	FOIC	FFC		FOR	FOI	FOSH	FOSL			FOIT	FOT	FOY	FOE				FQ
FF	FLOW RATIO	FFRC	FFIC																FDV
G	USER'S CHOICE																		FDV
H	HAND																		FDV
I	CURRENT	IRC	IRC	KQC	KQCV	IR	IR	ISH	ISL	ISHL	IRT	IRT	IT	IY	IE				IV
J	POWER	JRC	JIC	KQC	KQCV	JR	JR	ISH	ISL	ISHL	IRT	IRT	IT	IY	IE				IV
K	TIME QUANTITY	KRC	KIC	KQC	KQCV	KR	KR	KSH	KSL	KSHL	KRT	KRT	KT	KY	KOE		LW	LG	KQV
L	LEVEL	LRC	LIC	LC	LCV	LR	LR	LSH	LSL	LSHL	LRT	LRT	LT	LY	LE				LV
M	LEAK																		
N	USER'S CHOICE																		
O	USER'S CHOICE																		
P	PRESSURE	PRC	PIC	PC	PCV	PR	PI	PSH	PSL	PSHL	PRT	PIT	PT	PY	PE				PV
PD	PRESSURE, DIFFERENTIAL	PDRC	PDIC	PDC	PCV	PDR	PDI	PDSH	PDSL	QSHL	PDR	PDI	PDT	PQY	PE				PQZ
Q	QUANTITY	QRC	QIC	QC	QCV	QR	QI	QSH	QSL	QSHL	QRT	QIT	QT	QY	QE				
R	RADIATION	RRC	RIC	RC	RCV	RR	RI	RSH	RSL	RSHL	RRT	RIT	RT	RY	RE		RW		RZ
S	SPEED/FREQUENCY	SR	SIC	SC	SCV	SR	SI	SSH	SSL	SSH	SRT	SIT	ST	SY	SE				SV
T	TEMPERATURE	TRC	TIC	TC	TCV	TR	TI	TSH	TSL	TSHL	TRT	TRT	TT	TY	TE		TW		TDV
TD	TEMPERATURE, DIFFERENTIAL	TDRC	TDIC	TDC	TCV	TDR	TDI	TDH	TDL	TDHL	TDRT	TDIT	TDI	TDY	TE				TDV
U	TEMPERATURE, MULTIVARIABLE					UR	UI							UY					UV
V	VIBRATION/MACHINERY					VR	VI	VSH	VSL	VSHL	VRT	VIT	VT	VY	VE				VZ
W	WEIGHT/FORCE	WRC	WIC	WC	WCV	WR	WI	WSH	WSL	WSHL	WRT	WIT	WT	WY	WE				WZ
WO	WEIGHT/FORCE, DIFFERENTIAL	WDR	WDIC	WDC	WCV	WR	WDI	WDH	WDL	WDHL	WRD	WIT	WTD	WY	WE				WZ
X	UNCLASSIFIED																		
Y	EVENT/STATE/PRESENCE		YIC	YC		YR	YI	YSH	YSL			YT	YT	YY	YE				YZ
Z	POSITION/DIMENSION	ZRC	ZIC	ZC	ZCV	ZR	ZI	ZSH	ZSL	ZSHL	ZRT	ZIT	ZTD	ZY	ZE				ZV
ZD	GAUGING, DEVIATION	ZDRC	ZDIC	ZDC	ZDCV	ZDR	ZDI	ZD	ZD	ZD	ZDRT	ZDIT	ZD	ZDY	ZDE				ZDV

(a) "A", ALARM, THE ANNUNCIATING DEVICE MAY BE USED IN THE SAME FASHION AS "S", SWITCH, THE ACTUATING DEVICE. THE LETTERS H AND L MAY BE OMITTED IN THE UNDEFINED CASE. HH OR LL MAY BE USED TO INDICATE HIGH-HIGH OR LOW-LOW DEVICES.

							THE BOEING COMPANY SANTA SUSANA FIELD LABORATORY SIMI VALLEY, CALIFORNIA											
							AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM PIPING AND INSTRUMENTATION DIAGRAM SYMBOLS AND LEGENDS											
1	APPROVED FOR BID											7/29/07	 HARGIS+ASSOCIATES, INC.			G-2		0
0	CLIENT REVIEW						CML	KLC	CML		7/23/07							
REV	ISSUE					CL	CHK'D	PM	DE	DATE			RPT NO. 597.182	DATE 7/27/07	DWG BY SCS	DWG NO. 610-0090		



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
From	T-205	City Water	T-203	T-204	Extraction Wells	PS-200	Purge water	P-201	P-200	7	5	F-200/201	T-200	T-201	PC-200	PC-201	PA-200
To	P-202	PA-200	P-200	P-201	Chemical Connections	Purge water	10	11	11	F-200/201	T-200	T-201	PC-200	PC-201	18	10	
Temperature (deg F)	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Pressure (psig)		40															
Stream Description		Potable Water	KMnO4		Groundwater	Water	Groundwater		KMnO4	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Purge Water
Flow Rate (gallons per minute)	0/	0/40	0/	0/	60	0/5	0/5	0/	0/	0/5	60	0/5	60	0/5	60	0/5	0/40
Perchlorate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4E-04	0.00E+00	0.00E+00	3.96E-04	0.00E+00	3.96E-04	0.00E+00	4.00E-04	0.00E+00	3.96E-04	0.00E+00
1,4-Dioxane (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3E-05	0.00E+00	2E-05	0.00E+00	0.00E+00	1.66E-05	3.03E-05	1.66E-05	3.03E-05	2.00E-05	3.00E-05	1.66E-05	0.00E+00
NDMA (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9E-06	0.00E+00	2E-06	0.00E+00	0.00E+00	1.70E-06	9.32E-06	1.70E-06	9.32E-06	2.00E-06	9.00E-06	1.70E-06	0.00E+00
Trichloroethylene (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1E-02	0.00E+00	2E-03	0.00E+00	0.00E+00	1.58E-03	1.11E-02	1.58E-03	1.11E-02	2.00E-03	1.00E-02	1.58E-03	0.00E+00
Tetrachloroethylene (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1E-05	0.00E+00	0.00E+00	1.26E-05	0.00E+00	1.26E-05	0.00E+00	1.00E-05	0.00E+00	1.26E-05	0.00E+00
Iron (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2E-06	0.00E+00	0.00E+00	2.17E-06	0.00E+00	2.17E-06	0.00E+00	2.00E-06	0.00E+00	2.17E-06	0.00E+00

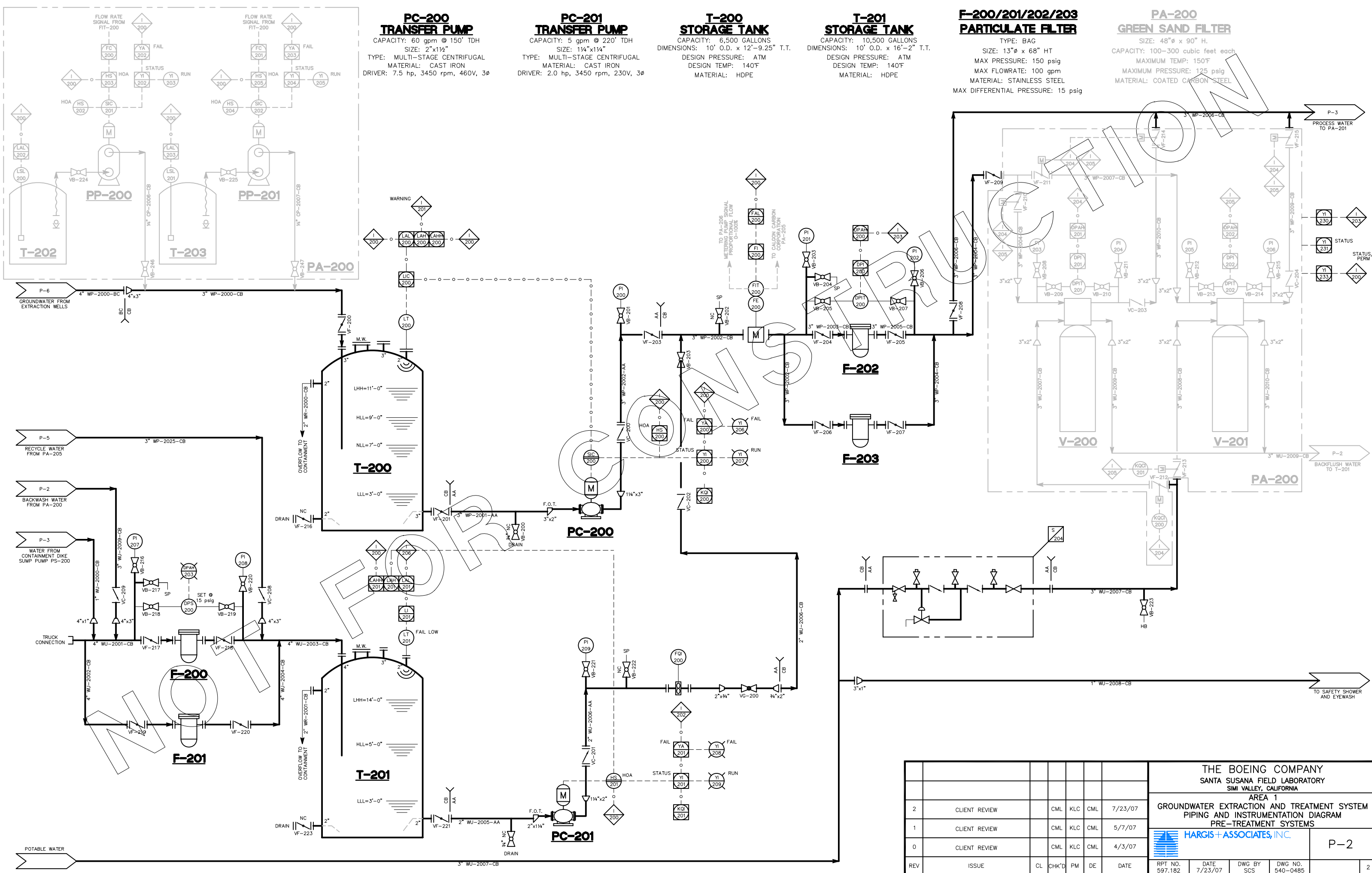
	18	19	20	21	22	23	24	25	26	27	28
From	15	F-202/203	P-202	PA-200	PA-205	PA-201	PA-102	PA-202	PA-203	PA-205	PA-204
To	F-202/203	PA-200	PA-205	PA-201	T-201	PA-202	H-200	PA-203	PA-205	Outfall 19	Atmosphere
Temperature (deg F)	70		70	70	95	70	95	70			70
Pressure (psig)											
Stream Description	Groundwater	Groundwater		Groundwater	Air	Groundwater	Air	Groundwater	Groundwater	Groundwater	Air
Flow Rate (gallons per minute)	60/65	60/65	0/	60/65	350 cfm	60/65	350 cfm	60/65	60/65	60/65	350 cfm
Perchlorate (lb/hr)	0.00E+00/3.96E-04	0.00E+00/3.96E-04	0.00E+00	0.00E+00/4.00E-04	0.00E+00/2.00E-05	0.00E+00/2.00E-05	0.00E+00/0.00E+00	0.00E+00/2.00E-05	0.00E+00/2.00E-05	0.00E+00/2.00E-05	0.00E+00/0.00E+00
1,4-Dioxane (lb/hr)	9.32E-06/1.10E-05	9.32E-06/1.10E-05	0.00E+00	9.00E-06/1.00E-05	5.00E-07/6.00E-07	9.00E-06/1.00E-05	0.00E+00/0.00E+00	9.00E-06/1.00E-05	9.00E-06/1.00E-05	5.00E-07/6.00E-07	0.00E+00/0.00E+00
NDMA (lb/hr)	9.32E-06/1.10E-05	9.32E-06/1.10E-05	0.00E+00	9.00E-06/1.00E-05	5.00E-07/6.00E-07	9.00E-06/1.00E-05	0.00E+00/0.00E+00	9.00E-06/1.00E-05	9.00E-06/1.00E-05	5.00E-07/6.00E-07	0.00E+00/0.00E+00
Trichloroethylene (lb/hr)	1.11E-02/1.27E-02	1.11E-02/1.27E-02	0.00E+00	1.00E-02/1.00E-02	1.00E-06/2.00E-06	1.00E-02/1.00E-02	1.00E-02/1.00E-02	6.00E-04/6.00E-04	3.00E-05/3.00E-05	1.00E-06/2.00E-06	5.00E-04/6.00E-04
Tetrachloroethylene (lb/hr)	0.00E+00/1.26E-05	0.00E+00/1.26E-05	0.00E+00	0.00E+00/1.00E-05	0.00E+00/2.00E-09	0.00E+00/1.00E-05	0.00E+00/1.00E-05	0.00E+00/6.00E-07	0.00E+00/3.00E-08	0.00E+00/2.00E-09	0.00E+00/6.00E-07
Iron (lb/hr)	0.00E+00/2.17E-06	0.00E+00/2.17E-06	0.00E+00	0.00E+00/1.00E-07	0.00E+00/1.00E-07	0.00E+00/1.00E-07	0.00E+00/0.00E+00	0.00E+00/1.00E-07	0.00E+00/1.00E-07	0.00E+00/1.00E-07	0.00E+00/0.00E+00

EXPLANATION

CONTINUOUS — 0E+00
INTERMITTENT — 5E-06

lb/hr = POUNDS PER HOUR
PSIG = POUNDS PER SQUARE INCH GAUGE
deg F = DEGREES FAHRENHEIT
ug/l = MICROGRAMS PER LITER

						THE BOEING COMPANY SANTA SUSANA FIELD LABORATORY SIMI VALLEY, CALIFORNIA					
						AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM PROCESS FLOW DIAGRAM					
1	APPROVED FOR BID					7/27/07					
0	CLIENT REVIEW		CML	KLC	CML	7/23/07	HARGIS+ASSOCIATES, INC.				P-1
REV	ISSUE	CL	CHK'D	PM	DE	DATE	RPT NO. 597.182	DATE 7/27/07	DWG BY SCS	DWG NO. 560-0238	0



							THE BOEING COMPANY SANTA SUSANA FIELD LABORATORY SIMI VALLEY, CALIFORNIA					
							AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM PIPING AND INSTRUMENTATION DIAGRAM PRE-TREATMENT SYSTEMS					
2	CLIENT REVIEW		CML	KLC	CML	7/23/07	 HARGIS + ASSOCIATES, INC.				P-2	
1	CLIENT REVIEW		CML	KLC	CML	5/7/07						
0	CLIENT REVIEW		CML	KLC	CML	4/3/07						
REV	ISSUE	CL	CHK'D	PM	DE	DATE	RPT NO. 597.182	DATE 7/23/07	DWG BY SCS	DWG NO. 540-0485		2

PS-200
SUMP PUMP

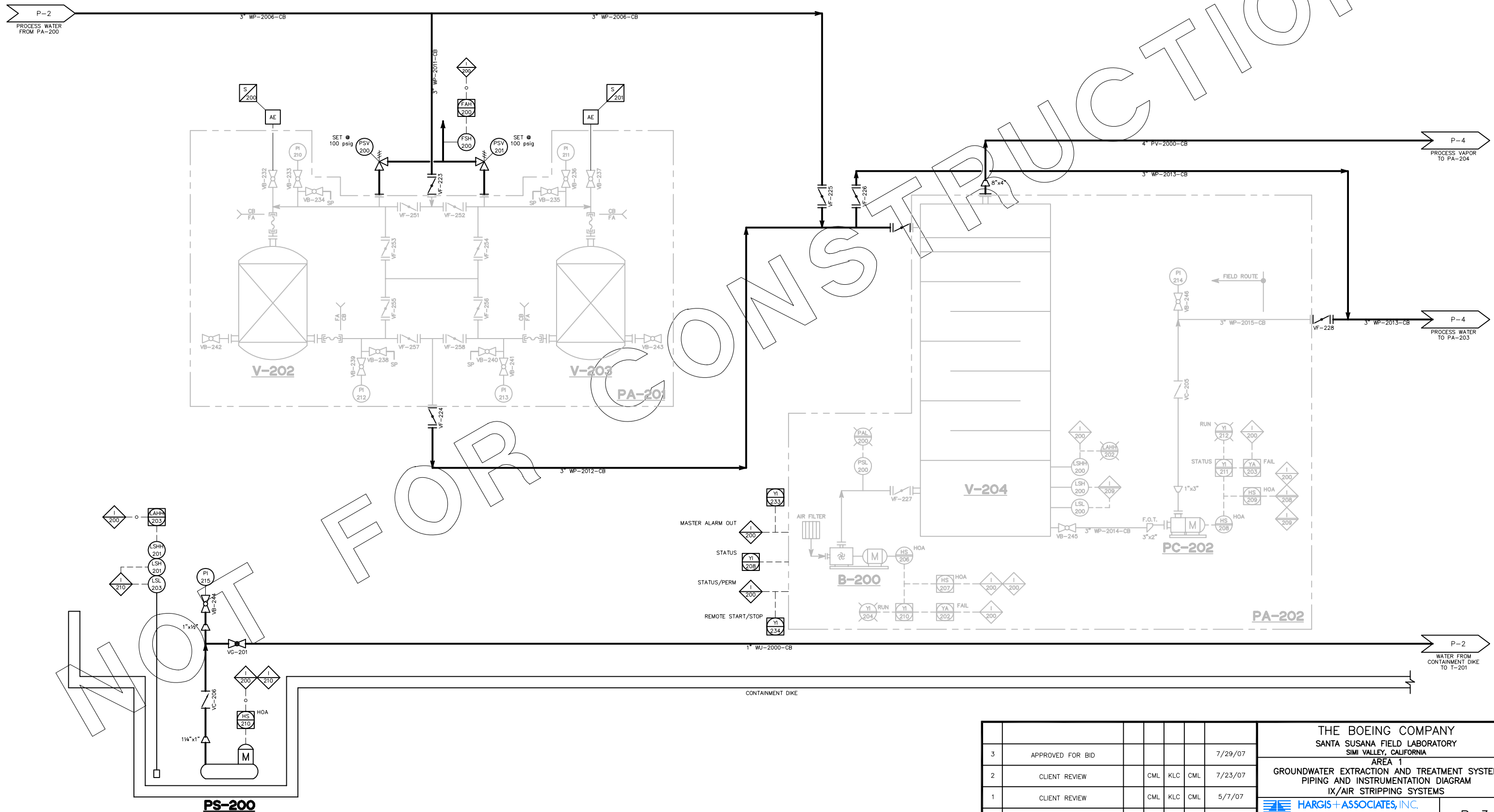
CAPACITY: 20 gpm @ 22' TDH
SIZE: 1 1/4" DISCHARGE
DRIVER: 1/2" hp, 3,350 rpm, 115V, 1Ø
MATERIAL: STAINLESS STEEL

PA-201
MAGFLEX 48" ION EXCHANGE VESSELS (FUTURE)

SIZE: 48"Ø x 90" H.
CAPACITY: 100-300 cubic feet each
MAXIMUM TEMP: 150°F
MAXIMUM PRESSURE: 125 psig
MATERIAL: COATED CARBON STEEL

PA-202
AIR STRIPPING (FUTURE)

DIMENSION: 5'6"x5'0"x8'1 1/2"
DESIGN TEMP: 140°F
DESIGN PRESSURE: 1.5 psig
MATERIAL: STAINLESS STEEL



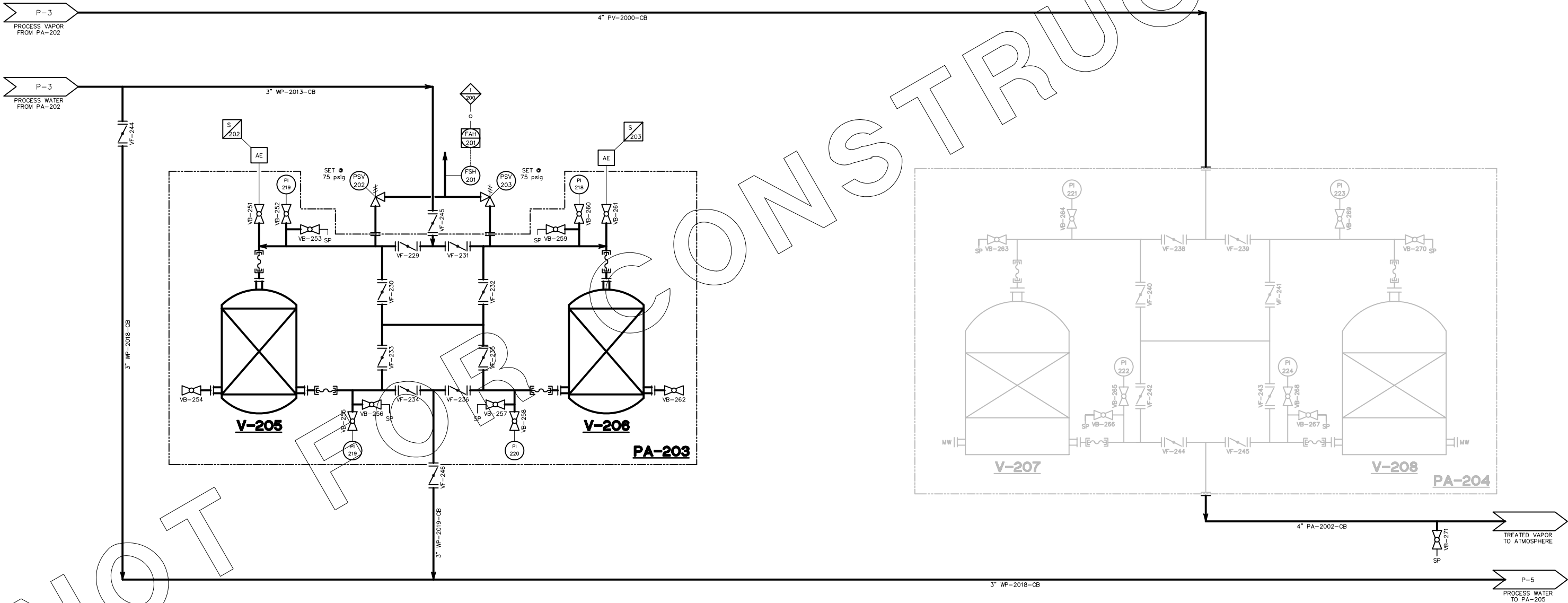
							THE BOEING COMPANY				
							SANTA SUSANA FIELD LABORATORY				
							SIMI VALLEY, CALIFORNIA				
							AREA 1				
							GROUNDWATER EXTRACTION AND TREATMENT SYSTEM				
							PIPING AND INSTRUMENTATION DIAGRAM				
							IX/AIR STRIPPING SYSTEMS				
							 HARGIS+ASSOCIATES, INC.			P-3	
REV	ISSUE	CL	CHK'D	PM	DE	DATE	RPT NO. 597.182	DATE 7/27/07	DWG BY SCS	DWG NO. 540-0482	2

PA-203
LIQUID PHASE CARBON VESSELS

SIZE: 4'-0"ø x 8'-9" T.T.
CAPACITY: 2,000 lbs.
MAXIMUM TEMP: 150°F
MAXIMUM PRESSURE: 75 psig
MATERIAL: COATED CARBON STEEL
MAXIMUM FLOW: 100 gpm

PA-204
VAPOR PHASE CARBON VESSELS (FUTURE)

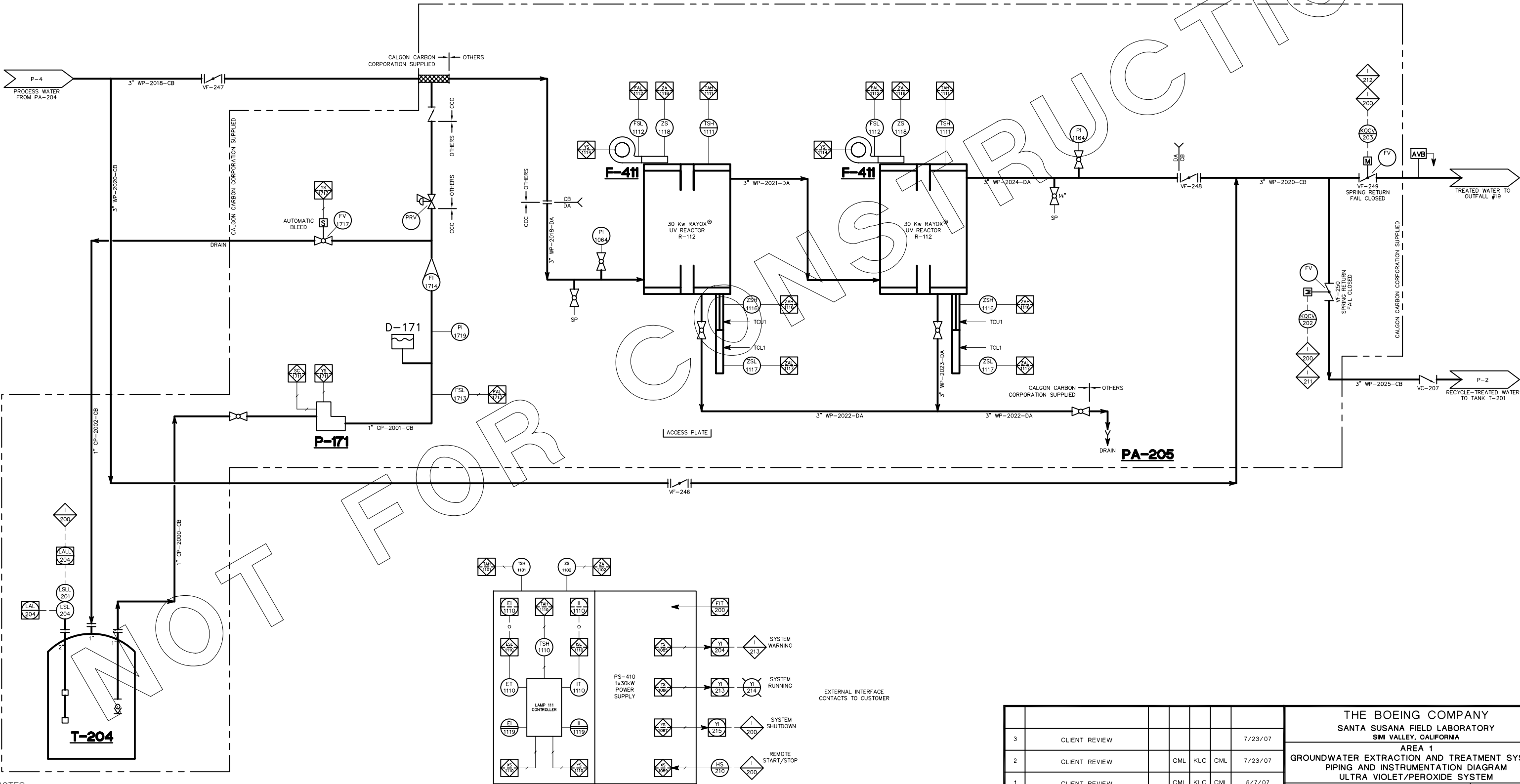
SIZE: 4'-0"ø x 7'-11½" T.T.
CAPACITY: 2,000 lbs.
DESIGN PRESSURE: 15 psi
DESIGN TEMP: 120° F
MATERIAL: COATED CARBON STEEL



							THE BOEING COMPANY SANTA SUSANA FIELD LABORATORY SIMI VALLEY, CALIFORNIA				
3	APPROVED FOR BID					7/27/07	AREA 1				
2	CLIENT REVIEW		CML	KLC	CML	7/23/07	GROUNDWATER EXTRACTION AND TREATMENT SYSTEM PIPING AND INSTRUMENTATION DIAGRAM CARBON ADSORPTION SYSTEMS				
1	CLIENT REVIEW		CML	KLC	CML	5/7/07	 HARGIS+ASSOCIATES, INC.				
0	CLIENT REVIEW		CML	KLC	CML	4/3/07					
REV	ISSUE	CL	CHK'D	PM	DE	DATE	RPT NO. 597	DATE 7/27/07	DWG BY SCS	DWG NO. 540-0483	P-4 2

PA-205
ULTRAVIOLET/PEROXIDE SYSTEM

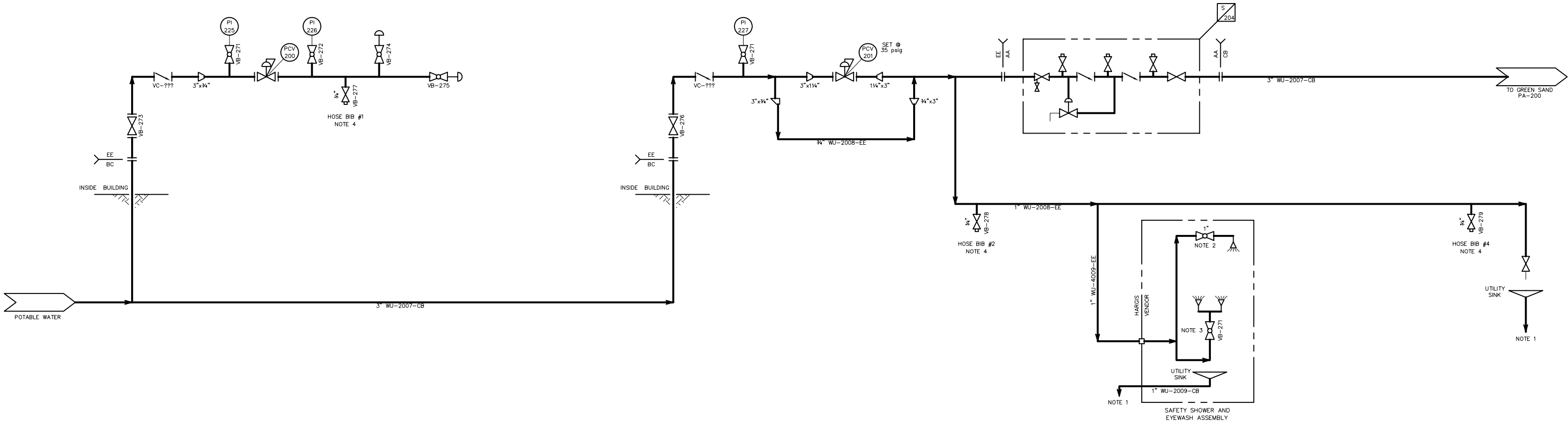
MODEL: RAYOX 2x30KW
SIZE: 77"Lx49"Wx88"H
MAX FLOW: 100 GPM



NOTES:

1. PA-205 PROVIDED BY CALGON CARBON.

						THE BOEING COMPANY						
						SANTA SUSANA FIELD LABORATORY						
3	CLIENT REVIEW					SIMI VALLEY, CALIFORNIA						
2	CLIENT REVIEW		CML	KLC	CML	7/23/07	AREA 1					
1	CLIENT REVIEW		CML	KLC	CML	5/7/07	GROUNDWATER EXTRACTION AND TREATMENT SYSTEM					
0	CLIENT REVIEW		CML	KLC	CML	4/3/07	PIPING AND INSTRUMENTATION DIAGRAM					
							ULTRA VIOLET/PEROXIDE SYSTEM					
							 HARGIS+ASSOCIATES, INC.				P-5	
REV	ISSUE	CL	CHK'D	PM	DE	DATE	RPT NO. 597.182	DATE 7/27/07	DWG BY SCS	DWG NO. 540-0484	2	



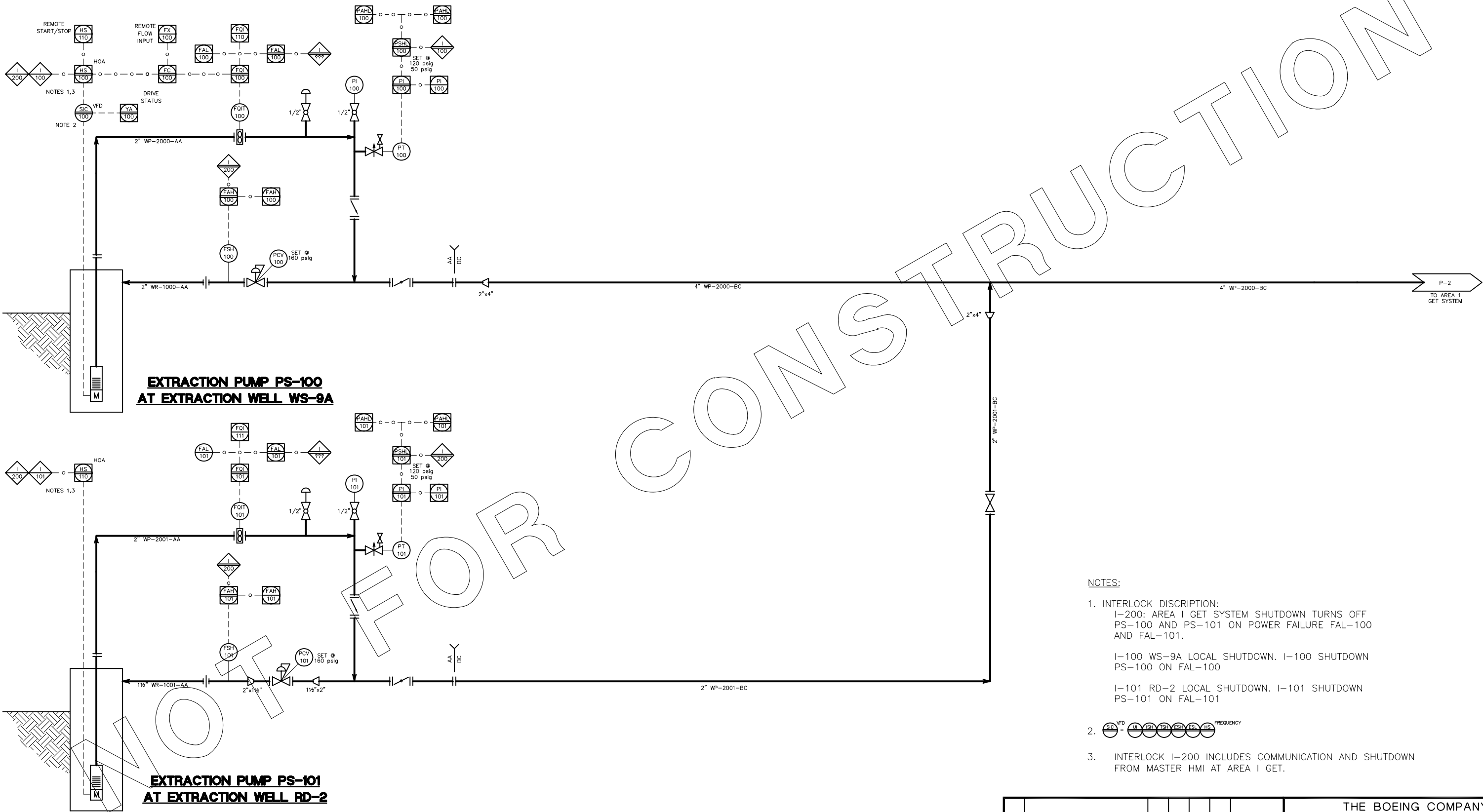
NOTES:

- 1. FIELD ROUTE PIPE TO FLOOR DRAIN
- 2. PULL CHAIN OPERATED
- 3. LEVER OPERATED
- 4. AIR VACUUM BREAK

							THE BOEING COMPANY SANTA SUSANA FIELD LABORATORY SIMI VALLEY, CALIFORNIA									
							AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM PIPING AND INSTRUMENTATION DIAGRAM UTILITY SYSTEMS									
0	CLIENT REVIEW										HARGIS+ASSOCIATES, INC.			P-6		
REV	ISSUE					CL	CHK'D	PM	DE	DATE	RPT NO. 597.182	DATE 7/29/07	DWG BY SCS	DWG NO. 540-0485		1

PS-100
SUBMERSIBLE PUMP AT WELL WS-9A

PS-101
SUBMERSIBLE PUMP AT WELL RD-2



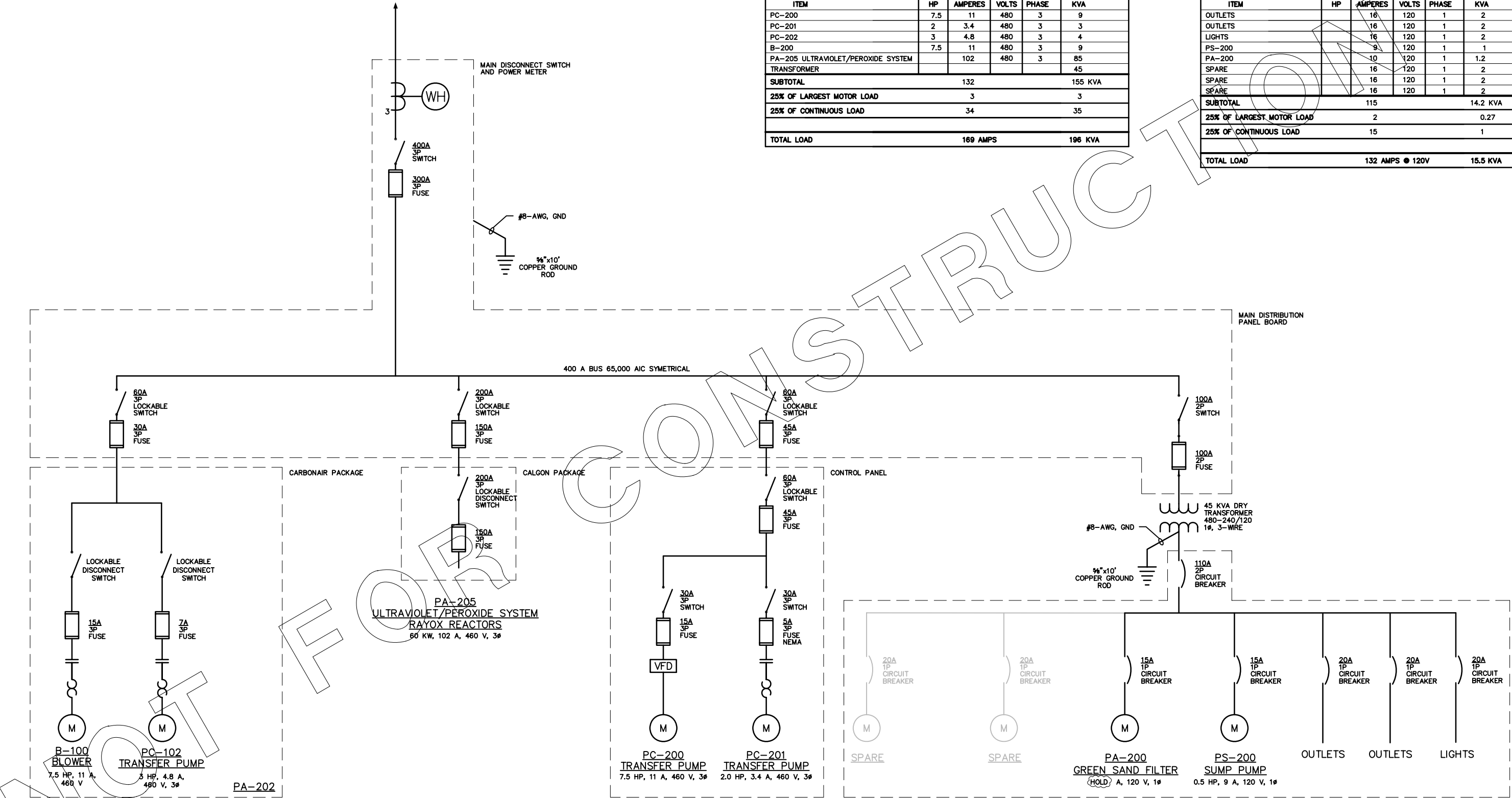
- NOTES:
1. INTERLOCK DISCRPTION:
I-200: AREA I GET SYSTEM SHUTDOWN TURNS OFF
PS-100 AND PS-101 ON POWER FAILURE FAL-100
AND FAL-101.
- I-100 WS-9A LOCAL SHUTDOWN. I-100 SHUTDOWN
PS-100 ON FAL-100
- I-101 RD-2 LOCAL SHUTDOWN. I-101 SHUTDOWN
PS-101 ON FAL-101
2. VFD UL IS ISH FSH ESL HS FREQUENCY
3. INTERLOCK I-200 INCLUDES COMMUNICATION AND SHUTDOWN
FROM MASTER HMI AT AREA I GET.

							THE BOEING COMPANY			
							SANTA SUSANA FIELD LABORATORY			
							SIMI VALLEY, CALIFORNIA			
							AREA 1			
							GROUNDWATER EXTRACTION AND TREATMENT SYSTEM			
							PIPING AND INSTRUMENTATION DIAGRAM			
							WS-9A AND RD-2			
1	APPROVED FOR BID					7/29/07	HARGIS+ASSOCIATES, INC.			
0	CLIENT REVIEW		CML	KLC	CML	7/23/07				
REV	ISSUE	CL	CHK'D	PM	DE	DATE	RPT NO. 597	DATE 7/27/07	DWG BY SCS	DWG NO. 540-0492
							P-7			
							0			

TO RELOCATED BOEING SSFL FACILITY TRANSFORMER
480-VOLT, 3Ø, 4-WIRE

LOAD CALCULATION					
ITEM	HP	AMPERES	VOLTS	PHASE	KVA
PC-200	7.5	11	480	3	9
PC-201	2	3.4	480	3	3
PC-202	3	4.8	480	3	4
B-200	7.5	11	480	3	9
PA-205 ULTRAVIOLET/PEROXIDE SYSTEM		102	480	3	85
TRANSFORMER					45
SUBTOTAL		132			155 KVA
25% OF LARGEST MOTOR LOAD		3			3
25% OF CONTINUOUS LOAD		34			35
TOTAL LOAD		169 AMPS			196 KVA

LOAD CALCULATION					
ITEM	HP	AMPERES	VOLTS	PHASE	KVA
OUTLETS		16	120	1	2
OUTLETS		16	120	1	2
LIGHTS		16	120	1	2
PS-200		9	120	1	1
PA-200		10	120	1	1.2
SPARE		16	120	1	2
SPARE		16	120	1	2
SPARE		16	120	1	2
SUBTOTAL		115			14.2 KVA
25% OF LARGEST MOTOR LOAD		2			0.27
25% OF CONTINUOUS LOAD		15			1
TOTAL LOAD		132 AMPS @ 120V			15.5 KVA



						THE BOEING COMPANY SANTA SUSANA FIELD LABORATORY SIMI VALLEY, CALIFORNIA					
						AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM ELECTRICAL ONE-LINE DIAGRAM					
1	CLIENT REVIEW		CML	KLC	JDS	7/23/07				HARGIS+ASSOCIATES, INC.	
0	CLIENT REVIEW		CML	KLC	JRL	5/7/07				E-1	
REV	ISSUE	CL	CHK'D	PM	DE	DATE	RPT NO. 597.182	DATE 7/23/07	DWG BY ADE	DWG NO. 521-0115	1

ATTACHMENT A

CONTROL SYSTEM DESCRIPTION

ATTACHMENT A

CONTROL SYSTEM DESCRIPTION AREA 1 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM THE BOEING COMPANY SANTA SUSANA FIELD LABORATORY SIMI VALLEY, CALIFORNIA

The Boeing Company (Boeing) plans to operate a groundwater extraction and treatment system at the Santa Susana Field Laboratory, Simi Valley, California (Drawing 1) as part of ongoing groundwater remediation efforts. The Control System will consist of two local wellhead control systems linked via radio communication to the Area 1 groundwater extraction and treatment facility (Area 1 GET) (Drawing 2). The local control systems will control the individual extraction wells and communicate process information, alarms, and shutdowns to the treatment system. The treatment system will record process data from the extraction wells and process equipment, log alarms, and allow remote operation of the two local wellhead control systems. The two local wellhead control systems are:

- o WS-9A wellhead
- o RD-2 wellhead

The Control System may be expanded to include additional wells at the site in the future.

PROCESS DESCRIPTION AREA 1 GET

The Area 1 GET will be installed to treat groundwater primarily impacted by volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and perchlorate using a combination of particulate filtration, , air stripping with vapor phase carbon treatment, liquid phase carbon adsorption, and ultraviolet-peroxide prior to disposal at Outfall #1 (Drawings P-1 and P-7). The Area 1 GET consists of two principal elements: the extraction wells and the treatment facility. The Area 1 GET has a design flow rate of 100 gallons per minute (gpm). Groundwater will be extracted from extraction wells WS-9A and RD-2 using electrical submersible pumps. Extraction well WS-9A will be operated using a variable frequency drive on flow or speed control. Extraction well RD-2 will be operated using a standard motor starter with manual flow control. The extraction pumps will have sufficient head to convey the water to an equalization tank at the treatment compound located at the Area 1 GET System. A transfer pump operated using level control will convey water through the treatment process and disposal pipeline to Outfall #1. The Area 1 GET will include a purge water storage and transfer system that will allow treatment of groundwater generated from ongoing monitoring activities. The purge water storage and transfer system will be partially-automated continuous treatment system operating at a design flowrate of 5 gpm. The purge water will be treated using a combination of particulate filtration, green sand filtration, ion exchange, air stripping with vapor phase carbon treatment, liquid phase carbon adsorption, and ultraviolet-peroxide prior to disposal at Outfall #1.

Routine Operation Description

The Area 1 GET routine operation will involve operation of the air stripping treatment system PA-202 and the ultraviolet-peroxide treatment system PA-205. The Area 1 GET will give a permissive to PA-205 followed by issuing a permissive to PA-202. The Control System will then issue a start command to transfer pump PC-200, followed by start commands to the remote wells. At initial startup PA-205 will operate in recycle mode for up to 10 minutes with the partially treated water being conveyed to tank T-201.

Purge Water Treatment

For purge water treatment, two additional treatment operations green sand filtration PA-200 and ion exchange system PA-201 need to be activated. The Control System will need to allow selection of the additional equipment, and enable alarms from the additional unit operations equipment. The additional equipment will allow the operation of transfer pump PC-201. Some purge water will not require these unit operations, so the control system will need to accommodate different equipment operation.

LOCAL CONTROL SYSTEM DESCRIPTION

The local control systems for extraction wells WS-9A and RD-2 are outlined below. The local control system will consist of local control panels linked via radio communication to the Area 1 GET control panel. The radio link will include one solar-powered repeater station to allow communication between the remote well sites and the Area 1 GET main control panel. One local control panel will be installed adjacent to extraction well WS-9A, a second local control panel will be installed adjacent to extraction well RD-2, and the main control panel will be installed at the treatment system. Radio communication between the three control panels will be via the repeater station. Control system inputs and outputs have been summarized (Table 1). The following will provide a description of the operation of the control system.

The local control panels for WS-9A, RD-2, and the main control panel for Area 1 GET will be automated microprocessor based control systems with a local operator interface. The control systems will consist of the following major elements: the programmable logic controller (PLC), the local operator interface, the radio link to the Area 1 GET main control panel, and the instrumentation and end-devices.

The PLC will consist of an Allen-Bradley PLC-500 family processor SLC 5/03, with one rack of input/output (I/O) or equal. The operator interface will consist of an Allen Bradley Panel View 600 or approved equal configured to interrogate the PLC to display status and alarm screens. The local operator interface will be grayscale. The local operator interface will allow for the control of the extraction pumps for WS-9A and RD-2 including: start, stop, alarm monitoring, and manual operation of the WS-9A and RD-2 extraction pumps. The instruments and end devices will include all sensors, switches, and control elements for operation of extraction wells WS-9A and RD-2. The local control system will be provided with a radio link to transmit process data, and control signals to the Area 1 GET main control panel.

The Area 1 GET main control panel will relay the status of the individual local control panels to each other to allow shutdown of local control in the event of a treatment system failure or a treatment system shutdown alarm at a local control panel. The

Area 1 GET is controlled by the main control panel at the Area 1 GET. The two extraction wells will shutdown in the event of a communications loss between the local control panels and the Area 1 GET main control panel.

The Area 1 GET control system will consist of 9 primary interlock, 5 control loops, and 28 shutdown alarms.

INTERLOCK DESCRIPTIONS

The interlocks provide action/reaction control for the Area 1 GET control system. The interlocks are activated based on discrete events during the normal operation of the control system.

The following interlock will be provided to control the Area 1 GET control system:

- Master (Global) Shutdown with Callout (Interlock I-200)
- WS-9A Shutdown with Callout (Interlock I-100)
- RD-2 Shutdown with Callout (Interlock I-101)
- High Tank Level T-200 Warning Alarm with Callout (Interlock I-201)
- Transfer Pump PC-201 Failure Warning Alarm with Callout (Interlock I-202)
- High Differential Pressure at F-202 Warning Alarm with Callout (Interlock I-203)
- Transfer Pump PC-201 Off/On Control (Interlock I-206)
- Sump Pump PS-200 Off/On Control (Interlock I-210)
- Ultraviolet/Peroxide System PA-205 Warning Alarm with Callout (Interlock I-213)

Interlock I-200 Master Shutdown

The master shutdown is an interlock that provides for an orderly shutdown of the Area 1 GET by the local control system in response to a process or equipment failure.

The following conditions will result in a master shutdown interlock I-200:

1. High flow in WS-9A relief line at FSH-100.
2. High flow in RD-2 relief line at FSH-101.
3. High pressure at extraction well WS-9A measured by PT-100.
4. Low pressure at extraction well WS-9A measured by PT-100.
5. High pressure at extraction well RD-2 measured by PT-101.
6. Low pressure at extraction well RD-2 measured by PT-101.
7. High water level in Storage Tank T-200 measured at LT-200.
8. Low water level in Storage Tank T-200 measured at LT-200.
9. High water level in Storage Tank T-201 measured at LT-201.
10. Transfer Pump PC-200 failure measured at YA-200.
11. Low water flow measured at FIT-200.
12. High water level in treatment system containment pad at LSHH-201.
13. Equipment failure Green Sand Filter System PA-200.
14. Equipment failure from Air Stripping Tower PA-202.

15. High flow burst plate relief line from carbon adsorbers PA-203 at FSH-201.
16. Emergency stop at the control panel WS-9A.
17. Emergency stop at the control panel RD-2.
18. Emergency stop at the control panel Area 1 GET main control panel.
19. Communication loss between RD-2 and Area 1 GET main control panel.
20. Communication loss between radio repeater and Area 1 GET main control panel.
21. Power loss at radio repeater.
22. Power loss at Area 1 GET main control panel.
23. Communication loss between WS-9A and Area 1 GET main control panel.
24. Equipment failure Ultraviolet/Peroxide System PA-205 failure measured at PA-205.
25. High flow burst plate relief line from Ion Exchange Vessels PA-201 at FSH-200. (Future)

The master shutdown consists of the shutdown:

1. Shutdown of Extraction Pump PS-100 at WS-9A
2. Shutdown of Extraction Pump PS-101 at RD-2
3. Shutdown of Transfer Pump PC-200
4. Shutdown of Transfer Pump PC-201
5. Shutdown of Sump Pump PS-200
6. Shutdown of Green Sand Filter Package PA-200 (Future)
7. Shutdown of Air Stripping Tower Package PA-202
8. Shutdown of Ultraviolet/Peroxide System Package PA-205

The shutdown will include time delays between actions to allow for the orderly shutdown of equipment. In addition to the shutdown, the local interface will display the alarm condition; the local control panel will transmit the alarm condition to the Area 1 GET main control panel. The Area 1 GET system will have an auto-dialer to notify an operator that the Area 1 GET has shutdown.

Interlock I-100 WS-9A Shutdown

The WS-9A shutdown is an interlock that provides for an orderly shutdown of the WS-9A by the local Control System in response to a process or equipment failure.

The following conditions will result in a local shutdown interlock I-100:

1. Variable frequency drive (VFD) failure for PS-100 at WS-9A
2. Low flow measure at FQIT-100

The I-100 shutdown consists of:

1. Shutdown of Extraction Pump PS-100 at WS-9A

The shutdown will include time delays between actions to allow for the orderly shutdown of equipment. In addition to the shutdown, the local interface will display the alarm

condition; the local control panel will transmit the alarm condition to the Area 1 GET main control panel. The Area 1 GET main control panel will have an auto-dialer to notify an operator that the WS-9A has shutdown.

Interlock I-101 RD-2 Shutdown

The RD-2 shutdown is an interlock that provides for an orderly shutdown of the RD-2 by the local Control System in response to a process or equipment failure.

The following conditions will result in a local shutdown interlock I-101:

1. Motor starter failure at RD-2.
2. Low flow measured at FQIT-101

The I-101 shutdown consists of:

1. Shutdown of Extraction Pump PS-101 at RD-2

The shutdown will include time delays between actions to allow for the orderly shutdown of equipment. In addition to the shutdown, the local interface will display the alarm condition; the local control panel will transmit the alarm condition to the Area 1 GET main control panel. The Area 1 GET main control panel will have an auto-dialer to notify an operator that the RD-2 has shutdown.

Interlock I-201 Tank T-200 Warning Alarm

The Tank T-200 Warning Alarm interlock I-201 provides a warning to the operator based on high level measured in Tank T-200 measured at LAH-200.

Interlock I-202 Transfer Pump PC-201 Warning Alarm

Transfer Pump PC-201 Warning Alarm interlock I-202 provides a warning to the operator based on failure of transfer pump PC-201 determined at YA-201.

Interlock I-203 High Differential Pressure F-202/F-203 Warning Alarm

High Differential Pressure F-202/F-203 Warning Alarm interlock I-203 provides a warning to the operator based on failure of high differential pressure across filters F-202/F-203 measured at DPIT-200.

Interlock I-206 PC-201 Start/Stop

The PC-201 Start/Stop interlock I-206 starts and stops transfer pump PC-201 based on level switch LSHL-201. Transfer pump PC-201 starts on a high level at LSH-201 and stops on a low level at LSL-201, if the Area 1 GET is operating.

Interlock I-210 PS-200 Start/Stop

The PS-200 Start/Stop interlock I-210 starts and stops sump pump PS-200 based on level switches LSH-201 and LSL-203. Sump pump PS-200 starts on a high level at LSH-201 and stops on a low level at LSL-203, if the Area 1 GET is operating.

Interlock I-213 Ultraviolet/Peroxide System PA-205 Warning Alarm

Ultraviolet/Peroxide System Warning Alarm interlock I-213 provides a warning to the operator based on a warning alarm issued by PA-205 and closes flow control valve FV-249 and opens flow control valve FV-250 (recycle mode) The I-213 interlock will shutdown PS-100 and PS-101.

Interlock I-214 Particulate Filter F-200/F-201 Warning Alarm

Particulate Filter F-200/F-201 Warning Alarm interlock I-214 activates a local warning alarm light at a local panel adjacent to the filter skid to notify the operator of high differential pressure based on differential pressure switch high DPS-200.

CONTROL LOOPS

The following control loops are maintained by the local control system during Area 1 GET system operation:

1. Extraction Pump PS-100 flow control loop
2. Extraction Pump PS-100 speed control loop
3. Storage Tank T-200 level control loop

Extraction Pump PS-100 Flow Control Loop

This control loop maintains a constant flowrate from extraction pump PS-100 as measured by FQIT-100. The flow is controlled by the adjustment of variable frequency drive SIC-100 using a 4-20ma signal input to the VFD. The flowrate set point will be entered by the operator at the local control panel or through the Area 1 GET main control panel. The local control panel will allow the selection of flow control or speed control through a software switch on the local operator interface.

Extraction Pump PS-100 Speed Control Loop

This control loop maintains a constant speed for extraction pump PS-100 as measured by SIC-100. The speed is controlled by the adjustment of variable frequency drive SIC-100 using a 4-20ma signal input to the VFD. The speed set point will be entered by the operator at the local control panel or through the Area 1 GET main control panel. The local control panel will allow the selection of flow control or speed control through a software switch on the local operator interface.

Storage Tank T-200 Level Control Loop

This control loop maintains a constant level in Storage Tank T-200 by controlling the flowrate of transfer pump PC-200. The tank level is measured by level transmitter LT-200 and Level Indicating Controller LIC-200 adjusts the variable frequency drive SIC-200 using a 4-20ma signal input to the VFD. The level set point will be entered by the operator at the local control panel or through the Area 1 GET main control panel.

ALARMS

Alarms are notification to the operator that the Area 1 GET is operating at a process-upset condition. The alarms for the Area 1 GET are shutdown and warning alarms. Shutdown alarms notify the operator that a system condition has resulted in an Area 1 GET shutdown (Interlocks I-200, I-100, or I-101) and that immediate attention is required to correct the condition and restart the Area 1 GET. The shutdown alarms have been summarized (Table 2). Shutdown alarms will appear on the local operator interface, on the alarm pop-up screen on the Area 1 GET main control panel, and will perform an operator call out using an auto-dialer. Warning alarms notify the operator that a system condition that could result in a system shutdown has occurred. Additional control system and diagnostic alarms will be provided to indicate power failure, communications failure, high temperature and low temperature in the local control panel, and local control panel doors open.

SUMMARY OF AREA 1 GET INPUTS AND OUTPUTS

The AREA 1 GET control system will have the following minimum I/O:

Inputs

- 35 Discreet
- 8 Analog

Outputs

- 9 Discreet
- 4 Analog

Total points 56

The minimum I/O has been summarized (Table 1).

ATTACHMENT B

INSTRUMENTATION DATA SHEETS

	DOC. NO.:
	PROJECT. NO.: 597
	CLIENT: The Boeing Company
	PROJECT: SSFL
	LOCATION: Santa Susana, California

DIFFERENTIAL PRESSURE SWITCHES

REVISION	0	1	2	3	4	5
REV. DATE	7/26/2007					
REV. DESC.	Original					
PREPARER	J. Latham					
LEAD ENG.	C. Liles					
PROJECT						

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CLIENT: The Boeing Company		DIFFERENTIAL PRESSURE SWITCHES							DOC NO:	Table PDT-1	
PROJECT: SSFL									JOB NO:	597	
LOCATION: Santa Susana, California									REVISION:	0	
UNIT:									DATE:	8/1/2007	
TAG NO.	SERVICE	P&ID NO.	LINE/EQUIP NO	FLUID	MAX PRESS	MAX TEMP	OPER PRESS	SET RANGE	ELEMENT RANGE	MANUFACTURER	MODEL NO
DPS-200	F-200/201	P-2	4" WU-2001-CB	Water	500 psig	100 DegF	80 psig	25 psid	0-60 psid	Ashcroft	D4-23-V-60



TAG NO.	LOOP NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	LOCATION	INSTRUMENT TYPE	STATUS	I/O TYPE	DATASHEET	MANUFACTURER	MODEL NO	REVISION
DPS-200		F-200/201	P-2	4" WU-2001-CB	Field	Differential Pressure Switch	New Instrument	N/A	DS-PDT-001	Ashcroft	D4-23-V-60	A

	DOC. NO.:
	PROJECT. NO.: 597
	CLIENT: The Boeing Company
	PROJECT: SSFL
	LOCATION: Santa Susana, California

DIFFERENTIAL PRESSURE TRANSMITTERS

REVISION	0	1	2	3	4	5
REV. DATE	7/26/2007					
REV. DESC.	Original					
PREPARER	J. Latham					
LEAD ENG.	C. Liles					
PROJECT						

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Diff Pressure Trans Spec Sheet.xls PAGE 2 OF 4



CLIENT: The Boeing Company				DIFFERENTIAL PRESSURE TRANSMITTERS					DOC NO:	Table PDT-1	
PROJECT: SSFL									JOB NO:	597	
LOCATION: Santa Susana, California									REVISION:	0	
UNIT:									DATE:	8/1/2007	
TAG NO.	SERVICE	P&ID NO.	LINE/EQUIP NO	FLUID	MAX PRESS	MAX TEMP	OPER PRESS	SET RANGE	ELEMENT RANGE	MANUFACTURER	MODEL NO
DPIT-200	F-202/203	P-2	3"WP-2003-CB	Water	150 psig	100 DegF	80 psig	0 - 50 psid	0 - 100 psid	ROSEMOUNT	1151DP 6 E 52 B1 M7 D1



TAG NO.	LOOP NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	LOCATION	INSTRUMENT TYPE	STATUS	I/O TYPE	DATASHEET	MANUFACTURER	MODEL NO	REVISION
DPIT-200		F-202/203	P-2	3"WP-2003-CB	Field	Differential Pressure Transmitt	New Instrument	4-20 mA VDC	DS-PDT-001	ROSEMOUNT	1151DP 6 E 52 B1 M7 A	

	DOC. NO.:
	PROJECT. NO.: 597
	CLIENT: The Boeing Company
	PROJECT: SSFL
	LOCATION: Santa Susana, California

FLOW SWITCHES

REVISION	0	1	2	3	4	5
REV. DATE	7/26/2007					
REV. DESC.	Original					
PREPARER	J. Latham					
LEAD ENG.	C. Liles					
PROJECT						

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GENERAL	1	Tag Number	See Table FS-01		
	2	Service	See Table FS-01		
	3	P&ID No.	See Table FS-01		
	4	Line Number	Instr. SIL	See Table FS-01	
	5	Case Size	Material	Color	N/A Brass Brass
	6	Mounting Style	Top of Line		
	7	Setting	Adjustable		
	8	Dead band			
	9	Area Classification	Enclosure Class	General Purpose	NEMA 4X
	10	Cable / Conduit Conn.	3/4" NPT (F)		
	11	Power Supply	Not Required		
	12				
	ELEMENT	16	Element Type	Vane Switch	
17		Element Material	316 SS		
18		Mounting	Integral		
19		Process Conn.	Location	1-1/2" NPT (M)	Bottom
20					
21					
PROCESS CONDITIONS	23	Oper. Flow	See Table FS-01		
	24	Actuation Flow	Deactuation Flow	See Table FS-01	See Table FS-01
	25	Oper. Temperature	70 DegF		
	26	Temp Min.	Max.	32 DegF	140 DegF
	27	Set Point:			
	28	Process	Electrical Signal	See Table FS-01	N/A
	29				
	30				
SWITCH	33	Type	SPDT snap switch standard		
	34	No. of Contacts	1		
	35	Contact Form	SPDT		
	36	Contact Current Rating	10A @ 125/250 VAC. CSA models: 5A @ 125/250 VAC; 5A r		
	37	Load	NIL (PLC Input)		
	38				
	39				
	40				
	41				
PURCHASE	49	Manufacturer	Dwyer		
	50	Model No.	V4-2-U		
	51				

Notes:

				FLOW SWITCHES			 Client: BOEING IRCTS Project: The Boeing Company Location: SSFL Proj. No.: 597
				Req/PO:			
				By:	Chkd:	Appr:	
				Dwg. No.:		Rev:	
No.	By	Date	Revision	Sheet		Date:	



CLIENT: The Boeing Company				FLOW SWITCHES					DOC NO:		Table FS-1	
PROJECT: SSFL									JOB NO:		597	
LOCATION: Santa Susana, California									REVISION:		0	
UNIT:									DATE:		8/1/2007	
TAG NO.	SERVICE	P&ID NO.	LINE/EQUIP NO	FLUID	MAX PRESS	MAX TEMP	ACTUATION FLOW	DEACTUATION FLOW	ELEMENT RANGE	MANUFACTURER	MODEL NO	
FSH-200	PA-201 Return Line	P-3		Water	160 psig	140 DegF	7 gpm	4 gpm	7 - 15 gpm	Dwyer	V4-2-U	
FSH-201	PA-203 Return Line	P-4		Water	160 psig	140 DegF	7 gpm	4 gpm	7 - 15 gpm	Dwyer	V4-2-U	
FSH-202	PA-Future Return Line	N/A		Water	160 psig	140 DegF	7 gpm	4 gpm	7 - 15 gpm	Dwyer	V4-2-U	



TAG NO.	LOOP NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	LOCATION	INSTRUMENT TYPE	STATUS	I/O TYPE	DATASHEET	MANUFACTURER	MODEL NO	REVISION
FSH-200		PA-201 Return Line	P-3		Field	Flow Switch	New Instrument	DI	DS-FS-01	Dwyer	V4-2-U	A
FSH-201		PA-203 Return Line	P-4		Field	Flow Switch	New Instrument	DI	DS-FS-01	Dwyer	V4-2-U	A
FSH-202		PA-Future Return Line	N/A		Field	Flow Switch	New Instrument	DI	DS-FS-01	Dwyer	V4-2-U	A

	DOC. NO.:
	PROJECT. NO.: 597
	CLIENT: The Boeing Company
	PROJECT: SSFL
	LOCATION: Santa Susana, California

LEVEL SWITCH - DISPLACER OR FLOAT

REVISION	0	1	2	3	4	5
REV. DATE	7/26/2007					
REV. DESC.	Original					
PREPARER	J. Latham					
LEAD ENG.	C. Liles					
PROJECT						

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GENERAL	1	Tag Number		See Table LS-01	
	2	Service		See Table LS-01	
	3	Vessel No.	Line No.	See Table LS-01	N/A
	4	P&ID No.		See Table LS-01	
	5				
PROCESS CONDITIONS	6	Upper Liquid	Name	Phase	N/A
	7	Lower Liquid	Name	Phase	WATER
	8	Density/MW (Gas)	Upper	Lower	N/A
	9	Oper S.G.	Upper	Lower	N/A
	10	Pressure	Design	Operating	0 PSIG
	11	Temperature	Design	Operating	AMBIENT
	12	Press. Design Min.		0 PSIG	
BODY / CAGE	13	Temperature Design Min.		25 DegF	
	14	Body or Gage Material		Stainless Steel	
	15	Rating		N/A	
	16	Connection Size & Location Upper		1" FNPT	
	17	Type		Single-Sensor Buoyancy Probe	
	18	Connection Size & Location Lower		N/A	
	19	Type		N/A	
	20	Case Mounting		N/A	
	21	Type		N/A	
	22	Rotatable Head		N/A	
	23	Orientation		N/A	
DISPLACER OR FLOAT	24	Cooling Extension		N/A	
	25	Center to Center Conn. Dimension		N/A	
	26				
	27				
	28	Dimensions		N/A	
	29	Length		See Table LS-01	
	30	Displacer Extension Length		N/A	
SWITCH / TRANSMITTER	31	Displacer or Float Material		316 SS	
	32	Spring Material	Tube Material	N/A	N/A
	33				
	34				
	35				
	36	Function		high high level switch	
	37	Output		Contact closures (1)	
OPTIONS	38	Control Modes		N/A	
	39	Differential		Manufacturer Standard	
	40	Output Actuator: Level Rise		Open on level rise	
	41	Mounting	Local Indicator	Wall	No
	42	Enclosure Class	Area Classification	NEMA 4X	General Purpose
	43	Power Supply		Not Required (Dry Contact Reed Switch)	
	44	Cable/Conduit Conn.		1/2" NPT	
PURCHASE	45				
	46	Airset	Supply Gage	N/A	N/A
	47	Gage Glass Connections		N/A	
	48	Gage Glass Model No.		N/A	
	49	Contacts: No.	Form	1	SPST
	50	Contact Rating		20VA	
	51	Action of Contacts		open on high high level	
	52	Manufacturer		Gem Sensors	
	53	Model No.		LS-700 Float 141750	
	54				
Notes: 1. Probe specified with all sensor dimension equal to the probe length for maximum field adjustability. Factory to ship probe with sensor set at 6" from probe tip.					
				LEVEL SWITCH - DISPLACER OR FLOAT	
				Req/PO:	
				By: Chkd: Appr:	
				Dwg. No.: Rev:	
				Sheet Date:	
No.	By	Date	Revision		
				 Client: The Boeing Company Project: SSFL Location: The Boeing Company Proj. No.: 597	



CLIENT: The Boeing Company		LEVEL SWITCH - DISPLACER OR FLOAT							DOC NO:	Table LS-01
PROJECT: SSFL									JOB NO:	597
LOCATION: Santa Susana, California									REVISION:	0
UNIT:									DATE:	8/1/2007
TAG NO.	SERVICE	P&ID NO.	LINE/EQUIP NO	FLUID	PROBE LENGTH	SWITCH POINT (FROM TIP)	OPER PRESS	OPER TEMP	MANUFACTURER	MODEL NO
LSHH-201	High Dike Level	P-3	High Dike Level	Water	9-inches	2-inches	Ambient	Ambient	GEMS SENSORS	LS-700 Float 141749
LSH-201/LSL-203	Operate PS-200	P-3	PS-200	Water	42-inches	6-inches low, 18-inches high	Ambient	Ambient	GEMS SENSORS	LS-700 Float 141750



TAG NO	LOOP NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	LOCATION	INSTRUMENT TYPE	STATUS	I/O TYPE	DATASHEET	MANUFACTURER	MODEL NO	REVISION
LSHH-201		Water Containment Dike	P-03	Containment Dike	Field	Level Switch	New Instrument	DI	DS-LS-01	GEMS SENSORS	LS-700 Float 141750	A
LSH-200/LSL-203		Water Containment Dike	P-03	PS-200	Field	Level Switch	New Instrument	DI	DS-LS-01	GEMS SENSORS	LS-700 Float 141750	A

	DOC. NO.:
	PROJECT. NO.: 597
	CLIENT: The Boeing Company
	PROJECT: SSFL
	LOCATION: Santa Susana, California

MAGNETIC FLOW METERS

REVISION	0	1	2	3	4	5
REV. DATE	7/26/2007					
REV. DESC.	Original					
PREPARER	J. Latham					
LEAD ENG.	C. Liles					
PROJECT						

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CLIENT: The Boeing Company
PROJECT: SSFL
LOCATION: Santa Susana, California
UNIT:

MAGNETIC FLOW METERS

DOC NO: Table FQIT-1
JOB NO: 597
REVISION: 0
DATE: 8/1/2007

TAG NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	FLUID	MAX VELOCITY	MIN FLOW	MAX FLOW	NORMAL FLOW	SCALE RANGE	MAX TEMP	MAX PRESS	MANUFACTURER	MODEL NO
FE-200	Water Process	P-2	3" WP-2002-CB	Water	0.03	50 gpm	75	65	0-75 gpm	100 DegF	223 psig	Sparling	FM656-03-3-1-1-0-1



TAG NO.	LOOP NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	LOCATION	INSTRUMENT TYPE	STATUS	I/O TYPE	DATASHEET	MANUFACTURER	MODEL NO	REVISION
FE-200		Water Process	P-2	3" WP-2002-CB	Field	Flow Element - Magnetic	New Instrument	4-20 mA VDC	DS-FE-200	Sparling	FM656-03-3-1-1-0-1	A

	DOC. NO.:
	PROJECT. NO.: 597
	CLIENT: The Boeing Company
	PROJECT: SSFL
	LOCATION: SANTA SUSANA, CALIFORNIA

LEVEL TRANSMITTERS

REVISION	0	1	2	3	4	5
REV. DATE	7/24/2007					
REV. DESC.	Original					
PREPARER	J. Latham					
LEAD ENG.	C. Liles					
PROJECT						

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GENERAL	1	Tag Number		See Table LT-1		
	2	Service		See Table LT-1		
	3	Vessel No.	Line No.	See Table LT-1		
	4	P&ID No.		See Table LT-1		
	5	Area Classification	Enclosure	See Table LT-1	NEMA 4X	
	6	Power Supply		24 VDC loop powered		
	7					
PROCESS CONDITIONS	8	Upper Liquid	Name	Phase	N/A	N/A
	9	Lower Liquid	Name	Phase	Water	Liquid
	10	Pressure	Min.	Oper.	Max.	0 psig 0 psig 15 psig
	11	Temp	Min.	Oper.	Max.	32 DegF 80 DegF 120 DegF
	12	Density/MW (Gas)	Upper	Lower	N/A	1.0 SGU
	13	Solids Buildup	Upper	Lower	N/A	0%
	14	Level	Min.	Oper.	Max.	0'-3" 6'-6" 12'-10"
DEVICE	15					
	16	Equip Wall Material	Lining Material		XLPE	N/A
	17	Compensation		N/A		
	18	Flange Material		N/A		
	19	Sensor Material		316L SS		
	20	Case Material		Aluminum		
	21	Mounting Style	Position		Coaxial Probe	Top
	22	Electronics Location		Integral		
	23	Distance to Electronics		N/A		
	24	Calibration Range		0 - 12' 10"		
	25	Orientation		Top		
BODY CONNECTIONS	26	Instr. Rating	Temp.	Press.	-40 to 300 DegF	FV to 1000 psig
	27					
	28	Instr. Conn. Size		3/4" NPT		
	29	Conn. Type		NPT		
	30	Conn. End Finish		N/A		
TRANSMITTER	31	Conn. Rating		N/A		
	32					
	33	Mounting Style	Output Signal Range		Integral	4-20 mdc
	34	Communication Type	Internal Diagnostics		Hart	
SWITCH	35	Cable/Conduit Connection		3/4" FNPT		
	36	Area Classification	Enclosure		General Purpose	NEMA 4X
	37					
	38	Type	No. of Contacts		N/A	N/A
SW1	39	Contact:	Action	Actuation	N/A	N/A
	40		Form	Rating	N/A	N/A
	41	Load Type @ Rating	Deadband		N/A	N/A
	42	Set Point	Set Point Range		N/A	N/A
	43					
	44	Type	No. of Contacts		N/A	N/A
	45	Contact:	Action	Actuation	N/A	N/A
	46		Form	Rating	N/A	N/A
SW2	47	Load Type @ Rating	Deadband		N/A	N/A
	48	Set Point	Set Point Range		N/A	N/A
	49					
	50	Area Classification	Enclosure		N/A	N/A
	51					
	52	Manufacturer		MAGNETROL		
	53	Model		705-5100-110		
	54	Probe Model Number		See Table LT-1		

Notes: 1. Level min, operating, max measured from vessel connection.

				LEVEL TRANSMITTERS			 Client: The Boeing Company Project: SSFL Location: Santa Susana, California Proj. No.: 0
				Req/PO:			
				By:	Chkd:	Appr:	
				Dwg. No.:	Rev:		
No.	By	Date	Revision	Sheet	Date:		



CLIENT: The Boeing Company		LEVEL TRANSMITTERS								DOC NO:	Table LT-1
PROJECT: SSFL										JOB NO:	597
LOCATION: SANTA SUSANA, CALIFORNIA										REVISION:	0
UNIT:										DATE:	8/1/2007
TAG NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	FLUID	MAX PRESS	MAX TEMP	OPER PRESS	CABLE LENGTH	ELEMENT RANGE	PROBE MODEL NO.	MANUFACTURER MODEL NO.
LT-200	LT-200 Level Transmitter	P-2	T-200	Water	15 psig	100 DegF	60 inches of water	154 inches	0 to 152 inches of water	7EA-A431-152	MAGNETROL 705
LT-201	LT-201 Level Transmitter	P-2	T-201	Water	16 psig	101 DegF	61 inches of water	155 inches	0 to 192 inches of water	7EA-A431-192	MAGNETROL 705



TAG NO.	LOOP NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	LOCATION	INSTRUMENT TYPE	STATUS	I/O TYPE	DATASHEET	MANUFACTURER	MODEL NO	REVISION
LT-200		LT-200 Level Transmitter	P-2	T-200	Field	Level Transmitter	New Instrument	4-20 mA VDC	DS-LT-20X	MAGNETROL	705	A

	DOC. NO.:
	PROJECT. NO.: 597
	CLIENT: The Boeing Company
	PROJECT: SSFL
	LOCATION: Santa Susana, California

PRESSURE GAUGES

REVISION	0	1	2	3	4	5
REV. DATE	7/26/2007					
REV. DESC.	Original					
PREPARER	J. Latham					
LEAD ENG.	C. Liles					
PROJECT						

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CLIENT: The Boeing Company
PROJECT: SSFL
LOCATION: Santa Susana, California
UNIT:

PRESSURE GAUGES

DOC NO: Table PI-1
JOB NO: 597
REVISION: 0
DATE: 8/1/2007

TAG NO.	SERVICE	P&ID NO.	LINE/EQUIP NO	FLUID	MAX PRESS	MAX TEMP	OPER PRESS	GAUGE RANGE	DIAL SIZE	SYPHON?	SNUBBER?	LIQ FILLED	MANUFACTURER	MODEL NO
PI-200		P-2		Water	65 psig	140 DegF	35 psig	0-60 psig	3.5	No	No	Yes	Ashcroft	35-1009-SW-(L)-02L-AW-60#
PI-201		P-2		Water	65 psig	140 DegF	35 psig	0-60 psig	3.5	No	No	Yes	Ashcroft	35-1009-SW-(L)-02L-AW-60#
PI-202		P-2		Water	65 psig	140 DegF	35 psig	0-60 psig	3.5	No	No	Yes	Ashcroft	35-1009-SW-(L)-02L-AW-60#
PI-203		P-2		Water	65 psig	140 DegF	35 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-204		P-2		Water	65 psig	140 DegF	35 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-205		P-2		Water	65 psig	140 DegF	35 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-206		P-2		Water	65 psig	140 DegF	35 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-207		P-2		Water	50 psig	140 DegF	35 psig	0-60 psig	3.5	No	No	Yes	Ashcroft	35-1009-SW-(L)-02L-AW-60#
PI-208		P-2		Water	50 psig	140 DegF	35 psig	0-60 psig	3.5	No	No	Yes	Ashcroft	35-1009-SW-(L)-02L-AW-60#
PI-209		P-2		Water	100 psig	140 DegF	80 psig	0-150 psig	3.5	No	No	Yes	Ashcroft	35-1009-SW-(L)-02L-AW-150#
PI-210		P-3		Water	75 psig	140 DegF	35 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-211		P-3		Water	75 psig	140 DegF	35 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-212		P-3		Water	75 psig	140 DegF	35 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-213		P-3		Water	75 psig	140 DegF	35 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-214		P-3		Water	60 psig	140 DegF	40 psig	0-100 psig	Carbon Air Supplied	No	No	Supplied	Carbon Air Supplied	0
PI-215		P-3		Water	10 psig	140 DegF	8 psig	0-30 psig	2.5"	No	No	No	Ashcroft	25-1009-SW-(L)-02L-AW-30#
PI-217		P-4		Water	75 psig	140 DegF	40 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-218		P-4		Water	75 psig	140 DegF	40 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-219		P-4		Water	75 psig	140 DegF	40 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-220		P-4		Water	75 psig	140 DegF	40 psig	0-100 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-221		P-4		Water	55 psig	140 DegF	35 psig	0-60 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-222		P-4		Water	55 psig	140 DegF	35 psig	0-60 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-223		P-4		Water	55 psig	140 DegF	35 psig	0-60 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0
PI-224		P-4		Water	55 psig	140 DegF	35 psig	0-60 psig	Siemens Supplied	No	No	Supplied	Siemens Supplied	0



TAG NO.	LOOP NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	LOCATION	INSTRUMENT TYPE	STATUS	DATASHEET	MANUFACTURER	MODEL NO	REVISION
PI-200			P-2	3" WP-2002-AA	Field	Pressure Gauge	New Instrument	DS-PI-01	Ashcroft	35-1009-SW-(L)-02L-AW-60#	
PI-201			P-2	3" WP-2003-CB	Field	Pressure Gauge	New Instrument	DS-PI-01	Ashcroft	35-1009-SW-(L)-02L-AW-60#	
PI-202			P-2	3" WP-2005-CB	Field	Pressure Gauge	New Instrument	DS-PI-02	Ashcroft	35-1009-SW-(L)-02L-AW-60#	
PI-203			P-2	PA-200	Field	Pressure Gauge	New Instrument	DS-PI-03	Siemens Supplied		0
PI-204			P-2	PA-200	Field	Pressure Gauge	New Instrument	DS-PI-04	Siemens Supplied		0
PI-205			P-2	PA-200	Field	Pressure Gauge	New Instrument	DS-PI-05	Siemens Supplied		0
PI-206			P-2	PA-200	Field	Pressure Gauge	New Instrument	DS-PI-06	Siemens Supplied		0
PI-207			P-2	4" WU-2001-CB	Field	Pressure Gauge	New Instrument	DS-PI-07	Ashcroft	35-1009-SW-(L)-02L-AW-60#	
PI-208			P-2	4" WU-2003-CB	Field	Pressure Gauge	New Instrument	DS-PI-08	Ashcroft	35-1009-SW-(L)-02L-AW-60#	
PI-209			P-2	2" WU-2006-AA	Field	Pressure Gauge	New Instrument	DS-PI-09	Ashcroft	35-1009-SW-(L)-02L-AW-150#	
PI-210			P-3	PA-201	Field	Pressure Gauge	New Instrument	DS-PI-10	Siemens Supplied		0

	DOC. NO.:
	PROJECT. NO.: 597
	CLIENT: The Boeing Company
	PROJECT: SSFL
	LOCATION: SANTA SUSANA, CALIFORNIA

SONIC LEVEL TRANSMITTERS

REVISION	0	1	2	3	4	5
REV. DATE	7/24/2007					
REV. DESC.	Original					
PREPARER	J. Latham					
LEAD ENG.	C. Liles					
PROJECT						

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0 GENERAL	1	Tag Number		See Table LT-1					
	2	Service		See Table LT-1					
	3	Vessel No.	Line No.	See Table LT-1					
	4	P&ID No.		See Table LT-1					
	5	Area Classification	Enclosure	See Table LT-1		NEMA 4X			
	6	Power Supply		24 VDC loop powered					
	7								
PROCESS CONDITIONS	8	Upper Liquid	Name	Phase	N/A		N/A		
	9	Lower Liquid	Name	Phase	Water		Liquid		
	10	Pressure	Min.	Oper.	Max.	0 psig	0 psig 15 psig		
	11	Temp	Min.	Oper.	Max.	32 DegF	80 DegF 120 DegF		
	12	Density/MW (Gas)	Upper	Lower	N/A		1.0 SGU		
	13	Solids Buildup	Upper	Lower	N/A		0%		
	14	Level	Min.	Oper.	Max.	See Table LT-1	See Table LT-1 See Table LT-1		
DEVICE	16	Equip Wall Material	Lining Material		N/A		N/A		
	17	Compensation		N/A					
	18	Flange Material		N/A					
	19	Sensor Material		N/A					
	20	Case Material		Plastic (PBT) NEMA 6					
	21	Mounting Style	Position		Direct Mount		Top		
	22	Electronics Location		Integral					
	23	Distance to Electronics		N/A					
	24	Calibration Range		Manufacturer Standard					
	25	Orientation		Top					
	26	Instr. Rating	Temp.	Press.	-22 to 195 DegF		FV to 44 psig		
BODY CONNECTIONS	28	Instr. Conn. Size		2" NPT					
	29	Conn. Type		NPT					
	30	Conn. End Finish		N/A					
	31	Conn. Rating		N/A					
	32								
TRANSMITTER	33	Mounting Style	Output Signal Range		Integral		4-20 mdc		
	34	Communication Type	Internal Diagnostics		Hart				
	35	Cable/Conduit Connection		1/2" FNPT					
	36	Area Classification	Enclosure		General Purpose		NEMA 4X		
	37								
SWITCH	SW1	38	Type	No. of Contacts		N/A		N/A	
		39	Contact:	Action	Actuation		N/A		N/A
		40		Form	Rating		N/A		N/A
		41	Load Type @ Rating	Deadband		N/A		N/A	
		42	Set Point	Set Point Range		N/A		N/A	
	SW2	44	Type	No. of Contacts		N/A		N/A	
		45	Contact:	Action	Actuation		N/A		N/A
		46		Form	Rating		N/A		N/A
		47	Load Type @ Rating	Deadband		N/A		N/A	
		48	Set Point	Set Point Range		N/A		N/A	
PURCHASE	52	Manufacturer		MAGNETROL					
	53	Model		338-P53A-G5P					
	54	Probe Model Number		N/A					
Notes: 1. Level min, operating, max measured from vessel connection.									
SONIC LEVEL TRANSMITTERS				 Client: The Boeing Company Project: SSFL Location: Santa Susana, California Proj. No.: 0					
Req/PO:				By: Chkd: Appr:					
Dwg. No.:				Rev:					
No.	By	Date	Revision	Sheet	Date:				



CLIENT: The Boeing Company
PROJECT: SSFL
LOCATION: SANTA SUSANA, CALIFORNIA
UNIT:

SONIC LEVEL TRANSMITTERS

DOC NO: Table LT-1
JOB NO: 597
REVISION: 0
DATE: 8/1/2007

TAG NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	FLUID	MAX PRESS	MAX TEMP	MIN OPER LEVEL	MAX OPER LEVEL	OPER PRESS	CABLE LENGTH	ELEMENT RANGE	MODEL NO.	MANUFACTURER
LT-200	LT-200 Level Transmitter	P-2	T-200	Water	15 psig	100 DegF	12 inches	132 inches	Ambient, 0 psig	N/A	0 to 240 inches of water	338-P53A-G5P	MAGNETROL
LT-201	LT-201 Level Transmitter	P-2	T-201	Water	15 psig	100 DegF	12 inches	154 inches	Ambient, 0 psig	N/A	0 to 240 inches of water	338-P53A-G5P	MAGNETROL

0



TAG NO.	LOOP NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	LOCATION	INSTRUMENT TYPE	STATUS	I/O TYPE	DATASHEET	MANUFACTURER	MODEL NO	REVISION
LT-200		LT-200 Level Transmitter	P-2	T-200	Field	Level Transmitter	New Instrument	4-20 mA VDC	DS-LT-20X	MAGNETROL	338	A

	DOC. NO.:
	PROJECT. NO.: 597
	CLIENT: The Boeing Company
	PROJECT: SSFL
	LOCATION: Santa Susana, California

TURBINE FLOW METERS

REVISION	0	1	2	3	4	5
REV. DATE	7/26/2007					
REV. DESC.	Original					
PREPARER	J. Latham					
LEAD ENG.	C. Liles					
PROJECT						

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CLIENT: The Boeing Company		TURBINE FLOW METERS										DOC NO:	Table FQIT-1
PROJECT: SSFL												JOB NO:	597
LOCATION: Santa Susana, California												REVISION:	0
UNIT:												DATE:	8/1/2007
TAG NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	FLUID	MAX VELOCITY	MIN FLOW	MAX FLOW	NORMAL FLOW	SCALE RANGE	MAX TEMP	MAX PRESS	MANUFACTURER	MODEL NO
FE-201/FQI-200	Water Process	P-2	2" WU-2006-AA	Water	0.01	1	10	5	0-15 gpm	140 DegF	250 psig	Cameron	EZ-IN



TAG NO.	LOOP NO.	SERVICE	P&ID NO.	LINE/EQUIP NO.	LOCATION	INSTRUMENT TYPE	STATUS	I/O TYPE	DATASHEET	MANUFACTURER	MODEL NO	REVISION
FE-201/FQI-201		Water Process	P-2	2" WU-2006-AA	Field	Flow Meter - Turbine	New Instrument	N/A	DS-FQI-02	Cameron	EZ-IN	A

ATTACHMENT C

RADIO SURVEY RESULTS



April 20, 2007

Santa Susana Field Laboratory Radio Site Survey Report

The radio site survey was conducted on Tuesday, April 10, 2007. The survey was performed to test the feasibility and quality of proposed wireless Ethernet system for the Santa Susana Field Laboratory Facility.

The Ethernet radio used in the survey is a model iNET 900 II, manufactured by Microwave Data Systems of Rochester, New York. This radio operates in the 902-928MHz ISM band. It uses a Frequency Hopping Spread Spectrum protocol, which allows it to operate license free. The radio has two modulation rates; 512kbps and 1Mbps. This test was conducted at the 512kbps setting. The iNET transceiver produces 30dBm or 1W of transmit power.

TREATMENT SITE

We began by setting up our telescoping mast truck at the Treatment site as specified. The mast was raised to a height of approximately 40' with a 6dB omni antenna. The coax used for the test was LMR400 manufactured by Times Microwave, 50' in length. LMR 400 is a low loss .4" coax (3.9dB loss per 100'). Typically for water applications we prefer to use ½" coax not only for its low loss (3.1dB loss per 100') characteristics but also for its ability to withstand the elements. The radios were previously checked on the bench to confirm communication between the radios. The Access Point radio was powered up and attached to the omni antenna located on the mast.

REMOTE SITES

We surveyed a total of 3 remote sites utilizing our telescoping mast truck. The WS-9 site was surveyed three times from three different locations because when first surveyed from the Treatment site it was not able to establish a link. This required an additional site to be found that would function as a repeater from the Treatment Site to WS-9 site. The survey truck mast originally located at the Treatment Site had to be torn down and moved to the alternative locations. The first alternative site visited was able to establish a link with WS-9 but the signal was still too marginal for a dependable radio link. The second alternative repeater site proved to be a very good site for communication to WS-9. Once the survey to WS-9 was completed, the survey van was moved back to the Treatment Site and the remaining sites were surveyed. The radio used was an iNET900 II radio

configured as an Ethernet remote. The antenna was a 10dB yagi. The coax was 50' of Times Microwave LMR400, the same that was used at the Access Point.

The following is a recap of the results for each site (survey worksheets also included):

WS-9 to Treatment Site (first test)

Test Height: 40'

Signal Strength: N/A

Signal to Noise: N/A

Throughput: N/A

No link was established between the radios.

WS-9 to First Alternate Repeater Site (second test)

Test Height: 40'

Signal Strength: -85

Signal to Noise: 24

Throughput: Not performed

Marginal link not strong enough to assure a reliable link between radios.

WS-9 to Second Alternate Repeater Site (third test)

Test Height: 40'

Signal Strength: -69

Signal to Noise: 23

Throughput:

Downloads: 295kbs*

Uploads: 283kbs*

Excellent link to WS-9.

* Please note that after the completion of this survey from WS-9, we discovered that the remote radio's power was set at its minimum setting of 20dBm, it should have been set at 30dBm. What this means is that the quality of the link as tested will be even better than what we recorded and that the throughput numbers will be much improved from the actual recorded above. Note the throughput numbers recorded at the RD 2 site with the power set to maximum; WS-9 should experience as good if not better performance.

RD 2 to Treatment Site

Test Height: 20', 30', 40'

Signal Strength: -77, -76, -77

Signal to Noise: 22, 21, 21

Throughput:

Downloads: 340kbs

Uploads: 365kbs

Excellent link to RD 2. We recommend mounting the antenna at the 20' to 30' level.

Building 436 to Treatment Site

Test Height: 20', 30', 40'

Signal Strength: -82, -82, -83

Signal to Noise: 22, 22, 20

Throughput:

Downloads: 280kbs

Uploads: 359kbs

Marginal link to Treatment Site. This site may require a dedicated repeater or this site may be able to utilize the same repeater that will be used for communication with WS-9. We were unable to test this possibility, however, once the WS-9 / Repeater /Treatment Site links are built, it will be very easy to test the link with a remote from Building 436. We recommend mounting the antenna at the 20' to 30' level. We prefer better signal strength numbers so that we have a better "fade margin". We feel a repeater solution will improve the signal as it did at WS-9.

Recommendations:

This system as tested should perform very well for a video/data application.

Treatment Site:

The addition of the Repeater Site to the system will change the radio topology of the system. We originally assumed that the Access Point would reside at the Treatment Site, however, a Remote iNET will now be located here. The Access Point will now serve as a single radio repeater at the Repeater Site. (I will explain in the "Repeater Site" portion of this report).

The antenna for this site will be a 10dB yagi pointed at the repeater site.

We also recommend using ½" Heliax made by Andrew Corp. for the coax as this will give you less signal loss than the LMR400 coax we used during the survey.

Repeater Site:

Since this repeater site was a site that was not on the original list of sites, we were not able to add it to our original Computer Path Study and therefore consider this location as a hub for the rest of the system, but I have since ran the paths again (I will include these with this report) this time using the repeater site. I have found that this site should have a much better line of site to not only the WS-9 location, which we confirmed, but also the RD 2 and Bldg 436 locations. It is important to note that these last two sites were NOT surveyed to confirm my Path Study results but it is such a prime site that it should be seriously considered as the "hub".

Utilizing this site as a central hub site has several advantages; a single radio can now be utilized as the repeater because the Access Point is a wireless bridge and as long as a radio has connectivity to the Access Point it will be on the network. Another advantage is that since you have to power this site via solar, you only have to provide power for one radio. (By the way, the solar package is complete with enclosure, panels, batteries and everything needed to assemble it to a pole) Additionally, less infrastructure at the repeater site because only one antenna will be required. We strongly recommend a 9dB omni.

As this system is built out, I would recommend constructing the Repeater Site first and then build each remote site after that, in this way, the radio performance can be confirmed as each site is built.

We also recommend using ½" Helix made by Andrew Corp. for the coax as this will give you less signal loss than the LMR400 coax we used during the survey.

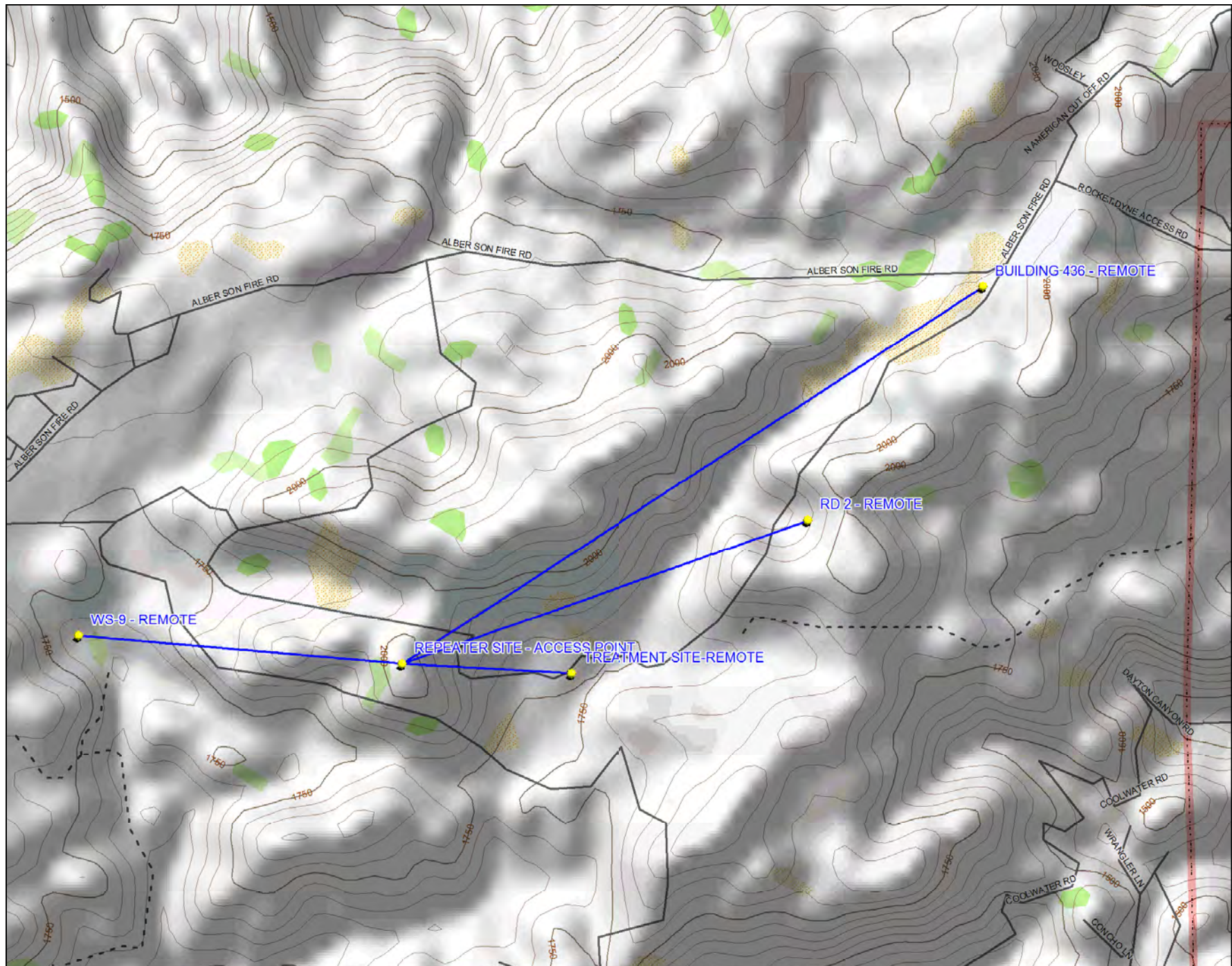
Remote Sites:

This now will include the Treatment Site as mentioned above. Each remote site will require a 10dB yagi antenna and ½" Helix. The antennas, including the 9dB omni for the repeater site already have mounting brackets that typically will mount on pipe up to 2 7/8" diameter. I will submit an approximate parts list for each site by name.

If you should have any questions, please call me at the office or on my cell at 661-203-1624.

Sincerely,

Chuck Hoyt
Communications Specialist
Applied Technology Group, Inc.
661-322-8650



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Scale: 1 : 17,600 Zoom Level: 13-5 Datum: WGS84 Map Rotation: 0° Magnetic Declination: 13.7°E

1,000 ft

Company Information

Company	Hargis & Associates		
Address	2365 Northside Drive, Suite C-100		
City,ST ZIP	San Diego, CA 92108		
Contact	Chris Liles		
Phone	619-521-0165 x150	Acct:	
Fax			
Date	04/10/07	Time IN	Time OUT

Site Layout:			

Master Site

Name	Treatment System		
Latitude	N34 13 36.69	Ant: Make	Antenex
Longitude	W118 42 19.88	Ant: Model	FG9026
Elevation		Ant: Gain	6dB
GPS Marker		Ant: Height	40'

Remote Site

Name	WS-9A		
Latitude	N34 13 29.94	Ant: Make	Maxrad
Longitude	W118 42 30.78	Ant: Model	BMOY8905
Elevation		Ant: Gain	10dB
GPS Marker		Ant: Height	40'

Test Radio

	Master	Remote		Master	Remote
Make	MDS	MDS	Tx Pwr (dBm)	30	20
Model	iNET	iNET	Frequency	902-928MHz	
Serial			Callsign		

Test Coax

	Master	Remote		Master	Remote
Make	Times	Times	Length	50	50
Model	LMR400	LMR400	Loss / 100'	3.9dB	3.9dB

Signal and RSIM Test

Antenna Height	RSSI	SNR
40'	N/A	

File Transfer

File Size				File Size			
Download				Download			
Upload				Upload			
File Size				File Size			
Download				Download			
Upload				Upload			
File Size				File Size			
Download				Download			
Upload				Upload			

No Link was established

Company Information

Company	Hargis & Associates		
Address	2365 Northside Drive, Suite C-100		
City,ST ZIP	San Diego, CA 92108		
Contact	Chris Liles		
Phone	619-521-0165 x150	Acct:	
Fax			
Date	04/10/07	Time IN	Time OUT

Site Layout:			

Master Site

Name	1st Repeater Site		
Latitude	N/A	Ant: Make	Antenex
Longitude	N/A	Ant: Model	FG9026
Elevation		Ant: Gain	6dB
GPS Marker		Ant: Height	40'

Remote Site

Name	WS-9A		
Latitude	N34 13 29.94	Ant: Make	Maxrad
Longitude	W118 42 30.78	Ant: Model	BMOY8905
Elevation		Ant: Gain	10dB
GPS Marker		Ant: Height	40'

Test Radio

	Master	Remote		Master	Remote
Make	MDS	MDS	Tx Pwr (dBm)	30	20
Model	iNET	iNET	Frequency	902-928MHz	
Serial			Callsign		

Test Coax

	Master	Remote		Master	Remote
Make	Times	Times	Length	50	50
Model	LMR400	LMR400	Loss / 100'	3.9dB	3.9dB

Signal Test

Antenna Height	RSSI	SNR
40'	-85	24

File Transfer

File Size				File Size			
Download				Download			
Upload				Upload			
File Size				File Size			
Download				Download			
Upload				Upload			
File Size				File Size			
Download				Download			
Upload				Upload			

Link established but signal too weak.

Company Information

Company	Hargis & Associates		
Address	2365 Northside Drive, Suite C-100		
City,ST ZIP	San Diego, CA 92108		
Contact	Chris Liles		
Phone	619-521-0165 x150	Acct:	
Fax			
Date	04/10/07	Time IN	Time OUT

Site Layout:			

Master Site

Name	2nd Repeater Site		
Latitude	N34 13 26.9	Ant: Make	Antenex
Longitude	W118 41 48.2	Ant: Model	FG9026
Elevation		Ant: Gain	6dB
GPS Marker		Ant: Height	40'

Remote Site

Name	WS-9A		
Latitude	N34 13 29.94	Ant: Make	Maxrad
Longitude	W118 42 30.78	Ant: Model	BMOY8905
Elevation		Ant: Gain	10dB
GPS Marker		Ant: Height	40'

Test Radio

	Master	Remote		Master	Remote
Make	MDS	MDS	Tx Pwr (dBm)	30	20
Model	iNET	iNET	Frequency	902-928MHz	
Serial			Callsign		

Test Coax

	Master	Remote		Master	Remote
Make	Times	Times	Length	50	50
Model	LMR400	LMR400	Loss / 100'	3.9dB	3.9dB

Signal and RSIM Test

Antenna Height	RSSI	SNR
40'	-69	23

File Transfer at 40'

File Size	300 KB			File Size			
Download	33 KBps	36 KBps		Download			
Upload	30 KBps	41 KBps		Upload			
File Size	300 KB			File Size			
Download	33 KBps	47 KBps		Download			
Upload	26 KBps	50 KBps		Upload			
File Size	300 KB			File Size			
Download	38 KBps	34 KBps		Download			
Upload	26 KBps	39 KBps		Upload			

Average Throughput:

Downloads: 295Kb/sec

Uploads: 283Kb/sec

Excellent link. Throughput will increase slightly once radio & antenna have been optimized.

Company Information

Company	Hargis & Associates		
Address	2365 Northside Drive, Suite C-100		
City,ST ZIP	San Diego, CA 92108		
Contact	Chris Liles		
Phone	619-521-0165 x150	Acct:	
Fax			
Date	04/10/07	Time IN	Time OUT

Site Layout:			

Master Site

Name	Treatment System		
Latitude	N34 13 36.69	Ant: Make	Antenex
Longitude	W118 42 19.88	Ant: Model	FG9026
Elevation		Ant: Gain	6dB
GPS Marker		Ant: Height	40'

Remote Site

Name	RD 2		
Latitude	N34 13 42.48	Ant: Make	Maxrad
Longitude	W118 40 54.88	Ant: Model	BMOY8905
Elevation		Ant: Gain	10dB
GPS Marker		Ant: Height	Various

Test Radio

	Master	Remote		Master	Remote
Make	MDS	MDS	Tx Pwr (dBm)	30	30
Model	iNET	iNET	Frequency	902-928MHz	
Serial			Callsign		

Test Coax

	Master	Remote		Master	Remote
Make	Times	Times	Length	50	50
Model	LMR400	LMR400	Loss / 100'	3.9dB	3.9dB

Signal and RSIM Test

Antenna Height	RSSI	SNR
20'	-77	22
30'	-76	21
40'	-77	21

File Transfer at 30'

File Size	300 KB		
Download	45 KBps	30 KBps	
Upload	58 KBps	40 KBps	
File Size	300 KB		
Download	52 KBps	42 KBps	
Upload	41 KBps	45 KBps	
File Size	300 KB		
Download	43 KBps	43 KBps	
Upload	45 KBps	45 KBps	

File Size			
Download			
Upload			
File Size			
Download			
Upload			
File Size			
Download			
Upload			

Average Throughput:

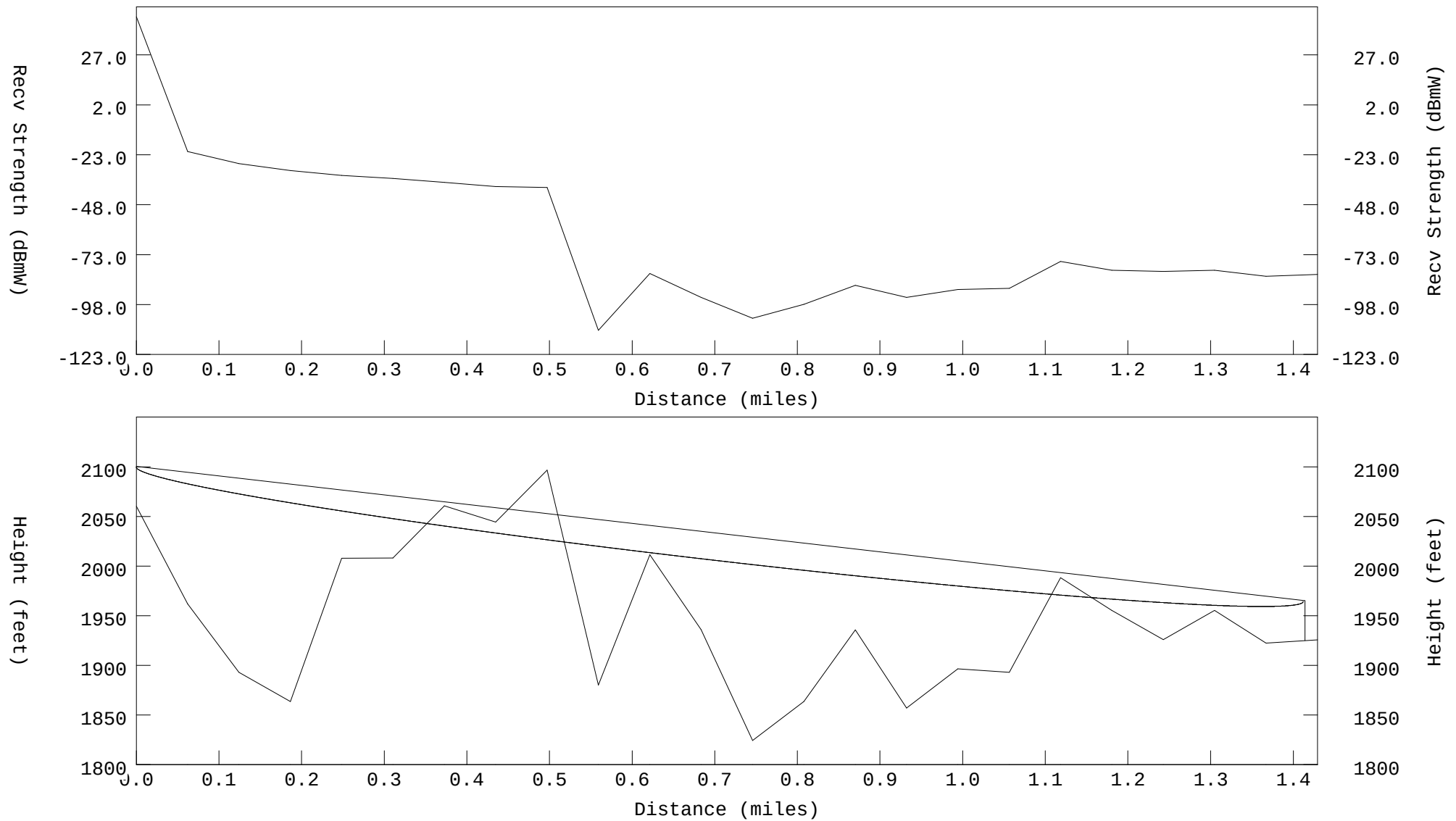
Downloads: 340Kb/sec

Uploads: 365Kb/sec

Very good performance.

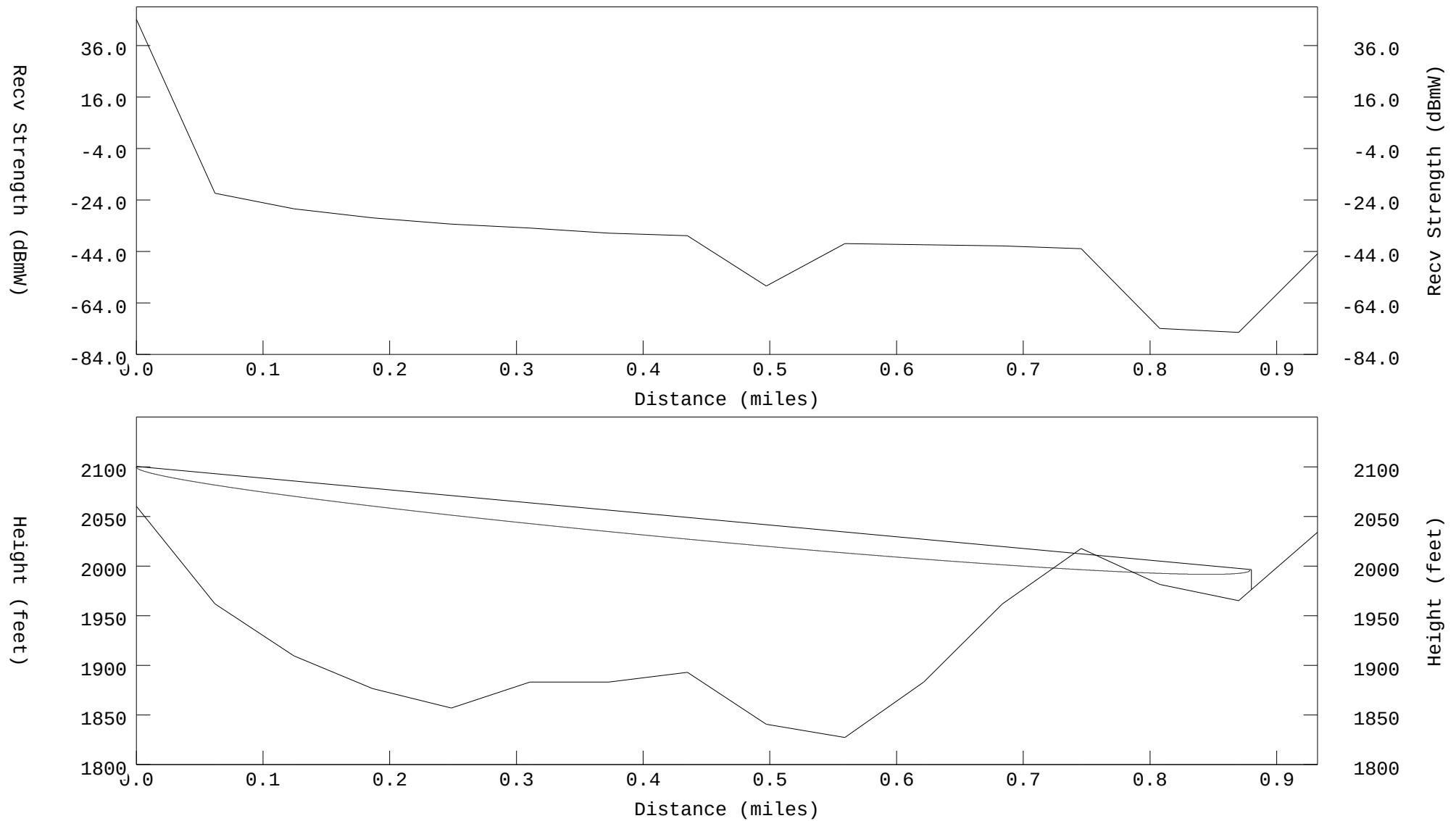
Study: Repeater Site 40' to Bldg 436 40'
TX Site: Repeater
RX Site: Building 436
TX --> RX: 1.41 mi, 59.1 degrees, 129.0 dB loss

TX Latitude: N34-13-29.94
TX Longitude: W118-41-48.20
RX Latitude: N34-14-07.83
RX Longitude: W118-40-31.75



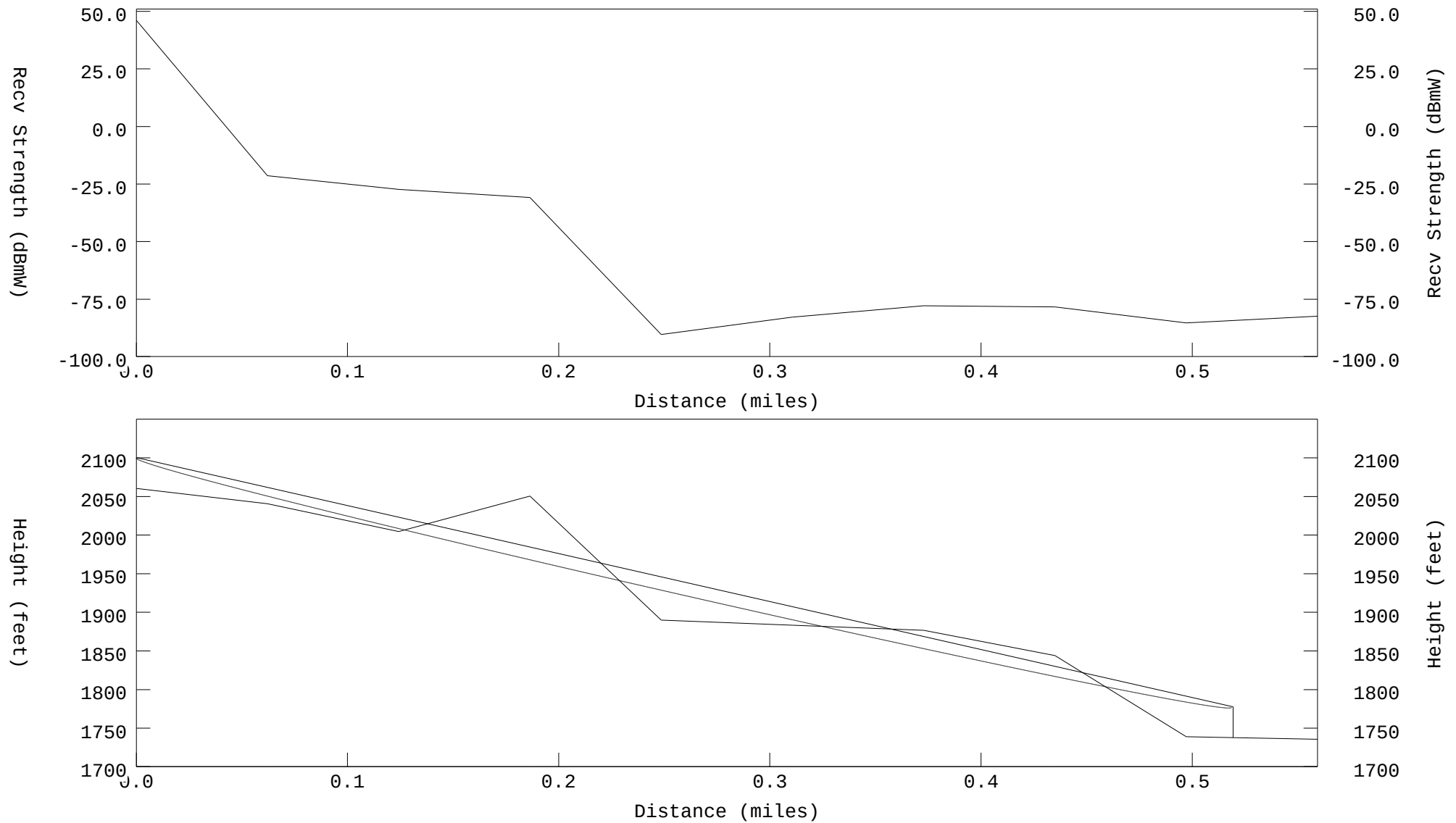
Study: Repeater Site 40' to RD 2 40'
TX Site: Repeater
RX Site: RD-2
TX --> RX: 0.88 mi, 74.1 degrees, 91.0 dB loss

TX Latitude: N34-13-29.94
TX Longitude: W118-41-48.20
RX Latitude: N34-13-42.48
RX Longitude: W118-40-54.88



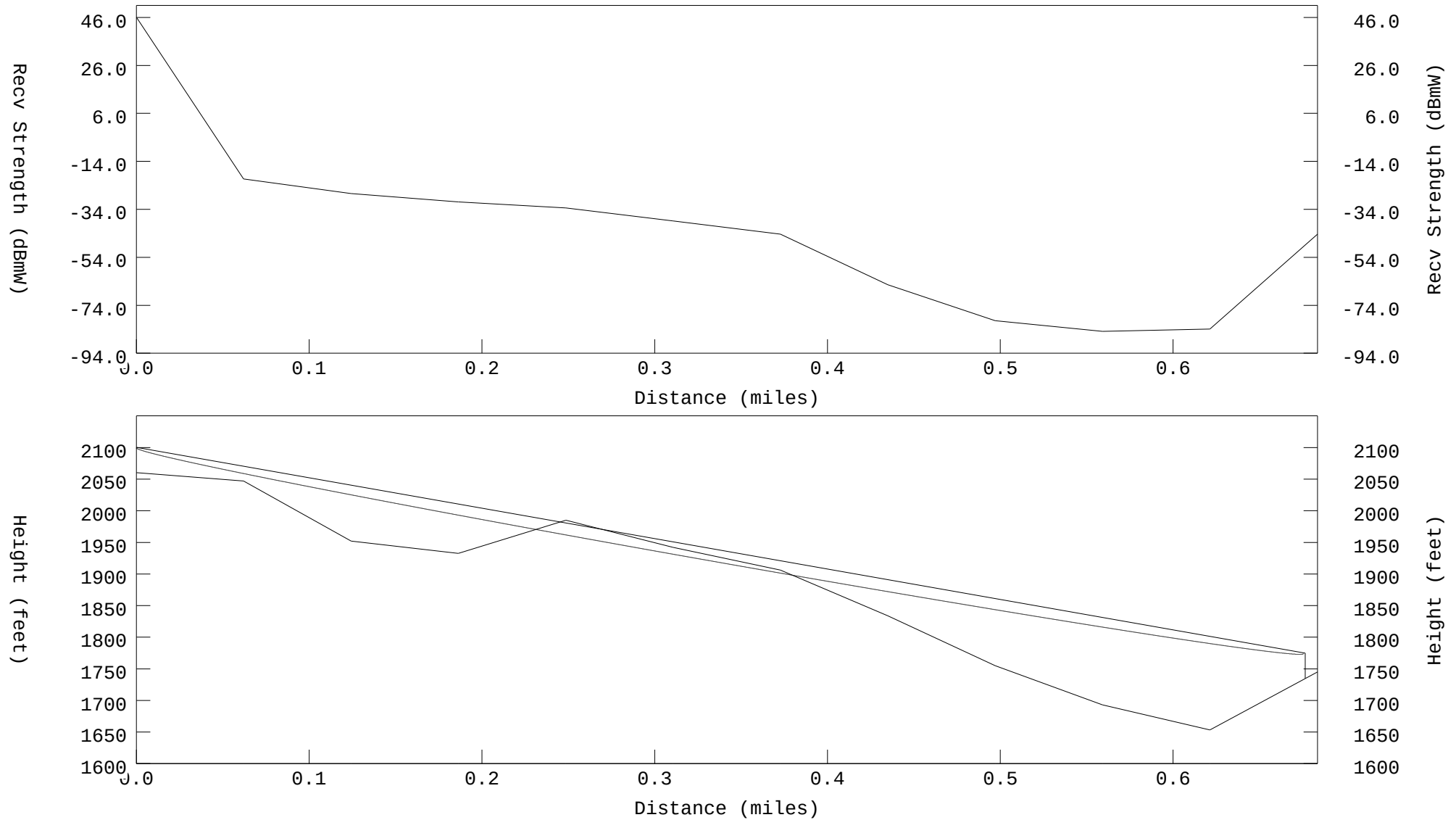
Study: Repeater Site 40' to Treatment 40'
TX Site: Repeater
RX Site: Treatment
TX --> RX: 0.52 mi, 284.5 degrees, 128.5 dB loss

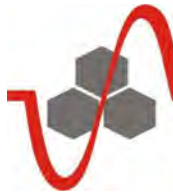
TX Latitude: N34-13-29.94
TX Longitude: W118-41-48.20
RX Latitude: N34-13-36.69
RX Longitude: W118-42-19.88



Study: Repeater Site 40' to WS-9 40'
TX Site: Repeater
RX Site: WS-9A
TX --> RX: 0.68 mi, 270.0 degrees, 90.5 dB loss

TX Latitude: N34-13-29.94
TX Longitude: W118-41-48.20
RX Latitude: N34-13-29.94
RX Longitude: W118-42-30.78





APPLIED TECHNOLOGY GROUP, INC.

SPECIALIZED COMMUNICATIONS SERVICES

4440 Easton Drive
Bakersfield, CA 93309
661-322-8650
661-322-4060 Fax
www.atg-inc.com
www.atginternet.com

Hargis & Associates

2365 Northside Dr. Ste# C-100
San Diego, Ca. 92108
Christopher M. Liles
cliles@hargis.com
619-521-0165; 619-540-9034c
619-521-8580.

Project Name:
Treatment Site Material List

Budgetary

Proprietary Information Do Not Duplicate or Redistribute

Prepared By: Chuck Hoyt 4/23/2007

Line	Qty	Make	Model	Description	Each	Line Total
1						
2						
3						
4						
5						
6	1	MDS	iNET-II 900	iNET-II 900 Remote IP / Ethernet Bridge	\$1,625.00	\$1,625.00
7						
8	1	MDS	iNET 900	DIN Rail Bracket Kit	\$15.94	\$15.94
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28	1	Maxrad		Antenna, Yagi 890-960MHz 9dBd N(F)	\$172.35	\$172.35
29						
30						
31						
32	1	ATG	LMR240	36" Coax Cable TNC(M)-N(M)	\$33.65	\$33.65
33						
34						
35	50	Andrew	LDF4-50	Coaxial Cable HELIAX .63 OD per foot	\$1.80	\$90.00
36	2	Andrew		Connector, LDF4-50 N(M)	\$20.53	\$41.06
37						
38	1	Polyphaser		Lightning Protector, Bulkhead N(F)-N(F)	\$65.00	\$65.00
39						
40						
41	1	Phoenix		Power Supply 24VDC 50W 2A DIN	\$132.00	\$132.00
42						
43						
44						

Proposal Valid for 30 days:

Prepared by: Chuck Hoyt

Total Parts \$2,175.00

Tax \$157.69

Labor

Travel

Shipping & Handling

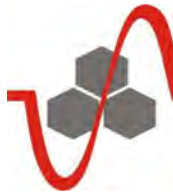
FOB Dest. Prepay & Add.

Grand Total

\$2,332.69

Fax copy to: 661-322-4060

Accepted By:	
PO#:	Date:



APPLIED TECHNOLOGY GROUP, INC.

SPECIALIZED COMMUNICATIONS SERVICES

4440 Easton Drive
Bakersfield, CA 93309
661-322-8650
661-322-4060 Fax
www.atg-inc.com
www.atginternet.com

Hargis & Associates

2365 Northside Dr. Ste# C-100
San Diego, Ca. 92108
Christopher M. Liles
cliles@hargis.com
619-521-0165; 619-540-9034c
619-521-8580.

Project Name:
Repeater Site Material List

Budgetary

Proprietary Information Do Not Duplicate or Redistribute

Prepared By: Chuck Hoyt 4/23/2007

Line	Qty	Make	Model	Description	Each	Line Total
1						
2						
3						
4						
5	1	MDS	iNET-II 900	iNET-II 900 Access Point / Dual Gateway	\$2,400.00	\$2,400.00
6						
7						
8	1	MDS	iNET 900	DIN Rail Bracket Kit	\$15.94	\$15.94
9						
10						
11	1	SUN		Solar Package	\$3,636.36	\$3,636.36
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24	1	Decibel		Antenna, Omni 890-960MHz 9dBd N(F)	\$893.00	\$893.00
26						
27						
28						
29						
30						
31						
32	1	ATG	LMR240	36" Coax Cable TNC(M)-N(M)	\$33.65	\$33.65
33						
34						
35	50	Andrew	LDF4-50	Coaxial Cable HELIAX .63 OD per foot	\$1.80	\$90.00
36	2	Andrew		Connector, LDF4-50 N(M)	\$20.53	\$41.06
37						
38	1	Polyphaser		Lightning Protector, Bulkhead N(F)-N(F)	\$65.00	\$65.00
39						
40						
41	1	Phoenix		Power Supply 24VDC 50W 2A DIN	\$132.00	\$132.00
42						
43						
44						

Proposal Valid for 30 days:

Prepared by: Chuck Hoyt

Total Parts \$7,307.01

Tax \$529.76

Labor

Travel

Shipping & Handling

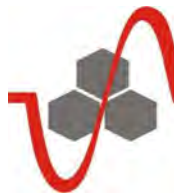
FOB Dest. Prepay & Add.

Grand Total

\$7,836.77

Fax copy to: 661-322-4060

Accepted By:	
PO#:	Date:



APPLIED TECHNOLOGY GROUP, INC.

SPECIALIZED COMMUNICATIONS SERVICES

4440 Easton Drive
Bakersfield, CA 93309
661-322-8650
661-322-4060 Fax
www.atg-inc.com
www.atginternet.com

Hargis & Associates

2365 Northside Dr. Ste# C-100
San Diego, Ca. 92108
Christopher M. Liles
cliles@hargis.com
619-521-0165; 619-540-9034c
619-521-8580.

Project Name:
WS-9 Site Material List

Budgetary

Proprietary Information Do Not Duplicate or Redistribute

Prepared By: Chuck Hoyt 4/23/2007

Line	Qty	Make	Model	Description	Each	Line Total
1						
2						
3						
4						
5						
6	1	MDS	iNET-II 900	iNET-II 900 Remote IP / Ethernet Bridge	\$1,625.00	\$1,625.00
7						
8	1	MDS	iNET 900	DIN Rail Bracket Kit	\$15.94	\$15.94
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28	1	Maxrad		Antenna, Yagi 890-960MHz 9dBd N(F)	\$172.35	\$172.35
29						
30						
31						
32	1	ATG	LMR240	36" Coax Cable TNC(M)-N(M)	\$33.65	\$33.65
33						
34						
35	50	Andrew	LDF4-50	Coaxial Cable HELIAX .63 OD per foot	\$1.80	\$90.00
36	2	Andrew		Connector, LDF4-50 N(M)	\$20.53	\$41.06
37						
38	1	Polyphaser		Lightning Protector, Bulkhead N(F)-N(F)	\$65.00	\$65.00
39						
40						
41	1	Phoenix		Power Supply 24VDC 50W 2A DIN	\$132.00	\$132.00
42						
43						
44						

Proposal Valid for 30 days:

Prepared by: Chuck Hoyt

Total Parts \$2,175.00

Tax \$157.69

Labor

Travel

Shipping & Handling

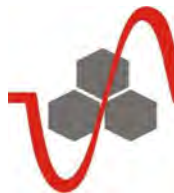
FOB Dest. Prepay & Add.

Grand Total

\$2,332.69

Fax copy to: 661-322-4060

Accepted By:	
PO#:	Date:



APPLIED TECHNOLOGY GROUP, INC.

SPECIALIZED COMMUNICATIONS SERVICES

4440 Easton Drive
Bakersfield, CA 93309
661-322-8650
661-322-4060 Fax
www.atg-inc.com
www.atginternet.com

Hargis & Associates

2365 Northside Dr. Ste# C-100
San Diego, Ca. 92108
Christopher M. Liles
cliles@hargis.com
619-521-0165; 619-540-9034c
619-521-8580.

Project Name:
RD 2 Site Material List

Budgetary

Proprietary Information Do Not Duplicate or Redistribute

Prepared By: Chuck Hoyt 4/23/2007

Line	Qty	Make	Model	Description	Each	Line Total
1						
2						
3						
4						
5						
6	1	MDS	iNET-II 900	iNET-II 900 Remote IP / Ethernet Bridge	\$1,625.00	\$1,625.00
7						
8	1	MDS	iNET 900	DIN Rail Bracket Kit	\$15.94	\$15.94
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28	1	Maxrad		Antenna, Yagi 890-960MHz 9dBd N(F)	\$172.35	\$172.35
29						
30						
31						
32	1	ATG	LMR240	36" Coax Cable TNC(M)-N(M)	\$33.65	\$33.65
33						
34						
35	50	Andrew	LDF4-50	Coaxial Cable HELIAX .63 OD per foot	\$1.80	\$90.00
36	2	Andrew		Connector, LDF4-50 N(M)	\$20.53	\$41.06
37						
38	1	Polyphaser		Lightning Protector, Bulkhead N(F)-N(F)	\$65.00	\$65.00
39						
40						
41	1	Phoenix		Power Supply 24VDC 50W 2A DIN	\$132.00	\$132.00
42						
43						
44						

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EXHIBIT 3

QUOTATION SUMMARY SHEET
CONTROL SYSTEM
SECTION 16400

EXHIBIT 3

**QUOTATION SUMMARY SHEET
CONTROL SYSTEM
SECTION 16400**

<u>ITEM</u>	<u>TASK</u>	<u>COST</u> <u>(dollars)</u>
1	FABRICATE CONTROL SYSTEM - Area 1 GET Control Panel and Variable Frequency Drive Panels (One Panel) (Section 2.01 to 2.05, 2.11, 2.12) - WS-9A Control Panel and Variable Frequency Drive Panel Integration (One Panel) (Section 2.01 to 2.05, 2.11, 2.12) - RD-2 Control Panel and Motor Control Panel Integration (One Panel) (Section 2.01 to 2.05, 2.11, 2.12) - Area 1 GET HMI Interface (Sections 2.06 to 2.08) - Power Distribution and Transformer (Sections 2.13)	
2	Coordination and Testing - Coordination (Section 3.05) - Reporting (Section 3.06) - Testing (Section 3.07) - Training (Section 3.09)	
3	PREPARE OPERATING MANUALS	
4	SHIPMENT (F.O.B. JOBSITE)	
5	OPTIONAL ITEMS PROVIDE FIELD SERVICE \$_____ per day @ 1 day	
6	LUMP SUM BID (Total of Items 1 through 4)	 (taxes included)

EXHIBIT 4

TERMS AND CONDITIONS

GENERAL TERMS AND CONDITIONS

PROFESSIONAL RESPONSIBILITY. EnviroSolve Corporation (EnviroSolve) shall perform services consistent with skill and care ordinarily exercised by other professional consultants under similar circumstances at the time services are performed, subject to any limitations established by client as to degree of care, time or expense to be incurred or other limitations of this Agreement. No other representation, warranty, or guaranty, express or implied, is included in or intended by EnviroSolve's services, proposals, agreements or reports.

RELATIONSHIP OF PARTIES. Nothing shall be construed or interpreted as requiring EnviroSolve to assume the status of owner, operator, generator, person who arranges for disposal, transporter or storer, as those terms or any other similar terms are used in any federal, state or local statute, regulation, ordinance or order governing the treatment, handling, storage or disposal of any toxic or hazardous substance or waste.

BILLING AND PAYMENT. Invoices will be submitted monthly and shall be due and payable on receipt. Interest at the rate of one and one-half percent (1.5%), but not exceeding the maximum rate allowable by law, shall be payable on any amounts that are due but unpaid within thirty (30) days from receipt of invoice; payment to be applied first to accrued late payment charges and then to the principal unpaid amount. EnviroSolve may, at its option, withhold delivery of reports and any other data pending receipt of payment for services rendered.

LIMITATION OF LIABILITY. Client agrees to limit the liability of EnviroSolve, its officers, directors, shareholders, employees, agents and representatives ("EnviroSolve Parties") to Client for all claims or legal proceedings of any type arising out of or relating to the performance of services under this Agreement (including but not limited to EnviroSolve's breach of the Agreement, its professional negligence, errors and omissions and other act(s) to the amount of EnviroSolve's fee. Failure of Client to give written notice to EnviroSolve of any claim of negligent act, error or omission within one (1) year of performance shall constitute a waiver of such claim by Client. In no event shall EnviroSolve be liable for any indirect, special or consequential loss or damages.

INDEMNIFICATION. Subject to the limitation of liability above, EnviroSolve shall indemnify, defend and hold harmless Client from any claim, suit, liability, damage, injury, cost or expense, including attorneys fees (hereafter collectively called "Loss") arising out of EnviroSolve Parties' breach of this Agreement, or EnviroSolve Parties' willful misconduct or negligence in connection with the performance of the services under this Agreement.

Client agrees to indemnify, defend and hold harmless EnviroSolve Parties from any Loss arising out of (a) Client's breach of the Agreement, (b) Client's willful misconduct or negligence in connection with performance of the Agreement, or (c) any acts taken or alleged failure to act with respect to matters covered in the section titled REPORTING AND DISPOSAL. Client further agrees to indemnify EnviroSolve Parties to the fullest extent permitted by law against any Loss arising out of any actual or potential environmental contamination or pollution, including without limitation, any actual or threatened release of toxic or hazardous materials not arising out of EnviroSolve Parties' willful misconduct or gross negligence. Without limiting the generality of the foregoing, Client specifically agrees to indemnify, defend and hold EnviroSolve Parties harmless for any Loss under CERCLA, RCRA, or any other similar federal, state or local environmental regulation, order or ordinance, where such Loss arises out of or relates to any preexisting actual or potential contamination and/or EnviroSolve Parties' performance of services under this Agreement, but does not arise out of EnviroSolve Parties' willful misconduct or gross negligence. Client further agrees to indemnify, defend and hold harmless the EnviroSolve Parties from any loss in excess of the liability limit set forth in the section titled LIMITATION OF LIABILITY.

TIME OF PERFORMANCE. EnviroSolve makes no warranties regarding the time of completion of services and shall not be in default of performance under this Agreement where such performance is prevented, suspended or delayed by any cause beyond EnviroSolve's control. Neither party will hold the other responsible for damages for delays in performance caused by Acts of God or other events beyond the control of the other party and which could not have been reasonably foreseen or prevented. Such delays will extend completion dates commensurably.

CHANGED CONDITIONS. If, during the course of the performance of Services, conditions or circumstances develop or are discovered which were not contemplated by EnviroSolve and which materially affect EnviroSolve's ability to perform or which would materially increase the costs to EnviroSolve of performing, then EnviroSolve will notify Client in writing, and EnviroSolve and Client shall renegotiate in good faith the terms of this Agreement within thirty (30) days. Alternatively, either party shall thereupon have the right to terminate the Agreement;

provided, however, that upon any such termination, EnviroSolve shall be compensated for services rendered to the date of termination.

HAZARDOUS OR UNSAFE CONDITIONS. Client has fully informed EnviroSolve of, and shall immediately inform EnviroSolve when it becomes aware of any new information regarding the type, quantity and location of any hazardous, toxic or dangerous materials or unsafe or unhealthy conditions known or suspected at all real property where services are to be performed ("the Project Site"). Fees shall be adjusted to compensate EnviroSolve if conditions require EnviroSolve to take emergency measures to protect the health and safety of the parties, the public or the environment.

SUBSURFACE OBSTRUCTIONS. Client shall supply to EnviroSolve plans which designate the location of all subsurface structures at the Project Site, and shall be responsible for any damage and shall indemnify EnviroSolve for all Loss inadvertently caused by EnviroSolve to any structure not so designated, or by Client's inaccurate identification of underground obstructions. Client warrants the accuracy of any information so supplied and understands and agrees that EnviroSolve is entitled to and may rely on the accuracy of any and all information so supplied without independently verifying its accuracy.

RIGHT OF ENTRY. Client agrees to grant or arrange for right of entry at the Project Site, whether or not owned by Client. The cost of repairing any reasonably unavoidable damages is not part of the services or fee contemplated by this Agreement and shall be borne by Client.

REPORTING AND DISPOSAL. Client shall be solely responsible for notifying all appropriate federal, state, local or other governmental agencies of the existence of any hazardous, toxic or dangerous materials on or in the Project Site or discovered during performance of this Agreement. EnviroSolve may, in its sole discretion, agree to paying the costs to lawfully transport, store, treat, recycle, dispose of, or otherwise handle, hazardous or toxic substances or wastes and samples.

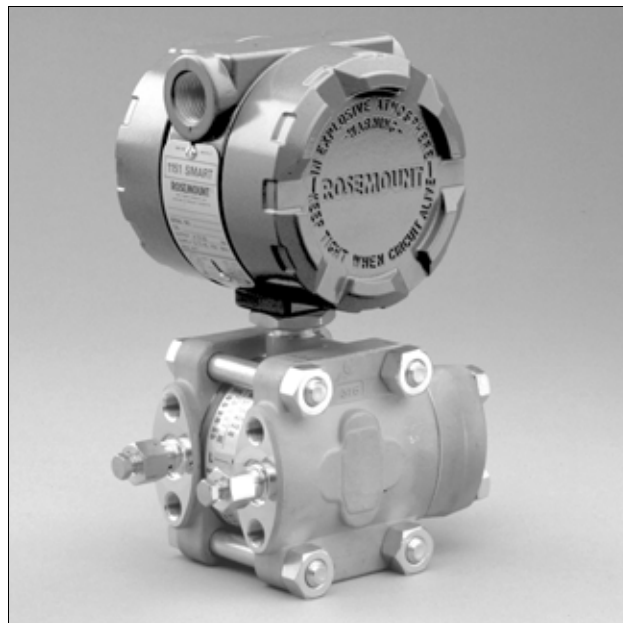
NO THIRD PARTY BENEFICIARIES. There are no third party beneficiaries of this Agreement entitled to rely on any work performed or reports prepared by EnviroSolve hereunder for any purpose. Client shall indemnify and hold EnviroSolve harmless against any liability for any Loss arising out of or relating to reliance by any third party on any work performed or reports issued hereunder.

DESIGNS AND DISCOVERIES; OWNERSHIP AND REUSE. All designs, ideas, discoveries, inventions or improvements utilized or developed by EnviroSolve, including, but not limited to, software, computer programs or databases, hereunder shall be deemed property of EnviroSolve. Client is given no right in the form of ownership or license to such items. Any documents furnished by EnviroSolve are not intended or represented as suitable for reuse by Client or others; any reuse without specific written approval and/or adaptation by EnviroSolve for the specific purpose intended will be at the reuser's sole risk and without liability or exposure to EnviroSolve. Any transfer of electronic data hereunder is solely for Client's convenience "as is" without warranty as to contents, and is not project deliverable unless specifically agreed to the contrary. EnviroSolve disclaims all warranties, express or implied with regard to any electronic data provided hereunder, including any warranties of merchantability or fitness for a particular purpose.

ATTORNEYS FEES AND COSTS, OTHER. The prevailing party in any action to enforce or interpret provisions of this Agreement shall be entitled to recover all reasonable fees, costs and expenses, including staff time at current billing rates, court costs and other claim-related expenses. If EnviroSolve is requested to respond to any mandatory orders for the production of documents or witnesses on Client's behalf regarding work performed by EnviroSolve, Client agrees to pay all costs and expenses incurred by EnviroSolve not reimbursed by others in responding to such order, including attorneys fees, staff time at current billing rates and reproduction expenses. Any provisions of this Agreement held in violation of any law shall be deemed stricken and all remaining provisions will remain binding on the parties. The obligations of the parties to indemnify and the limitations on liability set forth in this Agreement shall survive the expiration of termination of this Agreement. This Agreement, consisting of all documents attached hereto, constitutes the entire agreement between the parties, and supersedes any and all prior written or oral agreements with respect to the subject matter hereof. No amendment hereto will be binding unless reduced to writing and signed by authorized representatives of each party. This Agreement shall be subject to the laws of the state from which services of EnviroSolve are procured.

Rosemount 1151 Pressure Transmitter

- *Proven field performance and reliability*
- *Commitment to continuous improvement*
 - $\pm 0.075\%$ reference accuracy
 - *Rangeability to 50:1*
 - *Two year stability of $\pm 0.1\%$*
- *Application flexibility*



Contents

Specifications	page 3
Product Certifications	page 8
Dimensional Drawings	page 10
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Leading a tradition of excellence

With over five million transmitters installed worldwide, the Rosemount 1151 continues to offer industry leading value. Changing customer needs and new technologies have driven product improvements, while advanced manufacturing and testing processes have guaranteed product quality. Even today, the Rosemount 1151 is world-reowned for proven field reliability and longevity.

Proven field performance and reliability

For over 30 years, the 1151 has provided the process control industry with unsurpassed service and reliability in even the harshest of environments. The lasting customer preference results from a combination of advanced technology, and a tradition of field proven performance.

Commitment to continuous improvement

Through ongoing focus on continuous improvement, $\pm 0.075\%$ reference accuracy has been accomplished as a result of manufacturing and engineering enhancements. In addition, Smart electronics offer rangeability to 50:1, reducing the number of transmitters to specify, procure, and carry in inventory. A modular design allows interchangeable mechanical and electrical components, providing backward and forward compatibility.

Application flexibility

The 1151 offers a variety of configurations for differential, gage, absolute and liquid- level measurements including integrated solutions for pressure, level, and flow. High pressure models allow static line pressures up to 4500 psi (310 bar). Multiple wetted materials, as well as alternative fill fluids ensure process compatibility. Smart, analog and low-power electronics are available to meet specific application requirements.

Rosemount Pressure Solutions

Rosemount 3051S Series of Instrumentation

Scalable pressure, flow and level measurement solutions improve installation and maintenance practices.

Rosemount 3095MV Mass Flow Transmitter

Accurately measures differential pressure, static pressure and process temperature to dynamically calculate fully compensated mass flow.

Rosemount 305 and 306 Integral Manifolds

Factory-assembled, calibrated and seal-tested manifolds reduce on-site installation costs.

Rosemount 1199 Diaphragm Seals

Provides reliable, remote measurements of process pressure and protects the transmitter from hot, corrosive, or viscous fluids.

Compact Orifice Flowmeter Series: Rosemount 3051SFC, 3095MFC, and 405

Compact Orifice Flowmeters can be installed between existing flanges, up to a Class 600 (PN100) rating. In tight fit applications, a conditioning orifice plate version is available, requiring only two diameters of straight run upstream.

Annubar® Flowmeter Series: Rosemount 3051SFA, 3095MFA, and 485

The state-of-the-art, fifth generation Rosemount 485 Annubar combined with the 3051S or 3095MV MultiVariable transmitter creates an accurate, repeatable and dependable insertion-type flowmeter.

Integral Orifice Flowmeter Series: Rosemount 3051SFP, 3095MFP, and 1195

These integral orifice flowmeters eliminate the inaccuracies that become more pronounced in small orifice line installations. The completely assembled, ready to install flowmeters reduce cost and simplify installation.

Orifice Plate Primary Element Systems: Rosemount 1495 and 1595 Orifice Plates, 1496 Flange Unions and 1497 Meter Sections

A comprehensive offering of orifice plates, flange unions and meter sections that is easy to specify and order. The 1595 Conditioning Orifice provides superior performance in tight fit applications.

Specifications

PERFORMANCE SPECIFICATIONS

(Zero-based calibrated ranges, reference conditions, silicone oil fill, 316 SST isolating diaphragms.)

Accuracy

Output Code S

Ranges 3 through 8, DP and GP transmitters;

Ranges 4 through 7, HP transmitters

±0.075% of calibrated span for spans from 1:1 to 10:1 of URL.

Between 10:1 and 50:1 of URL.

$$\text{accuracy} = \pm \left[0.02 \left(\frac{\text{URL}}{\text{span}} \right) - 0.1 \right] \% \text{ of calibrated span}$$

All other ranges and transmitters

±0.25% of calibrated span⁽¹⁾

Output Code S, square root mode

$$\pm \left[0.2 + 0.05 \times \left(\frac{\text{URL}}{\text{span}} \right) \right] \% \text{ of calibrated flow span}$$

Output Codes E, G, L, and M

±0.2% of calibrated span for 1151DP Ranges 3 through 5. All other ranges and transmitters, ±0.25% of calibrated span.

High Accuracy Option, P8

±0.1% of calibrated span for 1151DP and GP ranges 3 through 8, HP, and LT.

Stability

Output Code S

±0.1% of URL for 2 years for DP and GP Ranges 3 through 8. (±0.25% for all other ranges and transmitters.)

Output Codes E and G

±0.2% of URL for six months for Ranges 3 through 5. (±0.25% for all other ranges.)

Output Codes L and M

±0.25% of URL for six months

Temperature Effect

Output Code S [–20 to 185 °F (–29 to 85 °C)]

For DP and GP transmitter Range 4 through 8;

HP transmitter Range 4 through 7:

Zero Error = ±0.2% URL per 100 °F (56 °C)

Total Error = ±(0.2% URL + 0.18% of calibrated span)

per 100 °F; For Range 3, double the stated effects. For other ranges and transmitters follow analog temperature specifications (Output Code E).

Output Code E, G, L, and M

[–20 to 200 °F (–29 to 93 °C)]

For Ranges 4 through 0

Zero Error = ±0.5% URL per 100 °F.

Total Error = ±(0.5% URL + 0.5% of calibrated span) per 100 °F; double the effect for Range 3.

Static Pressure Effect – DP Transmitters

DP Transmitters

Zero Error

±0.25% of URL for 2,000 psi (13790 kPa)

for Range 4 and 5 or ±0.5% for other ranges, correctable through rezeroing at line pressure.

Span Error

Correctable to ±0.25% of input reading per 1,000 psi (6895 kPa), or to ±0.5% for Range 3.

HP Transmitters

Zero Error

±2.0% of URL for 4,500 psi (31027 kPa), correctable through rezeroing at line pressure.

Span Error

Correctable to ±0.25% of input reading per 1,000 psi (6895 kPa).

Vibration Effect

0.05% of URL per g to 200 Hz in any axis

Power Supply Effect

Output Codes S, E, and G

Less than 0.005% of output span per volt

Output Codes L, M

Output shift of less than 0.05% of URL for a 1 V power supply shift

Load Effect

Output Codes S, E, and G

No load effect other than the change in power supplied to the transmitter.

Output Codes L, M

Less than 0.05% of URL effect for a change in load from 100kΩ to infinite ohms.

Short Circuit Condition (Low Power Only)

No damage to the transmitter will result when the output is shorted to common or to power supply positive (limit 12 V).

EMI/RFI Effect

Output shift of less than 0.1% of span when tested to SAMA PMC 33.1 from 20 to 1000 MHz and for field strengths up to 30 V/m.

(1) Accuracy for Range 9, GP transmitter at 40:1 is ±0.7% of calibrated span.

Mounting Position Effect

Zero shift of up to 1 inH₂O (0.25 kPa).

With liquid level diaphragm in vertical plane, zero shift of up to 1 inH₂O (0.25 kPa). With liquid level diaphragm in horizontal plane, zero shift of up to 5 inH₂O (1.25 kPa) plus extension length on extended units. All zero shifts can be calibrated out. No effect on span.

FUNCTIONAL SPECIFICATIONS

Service

Liquid, gas, and vapor applications

Ranges

See Table 2 for ranges. Minimum span equals the upper range limit (URL) divided by rangedown. Rangedown varies with the output code See Table 1.

Outputs

Code S, Smart

4–20 mA dc, user selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the HART® protocol.

Code E, Analog

4–20 mA dc, linear with process pressure

Code G, Analog

10–50 mA dc, linear with process pressure

Code L, Low Power

0.8 to 3.2 V dc, linear with process pressure

Code M, Low Power

1 to 5 V dc, linear with process pressure

Current Consumption Under Normal Operating Conditions (Low Power Only)

Output Code L

1.5 mA dc

Output Code M

2.0 mA dc

Zero Elevation and Suppression

Output Codes S, E, and G

Zero elevation and suppression must be such that the lower range value is greater than or equal to the (–URL) and the upper range value is less than or equal to the (+URL). The calibrated span must be greater than or equal to the minimum span and less than or equal to the maximum span.

Output Code L

Zero is adjustable ±10% of URL and span is adjustable from 90 to 100% of URL.

Output Code M

Zero is adjustable ±50% of URL and span is adjustable from 50 to 100% of URL.

Span and Zero

Output Code S

Span and zero may be accessed with local adjustments or remotely through a HART-compatible Interface.

Output Codes E, G, L, and M

Span and zero are continuously adjustable.

Power Supply

External power supply required. Transmitter operates according to the following requirements:

Output Codes S, E

12 to 45 V dc with no load

Output Code G

30 to 85 V dc with no load

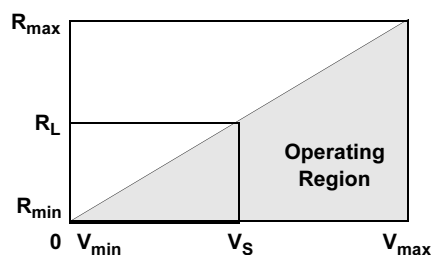
Output Code L

5 to 12 V dc

Output Code M

8 to 14 V dc

Where:



Code	V _{min}	V _{max}	R _{min}	R _{max}	R _L at Supply Voltage (V _S)
S ⁽¹⁾	12	45	0	1650	R _L = 43.5 (V _S – 12)
E ⁽²⁾	12	45	0	1650	R _L = 50 (V _S – 12)
G	30	85	0	1100	R _L = 20 (V _S – 30)
L	5	12	Low Power Minimum Load Impedance: 100 kΩ		
M	8	14			

(1) A minimum of 250 ohms is required for communication.

(2) For CSA approvals V_{max} = 42.4 V dc.

Temperature Limits

Electronics Operating

Code S: –40 to 185 °F (–40 to 85 °C)

Code E: –40 to 200 °F (–40 to 93 °C)

Code G, L, M: –20 to 200 °F (–29 to 93 °C)

Sensing Element Operating

Silicone fill: –40 to 220 °F (–40 to 104 °C)

Inert fill: 0 to 160 °F (–18 to 71 °C)

Storage

Code S: –60 to 185 °F (–51 to 85 °C)

Codes E, G, L, M: –60 to 250 °F (–51 to 121 °C)

TABLE 1. Rangeability

Output Code	Minimum Span	Maximum Span
S (DP and GP, SST, Range 3–8; HP SST, Range 4–7)	URL/50	2 × URL ⁽¹⁾
S (All Others)	URL/50 ⁽²⁾	2 × URL ⁽¹⁾
E, G	URL/6	URL
L	URL/1.1	URL
M	URL/2	URL

(1) Transmitter is capable of measuring from –URL to URL.

(2) Accuracy specification for calibrated spans from 1:1 to 6:1 of URL only.

TABLE 2. Transmitter Range Availability by Model (URL = Upper Range Limit)

Range Code	1151 Ranges (URL)	DP	HP	GP	DP/GP/Seals	AP	LT
3	30 inH ₂ O (7.46 kPa)	•	NA	•	NA	NA	NA
4	150 inH ₂ O (37.3 kPa)	•	•	•	•	•	•
5	750 inH ₂ O (186.4 kPa)	•	•	•	•	•	•
6	100 psi (689.5 kPa)	•	•	•	•	•	•
7	300 psi (2,068 kPa)	•	•	•	•	•	NA
8	1,000 psi (6,895 kPa)	•	NA	•	NA	•	NA
9	3,000 psi (20,684 kPa)	NA	NA	•	NA	NA	NA
0	6,000 psi (41,369 kPa)	NA	NA	•	NA	NA	NA

TABLE 3. Upper Range Limits (URL)

Range Code	bar	mbar	kg/cm ²	psi	kPa	inH ₂ O @20 °C	mmH ₂ O @20 °C	inHg @0 °C
3	0.075	75	0.076	1.082	7.461	30	762	2.203
4	0.373	373	0.380	5.409	37.305	150	3810	11.013
5	1.865	1865	1.901	27.045	186.505	750	19050	55.065
6	6.90	6895	7.031	100	690	2773	70434	204
7	21	20685	21	300	2069	8319	211302	611
8	69	68950	70	1000	6895	27730	704340	2036
9	207	206850	211	3000	20685	83190	2113020	6108
0	413.686	413686	421.842	6000	41369	166378	4225992	12216.12

TABLE 4. Output Code Availability

Code	1151 Output Options/Damping	DP	HP	GP	DP/GP/Seals	AP	LT
S	4–20 mA, Digital, Smart/Variable	•	•	•	•	•	•
E	4–20 mA, Linear, Analog/Variable	•	•	•	•	•	•
G	10–50 mA, Linear, Analog/Variable	•	•	•	•	•	•
L	0.8 to 3.2 V, Linear, Low Power/Fixed	•	•	•	•	•	NA
M	1 to 5 V, Linear, Low Power/Fixed	•	•	•	•	•	NA

TABLE 5. Fill Fluid Specifications

Fill Fluid	Temperature Limits ⁽¹⁾	Specific Gravity	Coeff. of Therm. Exp. cc/cc/°F (cc/cc/°C)	Viscosity at 25 °C centistokes
D.C.® 200 Silicone	–40 to 400 °F (–40 to 205 °C)	0.934	0.00060 (0.00108)	9.5
D.C. 704 Silicone	60 to 400 °F (15 to 204 °C)	1.07	0.00053 (0.00095)	44
Inert Fill	–50 to 350 °F (–45 to 177 °C)	1.85	0.0004 (0.000864)	6.5
Syltherm®XLT, Silicone	–100 to 300 °F (–73 to 149 °C)	0.85	0.000666 (0.001199)	1.6
Glycerin and Water ⁽²⁾	0 to 200 °F (–17 to 93 °C)	1.13	0.00019 (0.00034)	12.5
Propylene Glycol and Water ⁽³⁾	0 to 200 °F (–17 to 93 °C)	1.02	0.00019 (0.00034)	2.85
Neobee M-20 ⁽³⁾	0 to 400 °F (–17 to 205 °C)	0.900	0.00056 (0.001008)	9.8

(1) Temperature limits are reduced in vacuum service. Contact an Emerson Process Management representative for assistance.

(2) Glycerin and Water and Propylene Glycol and Water are not suitable for vacuum service.

(3) Not compatible with Buna-N or Ethylene-Propylene O-ring material.

Static Pressure and Overpressure Limits

1151DP

0 psia to 2,000 psig (0 to 13.79 MPa) on either side without damage to transmitter. Operates within specifications from static line pressures of 0.5 psia (3.45 kPa) to 2,000 psig (13.79 MPa).

1151HP

0 psia to 4,500 psig (0 to 31.02 MPa) on either side without damage to transmitter. Operates within specifications from 0.5 psia (3.45 kPa) to 4,500 psig (31.02 MPa).

1151AP

0 psia to 2,000 psia (0 to 13.79 MPa) without damage to transmitter. Operates within specifications from 0 psia to the upper range limit of the transmitter.

1151GP

0 psia to 2,000 psig (0 to 13.79 MPa) for ranges to 1,000 psig (6.90 MPa), 4,500 psig (31.02 MPa) for the 3,000 psig (20.68 MPa) range, and 7,500 psig (51.71 MPa) for the 6,000 psig (41.37 MPa) range, without damage to the transmitter. Operates within specifications from 0.5 psia (3.45 kPa) to the upper range limit of the transmitter.

1151LT

TABLE 6. Flange Pressure Rating

Standard	Class/Rating	Carbon Steel	Stainless Steel
ANSI	150	285 psig ⁽¹⁾	275 psig ⁽¹⁾
ANSI	300	740 psig ⁽¹⁾	720 psig ⁽¹⁾
ANSI	600	1,480 psig ⁽¹⁾	1,440 psig ⁽¹⁾
DIN	PN 10–40	40 bar ⁽²⁾	40 bar ⁽²⁾
DIN	PN 10/16	16 bar ⁽²⁾	16 bar ⁽²⁾
DIN	PN 25/40	40 bar ⁽²⁾	40 bar ⁽²⁾

(1) At 100 °F (38 °C); the rating decreases with increasing temperature.

(2) At 248 °F (120 °C); the rating decreases with increasing temperature.

Burst Pressure All Models

10,000 psig (68.95 MPa) proof pressure on the flanges.

Humidity Limits

0 to 100% relative humidity

Volumetric Displacement

Less than 0.01 in³ (0.16 cm³)

Failure Mode Alarm (Output Code S)

If self-diagnosis detects a gross transmitter failure, the analog signal will be driven below 3.9 mA or above 21 mA to alert the user. High or low alarm signal is user selectable.

Level	4–20 mA Saturation Value	4–20 mA Alarm Value
Low	3.9 mA	3.75 mA
High	20.8 mA	21.75 mA

Transmitter Security (Output Code S)

Activating the transmitter security function prevents changes to the transmitter configuration, including local zero and span adjustments. Security is activated by an internal switch.

Overpressure Alarm (Output Code S)

If the sensor detects a negative overpressure value, the analog signal will be driven to 3.9 mA. If the sensor detects a positive overpressure value, the analog signal is driven to 20.8 mA.

Damping

Numbers given are for silicone fill fluid at room temperature. The minimum time constant is 0.2 seconds (0.4 seconds for Range 3). Inert-filled sensor values would be slightly higher.

Output Code S

Time constant is adjustable in 0.1 second increments from minimum to 16.0 seconds.

Output Codes E and G

Time constant continuously adjustable between minimum and 1.67 seconds.

Output Codes L, M

Damping is fixed at minimum time constant.

1151LT

Time constant continuously adjustable between 0.4 and 2.2 seconds with silicone oil fill, or 1.1 and 2.7 seconds with inert fill for flush models and electronics codes E or G.

Turn-on Time

Maximum of 2.0 seconds with minimum damping. Low power output is within 0.2% of steady state value within 200 ms after application of power.

Physical Specifications, Standard Configuration

Electrical Connections

¹/₂–14 NPT conduit with screw terminals and integral test jacks compatible with miniature banana plugs (Pomona 2944, 3690, or equivalent). The HART Hand-Held Interface connections are fixed to the terminal block on smart transmitters.

Wetted Materials

Isolating Diaphragms

316L SST, Hastelloy® C-276®, or Tantalum. See ordering table for availability per model type.

Drain/Vent Valves

316 SST or Hastelloy C®, see ordering table for availability per model type.

Process Flanges and Adapters

Plated carbon steel, 316 SST or Hastelloy C, see ordering table for availability per model type.

Wetted O-rings

Viton® (other materials also available)

Weight

12 lb (5.4 kg) for AP, DP, GP, and HP transmitters, excluding options. Meter option: Add 2 lb (1 kg)

Non-wetted Materials

Fill Fluid

Silicone oil or inert fill

Bolts and Bolting Flange (GP and AP only)

Plated carbon steel

Electronics Housing

Low-copper aluminum. NEMA 4X

Cover O-rings

Buna-N

Paint

Polyurethane

Process Connections

¹/₄-18 NPT on 2.125-in. (54-mm) centers on flanges for Ranges 3, 4, and 5.

¹/₄-18 NPT on 2.188-in. (56-mm) centers on flanges for Ranges 6 and 7.

¹/₄-18 NPT on 2.250-in. (57-mm) centers on flanges for Range 8.

¹/₂-14 NPT on adapters.

For Ranges 3, 4, and 5, flange adapters can be rotated to give centers of 2.0 in. (51 mm), 2.125 in. (54 mm), or 2.250 in. (57 mm).

TABLE 7. Flange Weights with 1151LT Transmitter

Flange ⁽¹⁾	Flush	2-in (50mm) Ext.	4-in. (100mm) Ext.	6-in. (150mm) Ext.
2-in., Class 150	18 (8.2)	N/A	N/A	N/A
3-in., Class 150	23 (10.4)	25 (11.3)	26 (11.8)	27 (12.3)
4-in., Class 150	29 (13.2)	32 (14.5)	34 (15.4)	36 (16.3)
2-in., Class 300	20 (9.1)	N/A	N/A	N/A
3-in., Class 300	28 (12.7)	30 (13.6)	31 (14.1)	32 (14.5)
4-in., Class 300	38 (17.2)	41 (18.6)	43 (19.5)	45 (20.4)
2-in., Class 600	22 (10.0)	N/A	N/A	N/A
3-in., Class 600	31 (14.1)	33 (15.0)	34 (15.4)	35 (15.9)
DN 50, PN10-40	20 (9.1)	N/A	N/A	N/A
DN 80, PN 25/40	25 (11.3)	27 (12.3)	28 (12.7)	29 (13.2)
DN 100, PN 10/16	25 (11.3)	28 (12.7)	30 (13.6)	32 (14.5)
DN 100, PN 25/40	29 (13.2)	32 (14.5)	34 (15.4)	36 (16.3)

(1) Stainless steel flange weights are listed.

Product Certifications

Approved Manufacturing Locations

Rosemount Inc. — Chanhassen, Minnesota, USA
 Emerson Process Management GmbH & Co. — Wessling, Germany
 Emerson Process Management Asia Pacific Private Limited — Singapore
 Beijing Rosemount Far East Instrument Co., Limited — Beijing, China

European Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting our local sales office.

ATEX Directive (94/9/EC)

Emerson Process Management complies with the ATEX Directive.

European Pressure Equipment Directive (PED) (97/23/EC)

1151GP9, 0; 1151HP4, 5, 6, 7, 8 Pressure Transmitters
 — QS Certificate of Assessment - EC No. PED-H-20
 Module H Conformity Assessment

All other 1151 Pressure Transmitters
 — Sound Engineering Practice

Transmitter Attachments: Diaphragm Seal - Process Flange - Manifold
 — Sound Engineering Practice

Electro Magnetic Compatibility (EMC) (89/336/EEC)

All models
 — EN 50081-1: 1992; EN 50082-2:1995;

Hazardous Locations Certifications

North American Certifications

Ordinary Location Certification for Factory Mutual

As standard, the transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Factory Mutual (FM) Approvals

FM Explosion-Proof tag is standard. Appropriate tag will be substituted if optional certification is selected.

Explosion-Proof: Class I, Division 1, Groups B, C, and D.
 Dust-Ignition Proof: Class II, Division 1, Groups E, F, and G; Class III, Division 1. Indoor and outdoor use. NEMA 4X.
 Factory Sealed.

- 15 Intrinsically safe for Class I, II, and III Division 1, Groups A, B, C, D, E, F, and G hazardous locations in accordance with entity requirements and Control drawing 01151-0214 and 00268-0031. Non-incendive for Class I, Division 2, Groups A, B, C and D hazardous locations.
 For entity parameters see control drawing 01151-0214.

Canadian Standards Association (CSA) Approvals

- E6 Explosion-Proof for Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 Hazardous Locations. Suitable for Class I, Division 2, Groups A, B, C, and D; CSA enclosure type 4X. Factory Sealed.
- I6 Intrinsically safe for Class I, Division 1, Groups A, B, C, and D hazardous locations when connected per Drawing 01151-2575. For entity parameters see control drawing 01151-2575. Temperature Code T2D.

European Certifications

- I1 ATEX Intrinsically Safe and Combustible Dust (1151 Smart only)
 Certificate No.: BAS99ATEX1294X
 ATEX Marking  II 1 GD
 EEx ia IIC T5 (-60°C ≤ Ta ≤ 40°C)
 EEx ia IIC T4 (-60°C ≤ Ta ≤ 80°C)
CE 1180
 IP66

TABLE 8. IS Entity Parameters

Ui = 30 V

Ii = 125 mA

Pi = 1.0 W (T4) or 0.67 W (T5)

Ci = 0.034 μF

Li = 20 μH

Special Conditions for Safe Use (X)

The apparatus, is not capable of withstanding the 500V test as required by EN 50020: 1994. This must be taken into account when installing the apparatus.

Product Data Sheet

00813-0100-4360, Rev GA

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N1 ATEX Type n and Combustible Dust
(1151 Smart only)
Certificate No.: BAS 99ATEX3293X
ATEX marking:  II 3 GD
EEx nL IIC T5 ($-40^{\circ}\text{C} \leq T_a \leq 40^{\circ}\text{C}$)
EEx nL IIC T4 ($-40^{\circ}\text{C} \leq T_a \leq 80^{\circ}\text{C}$)
Dust Rating: T90 °C ($T_a = -20^{\circ}\text{C}$ to 40°C)
 $U_i = 45$ Vdc Max

IP66

Special Conditions for Safe Use (x)

The apparatus is not capable of withstanding the 500V insulation test required by EN 50021: 1999. This must be taken into account when installing the apparatus.

E8 ATEX Flame-Proof
Certification Number CESI03ATEX037
ATEX Marking  II 1/2 G
EEx d IIC T6 ($-40 \leq T_a \leq 40^{\circ}\text{C}$)
EEx d IIC T4 ($-40 \leq T_a \leq 80^{\circ}\text{C}$)
 1180
 $V = 60$ Vdc maximum

Australian Certifications

Standards Association of Australia (SAA) Certification

E7 SAA Flame-proof
Certificate Number Ex 494X
Ex d IIB + H₂ T6
DIP T6
IP65
Special Conditions for safe use (x):
For transmitters having NPT, PG or G cable entry threads, an appropriate flame-proof thread adaptor shall be used to facilitate application of certified flame-proof cable glands or conduit system.

I7 SAA Intrinsically Safe
Certificate Number: Ex 122X
Ex ia IIC T5 ($T_{amb} = 40^{\circ}\text{C}$)
Ex ia IIC T4 ($T_{amb} = 80^{\circ}\text{C}$)

Special Conditions for Safe Use (x):

The equipment has been assessed to the entity concept and accordingly the following electrical parameters must be taken into account during installation.

TABLE 9. Entity Parameters

$U_i = 30\text{V}$
$I_i = 125\text{ mA}$
$P_i = 1.0\text{ W (T4) or } 0.67\text{ W (T5)}$
$C_i = 14.8\text{ nF}$
$L_i = 20\text{ }\mu\text{H}$

N7 SAA Type n
Certificate Number: Ex 887X
Ex n IIC T6 ($T_{amb} = 40^{\circ}\text{C}$)
Ex n IIC T5 ($T_{amb} = 80^{\circ}\text{C}$)
IP66

Special Conditions for safe use (x):

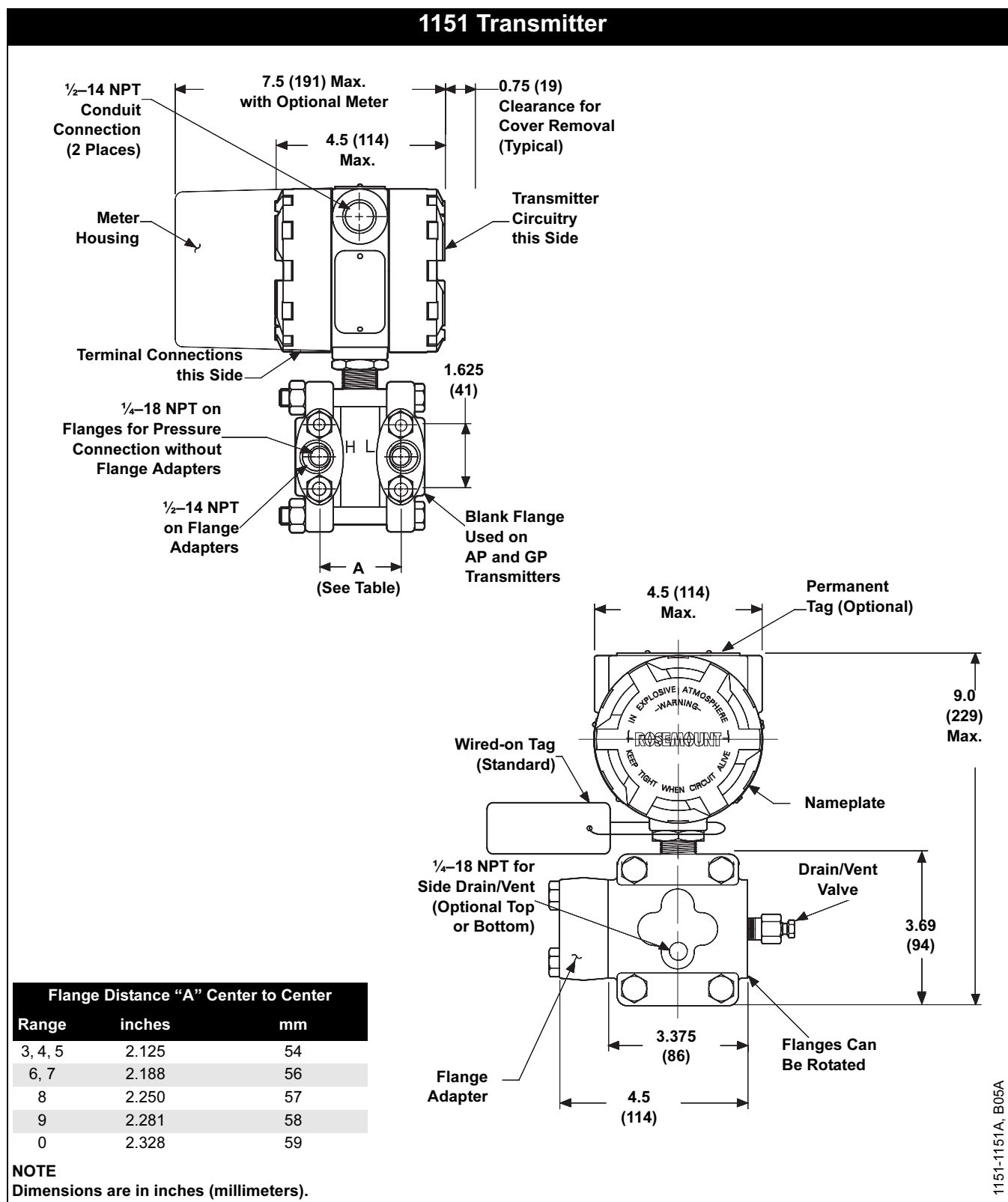
The equipment must be connected to a supply voltage which does not exceed the rated voltage. The enclosure end caps must be correctly fitted whilst the equipment is energized.

Combination Certifications

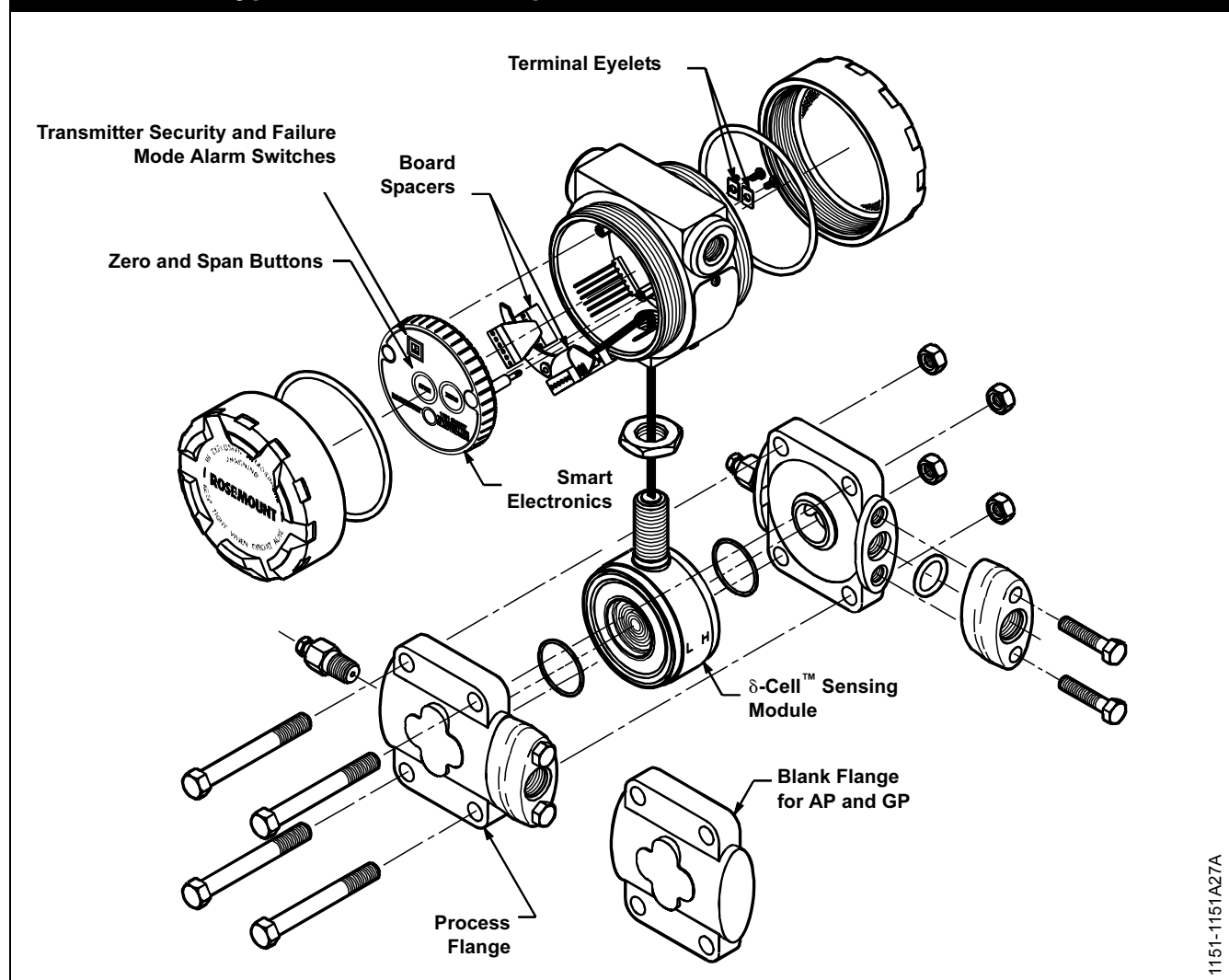
Stainless steel certification tag is provided when optional approval is specified. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

- C6 Combination of I6 and E6,
- K5 Combination of FM Approvals Explosion-Proof and I5.
- K6 Combination of E6, I6, I1, and E8

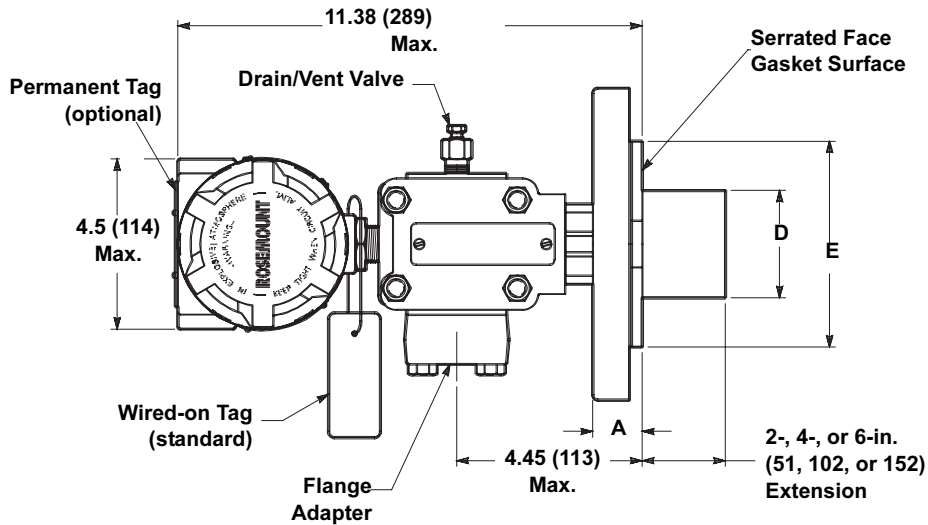
Dimensional Drawings



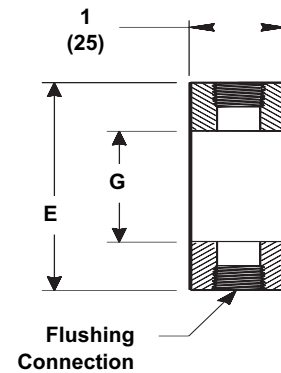
Typical Transmitter Exploded View with Smart Electronics



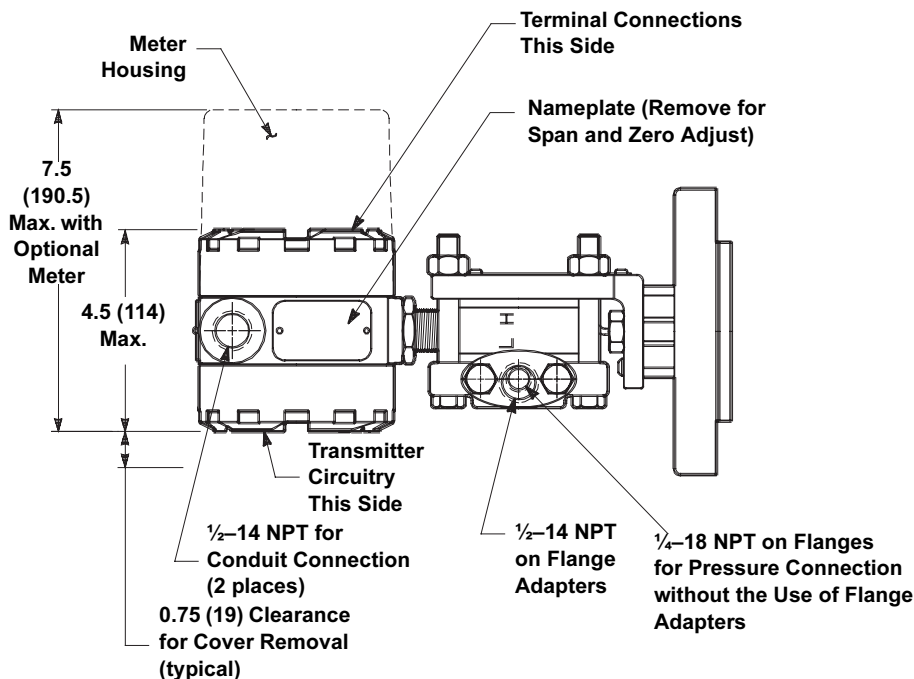
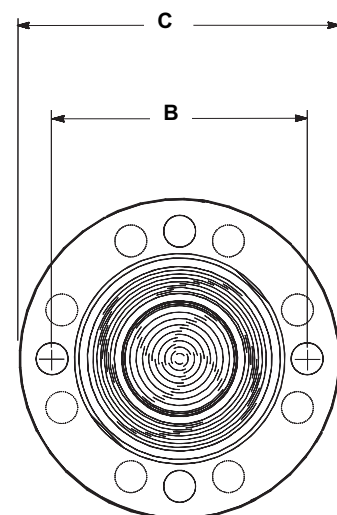
1151LT



OPTIONAL FLUSHING CONNECTION RING (LOWER HOUSING)



DIAPHRAGM ASSEMBLY AND MOUNTING FLANGE



NOTE
Dimensions are in inches (millimeters).

1151-51LTB05A 1151-1151B30B 1151-51LTA05A 3051-3051B27B

Product Data Sheet

00813-0100-4360, Rev GA

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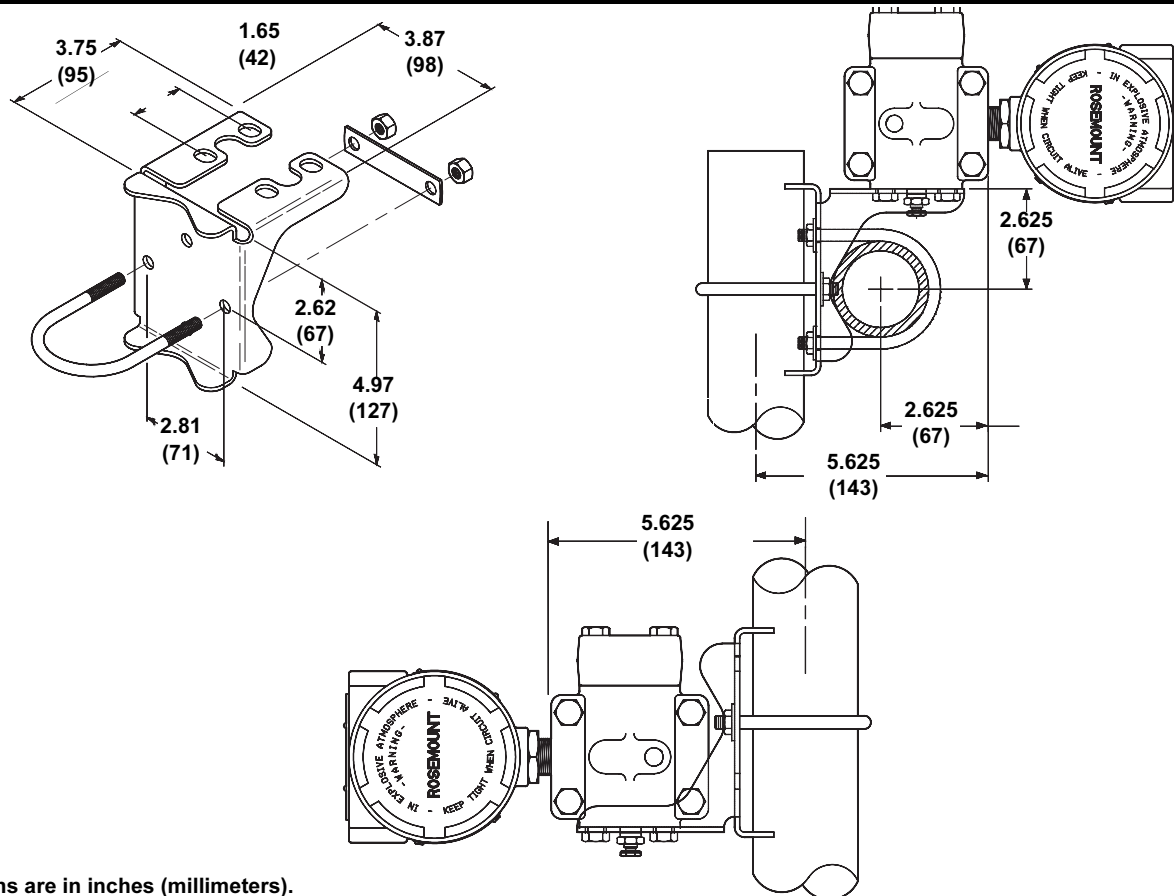
Rosemount 1151

TABLE 10. 1151LT Dimensional Specifications

Class	Pipe Size	Flange Thickness A	Bolt Circle Diameter B	Outside Diameter C	No. of Bolts	Bolt Hole Diameter	Exten. Diam. D ⁽¹⁾	O.D. Gask. Surf. E	Proc. Side G
ANSI 150	2 (51)	1.12 (28)	4.75 (121)	6.0 (152)	4	0.75 (19)	NA	3.6(92)	2.12 (54)
	3 (76)	1.31 (33)	6.0 (152)	7.5 (191)	4	0.75 (19)	2.58 (66)	5.0 (127)	3.5 (89)
	4 (102)	1.31 (33)	7.5 (191)	9.0 (229)	8	0.75 (19)	3.5 (89)	6.2 (158)	4.5 (114)
ANSI 300	2 (51)	1.25 (32)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6(92)	2.12 (54)
	3 (76)	1.50 (38)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)	3.5 (89)
	4 (102)	1.62 (41)	7.88 (200)	10.0 (254)	8	0.88 (22)	3.5 (89)	6.2 (158)	4.5 (114)
ANSI 600	2 (51)	1.12 (28)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6(92)	2.12 (54)
	3 (76)	1.37 (35)	6.62 (168)	6.62 (168)	8	0.88 (22)	2.58 (66)	5.0 (127)	3.5 (89)
DIN PN10-40	DN 50	26 mm	125 mm	165 mm	4	18 mm	NA	4.0 (102)	2.5 (63)
DIN PN 25/40	DN 80	30 mm	160 mm	200 mm	8	18 mm	65 mm	5.4 (138)	3.7 (94)
DIN PN 25/40	DN 100	30 mm	190 mm	235 mm	8	22 mm	89 mm	6.2 (158)	4.5 (114)
DIN PN 10/16	DN 100	26 mm	180 mm	220 mm	8	18 mm	89 mm	6.2 (158)	4.5 (114)

(1) Tolerances are 0.040 (1.02), -0.020 (0.51).

Mounting Bracket Option Codes B1, B4, and B7

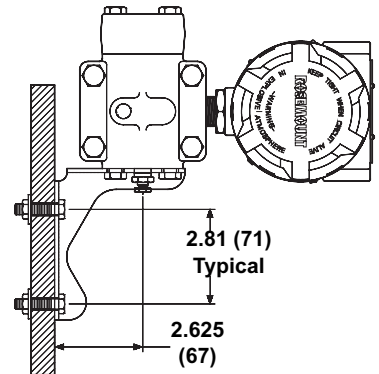
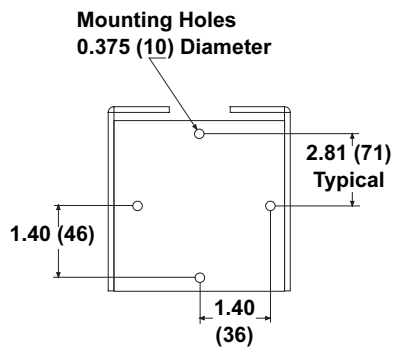
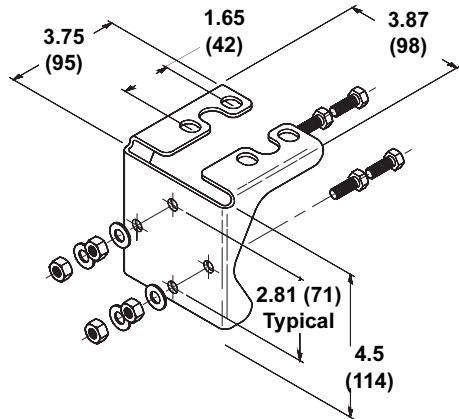


NOTE

Dimensions are in inches (millimeters).

3051-3051B19A 1151-1151D, A06A

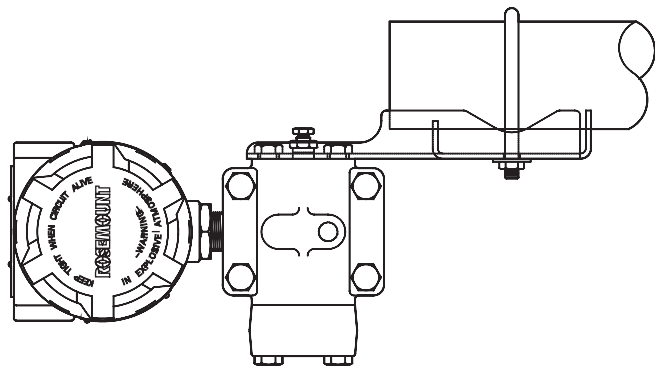
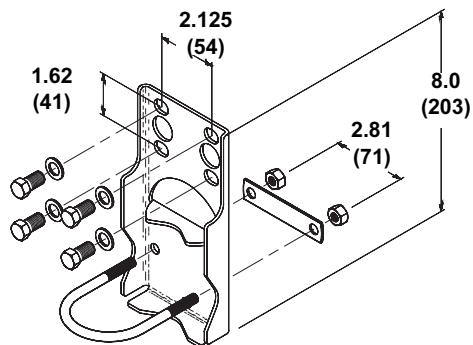
Panel Mounting Bracket Option Codes B2 and B5



NOTE
Dimensions are in inches

3051-3051A19A 1151-0244A 1151-1151E06A

Flat Mounting Bracket Option Codes B3, B6, and B9



NOTE
Dimensions are in inches (millimeters).

3051-3051H19B 1151-1151F06B

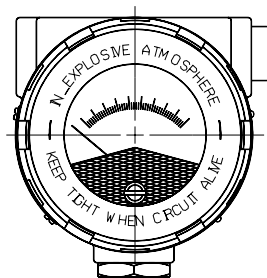
Product Data Sheet

00813-0100-4360, Rev GA

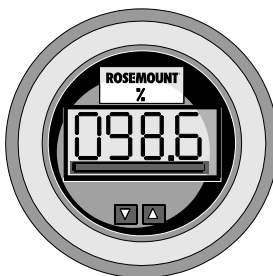
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Meter Options



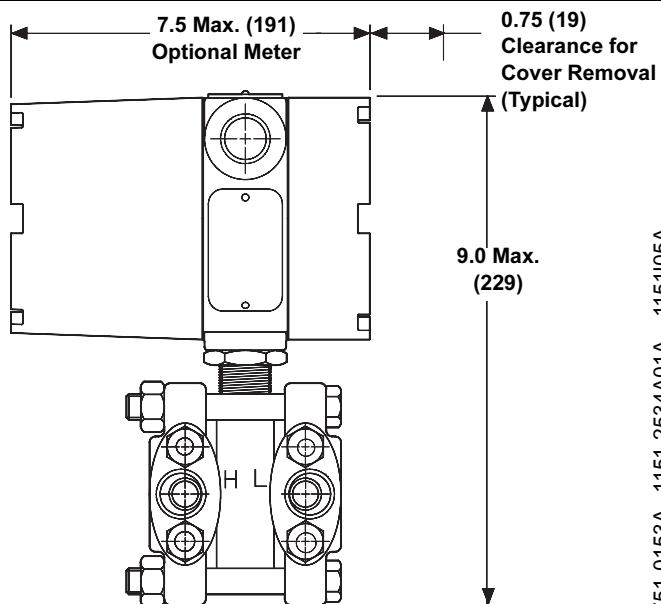
OPTION CODE M1
LINEAR SCALE



OPTION CODE M4
LINEAR SCALE

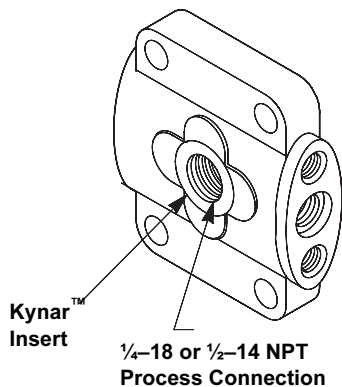
NOTE

Dimensions are in inches

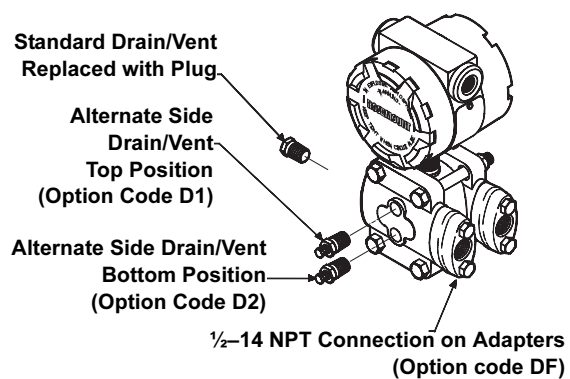


751-0153A, 1151-2534A01A, 115105A

Flange Insert



1151 Process Connections



Ordering Information

TABLE 11. 1151 Differential, High Line, Gage and Absolute Pressure Transmitters — = Not Applicable • = Applicable

Model	Transmitter Type (select one)	DP	HP	GP	AP			
1151DP	Differential Pressure Transmitter	•	—	—	—			
1151HP	Differential Pressure Transmitter for High Line Pressures	—	•	—	—			
1151GP	Gage Pressure Transmitter	—	—	•	—			
1151AP	Absolute Pressure Transmitter	—	—	—	•			
Code	Pressure Ranges (URL) (select one)	DP	HP	GP	AP			
3	30 inH ₂ O (7.46 kPa)	•	—	•	—			
4	150 inH ₂ O (37.3 kPa)	•	•	•	•			
5	750 inH ₂ O (186.4 kPa)	•	•	•	•			
6	100 psi (689.5 kPa)	•	•	•	•			
7	300 psi (2068 kPa)	•	•	•	•			
8	1,000 psi (6895 kPa)	•	—	•	•			
9	3,000 psi (20684 kPa)	—	—	•	—			
0	6,000 psi (41369 kPa)	—	—	•	—			
Code	Transmitter Output (select one)	DP	HP	GP	AP			
S	4–20 mA with Digital Signal based on HART Protocol	•	•	•	•			
E	4–20 mA, Linear with Input	•	•	•	•			
G	10–50 mA, Linear with Input	•	•	•	•			
L	Low Power 0.8 to 3.2 Vdc	•	•	•	•			
M ⁽¹⁾	Low Power 1 to 5 Vdc	•	•	•	•			
Code	Materials of Construction ⁽²⁾				DP	HP	GP ⁽³⁾	AP ⁽³⁾
	Flanges/Adapters	Drain/Vents	Diaphragms	Fill Fluid				
52	Nickel-plated Carbon Steel	316 SST	316L SST	Silicone	•	•	•	•
53	Nickel-plated Carbon Steel	316 SST	Hastelloy C-276	Silicone	•	•	•	•
55	Nickel-plated Carbon Steel	316 SST	Tantalum	Silicone	•	—	•	—
22	316 SST	316 SST	316L SST	Silicone	•	•	•	•
23	316 SST	316 SST	Hastelloy C-276	Silicone	•	•	•	•
25	316 SST	316 SST	Tantalum	Silicone	•	—	•	—
33 ⁽⁴⁾	Alloy C	Hastelloy C-276	Hastelloy C-276	Silicone	•	•	•	•
35	Alloy C	Hastelloy C-276	Tantalum	Silicone	•	—	•	—
73 ⁽⁴⁾	316 SST	Hastelloy C-276	Hastelloy C-276	Silicone	•	•	•	•
83 ⁽⁴⁾	Nickel-plated Carbon Steel	Hastelloy C-276	Hastelloy C-276	Silicone	•	•	•	•
5A	Nickel-plated Carbon Steel	316 SST	316L SST	Inert	•	—	•	—
5B	Nickel-plated Carbon Steel	316 SST	Hastelloy C-276	Inert	•	—	•	—
5D	Nickel-plated Carbon Steel	316 SST	Tantalum	Inert	•	—	•	—
2A	316 SST	316 SST	316L SST	Inert	•	—	•	—
2B	316 SST	316 SST	Hastelloy C-276	Inert	•	—	•	—
2D	316 SST	316 SST	Tantalum	Inert	•	—	•	—
3B ⁽⁴⁾	Alloy C	Hastelloy C-276	Hastelloy C-276	Inert	•	—	•	—
3D	Alloy C	Hastelloy C-276	Tantalum	Inert	•	—	•	—
7B ⁽⁴⁾	316 SST	Hastelloy C-276	Hastelloy C-276	Inert	•	—	•	—
8B ⁽⁴⁾	Nickel-plated Carbon Steel	Hastelloy C-276	Hastelloy C-276	Inert	•	—	•	—

(1) Meter or SST housing not valid with this option.

(2) Bolts and conduit plugs are plated carbon steel.

(3) On GP and AP transmitters, the low-side flange is plated carbon steel.
For a stainless-steel low-side flange, order process connection Option Code D6.

(4) Materials of Construction comply with recommendations per NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.

TABLE 12. Options

— = Not Applicable • = Applicable

Code	Mounting Brackets	DP	HP	GP	AP
B1	Bracket, 2-in. Pipe Mount	•	•	•	•
B2	Bracket, Panel Mount	•	•	•	•
B3	Bracket, Flat, 2-in. Pipe Mount	•	•	•	•
B4	B1 Bracket w/Series 316 SST Bolts	•	•	•	•
B5	B2 Bracket w/Series 316 SST Bolts	•	•	•	•
B6	B3 Bracket w/Series 316 SST Bolts	•	•	•	•
B7	316 SST B1 Bracket with 316 SST Bolts	•	•	•	•
B9	316 SST B3 Bracket with 316 SST Bolts	•	•	•	•
Code	Meters ⁽¹⁾	DP	HP	GP	AP
M1	Analog Scale, Linear Meter, 0–100%	•	•	•	•
M2	Analog Scale, Square Root Meter, 0–100% Flow	•	•	—	—
M3	Analog Scale, Linear Meter, Special Scale	•	•	•	•
M4	LCD Meter, Linear Meter, 0–100%, User Selectable (not available with Output Code G)	•	•	•	•
M6	Analog Scale, Square Root Meter, 1–10√	•	•	—	—
M7	LCD Meter, Linear Meter, Special Configuration (not available with Output Code G)	•	•	•	•
M8	LCD Meter Square Root Meter, 0–100% Flow (not available with Output Code G)	•	•	—	—
M9	LCD Meter, Square Root Meter, 0–10√ (not available with Output Code G)	•	•	—	—
Code	Product Certifications (FM explosion-proof approval is standard)	DP	HP	GP	AP
E8	ATEX Flame-proof	•	•	•	•
I1 ⁽²⁾	ATEX Intrinsically Safe and Combustible Dust	•	•	•	•
N1 ⁽²⁾	ATEX Type n and Combustible Dust	•	•	•	•
I5 ⁽²⁾	FM Approvals Intrinsically Safe, non-incendive	•	•	•	•
K5 ⁽²⁾	FM Approvals Explosion-Proof, Intrinsically Safe, non-incendive	•	•	•	•
C6 ⁽²⁾	CSA Explosion-Proof, Intrinsically Safe (combination of E6 and I6)	•	•	•	•
I6 ⁽²⁾	CSA Intrinsically Safe	•	•	•	•
K6 ⁽²⁾	CSA and ATEX Explosion-Proof, Intrinsically Safe (combination of E6, I6, I1, and E8)	•	•	•	•
E6	CSA Explosion-Proof	•	•	•	•
E7	SAA Flame-Proof	•	•	•	•
I7 ⁽²⁾	SAA Intrinsically Safe	•	•	•	•
N7 ⁽²⁾	SAA Type n	•	•	•	•
C5 ⁽³⁾	Measurement Canada Accuracy Approval	•	•	•	•
CN ⁽⁴⁾⁽⁵⁾	Analog Output Levels Compliant with NAMUR Recommendation NE43: 27-June-1996 and Low Alarm Level	•	•	•	•
C4 ⁽⁴⁾⁽⁵⁾	Analog Output Levels Compliant with NAMUR Recommendation NE43: 27-June-1996 and High Alarm Level	•	•	•	•
Q4	Calibration Certificate	•	•	•	•
Q16	Surface Finish Certification for Sanitary Remote Seals	•	•	•	•
Q8 ⁽⁶⁾	Material Traceability per EN 10204 3.1.B	•	•	•	•
Code	Housing	DP	HP	GP	AP
H1 ⁽⁷⁾	SST Non-Wetted Parts on Transmitter Without Meter	•	•	•	•
H2 ⁽⁷⁾	SST Non-Wetted Parts on Transmitter With Meter	•	•	•	•
H3	SST Housing Covers, Conduit Plug, Lock-nut, Without Meter	•	•	•	•
H4	SST Housing Covers, Conduit Plug, Lock-nut, With Meter	•	•	•	•
C2	M20 Conduit Threads (Available in Germany Only)	•	•	•	•
J1	G½ Conduit Threads	•	•	•	•
Code	Terminal Blocks	DP	HP	GP	AP
R1	Integral Transient Protection (Only available with Option Code S and E electronics)	•	•	•	•
Code	Bolts for Flanges and Adapters	DP	HP	GP	AP
L3	ASTM A193-B7 Flange and Adapter Bolts	•	•	•	•
L4	316 SST Flange and Adapter Bolts	•	•	•	•
L5	ASTM A193-B7M Flange and Adapter Bolts	•	•	•	•

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TABLE 12. Options

— = Not Applicable • = Applicable

Code	Process Connections (optional ⁽⁸⁾)				
D1	Side Drain/Vent, Top	•	•	•	•
D2	Side Drain/Vent, Bottom	•	•	•	•
DF	½–14 NPT Flange adapter(s)- Material determined by flange material	•	•	•	•
D4 ⁽⁹⁾	Conformance to DIN EN61518 (former DIN 19213) Ranges 3, 4, 5; with ¼ NPT process connection thread (Available in Germany only)	•	•	—	—
D5 ⁽⁹⁾	Conformance to DIN EN61518 (former DIN 19213) Ranges 6, 7, 8; no ¼ NPT process connection thread (Available in Germany only)	•	•	—	—
D6	316 SST Low Side Blank Flange	—	—	•	•
D9	JIS Process Connection—RC ¼ Flange with RC ½ Flange Adapter	•	•	•	•
G1	DIN Spacing (Single Entry Port, No Side V/D Hole Flange)	•	•	•	•
G2	DIN Spacing (Single Entry Port, Two Side V/D Hole Flange)	•	•	•	•
G3	DIN Spacing (Dual Entry Port, No Side V/D Hole Flange)	•	•	•	•
G4	DIN Spacing (Dual Entry Port, One Top Side V/D Hole Flange)	•	•	•	•
G5	DIN Spacing (Dual Entry Port, One Bottom Side V/D Hole Flange)	•	•	•	•
G6	DIN Spacing (Dual Entry Port, Two Side V/D Hole Flange)	•	—	•	•
K1 ⁽¹⁰⁾	Kynar insert, ¼–18 NPT	•	—	•	—
K2 ⁽¹⁰⁾	Kynar insert, ½–14 NPT	•	—	•	—
S1 ⁽¹¹⁾	Attachment of One Remote Seal	•	—	•	—
S2 ⁽¹¹⁾	Attachment of Two Remote Seals	•	•	•	—
S4 ⁽¹²⁾	Attachment of Integral Orifice Assembly	•	—	•	—
Code	Wetted O-ring Material	DP	HP	GP	AP
W2	Buna-N	•	•	•	•
W3	Ethylene-Propylene	•	•	•	•
W4	Aflas	•	•	•	•
W6 ⁽¹³⁾	Spring-loaded Teflon® (PTFE)	•	—	•	•
W7 ⁽¹⁴⁾	Teflon (PTFE)	•	—	•	•
Code	Procedures	DP	HP	GP	AP
C9 ⁽¹⁵⁾	Software Configuration	•	•	•	•
P1 ⁽¹⁶⁾	Hydrostatic Testing, 150% Maximum Working Pressure	•	•	•	•
P2 ⁽¹⁷⁾	Cleaning for Special Service	•	•	•	•
P3	Cleaning for <1 PPM Chlorine/Fluorine	•	•	•	•
P8 ⁽¹⁸⁾	Calibrate to 0.1% Accuracy	•	•	•	—
Code	Outputs	DP	HP	GP	AP
V1 ⁽¹⁹⁾	Reverse Output	—	—	•	—
V2 ⁽¹⁾	4–20 mV Test Signal	•	•	•	•
V3 ⁽¹⁾	20–100 mV Test Signal	•	•	•	•
Typical Model Number: 1151DP 4 S 52 B3 M1					

(1) Not available with Output Codes L or M, or Option Codes V2 or V3.

(2) Not available with Output Codes E, G, L, or M.

(3) Limited availability depending on transmitter type and range. Contact an Emerson Process Management representative.

(4) Not available with Output Code G.

(5) NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.

(6) This option is available for the transmitter flange and adapters.

(7) Option includes SST housing, covers, conduit plug, locknut, L4 bolting, and D6 low side blank flange for GP and AP transmitters. Option codes L4 and D6 parts are included with housing option codes H1 and H2.

(8) Allowable combinations are: D1, D6; D2, D6; and D6, S1.

(9) Material Traceability certificate option Q8 available.

(10) The maximum working pressure on this option is 300 psig. Available only with materials of construction Option Codes 1x or 2x.

(11) This option may only be used on Ranges 4 - 8.

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- (12) This option has a maximum static pressure rating of 3,000 psi, and is available for factory assembly only without associated piping and is available only for Ranges 2, 3, 4, and 5.*
- (13) Contains a Hastelloy spring that is wetted by the process; consult factory for Teflon O-ring without a spring.*
- (14) Teflon O-ring has seal property limitations; Consult an Emerson Process Management representative for more information.*
- (15) Available with Output Code S only.*
- (16) Hydrostatic testing for Range 0, 125% maximum working pressure.*
- (17) Fluorolube® grease on wetted O-rings.*
- (18) Available only with stainless steel isolators and for span of 10 inH₂O and greater; not available with output code S ranges 3 through 8. not available on AP.*
- (19) Reverse output option is not needed with smart electronics; configured via HART-based communicator.*

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TABLE 13. Rosemount 1151 LT Flange-Mounted Liquid Level Transmitter

Model	Product Description		
1151LT	Alphaline Flange-Mounted Liquid Level Transmitter		
Code	Range		
4	150 inH ₂ O (3,813 mmH ₂ O)		
5	750 inH ₂ O (19,066 mmH ₂ O)		
6	2,770 inH ₂ O (70,416 mmH ₂ O)		
Code	Output		
S	4–20 mA with Digital Signal based on HART Protocol		
E	4–20 mA, Linear with Input		
G	10–50 mA, Linear with Input		
Code	Size	Material	Extension Length ⁽¹⁾
G0	2 in./DN 50	316L SST	Flush Mount Only
H0	2 in./DN 50	Hastelloy C-276	Flush Mount Only
J0	2 in./DN 50	Tantalum	Flush Mount Only
A0	3 in./DN 80	316L SST	Flush Mount
A2	3 in./DN 80	316L SST	2 in./50 mm
A4	3 in./DN 80	316L SST	4 in./100 mm
A6	3 in./DN 80	316L SST	6 in./150 mm
B0	4 in./DN 100	316L SST	Flush Mount
B2	4 in./DN 100	316L SST	2 in./50 mm
B4	4 in./DN 100	316L SST	4 in./100 mm
B6	4 in./DN 100	316L SST	6 in./150 mm
C0	3 in./DN 80	Hastelloy C-276	Flush Mount
C2	3 in./DN 80	Hastelloy C-276	2 in./50 mm
C4	3 in./DN 80	Hastelloy C-276	4 in./100 mm
C6	3 in./DN 80	Hastelloy C-276	6 in./150 mm
D0	4 in./DN 100	Hastelloy C-276	Flush Mount
D2	4 in./DN 100	Hastelloy C-276	2 in./50 mm
D4	4 in./DN 100	Hastelloy C-276	4 in./100 mm
D6	4 in./DN 100	Hastelloy C-276	6 in./150 mm
E0	3 in./DN 80	Tantalum	Flush Mount Only
F0	4 in./DN 100	Tantalum	Flush Mount Only
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(1) Extension diameters are sized to fit schedule 80 pipe. Consult factory for Schedule 40 pipe.

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Code	Mounting Flange				
	Size	Rating	Material		
M	2 in.	Class 150	ANSI	CS	
A	3 in.	Class 150	ANSI	CS	
B	4 in.	Class 150	ANSI	CS	
N	2 in.	Class 300	ANSI	CS	
C	3 in.	Class 300	ANSI	CS	
D	4 in.	Class 300	ANSI	CS	
P	2 in.	Class 600	ANSI	CS	
E	3 in.	Class 600	ANSI	CS	
X	2 in.	Class 150	ANSI	SST	
F	3 in.	Class 150	ANSI	SST	
G	4 in.	Class 150	ANSI	SST	
Y	2 in.	Class 300	ANSI	SST	
H	3 in.	Class 300	ANSI	SST	
J	4 in.	Class 300	ANSI	SST	
Z	2 in.	Class 600	ANSI	SST	
L	3 in.	Class 600	ANSI	SST	
Q	DN 50	PN 10-40	DIN	CS	
R	DN 80	PN 40	DIN	CS	
S	DN 100	PN 40	DIN	CS	
V	DN 100	PN 10/16	DIN	CS	
K	DN 50	PN 10-40	DIN	SST	
T	DN 80	PN 40	DIN	SST	
U	DN 100	PN 40	DIN	SST	
W	DN 100	PN 10/16	DIN	SST	
Code	Sensor Module and Low Pressure Side Materials of Construction				
	Low-Side Flange and Adapter		Drain/Vent Valves	Low-Side Isolator Diaphragm	Low-Side Fluid Fill
52	Nickel-plated CS		316 SST	316L SST	Silicone
55	Nickel-plated CS		316 SST	Tantalum	Silicone
22	316 SST		316 SST	316L SST	Silicone
23	316 SST		316 SST	Hastelloy C-276	Silicone
25	316 SST		316 SST	Tantalum	Silicone
33	Alloy C		Hastelloy C-276	Hastelloy C-276	Silicone
35	Alloy C		Hastelloy C-276	Tantalum	Silicone
5D	Nickel-plated CS		316 SST	Tantalum	Inert
2A	316 SST		316 SST	316L SST	Inert
2B	316 SST		316 SST	Hastelloy C-276	Inert
2D	316 SST		316 SST	Tantalum	Inert
3B	Alloy C		Hastelloy C-276	Hastelloy C-276	Inert
3D	Alloy C		Hastelloy C-276	Tantalum	Inert
Code	Process Fill—High Pressure Side		Temperature Limits		
A	Syltherm XLT		–100 to 300 °F (–73 to 135 °C)		
C	D. C. Silicone 704		60 to 400 °F (15 to 205 °C)		
D	D. C. Silicone 200		–40 to 400 °F (–40 to 205 °C)		
H	Inert		–50 to 350 °F (–45 to 177 °C)		
G	Glycerin and Water		0 to 200 °F (–17 to 93 °C)		
N	Neobee M-20		0 to 400 °F (–17 to 205 °C)		
P	Propylene Glycol and Water		0 to 200 °F (–17 to 93 °C)		
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Code	Options (see complete approvals descriptions)					
S1 ⁽¹⁾	Assembly of one Remote Seal					
Meters						
M1 ⁽²⁾	Linear Meter, 0–100% Scale					
M3 ⁽²⁾	Special Scale Meter, Specify Range					
M4 ⁽²⁾	LCD Meter, 0–100%					
M7 ⁽²⁾⁽³⁾	LCD Meter, Linear, Special Configuration					
Product Certifications (FM explosion-proof approval is standard)						
E8	ATEX Flame-proof					
I1 ⁽³⁾	ATEX Intrinsically Safe and Combustible Dust					
N1 ⁽³⁾	ATEX Type n and Combustible Dust					
I5 ⁽³⁾	FM Approvals Intrinsically Safe, non-incendive					
K5 ⁽³⁾	FM Approvals Explosion-Proof, Intrinsically Safe, non-incendive					
C6 ⁽³⁾	CSA Explosion-Proof, Intrinsically Safe (combination of E6 and I6)					
I6 ⁽³⁾	CSA Intrinsically Safe					
K6 ⁽³⁾	CSA and ATEX Explosion-Proof, Intrinsically Safe (combination of E6, I6, I1, and E8)					
E6	CSA Explosion-Proof					
E7	SAA Flame-Proof					
I7 ⁽³⁾	SAA Intrinsically Safe					
N7 ⁽³⁾	SAA Type n					
C5 ⁽⁴⁾	Measurement Canada Accuracy Approval					
Other Options						
W5	Copper O-ring for Vacuum Service (Nonwetted)					
Q4	Calibration Certificate					
Q8 ⁽⁵⁾	Material Traceability Certificate per EN 10204 3.1.B					
Q16	Surface Finish Certification for Sanitary Remote Seals (all options)					
V1	Reverse Output					
V2	4–20 mV Test Signal					
V3	20–100 mV Test Signal					
P8 ⁽⁶⁾	Calibrate to 0.1% Accuracy					
F_	Select One Code from Flushing Connections Lower Housing Option					
Code	Flushing Connection Ring Material (Lower Housing)	Flushing Connections	Size	Diaphragm Size		
				2-in.	3-in.	4-in.
F1	SST	1	1/4-18 NPT	•	•	•
F2	SST	2	1/4-18 NPT	•	•	•
F3 ⁽⁷⁾	Hastelloy C-276	1	1/4-18 NPT	•	•	•
F4 ⁽⁷⁾	Hastelloy C-276	2	1/4-18 NPT	•	•	•
F7	SST	1	1/2-18 NPT	•	•	•
F8	SST	2	1/2-18 NPT	•	•	•
F9	Hastelloy C-276	1	1/2-18 NPT	•	•	•
F0	Hastelloy C-276	2	1/2-18 NPT	•	•	•
Typical Model Number: 1151LT 4 S A0 A 52 D F1						

(1) For welded capillary assemblies, order sensor module and low-side materials of construction Option Code 22.

(2) Not available with Option Codes V2, or V3.

(3) Not available with Output Codes E and G.

(4) Limited availability depending on transmitter type and range. Contact an Emerson Process Management representative.

(5) Available for the diaphragm, upper housing, flange, adapter, extension, and lower housing.

(6) available only with stainless steel isolators and for span of 10 inH₂O and greater.

(7) Not available with high pressure side Option Codes A0, B0, and G0.

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Standard Accessories

All models are shipped with drain/vent valves, and one instruction manual per shipment.

Tagging

The Alphaline Pressure Transmitter will be tagged, at no charge, in accordance with customer requirements. All tags are stainless steel. The standard tag is wired to the transmitter.

Tag character height is 0.125 in. (0.318 cm). A permanently attached tag is available upon request.

Calibration

Transmitters are factory calibrated to the customer's specified range. If calibration is not specified, the transmitters are calibrated at maximum range. Calibration is performed at ambient temperature and pressure.

Optional Three-Valve Manifolds

Part No. 01151-0150-0001: 3-valve manifold, carbon steel

Part No. 01151-0150-0002: 3-valve manifold, 316 SST

Optional Diaphragm and Sanitary Seals

Refer to Product Data Sheet (document numbers 00813-0100-4016 or 00813-0201-4016)

Options

The following sections describe a variety of available options for the 1151 Transmitter. These options permit greater application flexibility.

Mounting Brackets

B1 Bracket for 2-in. Pipe Mounting

- Bracket for mounting transmitter on 2-in. pipe
- Constructed of carbon steel with carbon steel U-bolt
- Coated with polyurethane paint

B4 Bracket for 2-in. Pipe with 316 SST Bolts

- Same bracket as Option Code B1 with 316 SST bolts

B7 304 SST Bracket and 316 SST Bolts for 2-in. Pipe Mounting

- Same bracket as Option Code B1 with all SST materials

B2 Bracket for Panel Mounting

- Bracket for mounting transmitter on panel or wall
- Constructed of carbon steel with carbon steel bolts
- Coated with polyurethane paint

B5 Bracket for Panel with 316 SST Bolts

- Same bracket as Option Code B2 with 316 SST bolts

B3 Flat Bracket for 2-in. Pipe Mounting

- Bracket for vertical mounting of transmitter on 2-in. pipe
- Constructed of carbon steel with carbon steel U-bolt
- Coated with polyurethane paint

Process Connections

D1 Side Drain/Vent-Top

- Drain/vent valve mounted in side of flange.
- Top position used to vent gas buildup in liquid process applications with transmitter mounted vertically.

B6 Flat Bracket for 2-in. Pipe with 316 SST Bolts

- Same bracket as Option Code B3 with 316 SST bolts

B9 304 SST Flat Bracket and 316 SST Bolts for 2-in. Pipe Mounting

- Same bracket as Option Code B3 with all 316 SST materials

Bolts and Nuts for Flanges and Adapters

Options permit bolts and nuts for flanges and adapters in the specified material.

- L3 ANSI/ASTM A - 193-B7
- L4 Austenitic 316 SST
- L5 ANSI/ASTM A193-B7M

Meters

Analog

- Meters have 2-in. (50.8 mm) scale
- Plug-in mounting configuration
- Indication accuracy $\pm 2\%$
- Operating temperature limit: -40 to 150 °F (-40 to 65 °C)
- Meters are enclosed in a housing certified by Factory Mutual as Explosion-Proof for Class I, Division 1, Groups B, C, and D; Class II, Division 1, Groups E, F, and G and Class III, Division 1
- For optional CSA explosion-proof approval, see certification Option Code E6
- M1 Linear Analog Meter, 0–100% Scale
- M2 Square Root Analog Meter, 0–100% Flow Scale
- M3 Special Scaling Analog Meter (Specify Range)
- M6 Square Root Analog Meter, 0– $10\sqrt{\quad}$ Scale

LCD

- 4-digit display
- Indication accuracy $\pm 0.25\%$ of calibrated span ± 1 digit
- Display resolution at $\pm 0.5\%$ of calibrated span ± 1 digit
- Operating temperature limit: -4 to 158 °F (-20 to 70 °C)
- Plug-in mounting configuration
- Meters are enclosed in a housing certified by FM as Explosion-Proof for Class I, Division 1, Groups B, C, and D; Class II, Division 1, Groups E, F, and G and Class III, Division 1
- For Optional CSA explosion-proof approval, see certification Option Code E6
- M4 Linear LCD Meter, 0 to 100%
- M7 Special Scale LCD Meter (Specify Range, Mode, and Engineering Units)
- M8 Square Root LCD Meter, 0 to 100%
- M9 Square Root LCD Meter, 0– $10\sqrt{\quad}$ Scale

NOTES

Meter Options are not available with Output Codes L or M, or Option Codes V2 or V3. Meter Options M4, M7, M8, and M9 are not available with Output Code G.

- Plug of same material as requested flange inserted in end of flange opposite adapter.

D2 Side Drain/Vent-Bottom

- Drain/vent valve mounted in side of flange.
- Bottom position used to drain liquid buildup in gas process applications with transmitter mounted vertically.
- Plug of same material as requested flange inserted in end of flange opposite adapter.

D6 316 SST Low Side Flange (1151GP and 1151AP Only)

DF 1/2–14 NPT flange adapters

- Options provide 1/2–14 NPT process connection on flanges rather than 1/4–18 NPT

K1 1/4–18 NPT Kynar™ Process Flange Insert

K2 1/2–14 NPT Kynar Process Flange Insert

- Options provide Kynar plastic process flange insert that prevents process from coming in contact with the metal of the flange. One process insert for the 1151GP and LT; two inserts for the 1151DP.
- Process connections are from the side.
- Available with carbon steel and stainless steel process flanges only.
- Pressure Maximum: 200 psi at 200 °F with Kynar impulse piping; 300 psi at 200 °F with metal impulse piping.

S1 Assembled with One Remote Diaphragm Seal

S2 Assembled with Two Remote Diaphragm Seals

- Options provide for the assembly of one or two remote diaphragm seals.

S4 Assembled with 1195 Integral Orifice

- Designed for highly accurate, small-bore flow measurement of any clean gas, liquid, or vapor.
- Reduce the costs associated with traditional orifice plate installations.
- Several configurations are available factory assembled to Rosemount differential pressure transmitters.⁽¹⁾
- Wide orifice bore/flow range capability.
- Wide choice of process connections, including threaded, socket weld, and ANSI flanges.
- Static pressure maximum limit is 3,000 psig.
- Wetted materials are available that comply with NACE MR 01-75(90).
- Available only with Ranges 2, 3, 4, and 5.

Wetted O-rings

- Standard: Viton® (2)
- W2 Buna N
- W3 Ethylene-Propylene
- W4 Aflas®
- W5 Copper O-ring for Vacuum Service (Nonwetted - 1151LT only)
- W6 Spring-Loaded Teflon
- Contains a Hastelloy spring that is in contact with the process fluid. Consult factory if Hastelloy is unacceptable.
- W7 Teflon

Procedures

Standard Configuration

Unless otherwise specified, transmitter will be shipped as follows:

Engineering Units:	inH ₂ O
4 mA:	0
20 mA:	Upper Range Limit
Output:	Linear
Software Tag:	Blank

Customer may specify the above items at no charge. Software tag (8 characters) is left blank unless specified.

C9 Custom Configuration (Option Code C9)

If Option Code C9 is ordered, the customer may specify the following data in addition to the standard configuration parameters.

Descriptor:	16 characters
Message:	32 characters
Date:	Day, Month, Year
Damping:	Seconds
Burst Mode:	Select Output Choice
Flange Material:	Model Code Information
O-Ring Material:	Model Code Information
Isolator Material:	Model Code Information
Sensor Fluid:	Model Code Information
Drain/Vent:	Model Code Information
Integral Meter:	installed or None
Remote Seal:	Specified Information
Failure Mode:	High or Low
Transmitter Security:	Off or On

TABLE 14. Hydrostatic Test Pressure

Model	Test Pressure
1151DP	3,000 psi
1151HP	6,750 psi
1151AP	2,000 psi
1151GP	
Ranges 3–8	2,000 psi
Range 9	4,500 psi
Range 0	7,500 psi
1151LT	
Class 150 Flange	450 psi
Class 300 Flange	1,100 psi

(1) Applicable only to orifice assemblies without piping.

(2) For enhanced sealing performance below 0°F (-18 °C), consult factory.

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P1 Hydrostatic Testing

- Each transmitter is hydrostatic tested according to Table 14.
- Test medium is water.
- This option provided for transmitters with remote diaphragm seal on application only.
- Rosemount Procedure 1746 outlines the testing procedure.

P2 Cleaning for Special Service

- This option minimizes contaminants to the process system by cleaning wetted surfaces with a suitable detergent.
- Rosemount Procedure 97412 outlines the cleaning procedure.

P3 Cleaning for <1 PPM Chlorine/Fluorine

P8 Calibrate for Improved Accuracy

- 0.1% accuracy available on 1151DP (Ranges 3–8), GP (Ranges 3–8), HP, and LT transmitters with 316 SST diaphragms and Output Codes E, G, L, and M. Also available on 1151DP (Range 9–0) and 1151GP (Range 9–0) with Output Code S (Min. Span = URL/10).

Outputs

V1 Reverse Output

- This option permits reversing of pressure input so that electrical output will increase as pressure input decreases.
- This option applies only to 1151GP and 1151LT. When this option is selected, the process flange, adapter, drain/vent valve, appropriate O-rings, and bolting are installed on low side of transmitter. Not available for Ranges 9 and 0.
- Not available with 1151AP. Reverse output on 1151DP and 1151HP can be obtained by connecting high-pressure input to low side of transmitter and vice versa.
- This option should not be ordered with smart transmitters (Output Code S). The 1151 Smart transmitter can be configured for reverse output through a HART-Compatible Interface.

V2 1 Ω Test Resistor

- A 1 Ω precision resistor is mounted across the test terminals to provide 4–20 mV output or a 10–50 mV output if 10–50 mA output is used.
- This option cannot be used with any meter options or Option Codes I5 or I6.

V3 5 Ω Test Resistor

- A 5 Ω precision resistor is mounted across test terminals to provide 20–100 mV output or a 50–250 mV output if 10–50 mA output is used.
- This option cannot be used with any meter options or Option Codes I5 or I6.

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Emerson Process Management

Rosemount Inc.

8200 Market Boulevard
Chanhassen, MN 55317 USA
T (U.S.) 1 800 999 9307
T (International) (952) 906 8888
F (952) 949 7001

www.rosemount.com

Emerson Process Management

Heath Place
Bognor Regis
West Sussex PO22 9SH
England
T 44 (0) 1243 863121
F 44 (0) 1243 867554

Emerson Process Management Asia Pacific

Private Limited

1 Pandan Crescent
Singapore 128461
T (65) 6777 8211
F (65) 6777 0947
Enquiries@AP.EmersonProcess.com



Model 1151 AlphaLine[®] Pressure Transmitters



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Model 1151 Alphaline[®] Pressure Transmitters

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

Within the United States, Rosemount Inc. has two toll-free assistance numbers.

Customer Central: 1-800-999-9307 (7:00 a.m. to 7:00 p.m. CST)
Technical support, quoting, and order-related questions.

North American Response Center: 1-800-654-7768 (24 hours a day – Includes Canada)
Equipment service needs.

For equipment service or support needs outside the United States, contact your local Rosemount representative.

⚠ CAUTION

The products described in this document are NOT designed for nuclear-qualified applications.

Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact your local Rosemount Sales Representative.

SNF-0004

May be protected by one or more of the following U.S. Patent Nos. 3,195,028; 3,271,669; 3,318,153; 3,618,390; 3,646,538; 3,793,885; 3,800,413; 3,854,039; 3,859,594; 3,975,719; 4,339,750; 5,237,285; Re. 30,603. May Depend on Model. Other U.S. and Foreign Patents Issued and Pending.

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Rosemount Inc.

8200 Market Boulevard
Chanhassen, MN 55317 USA
Tel 1-800-999-9307
Telex 4310012
Fax (612) 949-7001
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Introduction

USING THIS MANUAL

This manual is designed to assist in installing, operating, and maintaining the Rosemount Model 1151 Analog Pressure Transmitter Family.

Section 2 Installation

provides mechanical and electrical installation instructions.

Section 3 Calibration

explains technique for calibration of the device.

Section 4 Options

explains the options available for the Model 1151, including mounting brackets, LCD meters, custom configuration, transient protection, and filter terminal blocks.

Section 5 Maintenance and Troubleshooting

describes trim procedures and offers troubleshooting instructions for dealing with potential mechanical or electrical difficulties.

Section 6 Specifications and Reference Data

lists functional, performance, and physical specifications data as well as ordering information for the transmitter.

Appendix A Approval Drawings

contains approval drawings for Canadian Standards Association (CSA) and Factory Mutual (FM) intrinsic safety drawings.

Glossary

provides brief definitions of the terms used in this manual and tells where to find more information.

Index

contains a comprehensive, standard index.

MODEL 1151 ALPHALINE® PRESSURE TRANSMITTERS

This manual describes the following Model 1151 Alphaline® Pressure Transmitters.

- **Model 1151DP**— Differential Pressure Transmitter measures differential pressure from 6 inH₂O to 1,000 psi (1.493 to 6895 kPa).
- **Model 1151HP**— Differential Pressure Transmitter for High Line Pressures measures high line pressures from 25 inH₂O to 300 psi (6.22 to 2668 kPa).
- **Model 1151GP**— Gage Pressure Transmitter measures gage pressure from 6 inH₂O to 6,000 psi (1.493 to 41369 kPa).
- **Model 1151AP**— Absolute Pressure Transmitter measures absolute pressure from 25 inH₂O to 1,000 psi (6.22 to 6895 kPa).

TRANSMITTER OVERVIEW

The Rosemount Model 1151 Alphaline® series of pressure transmitters has set an industry standard as the largest-selling transmitter in the world. It brings true precision to the measurement of flow, level, gage and absolute pressures, vacuum, and specific gravity.

With proven performance, quality, and reliability, the Model 1151 provides accurate measurement using the variable capacitance principle. It is virtually unaffected by changes in temperature, static pressure, vibration, and power supply voltage.

Installation, calibration, and commissioning are simplified by the transmitter's compact design, integral junction box, and local span and zero adjustments. Its modular design and high degree of interchangeability result in a minimal investment for spare parts.

Installation

This section covers areas to consider when installing the Model 1151 Analog Transmitter:

- General Considerations
- Mechanical Considerations
- Environmental Requirements
- Electrical Considerations
- Liquid Level Measurement

GENERAL CONSIDERATIONS

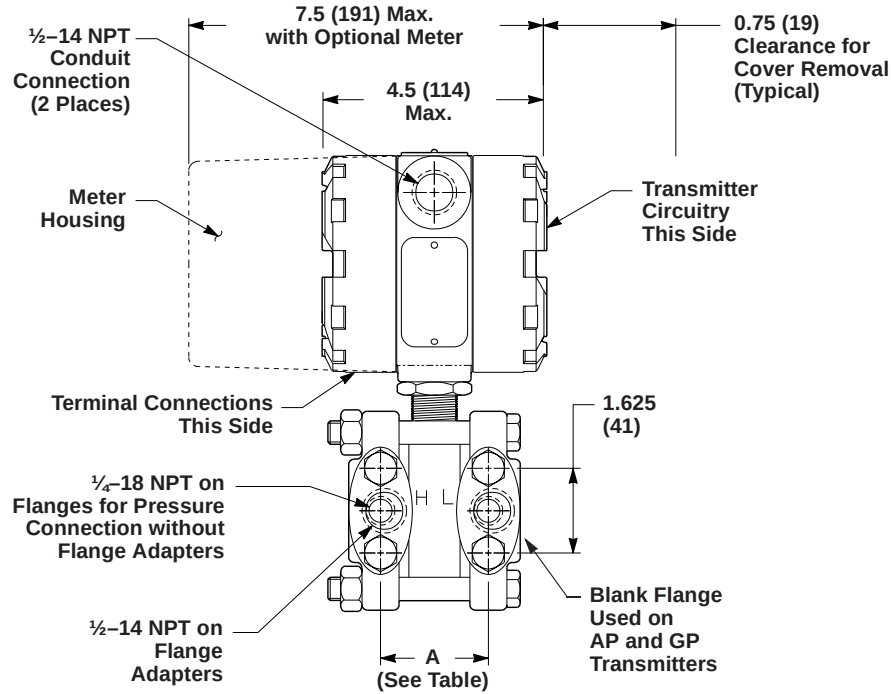
The accuracy of a flow, pressure, or level measurement depends on proper installation of the transmitter and impulse piping. The piping between the process and transmitter must accurately transmit process pressure to the transmitter. Mount the transmitter close to the process and use a minimum of piping to achieve best accuracy. Keep in mind, however, the need for easy access, safety of personnel, practical field calibration, and a suitable transmitter environment. In general, install the transmitter so as to minimize vibration, shock, and temperature fluctuations.

Installations in food, beverage, and pharmaceutical processes may require sanitary seals and fittings. Regulations may dictate special installation requirements needed to maintain sanitation and cleanability considerations. See Product Data Sheet 00813-0100-4016 for more information about sanitary pressure instruments from Rosemount Inc.

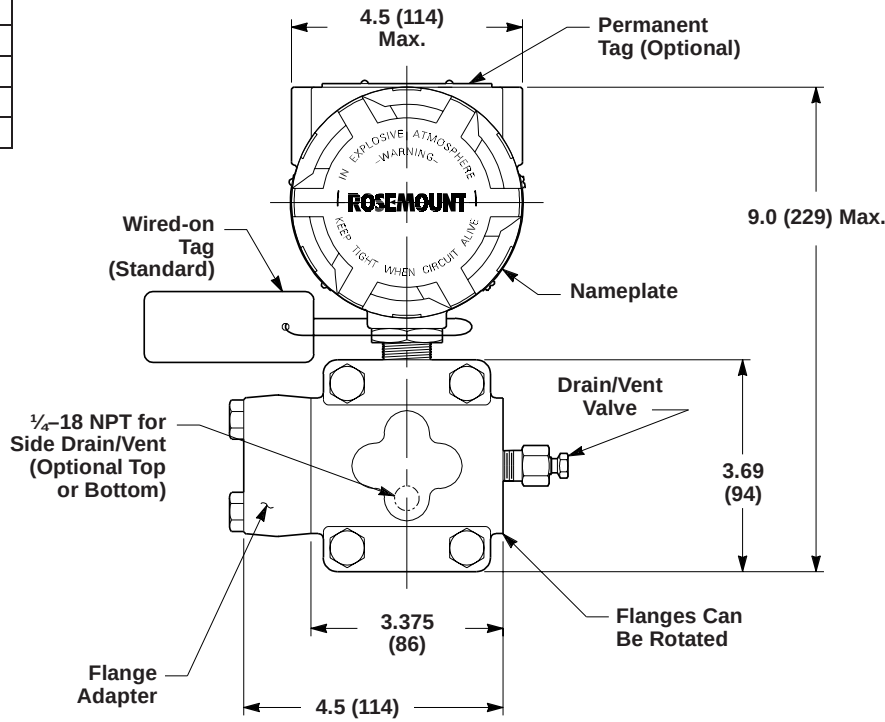
MECHANICAL CONSIDERATIONS

Rosemount Model 1151DP, GP, HP, and AP transmitters may be mounted in several ways. They may be panel-mounted, wall-mounted, or attached to a 2-inch pipe through an optional mounting bracket. Figure 2-1 shows the transmitter dimensions. The following paragraphs discuss factors necessary for a successful transmitter installation.

FIGURE 2-1. Dimensional Drawing for Model 1151 Transmitter.



Range	Flange Distance "A" Center to Center	
	inches	mm
3, 4, 5	2.125	54
6, 7	2.188	56
8	2.250	57
9	2.281	58
0	2.328	59



NOTE
Dimensions are in inches (millimeters).

1151-1151A, B05A

ENVIRONMENTAL REQUIREMENTS

Mount the transmitter to minimize ambient temperature changes. The transmitter electronics temperature operating limits are –40 to 200 °F (–40 to 85 °C) for “E” output options, –20 to 150 °F (–29 to 66 °C) for “J” output options, and –20 to 200 °F (–29 to 93 °C) for G, L, and M output options. **Section 5 Maintenance and Troubleshooting** lists the sensing element operating limits. Mount the transmitter to avoid vibration and mechanical shock, and to avoid external contact with corrosive materials.

Access Requirements

When choosing an installation location and position, take into account the need for access to the transmitter.

Process Flange Orientation

Orient the process flanges to enable process connections to be made. For safety reasons, orient the drain/vent valves so that process fluid is directed down and away from technicians when the valves are used. This can be accomplished by pointing the hole in the outside valve body downward and away. In addition, consider the need for a testing or calibration input.

CAUTION

Do not rotate the transmitter housing more than 90 degrees without disconnecting the header board. Exceeding 90 degrees rotation will damage the internal sensor module wiring. Refer to **Removing the Sensor from the Electrical Housing** on page 5-6 for further information.

Housing Rotation

The electronics housing may be rotated up to 90 degrees to improve field access to the two housing compartments. To rotate the housing less than 90 degrees, loosen the housing lock nut and turn the housing not more than 90 degrees from the orientation shown in Figure 2-1. To rotate the housing more than 90 degrees, follow the transmitter disassembly procedures in **Section 5 Maintenance and Troubleshooting**.

Terminal Side of Electronics Housing

Make wiring connections through the conduit openings on the top side of the housing. The terminal side of the housing is marked on the nameplate located on the side of the transmitter. Mount the transmitter so that the terminal side is accessible. A ¾-inch clearance is required for cover removal with no meter. A 3-inch clearance is required for cover removal if a meter is installed. If practical, provide approximately 6 inches clearance so that a meter may be installed later.

Circuit Side of Electronics Housing

The circuit compartment should not routinely need to be opened when the unit is in service; however, provide 6 inches clearance if possible to allow access for on-site maintenance. The circuit side of the housing is marked on the nameplate located on the side of the transmitter.

Exterior of Electronics Housing

The analog Model 1151 uses local span and zero screws, which are located under the nameplate on the side of the transmitter. Please allow 6 inches clearance if possible to allow access for on-site maintenance.

Mounting Effects

The analog Model 1151 weighs 12 lb (5.4 kg) for AP, DP, GP, and HP transmitters, excluding options. This weight must be securely supported; see Figure 2-2 on page 2-6 for mounting bracket information. The transmitter is calibrated in an upright position at the factory. If this orientation is changed during mounting, the zero point will shift by an amount equivalent to the liquid head caused by the mounting position. **Zero and Span Adjustment** on page 3-6 describes how to correct this shift.

WARNING

Process leaks can cause death or serious injury. Only use bolts supplied with the transmitter or sold by Rosemount Inc. as a spare part. Using unauthorized bolts may reduce pressure retaining capabilities and render the instrument dangerous.

CAUTION

Do not plug the low side with a solid plug. Plugging the low side will cause an output shift.

Process Connections

Model 1151AP, DP, GP, and HP process connections on the transmitter flanges are ¼–18 NPT. Flange adapter unions with ½–14 NPT connections are supplied as standard. These are Class 2 threads; use plant-approved lubricant or sealant when making the process connections. The flange adapters allow users to disconnect from the process by removing the flange adapter bolts. Figure 2-1 on page 2-2 shows the distance between pressure connections. This distance may be varied $\pm 1/8$ inch (3.2 mm) by rotating one or both of the flange adapters.

To ensure a tight seal on the flange adapters or three-valve manifold, first finger-tighten both bolts, then wrench-tighten the first bolt to approximately 29 ft-lbs (34 Nm). Wrench-tighten the second bolt to approximately 29 ft-lbs (34 Nm).

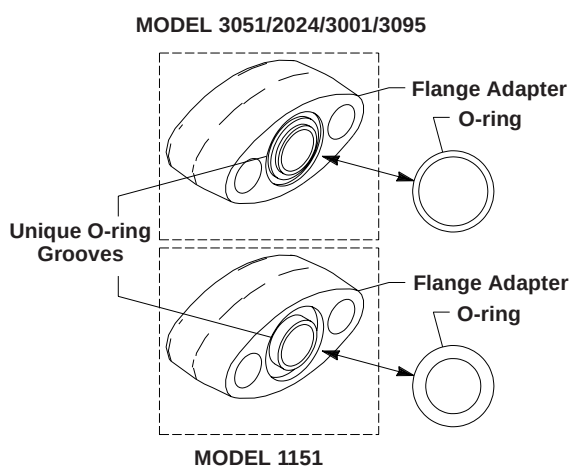
⚠ WARNING

Process leaks can cause death or serious injury. Install and tighten all four flange bolts before applying pressure, or process leakage may result. When properly installed, the flange bolts will protrude through the top of the module housing. Attempting to remove the flange bolts while the transmitter is in service may cause process fluid leaks.

⚠ WARNING

Failure to install flange adapter O-rings can cause process leaks, which can result in death or serious injury.

There are two styles of Rosemount flange adapters, each requiring a unique O-ring, as shown below. Each flange adapter is distinguished by its unique groove.



Use only the O-ring designed to seal with the corresponding flange adapter.

Refer to the Spare Parts List on page 6-13 for the part numbers of the flange adapters and O-rings designed for the Model 1151 Pressure Transmitter.

NOTE

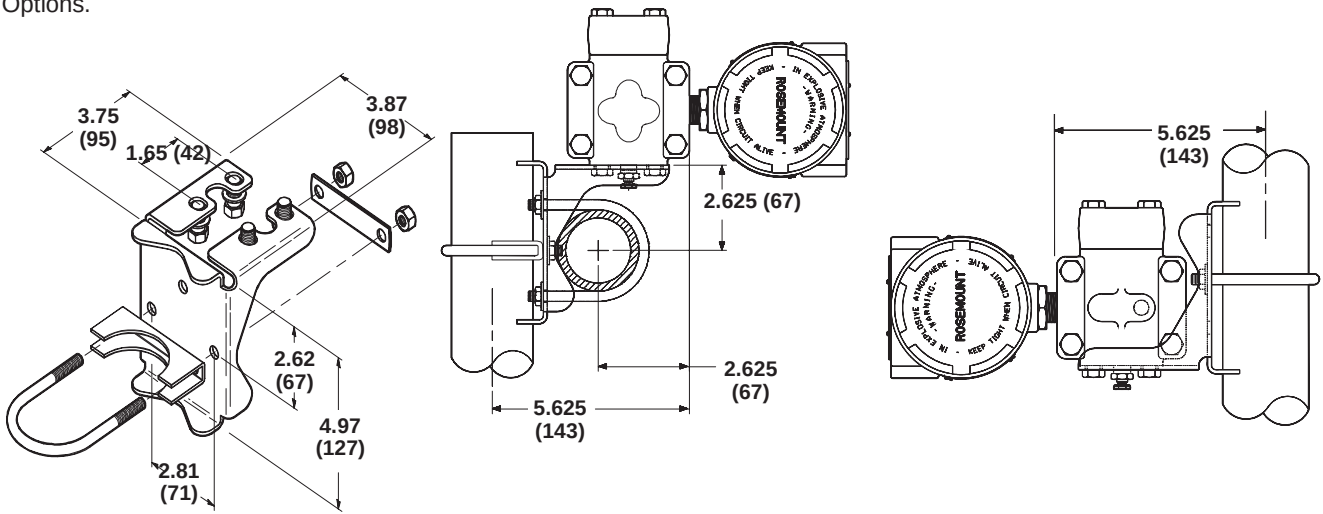
If Teflon O-rings are used, they should be replaced if the flange adapter is removed.

The low-side process flange has a ¼–18 NPT connection. A flange adapter union is supplied for ½–14 NPT process connections. The flange adapter allows the transmitter to be easily disconnected from the process by removing the flange adapter bolts. On open vessels the low-side process flange is open to atmosphere and should be mounted with the threaded hole pointed down. On closed vessels this connection is used for the dry or wet leg.

Mounting Brackets

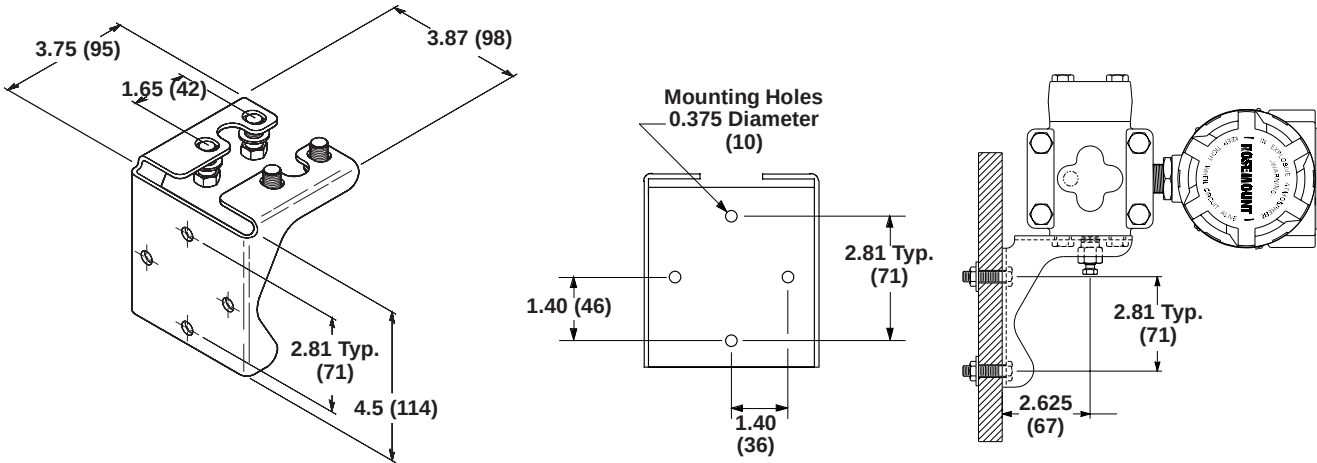
An optional mounting bracket permits mounting the transmitter to a wall, a panel, or a 2-inch horizontal or vertical pipe. Figure 2-2 illustrates some typical configurations using these mounting brackets.

FIGURE 2-2. Mounting Bracket Options.



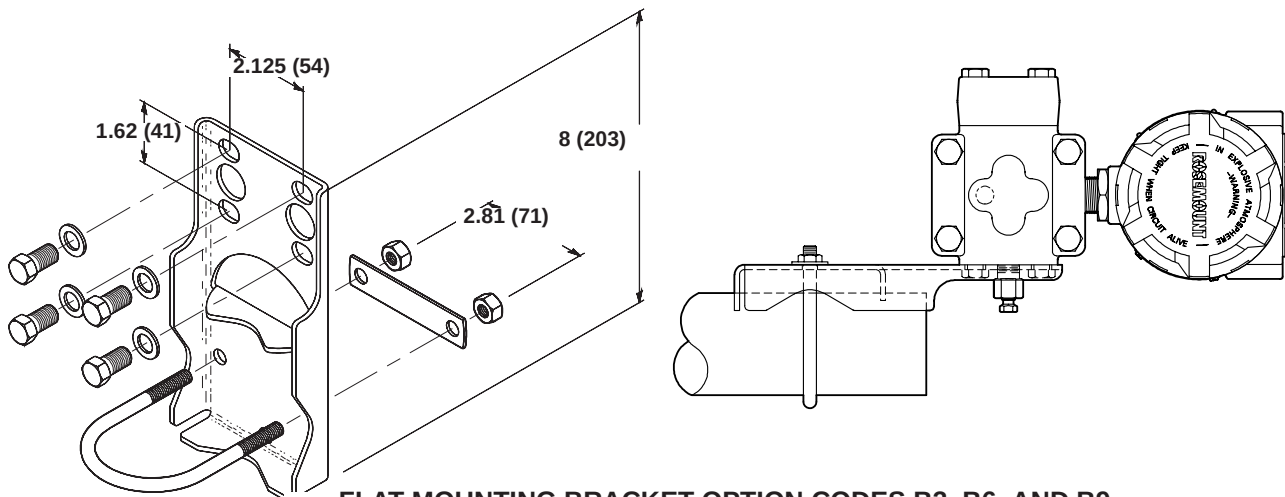
3051-3051D19A, 1151-1151D,B06C

PIPE MOUNTING BRACKET OPTION CODES B1, B4, AND B7



3051-3051B19A, 1151-0244A, 1151-1151E06A

PANEL MOUNTING BRACKET OPTION CODES B2 AND B5



3051-3051H19B, 1151-1151F06B

FLAT MOUNTING BRACKET OPTION CODES B3, B6, AND B9

NOTE
Dimensions are in inches (millimeters).

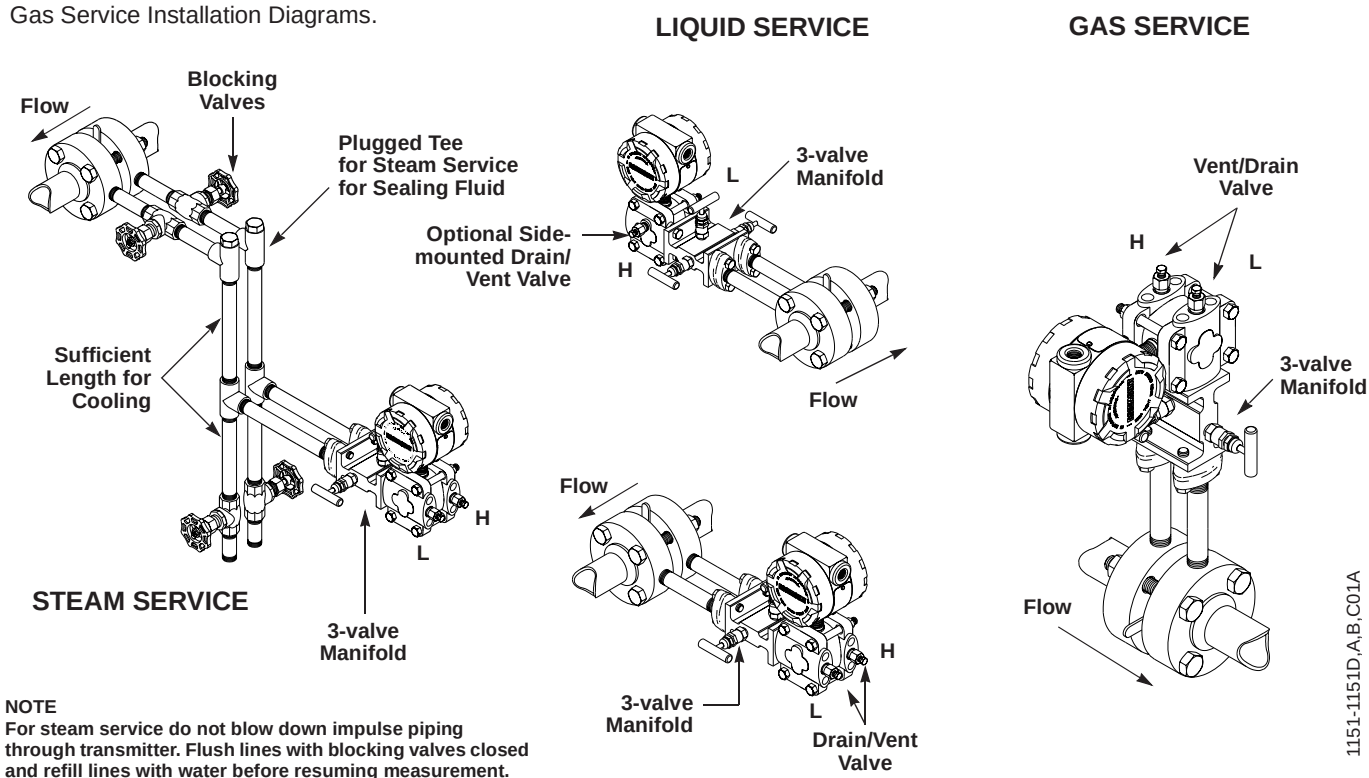
Mounting Requirements (for Steam, Liquid, Gas)

Taps

The following information applies to steam, liquid, and gas installations.

Different measurement conditions call for different piping configurations. For liquid flow measurement, place taps to the side of the line to prevent sediment deposits, and mount the transmitter beside or below these taps so gases can vent into the process line. For gas flow measurement, place taps in the top or side of the line and mount the transmitter beside or above the taps so liquid will drain into the process line. For steam flow measurement, place taps to the side of the line with the transmitter mounted below them to ensure that the impulse piping stays filled with condensate. See Figure 2-3 for a diagram of these arrangements.

FIGURE 2-3. Steam, Liquid, and Gas Service Installation Diagrams.



Drain/Vent Valves

For transmitters with side drain/vent valves, place taps to the side of the line. For liquid service, mount the side drain/vent valve upward to allow the gases to vent. For gas service, mount the drain/vent valve down to allow any accumulated liquid to drain. To change the drain/vent valve orientation from top to bottom, rotate the process flange 180 degrees.

⚠ CAUTION

Steam or other elevated temperature processes can cause damage to the sensor. Do not allow the temperature inside the process flanges to exceed the transmitter limit of 220 °F (104 °C).

In steam service, lines should be filled with water to prevent contact of the live steam with the transmitter.

Impulse Piping

The piping between the process and the transmitter must accurately transfer the pressure in order to obtain accurate measurements. In this pressure transfer, there are five possible sources of error: leaks, friction loss (particularly if purging is used), trapped gas in a liquid line, liquid in a gas line, and temperature-induced or other density variation between the legs.

The best location for the transmitter in relation to the process pipe depends on the process itself. Consider the following general guidelines in determining transmitter location and placement of impulse piping:

- Keep impulse piping as short as possible.
- Slope the impulse piping at least 1 inch per foot (8 centimeters per meter) upward from the transmitter toward the process connection for liquid.
- Slope the impulse piping at least 1 inch per foot (8 centimeters per meter) downward from the transmitter toward the process connection for gas.
- Avoid high points in liquid lines and low points in gas lines.
- Make sure both impulse legs are the same temperature.
- Use impulse piping large enough to avoid friction effects and prevent blockage.
- Vent all gas from liquid piping legs.
- When using a sealing fluid, fill both piping legs to the same level.
- When purging is necessary, make the purge connection close to the process taps and purge through equal lengths of the same size pipe. Avoid purging through the transmitter.
- Keep corrosive or hot process material out of direct contact with the sensor module and flanges.
- Prevent sediment deposits in the impulse piping.
- Keep the liquid head balanced on both legs of the impulse piping.

ELECTRICAL CONSIDERATIONS

Before making any electrical connections to the Model 1151 analog, consider the following standards and be sure to have proper power supply, conduit, and other accessories. Make sure all electrical installation is in accordance with national and local code requirements, such as the NEC (NFPA 70).

WARNING

Explosions can cause death or serious injury. Do not remove the instrument cover in explosive atmospheres when the circuit is alive.

CAUTION

Do not connect the power signal wiring to the test terminals. Voltage may burn out the reverse-polarity protection diode in the test connection. If the test diode is destroyed, then the transmitter can still be operated without local indication by jumping the test terminals.

⚠ CAUTION

High voltage (greater than 55 Volts for “E” electronics, 85 Volts for “G” electronics, 12 Volts for “L” electronics, and 14 Volts for “M” electronics.) can cause damage to the transmitter. Do not apply high voltage to the test terminals.

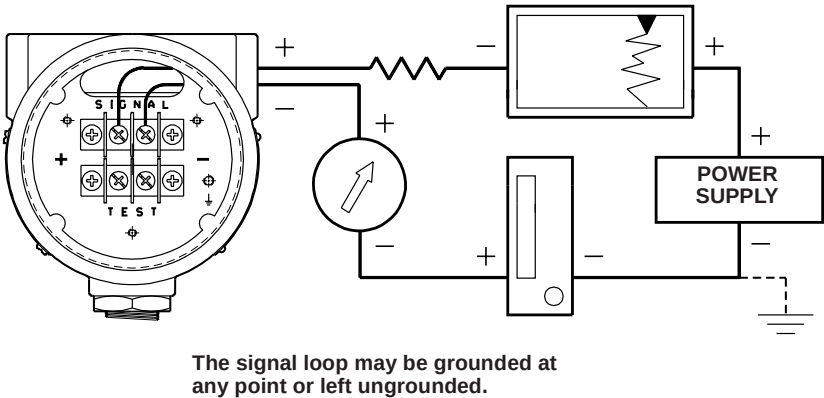
Wiring

The signal terminals and test terminals are located in a compartment of the electronics housing separate from the transmitter electronics. The nameplate on the side of the transmitter indicates the locations of the terminal and electronics compartments. The upper pair of terminals are the signal terminals and the lower pair are the test terminals. The test terminals have the same 4–20 mA output as the signal terminals and are only for use with the optional integral meter or for testing.

To make connections, remove the cover on the side marked “Terminal” on the nameplate. All power to the transmitter is supplied over the signal wiring. Connect the lead that originates at the positive side of the power supply to the terminal marked “+” and the lead that originates at the negative side of the power supply to the terminal marked “–” as shown in Figure 2-4. No additional wiring is required.

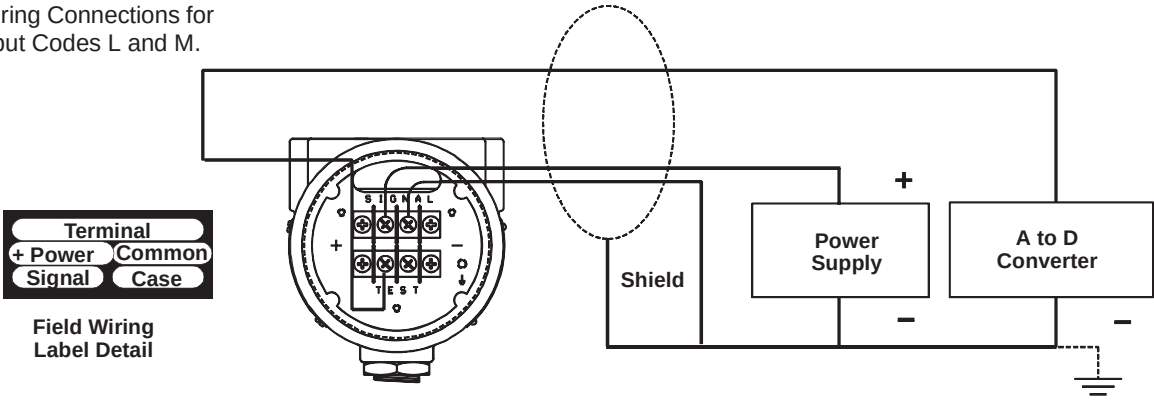
Shielded cable should be used for best results in electrically noisy environments.

FIGURE 2-4. Terminal Connections.



1151-1151G05A

FIGURE 2-5. Wiring Connections for Low Power Output Codes L and M.



1151-1151H05A

NOTE

An alternate location to connect an ammeter is on the set of terminals labelled “TEST.” Connect the positive lead of the ammeter to the positive test terminal, and the negative lead of the ammeter to the negative test terminal.

NOTE

When conduit lines are used, signal wiring need not be shielded, but twisted pairs should be used for best results. Wiring should be 12-24 AWG.

Conduit Sealing

The 1151 has been rated as “Factory Sealed” by Factory Mutual (FM) and Canadian Standards Association (CSA). It is therefore not necessary to install conduit seals near the transmitter enclosure.

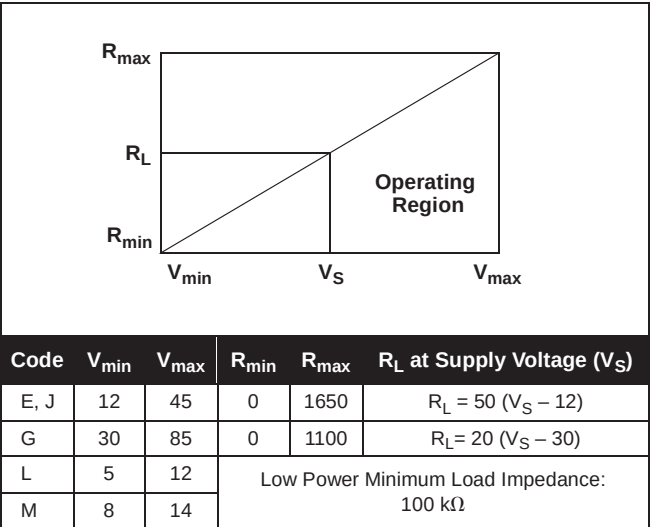
Do not run signal wiring in conduit or open trays with power wiring, or near heavy electrical equipment. Signal wiring may be grounded at any one point on the signal loop, or it may be left ungrounded. The negative terminal of the power supply is a recommended grounding point. The transmitter case must be grounded through the process or conduit connections.

Power Supply

The dc power supply should provide power with less than 2 percent ripple. The total resistance load is the sum of the resistance of the signal leads and the load resistance of the controller, indicator, and related pieces. Note that the resistance of intrinsic safety barriers, if used, must be included.

To power the loop, connect the leads at the set of terminal screws labeled “Signal.” Figure 2-6 illustrates power supply load limitations for the transmitter:

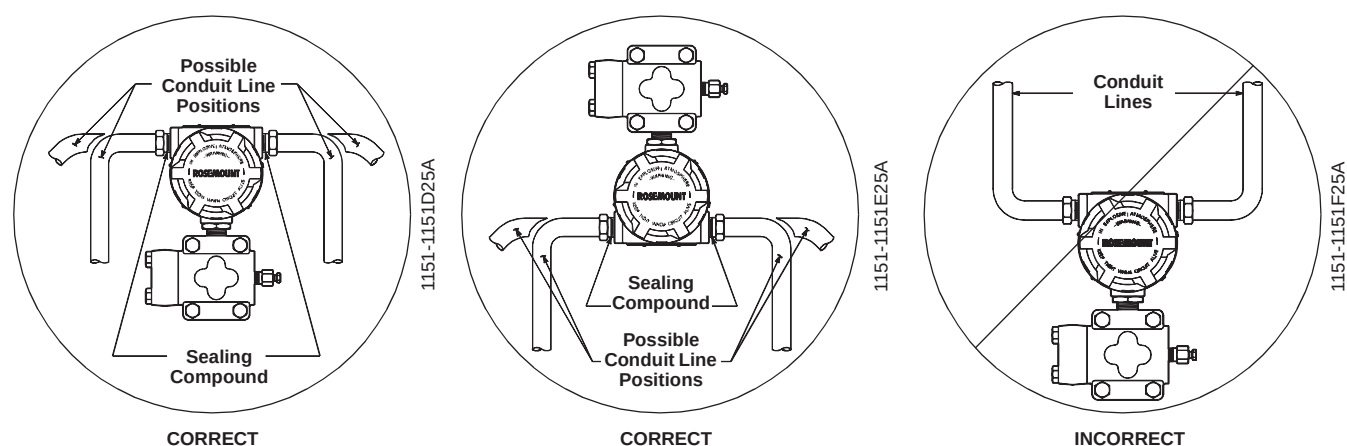
FIGURE 2-6. Power Supply Load Limitations.



NOTE

For CSA Approvals (codes E and J), V_{max} = 42.4 V dc.

FIGURE 2-7. Conduit Installation Diagrams.



Unused conduit connections on the transmitter housing should be plugged and sealed to avoid moisture accumulation in the terminal side of the housing. The recommended connections of conduit are shown in Figure 2-7.

⚠ WARNING

All explosion proof, flameproof, and dust-ignition proof installations require insertion of conduit plugs in all unused openings with a minimum of 40 ft-lbs (54 N-m) of torque. This will maintain five full threads of engagement.

⚠ CAUTION

If all connections are not sealed, excess moisture accumulation can damage the transmitter. Make sure to mount the transmitter with the electrical housing positioned downward for drainage. To avoid moisture accumulation in the housing, install wiring with a drip loop, and ensure the bottom of the drip loop is mounted lower than the conduit connections or the transmitter housing.

Grounding

Use the following techniques to properly ground the transmitter signal wiring and case:

Signal Wiring

Do not run signal wiring in conduit or open trays with power wiring, or near heavy electrical equipment. Signal wiring may be grounded at any one point on the signal loop, or it may be left ungrounded. The negative terminal of the power supply is a recommended grounding point.

Transmitter Case

The transmitter case must be grounded in accordance with national and local electrical codes. The most effective transmitter case grounding method is a direct internal connection to earth ground with minimal impedance.

Internal Ground Connection: Inside the FIELD TERMINALS side of the electronics housing is the Internal Ground Connection screw. This screw is identified by a ground symbol: .

NOTE

Grounding the transmitter case via threaded conduit connection may not provide sufficient ground continuity.

NOTE

The transient protection terminal block (See Figure 4-4 on page 4-8) does not provide transient protection unless the transmitter case is properly grounded. Use the preceding guidelines to ground the transmitter case.

Do not run the transient protection ground wire with signal wiring as the ground wire may carry excessive current if a lightning strike occurs.

Grounding Effects

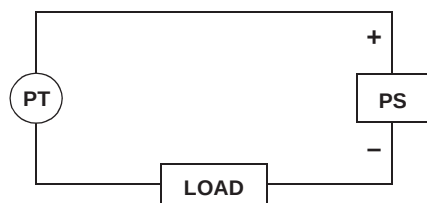
The capacitance sensing module requires alternating current to generate a capacitance signal. This alternating current is developed in an oscillator circuit with a frequency of approximately 32 kHz. This signal is capacitor-coupled to transmitter-case ground through the sensing module. Because of this coupling, a voltage may be imposed across the load, depending on the choice of grounding. See Figure 2-8.

This impressed voltage, which is seen as high frequency noise, will have no effect on most instruments. Computers with short sampling times will detect a significant noise signal, which should be filtered out by using a large capacitor (1 μ F) or by using a 32 kHz LC filter across the load. Computers are negligibly affected by this noise and do not need filtering

Hazardous Locations Certifications

The Model 1151 was designed with an explosion-proof housing and circuitry suitable for intrinsically safe and non-incendive operation. Factory Mutual explosion-proof certification is standard for the Model 1151 Transmitter. Individual transmitters are clearly marked with a tag indicating the approvals they carry. Transmitters must be installed in accordance with all applicable codes and standards to maintain these certified ratings. Refer to **Hazardous Locations Certifications** on page 6-2 for information on the approvals associated with the analog Model 1151.

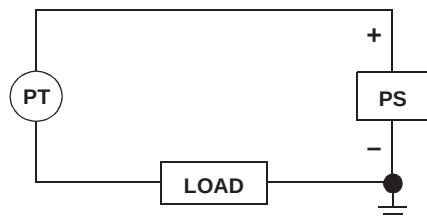
FIGURE 2-8. Typical Effects of Grounding on Accuracy for Fast Sample Computers (4-20 mA loops only).



Ungrounded System

Impressed Voltage: 12 to 22 mVp-p
32 kHz

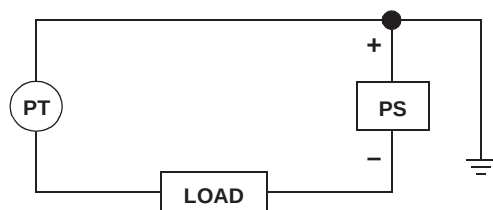
Effect: 0.01% of span.



Ground Between Negative Side of Power Supply and Load

Impressed Voltage: 35 to 60 mVp-p
32 kHz

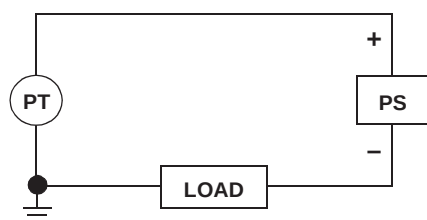
Effect: 0.03% of span.



Ground Between Positive Side of Transmitter and Power Supply

Impressed Voltage: 35 to 60 mVp-p
32 kHz

Effect: 0.03% of span.



Ground Between Negative Terminal of Transmitter and Load

Impressed Voltage: 500 to 600 mVp-p
32 kHz

Effect: 0.27% of span.

NOTE

Typical effects caused by the impressed voltage on a computer with a sampling time of 100 microseconds using a 2 to 10 volt signal.

LIQUID LEVEL MEASUREMENT

Differential pressure transmitters used for liquid level applications measure hydrostatic pressure head. Liquid level and specific gravity of a liquid are factors in determining pressure head. This pressure is equal to the liquid height above the tap multiplied by the specific gravity of the liquid. Pressure head is independent of volume or vessel shape.

Open Vessels

A pressure transmitter mounted near a tank bottom measures the pressure of the liquid above.

Make a connection to the high pressure side of the transmitter, and vent the low pressure side to the atmosphere. Pressure head equals the liquid's specific gravity multiplied by the liquid height above the tap.

Zero range suppression is required if the transmitter lies below the zero point of the desired level range. Figure 2-9 shows a liquid level measurement example.

Closed Vessels

Pressure above a liquid affects the pressure measured at the bottom of a closed vessel. The liquid specific gravity multiplied by the liquid height plus the vessel pressure equals the pressure at the bottom of the vessel.

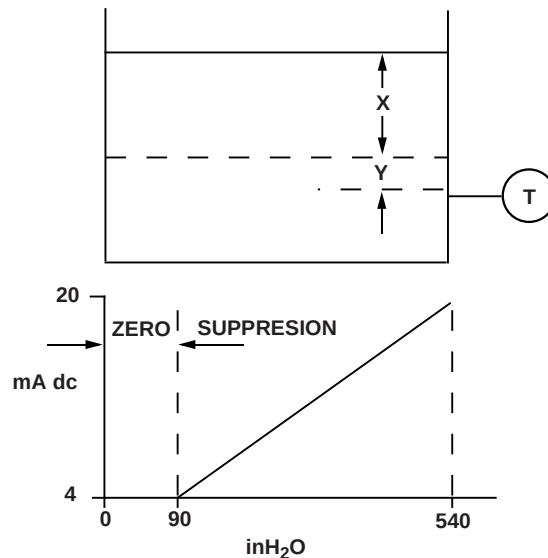
To measure true level, the vessel pressure must be subtracted from the vessel bottom pressure. To do this, make a pressure tap at the top of the vessel and connect this to the low side of the transmitter. Vessel pressure is then equally applied to both the high and low sides of the transmitter. The resulting differential pressure is proportional to liquid height multiplied by the liquid specific gravity.

Dry Leg Condition

Low-side transmitter piping will remain empty if gas above the liquid does not condense. This is a dry leg condition. Range determination calculations are the same as those described for bottom-mounted transmitters in open vessels, as shown in Figure 2-9.

FIGURE 2-9. Liquid Level Measurement Example.

Let **X** equal the vertical distance between the minimum and maximum measurable levels (500 in.).
 Let **Y** equal the vertical distance between the transmitter datum line and the minimum measurable level (100 in.).
 Let **SG** equal the specific gravity of the fluid (0.9).
 Let **h** equal the maximum head pressure to be measured in inches of water.
 Let **e** equal head pressure produced by **Y** expressed in inches of water.
 Let **Range** equal **e** to **e + h**.
 Then $h = (X)(SG)$
 $= 500 \times 0.9$
 $= 450 \text{ inH}_2\text{O}$
 $e = (Y)(SG)$
 $= 100 \times 0.9$
 $= 90 \text{ inH}_2\text{O}$
Range = 90 to 540 inH₂O



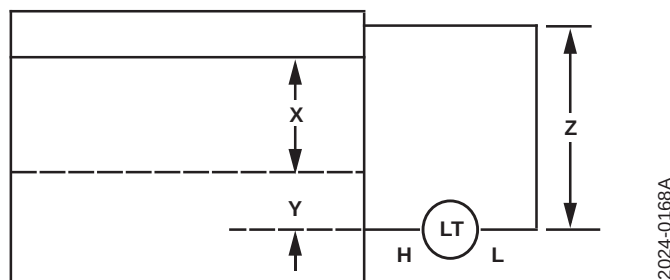
2024-0171A, 0172A

Wet Leg Condition

Condensation of the gas above the liquid slowly causes the low side of the transmitter piping to fill with liquid. The pipe is purposely filled with a convenient reference fluid to eliminate this potential error. This is a wet leg condition.

The reference fluid will exert a head pressure on the low side of the transmitter. Zero elevation of the range must then be made. See Figure 2-10.

FIGURE 2-10. Wet Leg Example.



Let **X** equal the vertical distance between the minimum and maximum measurable levels (500 in.).

Let **Y** equal the vertical distance between the transmitter datum line and the minimum measurable level (50 in.).

Let **z** equal the vertical distance between the top of the liquid in the wet leg and the transmitter datum line (600 in.).

Let **SG₁** equal the specific gravity of the fluid (1.0).

Let **SG₂** equal the specific gravity of the fluid in the wet leg (1.1).

Let **h** equal the maximum head pressure to be measured in inches of water.

Let **e** equal the head pressure produced by **Y** expressed in inches of water.

Let **s** equal head pressure produced by **z** expressed in inches of water.

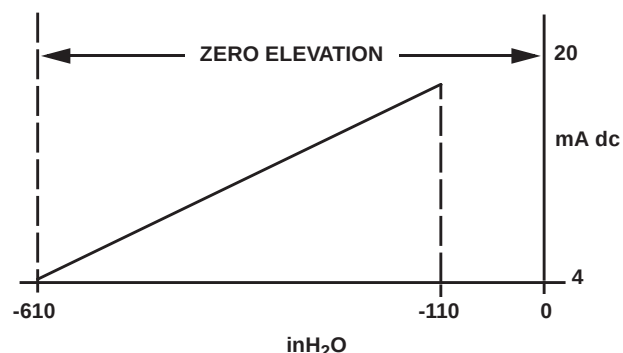
Let **Range** equal **e – s** to **h + e – s**.

$$\begin{aligned} \text{Then } h &= (X)(SG_1) \\ &= 500 \times 1.0 \\ &= 500 \text{ in H}_2\text{O} \end{aligned}$$

$$\begin{aligned} e &= (Y)(SG_1) \\ &= 50 \times 1.0 \\ &= 50 \text{ inH}_2\text{O} \end{aligned}$$

$$\begin{aligned} s &= (z)(SG_2) \\ &= 600 \times 1.1 \\ &= 660 \text{ inH}_2\text{O} \end{aligned}$$

$$\begin{aligned} \text{Range} &= e - s \text{ to } h + e - s \\ &= 50 - 660 \text{ to } 500 + 50 - 660 \\ &= -610 \text{ to } -110 \text{ inH}_2\text{O} \end{aligned}$$

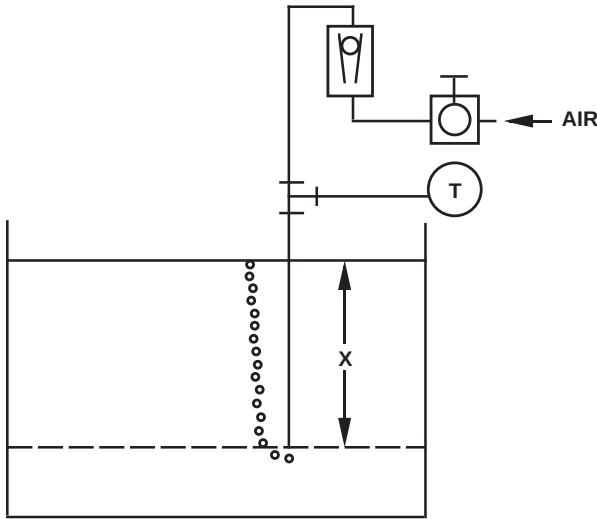


Bubbler System in Open Vessel

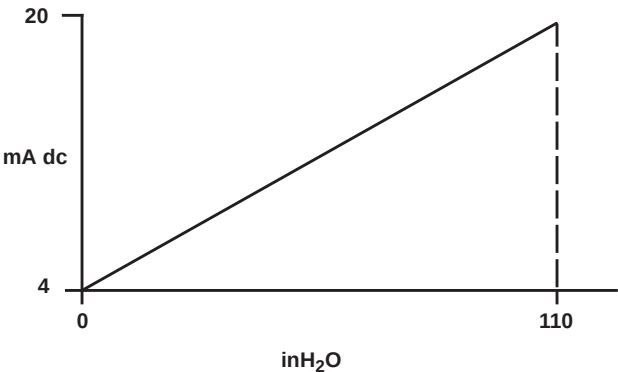
A bubbler system that has a top-mounted pressure transmitter can be used in open vessels. This system consists of an air supply, pressure regulator, constant flow meter, pressure transmitter, and a tube that extends down into the vessel.

Bubble air through the tube at a constant flow rate. The pressure required to maintain flow equals the liquid's specific gravity multiplied by the vertical height of the liquid above the tube opening. Figure 2-11 shows a bubbler liquid level measurement example.

FIGURE 2-11. Bubbler Liquid Level Measurement Example.



Let **X** equal the vertical distance between the minimum and maximum measurable levels (100 in.).
Let **SG** equal the specific gravity of the fluid (1.1).
Let **h** equal the maximum head pressure to be measured in inches of water.
Let **Range** equal zero to **h**.
Then $h = (X)(SG)$
 $= 100 \times 1.1$
 $= 110 \text{ inH}_2\text{O}$
Range = 0 to 110 inH₂O



Calibration

Calibration of the Rosemount Model 1151 Pressure Transmitter is simplified by its compact and explosion-proof design, external span and zero adjustments, separate compartments for electronics and wiring, and weatherproof construction. Descriptions of span, linearity, zero adjustments, and damping follow.

⚠ WARNING

Explosions can cause death or serious injury. Both transmitter covers must be fully engaged to meet explosion-proof requirements.

⚠ CAUTION

When replacing housing covers, tighten the covers enough to make contact with the O-ring seals. If the covers are not tightened enough, moisture can enter the housing and cause transmitter failure.

QUICK CALIBRATION PROCEDURE (FOR E, G, AND J ELECTRONICS)

The following Quick Calibration Procedures are for those users who are already familiar with the analog Model 1151.

NOTE

The zero and span adjustments are interactive. For applications requiring large elevated or suppressed values, refer to **Elevated or Suppressed Zeros** on page 3-7.

1. Apply 4 mA-point pressure and turn zero screw to output 4 mA.
2. Apply 20 mA-point pressure.
3. Subtract actual output from desired output.
4. Divide difference by 3.
5. Turn span screw above or below desired output by value in Step 4.
6. Repeat Steps 1 through 5 until calibrated.

QUICK CALIBRATION PROCEDURE (FOR L AND M ELECTRONICS)

1. Apply 1 V dc-point pressure for M electronics (0.8 V dc for L electronics) and turn zero screw to output 1 V dc (0.8 V dc for L electronics).
2. Apply 5 V dc-point pressure (M electronics) or 3.2 V dc (L electronics).
3. Subtract actual output from desired output.
4. Divide difference by 3.
5. Turn span screw above or below desired output by value in Step 4.
6. Repeat Steps 1 through 5 until calibrated.

Example for a Model 1151DP Range 4: For a desired calibration of 0 to 100 inH₂O, use the following procedure:

1. Adjust the zero. With zero input applied to the transmitter, turn the zero adjustment screw until the transmitter reads 4 mA.
2. Adjust the span. Apply 100 inH₂O to the transmitter high side connection. Turn the span adjustment screw until the transmitter output reads approximately 20 mA.
3. Release the input pressure and readjust the zero output to read 4 mA ± 0.032 mA.
4. Re-apply 100 inH₂O to the transmitter. If the output reading is greater than 20 mA, divide the difference by 3, and subtract the result from 20 mA. Adjust the 100% output to this value.

If the output reading is less than 20 mA, divide the difference by 3 and add the result to 20 mA. Adjust the 100% output to this value.

Example: The full scale transmitter output is 20.100 mA. Dividing 0.100 by 3.0 gives the product 0.033. Subtracting the product 0.033 from 20.00 mA gives the difference 19.967 mA. Adjust the 100% output to this value.

5. Release input pressure and readjust the zero.
6. Apply 100% input and repeat Steps 3 through 5 if the full scale output is not 20 ± 0.032 mA.

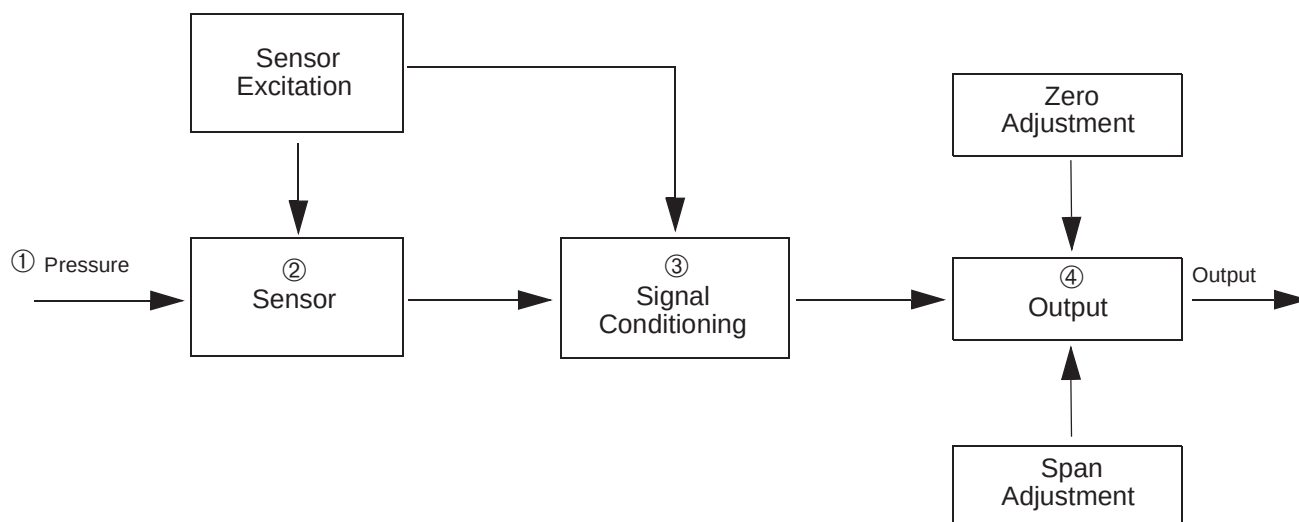
NOTE

Under operating conditions that subject the transmitter to temperature extremes or significant vibration, mechanical backlash may occur in the zero and span adjustment screws. To improve the stability of zero and span settings in these circumstances, back off the adjustment screws slightly after final adjustment to break contact between the potentiometer blades and the adjustment screw slot surfaces.

DATA FLOW WITH CALIBRATION OPTIONS

Figure 3-1 illustrates the Model 1151 Transmitter data flow with calibration tasks.

FIGURE 3-1. Model 1151 Transmitter Data Flow with Calibration Options.



This data flow can be summarized in four major steps:

1. Pressure is applied to the sensor.
2. A change in pressure is measured by a change in the sensor output.
3. The sensor signal is conditioned for various parameters.
4. The conditioned signal is converted to an appropriate analog output.

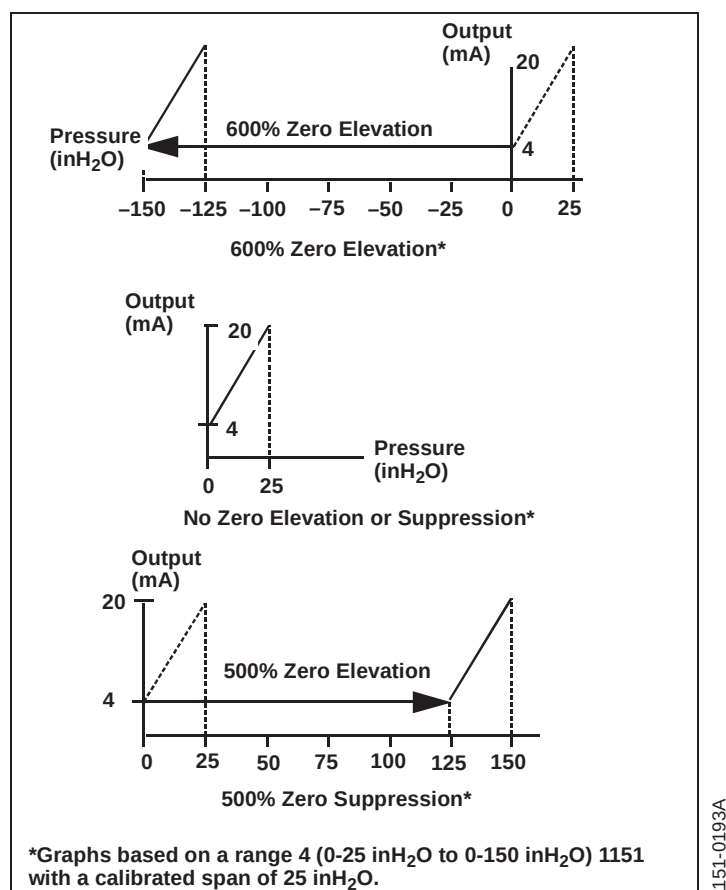
SPAN ADJUSTMENT RANGE

The span on a Model 1151 with E, G, and J output options is continuously adjustable to allow calibration anywhere between maximum span and one-sixth of maximum span. For example, the span on a Range 4 transmitter can be adjusted between 25 and 150 inH₂O (6.2 and 37.2 kPa).

ZERO ADJUSTMENT RANGE

The zero on a Model 1151 with the E or G output options can be adjusted for up to 500% suppression or 600% elevation. See Figure 3-2.

FIGURE 3-2. Zero Adjustment Range.



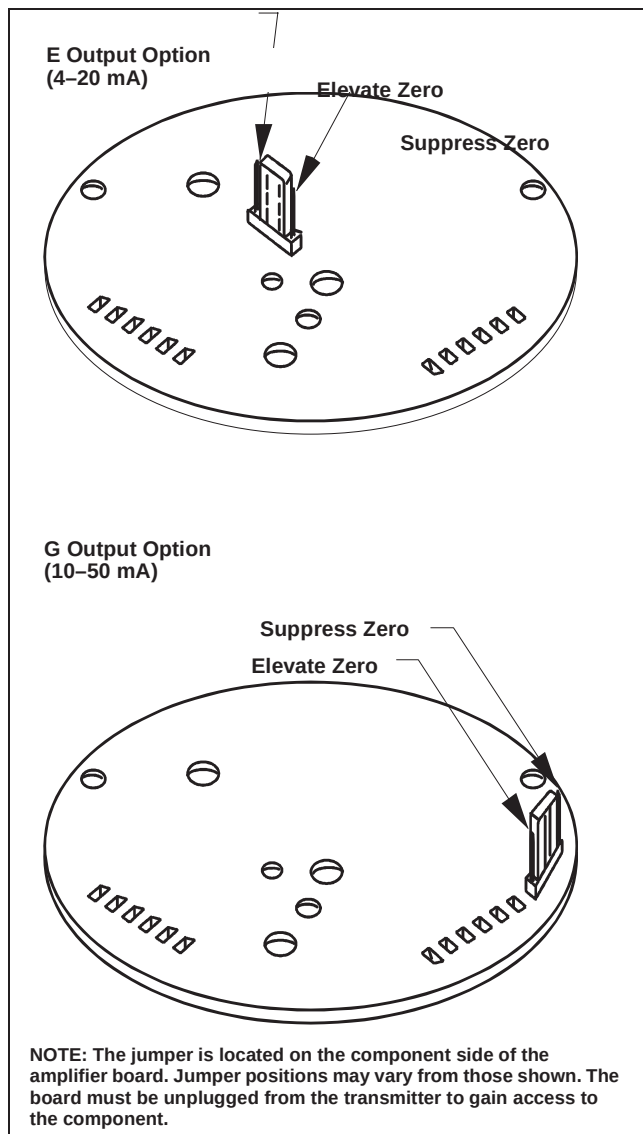
The zero may be elevated or suppressed to these extremes with the limitation that no pressure within the calibrated range exceeds the full-range pressure limit. For example, a Range 4 transmitter cannot be calibrated for 100 to 200 inH₂O (24.8 to 49.7 kPa) (only 100% zero suppression) because 200 inH₂O exceeds the 150 inH₂O full-range pressure limit of a Range 4.

To make large elevation or suppression adjustments, it is necessary to move the jumper on the component side of the amplifier board. Figure 3-3 on page 3-5 shows elevation and suppression jumper settings. The jumper has three positions. The middle position allows normal levels of elevation or suppression. For larger adjustments, move the jumper to the ELEVATE ZERO (EZ) or SUPPRESS ZERO (SZ) as marked.

NOTE

Always make sure that the jumper is fully seated on its pins. If the jumper has not been placed in any of the three positions, the amplifier board will provide normal levels of elevation or suppression. A slide switch replaces the jumper pin on some versions of the amplifier board.

FIGURE 3-3. Elevation and Suppression Jumper Settings.



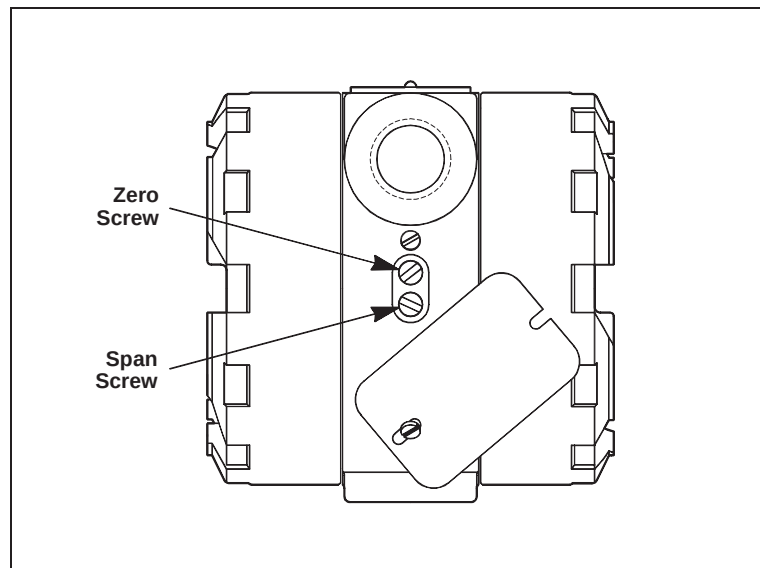
1151-0194A

ZERO AND SPAN ADJUSTMENT

The zero and span adjustment screws are accessible externally behind the nameplate on the terminal side of the electronics housing. See Figure 3-4. The output of the transmitter increases with clockwise rotation of the adjustment screws. The zero adjustment screw and ELEVATE ZERO/SUPPRESS ZERO jumper do not affect the span. Span adjustment, however, does affect zero. This effect is minimized with zero-based spans. Therefore, when calibrations having elevated or suppressed zeros are made, it is easier to make a zero-based calibration and achieve the required elevation or suppression by adjusting the zero adjustment screw (and ELEVATE ZERO/SUPPRESS ZERO jumper as required).

A degree of mechanical backlash is present in the zero and span adjustments, so there will be a dead band when the direction of adjustment is changed. Because of the backlash, the simplest procedure is to purposely overshoot a larger amount before reversing the direction of the adjustment.

FIGURE 3-4. Zero and Span Adjustment Screws.



1151-1151A25A

ELEVATED OR SUPPRESSED ZEROS

Non-zero-based calibrations are termed as having “elevated” or “suppressed” zeros. Calibrations that have a lower calibrated value below zero are termed elevated. Compound ranges are included in this category. Calibrations that have a lower calibrated value above zero are termed suppressed.

The easiest way to calibrate transmitters with elevated or suppressed zeros is to perform a zero-based calibration and then elevate or suppress the zero by adjusting the zero adjustment screw.

Model 1151DP Range 4 Suppression Example: For a desired calibration of 20 to 120 inH₂O (4.9 to 29.8 kPa), proceed as follows:

1. Calibrate the transmitter to 0 to 100 inH₂O (0 to 24.8 kPa) as described in the zero and span adjustment information.
2. Apply 20 inH₂O (4.9 kPa) to the high side process connection, and adjust the zero until the transmitter output reads 4 mA.

Do not use the span adjustment.

Model 1151DP Range 4 Elevation Example: For a calibration of –120 to –20 inH₂O (–29.8 to –4.9 kPa), proceed as follows:

1. Calibrate the transmitter to 0 to 100 inH₂O (0 to 24.8 kPa) as described in the zero and span adjustment information.
2. Apply 120 inH₂O (29.8 kPa) to the low side process connection, and adjust the zero until the transmitter output reads 4 mA.

Do not use the span adjustment.

NOTE

For large amounts of elevation or suppression, it may be necessary to reposition the ELEVATE/SUPPRESS ZERO jumper. To do this, remove the amplifier board, and move the jumper to the ELEVATE or SUPPRESS position as required. See Figure 3-3 on page 3-5.

LINEARITY ADJUSTMENT

In addition to the span and zero adjustments, a linearity adjustment screw (marked LIN) is located on the solder side of the amplifier board. See Figure 3-5. This is a factory calibration adjusted for optimum performance over the calibrated range of the instrument and normally is not readjusted in the field. The user may, however, maximize linearity over a particular range using the following procedure:

1. Apply mid-range pressure and note the error between the theoretical and actual output signal.
2. Apply full-scale pressure. Multiply the error noted in Step 1 by six and then that product by the Range Down Factor, which is calculated as shown below:

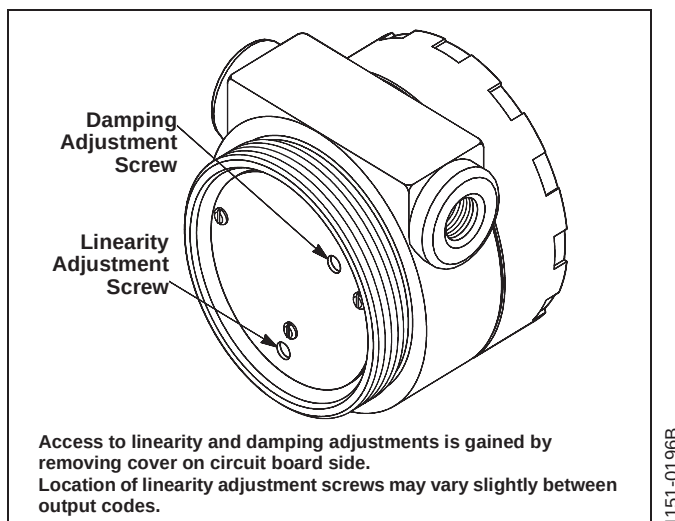
$$\text{Range Down Factor} = \frac{\text{Maximum Allowable Span}}{\text{Calibrated Span}}$$

Add this result to the full-scale output (for negative errors), or subtract the result from the full-scale output (for positive errors) by turning the linearity adjustment screw.

Example: At 4 to 1 Range Down Factor, the mid-scale point is low by 0.05 mA. Therefore, turn the linearity adjustment screw until full-scale output increases by $(0.05 \text{ mA} \times 6 \times 4) = 1.2 \text{ mA}$.

3. Readjust the zero and span.

FIGURE 3-5. Damping and Linearity Adjustment Screws.



DAMPING ADJUSTMENT

The amplifier boards for output options E, G, and J are designed to permit damping of rapid pulsations in the pressure source through adjustment of the damping screw shown in Figure 3-5 on page 3-8. The adjustment is marked DAMP on the solder side of the amplifier board.

The settings available provide time constant values between 0.2 and 1.66 seconds. The instrument is calibrated and shipped with this control set at the counterclockwise stop (0.2 second time constant). It is recommended that the shortest possible time constant setting be selected. Since the transmitter calibration is not influenced by the time constant setting, the damping may be adjusted with the transmitter connected to the process. Turn the damping control clockwise until the desired damping is obtained.

⚠ CAUTION

The adjustment screw has positive stops at both ends. Forcing it beyond the stops may cause permanent damage.

STATIC PRESSURE SPAN CORRECTION FACTOR

High static pressure causes a systematic span shift in the transmitter. It is linear and easily correctable during calibration. Table 3-1 shows the amount of span shift for range codes 3 through 8.

TABLE 3-1. Model 1151 DP/HP Span Shift.

Range Code	Span Shift % Input Per 1,000 psi		
	316L SST	Hastelloy	Monel
3	-1.75%	-1.00%	-1.00%
4	-0.87%	-0.60%	-0.50%
5	-0.81%	-0.70%	-0.75%
6	-1.45%	-1.45%	-1.45%
7	-1.05%	-1.05%	-1.05%
8	-0.55%	-0.55%	-0.55%

The following examples illustrate a compensation method of accounting for the span shift. For more complicated calibration conditions, refer to Rosemount Report D8500141 or contact Customer Central at 1-800-999-9307.

Example 1 - Refer to Table 3-1: One method is to adjust the input and allow the transmitter output to remain at 20 mA. Use the following formula:

Corrected Input

$$= \text{Desired URV} + [(S \times \text{URV}) \times (P/1000)],$$

Where S = Value from Table 3-1, divided by 100.

To calibrate a Range 4 transmitter 0 to 150 inH₂O (0 to 37.2 kPa) and correct for 1,500 psi static line pressure, use the following correction:

Corrected Input

$$= 150 + [(-0.0087 \times 150) \times (1500/1000)]$$

$$= 148.04 \text{ inches}$$

With 148.04 inches applied as input at atmospheric pressure, set the transmitter to 20 mA. When the transmitter is exposed to 1,500 psi static line pressure, output will be 20 mA at 150 inches input.

Where computers or microprocessor receivers are used, the mathematical definitions used in the preceding tables can be used to automatically and continuously make the correction.

All transmitters should be rezeroed under line pressure to remove zero

error.

Example 2 - Refer to Table 3-2: A Model 1151DP Range 4 with a 4–20 mA output operating at 1,200 psi static pressure requires the output at 100% to be corrected to 20.168 mA. Therefore, the transmitter should be adjusted from 4–20.168 mA during calibration. After installation, and with both process inputs pressurized to 1,200 psi, readjust the zero to 4.000 mA to remove the small zero error.

TABLE 3-2. Model 1151DP Static Pressure 4–20 mA Output Code E Corrected Output Calibration at 100% Input SST Isolators.

Static Pressure (psi)	Static Pressure (kPa)	Range 3	Range 4	Range 5
100	689	20.029	20.014	20.013
200	1379	20.057	20.028	20.026
300	2068	20.086	20.042	20.039
400	2758	20.114	20.056	20.052
500	3447	20.143	20.070	20.066
600	4137	20.171	20.084	20.079
700	4826	20.200	20.098	20.092
800	5516	20.228	20.112	20.104
900	6205	20.257	20.126	20.118
1000	6895	20.285	20.140	20.131
1100	7584	20.314	20.154	20.144
1200	8274	20.342	20.168	20.157
1300	8963	20.371	20.182	20.170
1400	9653	20.399	20.196	20.183
1500	10342	20.428	20.210	20.197
1600	11032	20.456	20.224	20.210
1700	11721	20.485	20.238	20.223
1800	12411	20.513	20.252	20.236
1900	13100	20.542	20.266	20.250
2000	13790	20.570	20.280	20.262

Example 3 - Refer to Table 3-3: The correction factor at 100% input shift for a Range 5 transmitter with a 4–20 mA output operating at 1,500 psi static pressure would be:

$$S = 0.131 \times 1.5 = 0.197 \text{ mA}$$

Therefore, the calibration for this transmitter would be from 4–20.197 mA.

TABLE 3-3. Output Correction Factors SST Isolators.

Range Code	E Output 4–20 mA	G Output 10–50 mA
3	S = 0.285 P	S = 0.712 P
4	S = 0.140 P	S = 0.350 P
5	S = 0.131 P	S = 0.327 P
6	S = 0.235 P	S = 0.588 P
7	S = 0.170 P	S = 0.425 P
8	S = 0.088 P	S = 0.220 P

NOTE

Correction factors apply to E and G outputs at 100% input (P = static pressure in 1,000 psi).

Options

Model 1151 options can simplify installation and operation. This section describes the following options:

- Mounting Brackets
- Analog and LCD Indicating Meters
- Terminal Blocks (Transient Protection and Filter)

MOUNTING BRACKETS

(OPTION CODES B1–B7 AND B9)

Optional mounting brackets available with the Model 1151 allow mounting to a 2-inch pipe or panel. Figure 4-1 shows bracket dimensions and mounting configurations for the various bracket options.

Pipe Mounting Brackets

Option Codes B1, B4, and B7 are sturdy, epoxy-polyester-painted brackets designed for 2-inch pipe mounting. Option Code B1 is constructed of carbon steel with carbon steel bolts. Option Code B4 is the same bracket as Option Code B1, with 316 SST bolts. Option Code B7 is also the same bracket as Option Code B1 with a 316 SST bracket and 316 SST bolts.

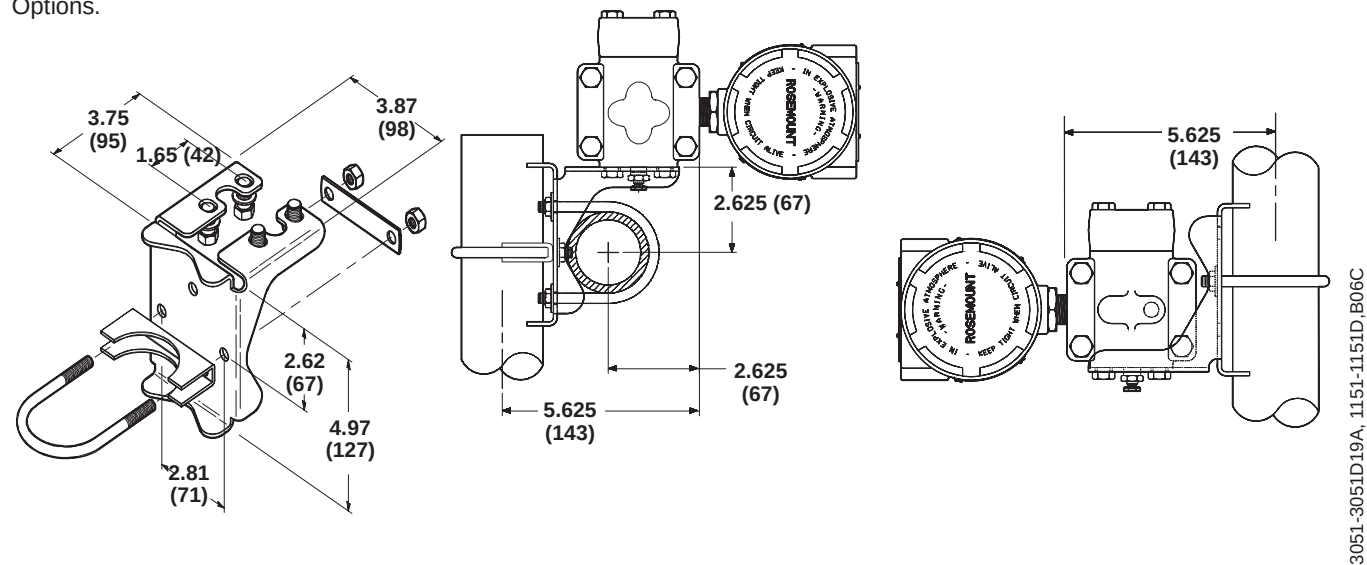
Flat Mounting Brackets

Option Codes B3, B6, and B9 are flat brackets designed for 2-inch pipe mounting. Option Code B3 is constructed of carbon steel with a carbon steel U-bolt. Option Codes B6 and B9 are the same bracket configuration as Option Code B3. Option Code B6 provides 316 SST bolts and Option Code B9 provides a 316 SST bracket and 316 SST bolts.

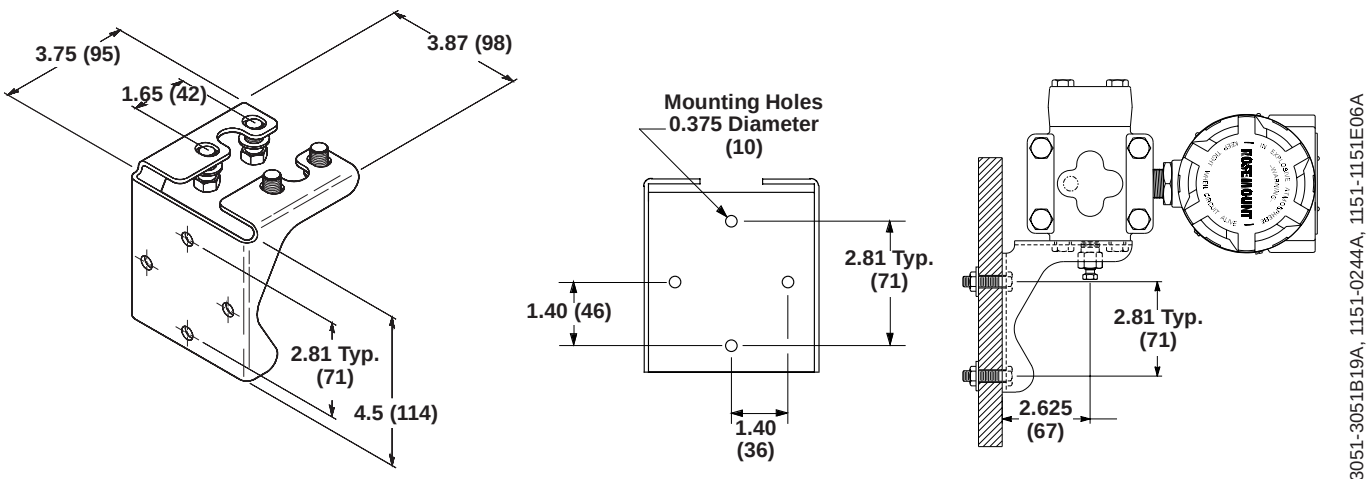
Panel Mounting Brackets

Option codes B2 and B5 are panel brackets designed for bolting to any flat surface.

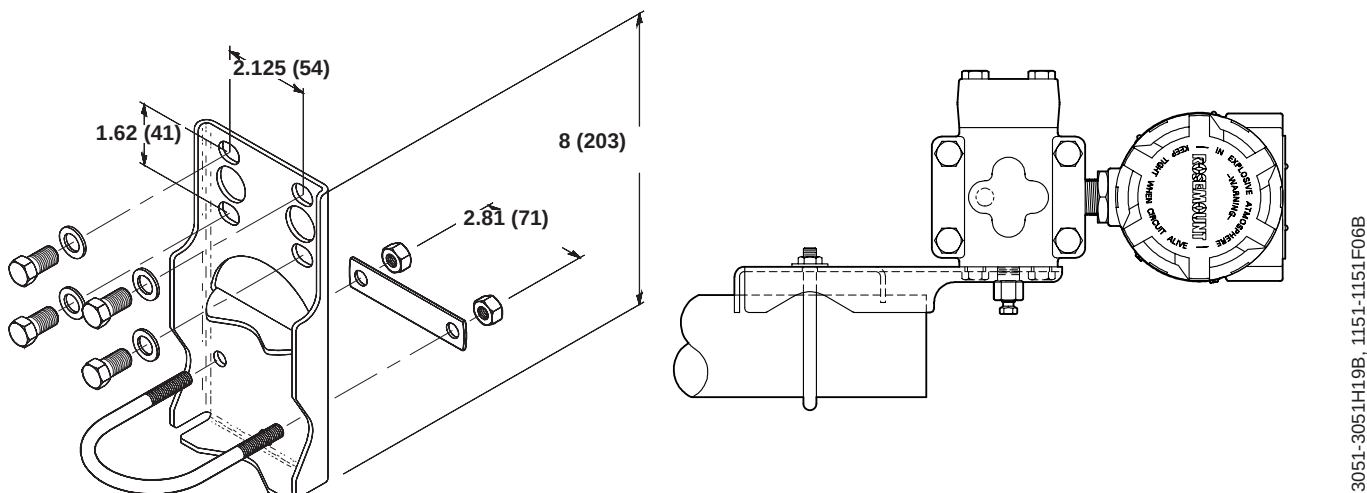
FIGURE 4-1. Mounting Bracket Options.



PIPE MOUNTING BRACKET OPTION CODES B1, B4, AND B7



PANEL MOUNTING BRACKET OPTION CODES B2 AND B5



NOTE
Dimensions are in inches (millimeters).

ANALOG METERS (4–20 mA ONLY)

Option Codes M1–M3 and M6 provide local indication of the transmitter output in a variety of scaling configurations with an indicator accuracy of ± 2 percent. The plug-in mounting configuration allows for simple installation and removal of the analog meters. The meter scaling options are shown below.

M1	Linear analog meter, 0-100% scale
M2	Square-root analog meter, 0-100% flow scale
M3	Special scaling analog meter, (specify range)
M6	Square-root analog meter, 0-10 $\sqrt{\quad}$ scale

⚠ WARNING

Explosions can cause death or serious injury. To meet hazardous location requirements, any transmitter with a tag specifying Option Codes I5, I1, N1, I8, I7, or N7 requires an intrinsically safe analog meter (Part No. 01151-0744-XXXX) or an LCD Meter (Part No. 01151-1300-XXXX).

LCD METERS (4–20 mA ONLY)

The LCD meter options, M4 and M7–M9 provide a highly accurate local display of the process variable. A variety of scaling configurations are available and listed as follows:

M4	Linear LCD Meter, 0 to 100%, User Selectable
M7	Special scale LCD meter (specify range, mode, and engineering units)
M8	Square-root LCD meter, 0 to 100%
M9	Square-root LCD meter, 0 to 10 $\sqrt{\quad}$

⚠ WARNING

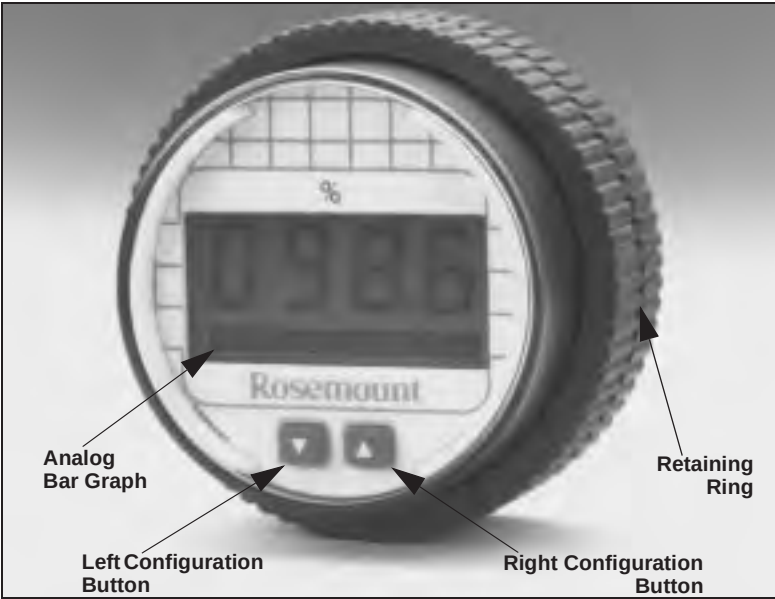
Explosions can cause death or serious injury. When adding a meter option to a Model 1151 with an Option Code R1 or R2 terminal block, make sure to change to cemented meter covers with a glass window. Make sure a sticker is located inside the cover that indicates a "cemented cover." This cover is required to maintain explosion-proof approval.

LCD Meter Configuration

The Rosemount LCD meter plugs directly into the Model 1151 to provide a highly accurate digital display of the process variable. The following explains the configuration and assembly of the LCD meter and includes the applicable functional, performance, and physical specifications. This meter adds no voltage drop in the 4–20 mA current loop when connected directly across the transmitter test terminals.

The LCD meter may be configured to meet specific requirements by using the left and right calibration buttons located on the meter face as shown in Figure 4-2. The analog bar graph is also shown in Figure 4-2. The 20-segment bar graph is factory calibrated and represents 4–20 mA directly.

FIGURE 4-2. LCD Meter.



No calibration equipment is required to configure the LCD meter, but there must be a current (between 4 and 20 mA) flowing through the loop. The actual value of the current is not significant. In addition, meter configuration does not affect the transmitter/loop current. Use the following meter configuration procedure to properly configure the LCD meter.

Remove the Cover

1. Unscrew the retaining ring shown in Figure 4-2 and lift the transparent cover off of the housing.

NOTE

The LCD meter time-out is approximately 16 seconds. If keys are not pressed within this period, the indicator reverts to reading the current signal.

Position the Decimal Point and Select the Meter Function

2. Press the left and right configuration buttons simultaneously and release them immediately.
3. To move the decimal point to the desired location, press the left configuration button. Note that the decimal point wraps around.
4. To scroll through the mode options, press the right configuration button repeatedly until the desired mode is displayed. See Table 4-1.

TABLE 4-1. LCD Meter Modes.

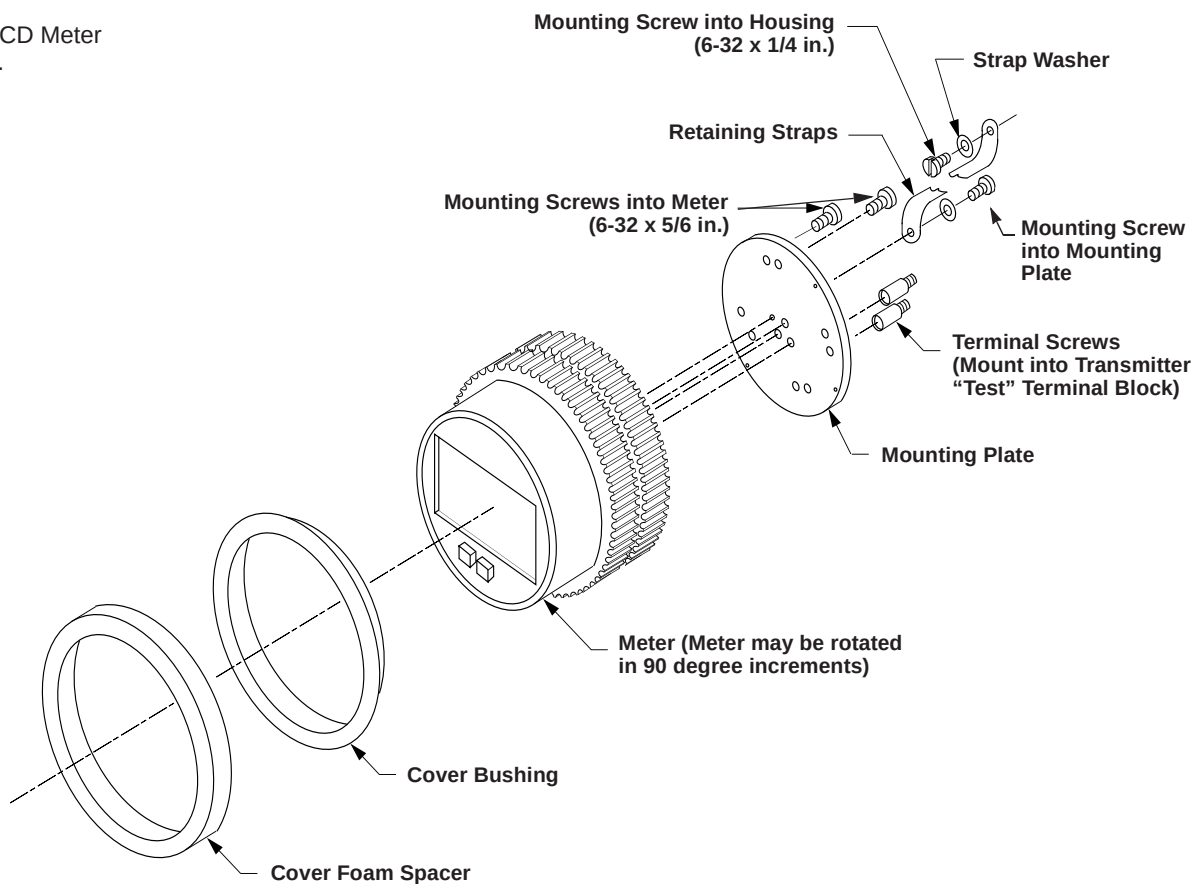
Options	Relationship between Input Signal and Digital Display
L in	Linear
L inF	Linear with five-second filter
Srt	Square root
SrtF	Square root with five-second filter
Square root function only relates to the digital display. The bar graph output remains linear with the current signal. Square root response The digital display will be proportional to the square root of the input current where 4 mA=0 and 20 mA=1.0, scaled per the calibration procedure. The transition point from linear to square root is at 25% of full scale flow. Filter response operates upon “present input” and “input received in the previous five second interval” in the following manner: Display = (0.75 × previous input) + (0.25 × present input) This relationship is maintained provided that the previous reading minus the present reading is less than 25% of full scale.	

Store the Information**Set the Display Equivalent to a 4 mA Signal****Set the Display Equivalent to a 20 mA Signal****Replace the Cover****LCD Meter Assembly**

5. Press both configuration buttons simultaneously for two seconds. Note that the meter displays “----” for approximately 7.5 seconds while the information is being stored.
6. Press the left button for two seconds.
7. To decrement the display numbers, press the left configuration button and to increment the numbers, press the right configuration button. Set the numbers between –999 and 1000.
8. To store the information, press both configuration buttons simultaneously for two seconds.
9. Press the right button for two seconds.
10. To decrement the display numbers, press the left configuration button on the display and to increment the numbers, press the right configuration button. Set the numbers between –999 and 9999. The sum of the 4 mA point and the span must not exceed 9999.
11. To store the information, press both configuration buttons simultaneously for two seconds. The LCD meter is now configured.
12. Make sure the rubber gasket is seated properly, replace the transparent cover, and replace the retaining ring.

Figure 4-3 shows the mounting hardware required to properly install the LCD meter on a transmitter or in the field signal indicator. This mounting hardware may also be used with the Rosemount universal (analog) meter.

FIGURE 4-3. LCD Meter Exploded View.



LCD Meter Specifications

Input Signal

4–20 mA dc.

Meter Indication

4-digit LCD showing –999 to 9999. A 20-segment bar graph directly represents the 4–20 mA current.

Scaling/Calibration

4 mA Point Limits: –999 to 1000.

Span limits: 0200 to 9999.

The sum of the 4 mA point and span must not exceed 9999.

Adjustments are made using non-interactive zero and span buttons.

Hazardous Locations Certifications

Approved for use with Model 1151.

WARNING

Explosions can cause death or serious injury. When adding a meter option to a Model 1151 with an Option Code R1 or R2 terminal block, make sure to change to cemented meter covers with a glass window. Make sure a sticker is located inside the cover that indicates a “cemented cover.” This cover is required to maintain explosion-proof approval.

Overload Limitation

666 mA.

Temperature Limits

Storage: –40 to 185 °F (–40 to 85 °C).

Operating: –4 to 158 °F (–20 to 70 °C).

Between temperatures –40 to –4 °F (–40 to –20 °C), the loop is intact and the meter is not damaged.

Humidity Limitation

0 to 95% non-condensing relative humidity.

Update Period

750 ms.

Response Time

Responds to changes in input within a maximum of two update periods. If the filter is activated, then the display responds to the change within nine update periods.

Digital Display Resolution

0.05% of calibrated range ± 1 digit.

Analog Bar Graph Resolution

5.0% of calibrated range.

Indication Accuracy

0.25% of calibrated range ± 1 digit.

Stability

Over Time: 0.1% of calibrated range ± 1 digit per 6 months.

Temperature Effect

0.01% of calibrated range per °C on zero.

0.02% of calibrated range per °C on span over the operating temperature range.

Power Interrupt

All calibration constants are stored in EEPROM memory and are not affected by power loss.

Failure Mode

LCD meter failure will not affect transmitter operation.

Under/Over Range Indication

Input current < 3.5 mA: Display blank.

Input current > 22.0 mA: Display flashes 112.5% of full scale value or 9999, whichever is less.

Meter Size

2¼-inch diameter face with ½-inch high characters.

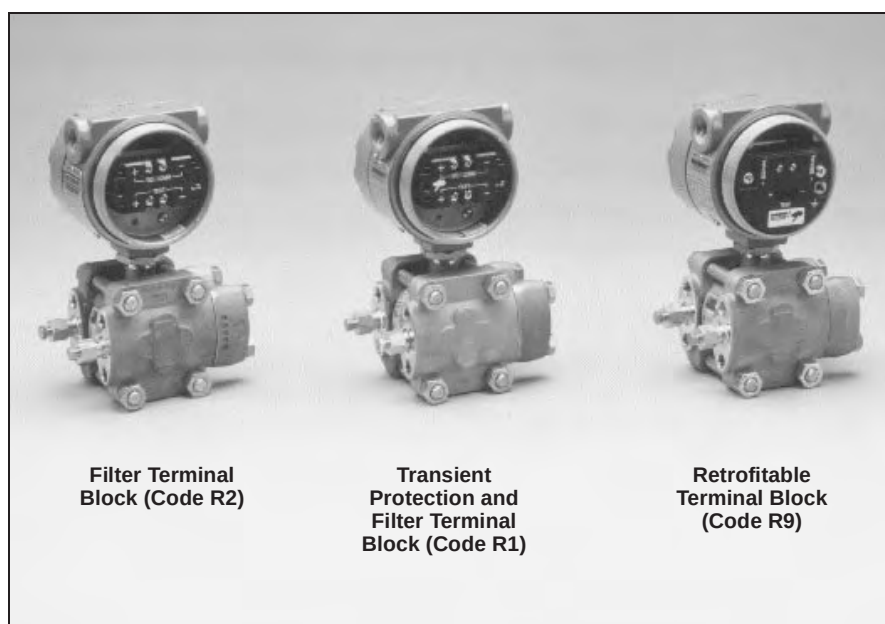
TERMINAL BLOCKS

The terminal block options can increase the Model 1151 (output code “E” only) Pressure Transmitter’s ability to withstand electrical transients induced by lightning, welding, heavy electrical equipment, or switch gears. The Model 1151, with the integral transient protection option, meets the standard performance specifications as outlined in this product manual. In addition, the transient protection circuitry meets IEEE Standard 587, Category B and IEEE Standard 472, Surge Withstand Capability.

NOTE

For a transient protection terminal block, specify Option Code R1 or R9.

FIGURE 4-4. Terminal Blocks.



Filter Terminal Block (Option Code R2)

Option Code R2 provides enhanced performance in extremely harsh EMI and RFI environments. This option cannot be retrofitted.

Transient Protection and Filter Terminal Block (Option Code R1)

Option Code R1 provides EMI/RFI protection and the benefit of integral transient protection. (This terminal block can be ordered as a spare part to retrofit existing Model 1151 Transmitters with Option Code R2.)

NOTE

Options R1 and R2 do not require the use of shielded cable in most electrically noisy environments.

Retrofitable Transient Terminal Block (Option Code R9)

The retrofitable transient protection terminal block (Option Code R9) protects any Rosemount Model 1151 Analog Pressure Transmitter (E electronics only without the R1 or R2 option). The terminal block module installs directly into a transmitter providing highly reliable transient protection. Included with the Retrofitable Transient Protection Terminal Block is a hardware kit containing two short mounting screws with two lock washers, one long grounding screw with a square washer, and one label indicating an option has been installed. If any parts of the hardware kit are missing, contact Rosemount North American Response Center at 1-800-THE-RSMT (1-800-654-7768).

R9 Terminal Block Installation

Use a phillips and a flat-blade screwdriver and the following steps to install the Retrofitable Transient Protection Terminal Block:

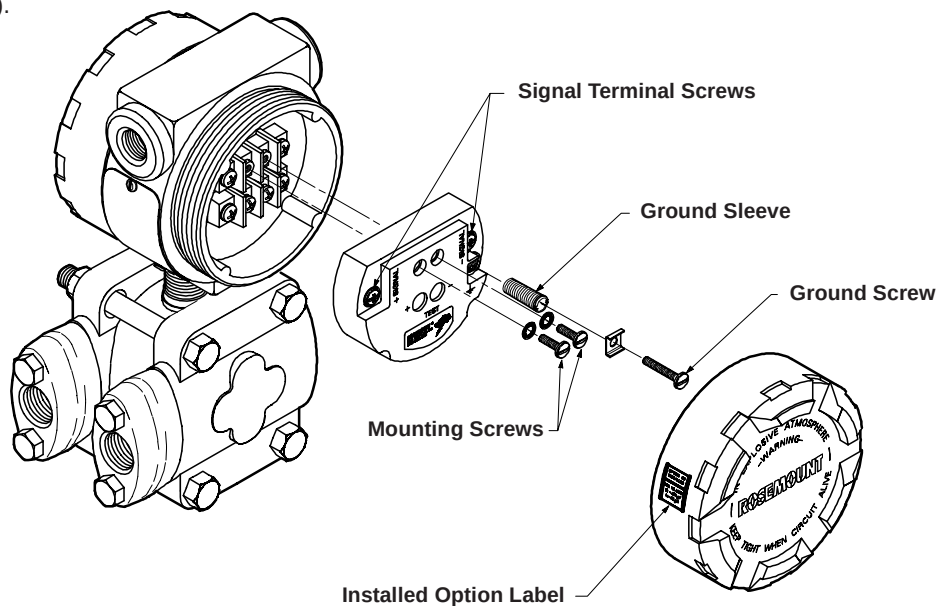
1. Turn off all power to the Model 1151 on which the terminal block is being installed.

WARNING

Explosion can cause death or serious injury. Do not remove the instrument cover in explosive atmospheres when the circuit is alive.

2. Unscrew the transmitter terminal-side (indicated on the housing nameplate) cover (on the high side of the transmitter) exposing the standard terminal block.
3. Disconnect wiring to the terminal block.
4. Remove the single grounding screw and the two signal terminal screws, with terminal eyelet washers, from the standard terminal block.
5. Set the Retrofitable Transient Protection Terminal Block into the housing, making sure the ground and signal terminals are properly aligned. See Figure 4-5 on page 4-9.
6. Insert the two short mounting screws with washers in the mounting holes and tighten the terminal block to the transmitter. See Figure 4-5 on page 4-9.
7. Turn the transient protector grounding sleeve, located in the grounding hole, just enough to stabilize the unit on the transmitter. See Figure 4-5 on page 4-9. Over tightening the grounding sleeve will shift the terminal block out of alignment.

FIGURE 4-5. Terminal Block
Exploded View (Option Code R9).



1151-1085/A01A

8. Insert the long grounding screw with the square washer into the grounding hole and tighten.
9. Connect the positive power supply wire to the transient protector terminal screw labeled “+ SIGNAL”, and the negative power supply wire to the terminal screw labeled “- SIGNAL.”
10. Attach the supplied label to the terminal side transmitter cover as shown in Figure 4-5.

⚠ WARNING

Explosions can cause death or serious injury. Both transmitter covers must be fully engaged to meet explosion-proof requirements.

11. Replace the terminal side cover on the transmitter.

Terminal Block Specifications (for R1, R2, and R9)

Hazardous Locations Certifications

Approved for use with I5, K5, I6, C6, E6, E8, I8⁽¹⁾, I1⁽¹⁾⁽²⁾, N1, E7, I7, and N7 approved transmitters.

Materials of Construction

Noryl plastic.

Loop Resistance

6 Ω .

Transient Protection Limits (for R1 and R9)

IEEE 587 Category B

6 kV Crest ($1.2 \times 50 \mu\text{s}$).

3 kV Crest ($8 \times 20 \mu\text{s}$).

6 kV (0.5 μs at 100 kHz).

IEEE 472

SWC 2.5 kV Crest,

1 MHz waveform.

Accuracy Specification

Same as specified electronics accuracy when transmitter is calibrated with installed Retrofittable Transient Protection Terminal Block.

(1) When the transient version of the filter module is used in an intrinsically safe installation, supply transmitter from a galvanically isolated barrier.

(2) I1 and R1/R9 are not compatible.

Maintenance and Troubleshooting

This section describes a variety of troubleshooting options associated with the Model 1151 Alphaline® transmitter and is divided into the following sections.

Hardware Maintenance

- Hardware Diagnostics
- Transmitter Disassembly
- Sensor Module Checkout
- Transmitter Reassembly
- Optional Plug-in Meters
- Return of Material

Contact Customer Central at 1-800-999-9307 for further technical support and the North American Response Center at 1-800-654-7768 for equipment service assistance.

WARNING

Use only the procedures and new parts specifically referenced in this manual. Unauthorized procedures or parts can affect product performance and the output signal used to control a process, and may render the instrument dangerous. Direct any questions concerning these procedures or parts to Rosemount Inc.

HARDWARE DIAGNOSTICS

If you suspect a malfunction, see Table 5-1 on page 5-2 to verify that transmitter hardware and process connections are in good working order. Under each of the five major symptoms, you will find specific suggestions for solving the problem. Always deal with the most likely and easiest to check conditions first.

WARNING

Isolate a failed transmitter from its pressure source as soon as possible. Pressure that may be present could cause death or serious injury to personnel if the transmitter is disassembled or ruptures under pressure.

TABLE 5-1. Troubleshooting
Symptoms and Corrective Action.

Symptom	Potential Source	Corrective Action
High Output	Primary Element	Check for restrictions at primary element.
	Impulse Piping	Check for leaks or blockage. Ensure that blocking valves are fully open. Check for entrapped gas in liquid lines and for liquid in dry lines. Ensure that the density of fluid in impulse lines is unchanged. Check for sediment in transmitter process flanges.
	Power Supply	Check the power supply output voltage at the transmitter.
	Transmitter electronics	Make sure that post connectors are clean. If the electronics are still suspect, substitute new electronics.
	Sensing Element	The sensing element is not field repairable and must be replaced if found to be defective. See "Transmitter Disassembly" later in this section for instructions on disassembly. Check for obvious defects, such as punctured isolating diaphragm or fill fluid loss, and contact Rosemount North American Response Center at 1-800-THE-RSMT (1-800-654-7768).
Erratic Output	Loop Wiring	Check for adequate voltage to the transmitter. Check for intermittent shorts, open circuits and multiple grounds.  CAUTION Do not use higher than the specified voltage to check the loop, or damage to the transmitter electronics may result.
	Process Pulsation	Adjust Damping
	Transmitter Electronics	Make sure the post connectors are clean. If the electronics are still suspect, substitute new electronics.
	Impulse Piping	Check for entrapped gas in liquid lines and for liquid in dry lines.

TABLE 5-1. (continued).

Symptom	Potential Source	Corrective Action
Low Output or No Output	Primary Element	Check the insulation and condition of primary element. Note any changes in process fluid properties that may affect output.
	Loop Wiring	Check for adequate voltage to the transmitter. Check the milliamp rating of the power supply against the total current being drawn for all transmitters being powered. Check for shorts and multiple grounds. Check for proper polarity at the signal terminal. Check loop impedance. Check whether the transmitter is in multidrop mode, thus locking the output at 4 mA. ⚠ CAUTION Do not use higher than the specified voltage to check the loop, or damage to the transmitter electronics may result. Check wire insulation to detect possible shorts to ground.
	Impulse Piping	Ensure that the pressure connection is correct. Check for leaks or blockage. Check for entrapped gas in liquid lines. Check for sediment in the transmitter process flange. Ensure that blocking valves are fully open and that bypass valves are tightly closed. Ensure that density of the fluid in the impulse piping is unchanged.
	Sensing Element	The sensing element is not field repairable and must be replaced if found to be defective. See "Transmitter Disassembly" later in this section for instructions on disassembly. Check for obvious defects, such as punctured isolating diaphragm or fill fluid loss, and contact Rosemount North American Response Center at 1-800-THE-RSMT (1-800-654-7768).
Transmitter Does Not Calibrate Properly	Pressure Source/Correction	Check for restrictions or leaks. Check for proper leveling or zeroing of the pressure source. Check weights/gauge to ensure proper pressure setting. Determine if the pressure source has sufficient accuracy.
	Meter	Determine if the meter is functioning properly.
	Power Supply	Check the power supply output voltage at transmitter.
	Transmitter Electronics	Make sure the post connectors are clean. If electronics are still suspect, substitute with new electronics.
	Sensing Element	The sensing element is not field repairable and must be replaced if found to be defective. See "Transmitter Disassembly" later in this section for instructions on disassembly. Check for obvious defects, such as punctured isolating diaphragm or fill fluid loss, and contact Rosemount North American Response Center at 1-800-THE-RSMT (1-800-654-7768).

TRANSMITTER DISASSEMBLY

Read the following information carefully before you disassemble a transmitter. General information concerning the process sensor body, electrical housing, and a procedure for their separation follow. Figure 5-1 shows an exploded view of the transmitter.

WARNING

The following performance limitations may inhibit efficient or safe operation. Critical applications should have appropriate diagnostic and backup systems in place.

Pressure transmitters contain an internal fill fluid. It is used to transmit the process pressure through the isolating diaphragms to the pressure sensing element. In rare cases, oil leak paths in oil-filled pressure transmitters can be created. Possible causes include: physical damage to the isolator diaphragms, process fluid freezing, isolator corrosion due to an incompatible process fluid, etc.

A transmitter with an oil fill fluid leak can continue to perform normally for a period of time. Sustained oil loss will eventually cause one or more of the operating parameters to exceed published specifications while a small drift in operating point output continues. Symptoms of advanced oil loss and other unrelated problems include:

- Sustained drift rate in true zero and span or operating point output or both
- Sluggish response to increasing or decreasing pressure or both
- Limited output rate or very nonlinear output or both
- Change in output process noise
- Noticeable drift in operating point output
- Abrupt increase in drift rate of true zero or span or both
- Unstable output
- Output saturated high or low

WARNING

Explosion can cause death or serious injury. Do not remove the instrument cover in explosive atmospheres when the circuit is alive.

WARNING

Explosions can cause death or serious injury. Do not break the housing seal in explosive environments. Breaking the housing seal invalidates the explosion-proof housing rating.

Electrical connections are located in a compartment identified as **TERMINAL SIDE** on the nameplate. The signal and test terminals are accessible by unscrewing the cover on the terminal side. The terminals to the housing must not be removed, or the housing seal between compartments will be broken. (Not applicable to R1 and R2 Options.)

Process Sensor Body Removal

Be aware of the following guidelines:

- The transmitter should be removed from service before disassembling the sensor body.
- Process flanges can be detached by removing the four large bolts.

⚠ CAUTION

Do not scratch, puncture, or depress the isolating diaphragms. Damaging the isolating diaphragms can inhibit transmitter performance.

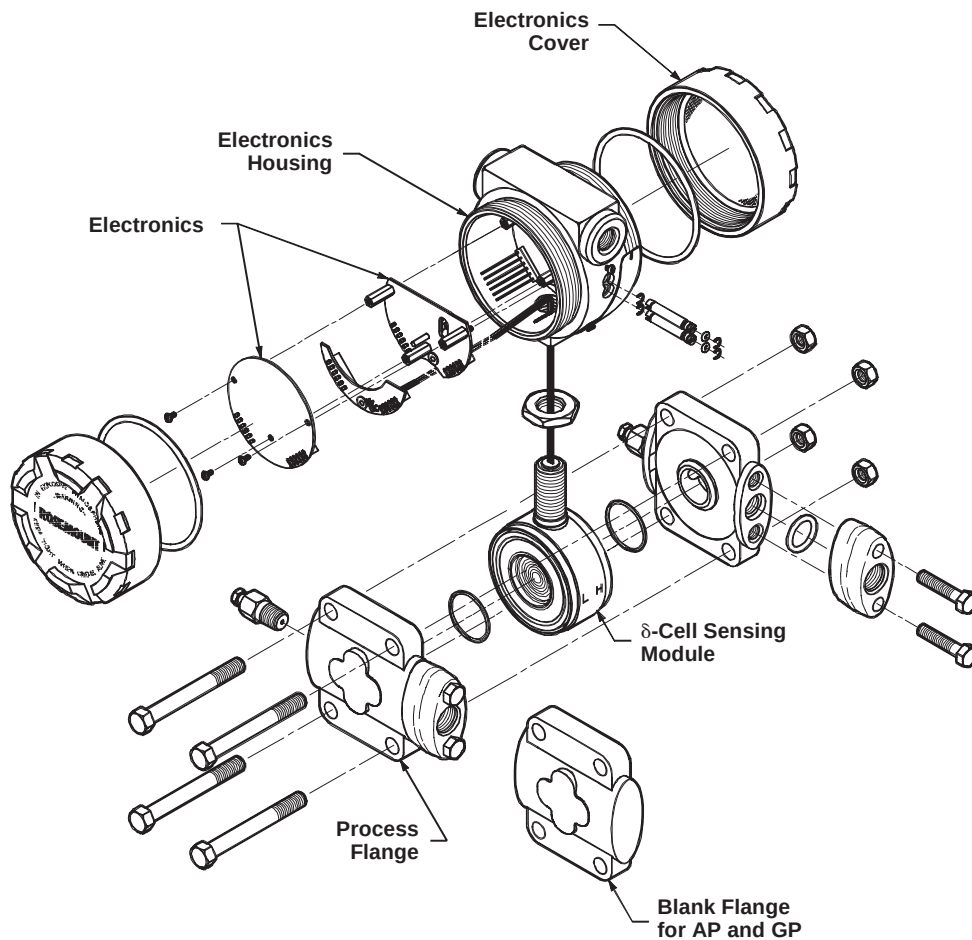
- Isolating diaphragms may be cleaned with a soft rag, mild cleaning solution, and clear water rinse.

⚠ CAUTION

Do not use chlorine or acid solutions to clean the diaphragms. Damaging the isolating diaphragms can inhibit transmitter performance.

- Flange adapters and process flanges may be rotated or reversed for mounting convenience.

FIGURE 5-1. Differential Pressure (DP) Transmitter Exploded View.



Removing the Sensor from the Electrical Housing

1. Disconnect the power source from the transmitter.
2. Unscrew the cover on the terminal side of the transmitter.
3. Remove the screws and unplug the electronics; see Figure 5-2.
4. Loosen the lock nut.
5. Remove the standoffs.

⚠ CAUTION

Do not damage the isolating diaphragms when unscrewing the sensor module. Damaging the isolating diaphragms can inhibit transmitter performance.

6. Unscrew the sensing module from the electronics housing, being careful not to damage the sensor leads. Carefully pull the header assembly board through the hole. The threaded connection has a sealing compound on it and must be broken loose.

The sensing module is a welded assembly and cannot be further disassembled.

FIGURE 5-2. Removal of Electronics.



1151-029AB

Sensor Module Checkout

The sensor module is not field repairable and must be replaced if found to be defective. If no obvious defect is observed (such as a punctured isolating diaphragm or fill fluid loss), the sensor module can be checked as follows.

1. Carefully pull the header assembly board off of the post connectors. Rotate the board 180 degrees about the axis formed by the connecting leads. The sensor module and electronics housing can remain attached for checkout.

NOTE

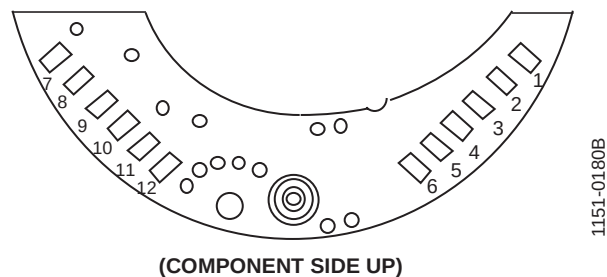
Do not touch the transmitter housing when checking resistances, or a faulty reading can result.

2. Check the resistance between the sensor module housing and pins one through four. This checks the resistance between both capacitor plates and the sensing diaphragm, which is grounded to the housing. This resistance should be greater than 10 M Ω .
3. Check the resistance between pin eight and the sensor module to ensure that the module is grounded. Resistance should be zero.

NOTE

The above procedure does not completely test the sensor module. If circuit board replacement does not correct the abnormal condition, and no other problems are obvious, replace the sensor module.

FIGURE 5-3. Header Board Connections.



REASSEMBLY PROCEDURE

Follow these procedures carefully to ensure proper reassembly.

Preliminary Precaution

Inspect all O-rings and replace if necessary. Lightly grease with silicone oil to ensure a good seal. Use halocarbon grease for inert fill options.

⚠ WARNING

Explosions can cause death or serious injury. Both transmitter covers must be fully engaged to meet explosion-proof requirements.

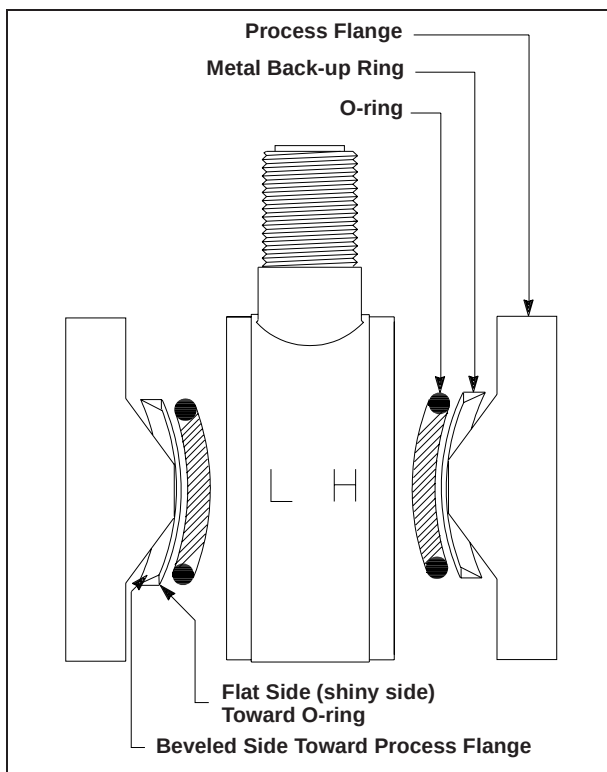
Connecting the Electrical Housing to the Sensor

1. Insert the header assembly board through the electronics housing.
2. Use a sealing compound (*Loctite 222 - Small Screw Threadlocker*) on the threads of the sensor module to ensure a watertight seal on the housing.
3. Screw the sensor module into the electrical housing making sure that the threads are fully engaged. Be careful not to damage or twist the sensor leads.
4. Align the sensor module with the high and low pressure sides oriented for convenient installation.
5. Tighten the lock nut.

Backup Ring and O-ring Installation

All HP transmitters and GP Range 9 and 0 transmitters require metal backup rings to ensure O-ring integrity. Figure 5-4 on page 5-8 illustrates the position and orientation of the metal backup rings. (Backup rings are not required on AP or DP transmitters or GP Range 3-8 transmitters.)

FIGURE 5-4. Detail Showing Process O-ring and Backup Ring Installation of Module Seal for Model 1151HP and GP Range 9 (GP Range 0 Requires Only One O-ring and Backup O-ring).



1151-0983A01A

NOTE

Handle the backup ring carefully, as it is fragile. Examine the ring carefully. One side is beveled, while the other side is flat. The flat side appears more shiny when viewed from above.

1. Clean the sealing surfaces carefully.
2. Place the module on a flat surface, “H” side up.
3. Place the greased flange O-ring around the isolator and push it into the cavity.

⚠ WARNING

Process leaks can cause death or serious injury. An incorrectly installed backup ring can destroy the o-ring and cause process leaks. Install the backup ring using the following procedure.

4. For all HP transmitters and GP transmitters Ranges 9 and 0, place the backup ring, shiny side down, on top of the O-ring. This places the flat side of the backup ring against the O-ring.
5. Carefully place the flange on top of the module, beveled side down so that the beveled flange surface mates with the beveled surface of the backup ring.
6. Keeping the flange and module together, turn them over so the “L” side is up. Repeat Steps 3 through 5. As before, the flat side of the backup ring must rest against the O-ring.
7. Insert the four flange bolts.
8. Tighten the nuts finger tight, making sure the flanges remain parallel. The transmitter may now be moved without disturbing the O-rings.
 - a. Tighten one bolt until the flanges seat.
 - b. Torque down the bolt diagonally across.
 - c. Torque down the first bolt.
 - d. Torque down the two remaining bolts.
 - e. Inspect the flange-to-sensor seating to be sure that the flanges are not cocked.
 - f. Check that all four bolts are tightened to approximately 33 ft-lb (39 Nm).
9. Recalibrate the transmitter.

NOTE

If the Model 1151 Range 3 transmitter sensor module serial number is below 2,900,000, it must be temperature cycled whenever changing or rebolting flanges.

Optional Plug-in Meters

The optional indicating meters available for Rosemount Model 1151 transmitters are listed in **Section 4 Options**. Please be aware of the following information while assembling the meter assembly. Refer to Table 6-6 on page 6-13 for part references.

- The meter may be rotated in 90-degree increments for convenient reading.

WARNING

Explosions can cause death or serious injury. Do not disassemble the glass in the meter cover in explosive atmospheres. Disassembling the glass in the meter cover invalidates the explosion-proof meter rating.

- If the meter cover is removed for any reason, be sure the O-ring is in place between the cover and housing before reattachment. To maintain an explosion-proof condition, the glass in the meter cover must not be disassembled for any reason.

RETURN OF MATERIAL

To expedite the return process, call the Rosemount North American Response Center using our 800-654-RSMT (7768) toll-free number. This center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. For safety reasons, the center will also ask for the name of the process material the product was last exposed to.

WARNING

Exposure to hazardous substances can cause death or serious injury. If a hazardous substance is identified, a Material Safety Data Sheet (MSDS), required by law to be available to people exposed to specific hazardous substances, must be included with the returned goods.

The North American Response Center will detail the additional information and procedures necessary to return goods exposed to hazardous substances.

Specifications and Reference Data

FUNCTIONAL SPECIFICATIONS

Service

Liquid, gas, and vapor applications.

Ranges

Minimum span equals the upper range limit (URL) divided by rangedown. Rangedown varies with the output code. See Table 6-1.

Outputs

Code E, Analog

4–20 mA dc, linear with process pressure.

Code G, Analog

10–50 mA dc, linear with process pressure.

Code J, Analog

4–20 mA dc, square root of differential input pressure between 4 and 100% of input. Linear with differential input pressure between 0 and 4% of input.

Code L, Low Power

0.8 to 3.2 V dc, linear with process pressure.

Code M, Low Power

1 to 5 V dc, linear with process pressure.

TABLE 6-1. Rangeability.

Output Code	Minimum Span	Maximum Span
E, G, J	URL/6	URL
L	URL/1.1	URL
M	URL/2	URL

TABLE 6-2. Model 1151 Transmitter Range Availability by Model (URL = Upper Range Limit).

Range Code	Model 1151 Ranges (URL)	DP	HP	GP	AP
3	30 inH ₂ O (7.46 kPa)	•	NA	•	NA
4	150 inH ₂ O (37.3 kPa)	•	•	•	•
5	750 inH ₂ O (186.4 kPa)	•	•	•	•
6	100 psi (689.5 kPa)	•	•	•	•
7	300 psi (2068 kPa)	•	•	•	•
8	1,000 psi (6895 kPa)	•	NA	•	•
9	3,000 psi (20684 kPa)	NA	NA	•	NA
0	6,000 psi (41369 kPa)	NA	NA	•	NA

TABLE 6-3. Model 1151 Output Code Availability.

Code	Model 1151 Output Options/Damping	DP	HP	GP	DP/GP/Seals	AP
E	4–20 mA, linear, analog/variable	•	•	•	•	•
G	10–50 mA, linear, analog/variable	•	•	•	•	•
J ⁽¹⁾	4–20 mA, square root, analog/variable	•	•	NA	NA	NA
L	0.8 to 3.2 V, linear, low power/fixed	•	•	•	•	•
M	1 to 5 V, linear, low power/fixed	•	•	•	•	•

(1) Available with Ranges 3–5.

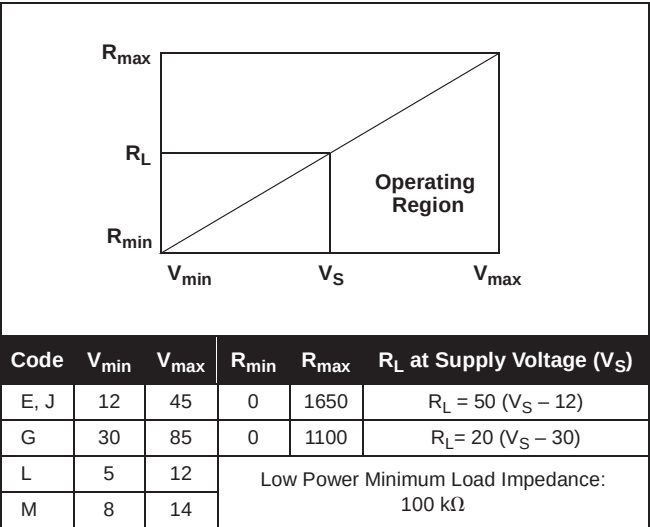
Power Supply

External power supply required. Transmitter operates on:

- 12 to 45 V dc with no load for Output Codes E and J.
- 30 to 85 V dc with no load for Output Code G.
- 5 to 12 V dc for Output Code L.
- 8 to 14 V dc for Output Code M.

Where:

FIGURE 6-1. Power Supply Load Limitations.



NOTE

For CSA Approvals (codes E and J), V_{max} = 42.4 V dc.

Current Consumption (Low Power Only)
Under Normal Operating Conditions

Output Code L

1.5 mA dc.

Output Code M

2.0 mA dc.

Span and Zero

Output Codes E, G, J, L, and M

Span and zero are continuously adjustable.

Hazardous Locations Certifications

Stainless steel certification tag is provided.

Factory Mutual (FM) Approvals

FM Explosion proof tag is standard. Appropriate tag will be substituted if optional certification is selected.

- Default** Explosion proof: Class I, Division 1, Groups B, C, D.
Dust-Ignition proof: Class II, Division 1, Groups E, F, G; Class III, Division 1. Indoor and outdoor use (NEMA 4X). Factory Sealed.
- I5** Intrinsically Safe: Class I, Division 1, Groups A, B, C, D; Class II, Division 1, Groups E, F, G; Class III, Division 1 when connected in accordance with Rosemount drawing 01151-0214 (See Appendix A).
Non-incendive: Class I, Division 2, Groups A, B, C, D.
- K5** Explosion proof, Intrinsic Safety, and Non-incendive combination.

Canadian Standards Association (CSA) Approvals

- E6** Explosion proof for Class I, Division 1, Groups C and D.
Dust-Ignition proof: Class II, Division 1, Groups E, F, and G; Class III, Division 1. Suitable for Class I, Division 2, Groups A, B, C, D. CSA Enclosure type 4X. Factory sealed.
- I6** Intrinsically Safe: Class I, Division 1, Groups A, B, C, D; Temperature Code T2D when connected in accordance with Rosemount drawing 01151-2575. (See Appendix A.)
- C6** Explosion proof, Division 2, and Intrinsic Safety combination.
- K6** Combined **E6**, **I6**, **E8**, and **I8**.

Standards Association of Australia (SAA)**E7 Flameproof**

Ex d IIB + H₂ T6.
Class I, Zone 1.

Dust-Ignition proof

DIP T6.
Class II.

Special Conditions: For transmitters having NPT or PG cable entry threads, an appropriate flame proof thread adaptor shall be used to facilitate application of certified flame proof cable glands.

I7 Intrinsically Safe

Ex ia IIC T6 ($T_{amb} = 40\text{ }^{\circ}\text{C}$).
Ex ia IIC T5 ($T_{amb} = 70\text{ }^{\circ}\text{C}$).
Class I, Zone 0. (See Appendix A.)

Special Conditions: Observe electrical connection parameters when installing transmitter.

N7 Type N

Ex n IIC T6 ($T_{amb} = 40\text{ }^{\circ}\text{C}$).
Ex n IIC T5 ($T_{amb} = 70\text{ }^{\circ}\text{C}$).
Class I, Zone 2.

Special Conditions: The equipment must be connected to a supply voltage which does not exceed the rated voltage. The enclosure endcaps must be correctly fitted whilst the equipment is energized.

CESI/CENELEC Approvals

E8 Flame proof

EEx d IIC T6.

I8 Intrinsically Safe

EEx ia IIC T6 ($T_{amb} = 40\text{ }^{\circ}\text{C}$); $P_{max} = 0.75\text{ W}$.

EEx ia IIC T5 ($T_{amb} = 55\text{ }^{\circ}\text{C}$); $P_{max} = 1.00\text{ W}$.

EEx ia IIC T5 ($T_{amb} = 80\text{ }^{\circ}\text{C}$); $P_{max} = 1.00\text{ W}$.

Special Conditions: When transient protection terminal options R1 or R9 are installed, the transmitter must be supplied from a galvanically isolated intrinsic safety barrier.

BASEEFA/CENELEC Approvals

I1 Intrinsically Safe

EEx ia IIC T5 ($T_{amb} = 40\text{ }^{\circ}\text{C}$).

EEx ia IIC T4 ($T_{amb} = 80\text{ }^{\circ}\text{C}$).

N1 Type N

Output Code E

Ex N II T6; $U_n = 28\text{ V}$.

Output Code F

Ex N II T5; $U_n = 45\text{ V}$.

Output Code J

Ex N II T5; $U_n = 30\text{ V}$; $I_n = 30\text{ mA}$.

Other Approvals

The Rosemount 1151 carries many other national and international approvals/certifications. Consult factory for other available options.

TABLE 6-4. Intrinsic Safety Entity Parameters.

BASEEFA (United Kingdom)	CESI (Italy)	SAA (Australia)
$U_{max,in} = 28\text{ V dc}$ $I_{max,in} = 120\text{ mA}$	$U_i = 30\text{ V}$ $I_i = 200\text{ mA}$ $P_i = 0.75\text{ W (T6)}$ $P_i = 1.0\text{ W (T4 and T5)}$ $C_i = 0.01\text{ }\mu\text{F}$ $L_i = 20\text{ }\mu\text{F}$	$U_i = 30\text{ V}$ $I_i = 200\text{ mA}$ $C_i = 0.034\text{ }\mu\text{F}$ $L_i = 20\text{ }\mu\text{H}$

Zero Elevation and Suppression**Output Codes E and G**

Zero elevation and suppression must be such that the lower range value is greater than or equal to the (–URL) and the upper range value is less than or equal to the (+URL). The calibrated span must be greater than or equal to the minimum span.

Output Code J

Zero is adjustable up to 10% of the calibrated flow span.

Output Code L

Zero is adjustable $\pm 10\%$ of URL and span is adjustable from 90 to 100% of URL.

Output Code M

Zero is adjustable $\pm 50\%$ of URL and span is adjustable from 50 to 100% of URL.

Temperature Limits**Electronics Operating**

Code E –40 to 200 °F (–40 to 93 °C).

Code G, L, M –20 to 200 °F (–29 to 93 °C).

Code J –20 to 150 °F (–29 to 66 °C).

Sensing element operating

Silicone fill: –40 to 220 °F (–40 to 104 °C).

Inert fill: 0 to 160 °F (–18 to 71 °C).

NOTE

When specifying Option Codes W4 and W6, sensing element operating temperatures are 32 to 200 °F (0 to 93 °C) for silicone fill and 32 to 160 °F (0 to 71 °C) for inert fill.

Storage

Codes E, G, L, M: –60 to 250 °F (–51 to 121 °C).

Code J: –60 to 180 °F (–51 to 82 °C).

Static Pressure Limits

Transmitters operate within specifications between the following limits:

Model 1151DP

0.5 psia (3.45 kPa) to 2,000 psig (13790 kPa).

Model 1151HP

0.5 psia (3.45 kPa) to 4,500 psig (31027 kPa).

Model 1151AP

0 psia to the URL.

Model 1151GP

0.5 psia (3.45 kPa) to the URL.

Overpressure Limits

Transmitters withstand the following limits without damage:

Model 1151DP

0 psia to 2,000 psig (0 to 13790 kPa).

Model 1151HP

0 psia to 4,500 psig (0 to 31027 kPa).

Model 1151AP

0 psia to 2,000 psia (0 to 13790 kPa).

Model 1151GP

Ranges 3–8: 0 psia to 2,000 psig (0 to 13790 kPa).

Range 9: 0 psia to 4,500 psig (31027 kPa).

Range 0: 0 psia to 7,500 psig (51710 kPa).

Burst Pressure Limit

All models: 10,000 psig (68.95 MPa) burst pressure on the flanges.

Humidity Limits

0 to 100% relative humidity.

Volumetric Displacement

Less than 0.01 in³ (0.16 cm³).

Damping

Numbers given are for silicone fill fluid at room temperature. The minimum time constant is 0.2 seconds (0.4 seconds for Range 3). Inert-filled sensor values would be slightly higher.

Output Codes E and G

Time constant continuously adjustable between minimum and 1.67 seconds.

Output Code J

Time constant continuously adjustable between minimum and 1.0 second.

Output Codes L, M

Damping is fixed at minimum time constant.

Turn-on Time

Maximum of 2.0 seconds with minimum damping. Low power output is within 0.2% of steady state value within 200 ms after application of power.

**PERFORMANCE
SPECIFICATIONS**

(Zero-based calibrated ranges, reference conditions, silicone oil fill, 316 SST isolating diaphragms.)

Accuracy

Output Codes E, G, L, and M

±0.2% of calibrated span for Model 1151DP Ranges 3 through 5.

All other ranges and transmitters, ±0.25% of calibrated span.

Output Code J

±0.25% of calibrated span.

Stability

Output Codes E and G

±0.2% of URL for six months for Ranges 3 through 5. (±0.25 for all other ranges.)

Output Codes J, L, and M

±0.25% of URL for six months.

Temperature Effect**Output Code E, G, L, and M****[-20 to 200 °F (-29 to 93 °C)]****For Ranges 4 through 0**Zero Error = $\pm 0.5\%$ URL per 100 °F.Total Error = $\pm(0.5\%$ URL + 0.5% of calibrated span) per 100 °F (56 °C); double the effect for Range 3.**Output Code J**

The total output effect, whether at zero or full scale, including zero and span errors is $\pm 1.5\%$ of URL per 100 °F (56 °C), or $\pm 2.5\%$ of URL per 100 °F (56 °C) for Range 3.

Static Pressure Effect**DP Transmitters****Zero Error:** $\pm 0.25\%$ of URL for 2,000 psi (13790 kPa) or $\pm 0.5\%$ for Range 3, correctable through rezeroing at line pressure.**Span Error:** Correctable to $\pm 0.25\%$ of input reading per 1,000 psi (6895 kPa), or to $\pm 0.5\%$ for Range 3. For Output Code J, the span error is correctable to $\pm 0.125\%$ of output reading per 1,000 psi, or to $\pm 0.25\%$ for Range 3.**HP Transmitters****Zero Error:** $\pm 2.0\%$ of URL for 4,500 psi (31027 kPa), correctable through rezeroing at line pressure.**Span Error:** Correctable to $\pm 0.25\%$ of input reading per 1,000 psi (6895 kPa). For Output Code J, the span error is correctable to $\pm 0.125\%$ of output reading per 1,000 psi (6895 kPa), or to $\pm 0.25\%$ for Range 3.**Vibration Effect**

0.05% of URL per g to 200 Hz in any axis.

Power Supply Effect**Output Codes E, G, and J**

Less than 0.005% of output span per volt.

Output Codes L, M

Output shift of less than 0.05% of URL for a 1 V dc power supply shift.

Load Effect**Output Codes E, G, and J**

No load effect other than the change in power supplied to the transmitter.

Output Codes L, MLess than 0.05% of URL effect for a change in load from 100 k Ω to infinite ohms.**Short Circuit Condition (Output Codes L and M only)**

No damage to the transmitter will result when the output is shorted to common or to power supply positive (limit 12 V).

EMI/RFI Effect

Output shift of less than 0.1% of span when tested to IEC 801-3 from 20 to 1000 MHz and for field strengths up to 30 V/m. (Output Code J is 0.1% of flow span.)

Mounting Position EffectZero shift of up to 1 inH₂O (0.24 kPa) that can be calibrated out. Range 3 transmitters with Output Code J should be installed with the diaphragm in the vertical plane.

**PHYSICAL
SPECIFICATIONS
(STANDARD
CONFIGURATION)**

Wetted Materials

Isolating Diaphragms

316L SST, Hastelloy C-276, Monel, gold-plated Monel, or Tantalum. See ordering table for availability per model type.

Drain/Vent Valves

316 SST, Hastelloy C, or Monel. See ordering table for availability per model type.

Process Flanges and Adaptors

Plated carbon steel, 316 SST, Hastelloy C, or Monel. See ordering table for availability per model type.

Wetted O-rings

Viton (other materials also available). With gold-plated Monel diaphragms (diaphragm Code _6), special fluorocarbon O-rings are supplied.

Non-wetted Materials

Fill Fluid

Silicone oil or inert fill.

Bolts and Bolting Flange (GP and AP only)

Plated carbon steel.

Electronics Housing

Low-copper aluminium. NEMA 4X. IP 65, IP 66.

Cover O-rings

Buna-N.

Paint

Polyurethane.

Process Connections

¼–18 NPT on 2.125-in. (54-mm) centers on flanges for Ranges 3, 4, and 5.

¼–18 NPT on 2.188-in. (56-mm) centers on flanges for Ranges 6 and 7.

¼–18 NPT on 2.250-in. (57-mm) centers on flanges for Range 8.

½–14 NPT on adaptors.

For Ranges 3, 4, and 5, flange adaptors can be rotated to give centers of 2.0 in. (51 mm), 2.125 in. (54 mm), or 2.250 in. (57 mm).

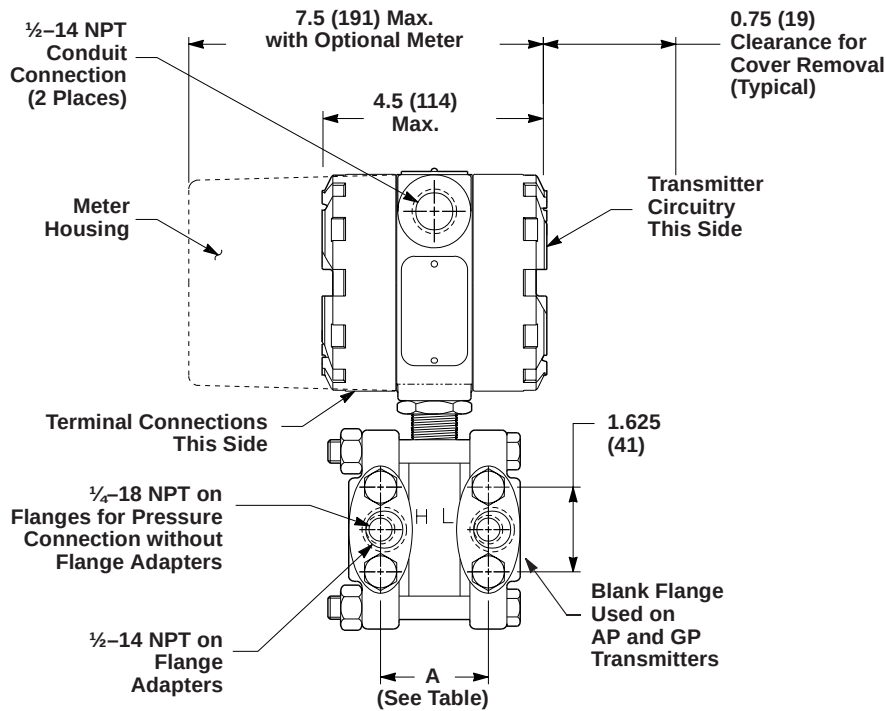
Electrical Connections

½–14 NPT conduit entry with screw terminals and integral test jacks compatible with miniature banana plugs (Pomona 2944, 3690, or equivalent).

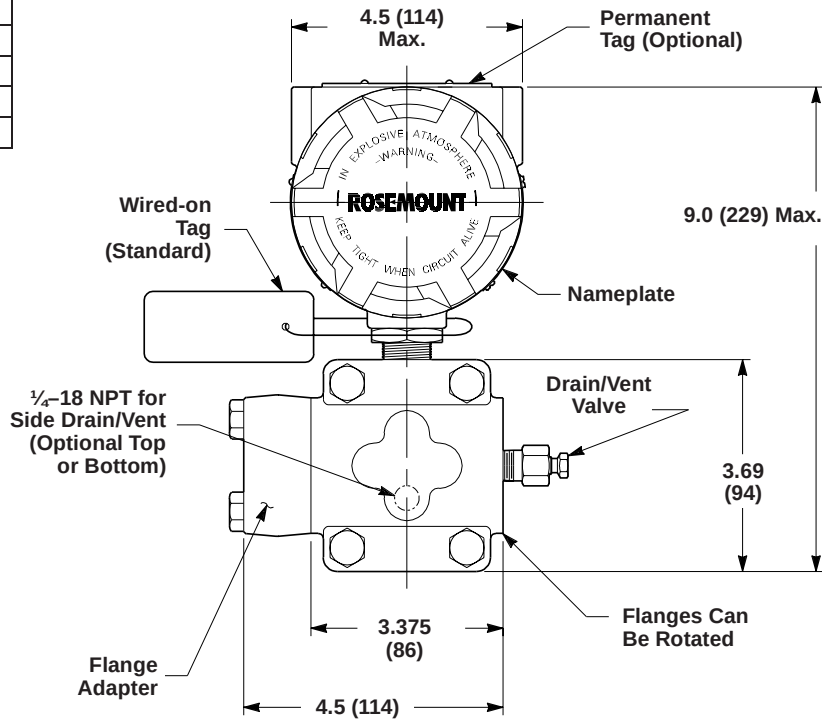
Weight

12 lb (5.4 kg) for AP, DP, GP, and HP transmitters, excluding options.

FIGURE 6-2. Dimensional Drawing for Model 1151 Transmitter.



Range	Flange Distance "A" Center to Center	
	inches	mm
3, 4, 5	2.125	54
6, 7	2.188	56
8	2.250	57
9	2.281	58
0	2.328	59



NOTE
Dimensions are in inches (millimeters).

1151-1151A, B05A

Model 1151 Alphaline® Pressure Transmitters

TABLE 6-5. Model 1151 Model Number Table.

					• = Applicable — =Not Applicable													
Model	Transmitter Type (select one)				DP	HP	GP	AP										
1151DP	Differential Pressure Transmitter				•	—	—	—										
1151HP	Differential Pressure Transmitter for High Line Pressures				—	•	—	—										
1151GP	Gage Pressure Transmitter				—	—	•	—										
1151AP	Absolute Pressure Transmitter				—	—	—	•										
Code	Pressure Ranges (URL) (select one)				DP	HP	GP	AP										
3	30 inH ₂ O (7.46 kPa)	<table><tr><th colspan="2">Rangeability</th></tr><tr><th>Output Code</th><th>Min.Span</th></tr><tr><td>E, G, J</td><td>URL/6</td></tr><tr><td>L</td><td>URL/1.1</td></tr><tr><td>M</td><td>URL/2</td></tr></table>			Rangeability		Output Code	Min.Span	E, G, J	URL/6	L	URL/1.1	M	URL/2	•	—	•	—
Rangeability																		
Output Code	Min.Span																	
E, G, J	URL/6																	
L	URL/1.1																	
M	URL/2																	
4	150 inH ₂ O (37.3 kPa)				•	•	•	•										
5	750 inH ₂ O (186.4 kPa)	•	•	•	•													
6	100 psi (689.5 kPa)	•	•	•	•													
7	300 psi (2068 kPa)	•	•	•	•													
8	1,000 psi (6895 kPa)	•	—	•	•													
9	3,000 psi (20684 kPa)	—	—	•	—													
0	6,000 psi (41369 kPa)	—	—	•	—													
Code	Transmitter Output (select one)				DP	HP	GP	AP										
E	4–20 mA, Linear, Analog/Variable Damping				•	•	•	•										
G	10–50 mA, Linear, Analog/Variable Damping				•	•	•	•										
J	4–20 mA, Square Root, Analog/Variable Damping				•	•	—	—										
L	0.8 to 3.2 V, Linear, Low Power/Fixed Damping				•	•	•	•										
M	1 to 5 V, Linear, Low Power/Fixed Damping				•	•	•	•										
Code	MATERIALS OF CONSTRUCTION ⁽¹⁾				DP	HP	GP ⁽²⁾	AP ⁽²⁾										
	Flanges/Adaptors	Drain/Vents	Diaphragms	Fill Fluid														
52	Nickel-plated Carbon Steel	316 SST	316L SST	Silicone	•	•	•	•										
53	Nickel-plated Carbon Steel	316 SST	<i>Hastelloy C</i>	Silicone	•	•	•	•										
54	Nickel-plated Carbon Steel	316 SST	<i>Monel</i>	Silicone	•	•	•	•										
55	Nickel-plated Carbon Steel	316 SST	Tantalum	Silicone	•	—	•	—										
56	Nickel-plated Carbon Steel	316 SST	Gold-plated <i>Monel</i>	Silicone	•	—	•	—										
12	Plated Carbon Steel	316 SST	316L SST	Silicone	•	•	•	•										
22	316 SST	316 SST	316L SST	Silicone	•	•	•	•										
23	316 SST	316 SST	<i>Hastelloy C</i>	Silicone	•	•	•	•										
24	316 SST	316 SST	<i>Monel</i>	Silicone	•	•	•	•										
25	316 SST	316 SST	Tantalum	Silicone	•	—	•	—										
26	316 SST	316 SST	Gold-plated <i>Monel</i>	Silicone	•	—	•	—										
33	<i>Hastelloy C</i>	<i>Hastelloy C</i>	<i>Hastelloy C</i>	Silicone	•	•	•	•										
34	<i>Hastelloy C</i>	<i>Hastelloy C</i>	<i>Monel</i>	Silicone	•	—	•	—										
35	<i>Hastelloy C</i>	<i>Hastelloy C</i>	Tantalum	Silicone	•	—	•	—										
36	<i>Hastelloy C</i>	<i>Hastelloy C</i>	Gold-plated <i>Monel</i>	Silicone	•	—	•	—										
43	<i>Monel</i>	<i>Monel</i>	<i>Hastelloy C</i>	Silicone	•	•	•	•										
44	<i>Monel</i>	<i>Monel</i>	<i>Monel</i>	Silicone	•	•	•	•										
45	<i>Monel</i>	<i>Monel</i>	Tantalum	Silicone	•	—	•	—										
46	<i>Monel</i>	<i>Monel</i>	Gold-plated <i>Monel</i>	Silicone	•	—	•	—										
73 ⁽³⁾	316 SST	<i>Hastelloy C</i>	<i>Hastelloy C</i>	Silicone	•	•	•	•										
83 ⁽³⁾	Nickel-plated Carbon Steel	<i>Hastelloy C</i>	<i>Hastelloy C</i>	Silicone	•	•	•	•										
5A	Nickel-plated Carbon Steel	316 SST	316L SST	Inert	•	—	•	—										
5B	Nickel-plated Carbon Steel	316 SST	<i>Hastelloy C</i>	Inert	•	—	•	—										
5C	Nickel-plated Carbon Steel	316 SST	<i>Monel</i>	Inert	•	—	•	—										
5D	Nickel-plated Carbon Steel	316 SST	Tantalum	Inert	•	—	•	—										
1A	Plated Carbon Steel	316 SST	316L SST	Inert	•	—	•	—										
2A	316 SST	316 SST	316L SST	Inert	•	—	•	—										
2B	316 SST	316 SST	<i>Hastelloy C</i>	Inert	•	—	•	—										
2D	316 SST	316 SST	Tantalum	Inert	•	—	•	—										
3B	<i>Hastelloy C</i>	<i>Hastelloy C</i>	<i>Hastelloy C</i>	Inert	•	—	•	—										
3D	<i>Hastelloy C</i>	<i>Hastelloy C</i>	Tantalum	Inert	•	—	•	—										
4B	<i>Monel</i>	<i>Monel</i>	<i>Hastelloy C</i>	Inert	•	—	•	—										
4C	<i>Monel</i>	<i>Monel</i>	<i>Monel</i>	Inert	•	—	•	—										
4D	<i>Monel</i>	<i>Monel</i>	Tantalum	Inert	•	—	•	—										
7B ⁽³⁾	316 SST	<i>Hastelloy C</i>	<i>Hastelloy C</i>	Inert	•	—	•	—										
8B ⁽³⁾	Nickel-plated Carbon Steel	<i>Hastelloy C</i>	<i>Hastelloy C</i>	Inert	•	—	•	—										

(1) Bolts and conduit plugs are plated carbon steel.

(2) On GP and AP transmitters, the low-side flange is plated carbon steel. For a stainless-steel low-side flange, order process connections Option Code D6.

(3) These selections meet NACE material recommendations per MR01-75.

TABLE 6-5. (continued).

Code	Mounting Brackets (optional – select one)	DP	HP	GP	AP
B1	Bracket, 2-in. Pipe Mount	•	•	•	•
B2	Bracket, Panel Mount	•	•	•	•
B3	Bracket, Flat, 2-in. Pipe Mount	•	•	•	•
B4	B1 Bracket with 316 SST Bolts	•	•	•	•
B5	B2 Bracket with 316 SST Bolts	•	•	•	•
B6	B3 Bracket with 316 SST Bolts	•	•	•	•
B7	316 SST B1 Bracket with 316 SST Bolts	•	•	•	•
B9	316 SST B3 Bracket with 316 SST Bolts	•	•	•	•
Code	Meters (optional – select one)	DP	HP	GP	AP
M1 ⁽¹⁾	Analog Scale, Linear Meter, 0–100%	•	•	•	•
M2 ⁽²⁾	Analog Scale, Square Root Meter, 0–100% Flow	•	•	—	—
M3 ⁽¹⁾	Analog Scale, Linear Meter, Special Scale	•	•	•	•
M4 ⁽³⁾	LCD Display, Linear Meter, 0–100% scale, User Selectable	•	•	•	•
M6 ⁽²⁾	Analog Scale, Square Root Meter, 0–10√	•	•	—	—
M7 ⁽³⁾	LCD Display, Linear Meter, Special Configuration	•	•	•	•
M8 ⁽²⁾⁽³⁾	LCD Display Square Root Meter, 0–100% Flow	•	•	—	—
M9 ⁽²⁾⁽³⁾	LCD Display, Square Root Meter, 0–10√	•	•	—	—
Code	Certifications (optional – select one)	DP	HP	GP	AP
	NOTE FM explosion-proof approval is standard.				
I5 ⁽⁴⁾	Factory Mutual (FM) Non-incendive and Intrinsic Safety Approval	•	•	•	•
K5 ⁽⁴⁾	Combination of E5 and I5.	•	•	•	•
E6	Canadian Standards Association (CSA) Explosion-Proof Approval, 42.4 V dc max.	•	•	•	•
I6 ⁽⁴⁾	Canadian Standards Association (CSA) Intrinsic Safety Approval, 42.4 V dc max.	•	•	•	•
C6 ⁽⁴⁾	Combination of I6 and E6; CSA Explosion-Proof and Intrinsic Safety Approval (Requires 42.4 V dc max. power supply)	•	•	•	•
K6 ⁽⁴⁾	CSA/CENELEC Explosion-Proof and Intrinsic Safety Approval	•	•	•	•
E7	Standards Association of Australia (SAA) Flameproof Certification	•	•	•	•
I7 ⁽⁶⁾	Standards Association of Australia (SAA) Intrinsic Safety Certification	•	•	•	•
N7	Standards Association of Australia (SAA) Type N Certification	•	•	•	•
E8	CESI/CENELEC Flameproof Certification	•	•	•	•
I8 ⁽⁵⁾	CESI/CENELEC Intrinsic Safety Certification	•	•	•	•
I1 ⁽⁶⁾	BASEEFA/CENELEC Intrinsic Safety Certification	•	•	•	•
N1 ⁽⁷⁾	BASEEFA Type N Certification	•	•	•	•
IC ⁽⁶⁾	Schweizerischer Elektrotechnischer Verein (SEV) Intrinsic Safety Certification	•	•	•	•
Code	Housing (optional – select one)	DP	HP	GP	AP
H1	SST Non-wetted Parts on Transmitter without Meter	•	•	•	•
H2	SST Non-wetted Parts on Transmitter with Meter	•	•	•	•
H3	SST Housing, Covers, Conduit Plug, Lock-nut, Without Meter	•	•	•	•
H4	SST Housing, Covers, Conduit Plug, Lock-nut, With Meter	•	•	•	•
J1 ⁽⁸⁾	Aluminum Housing, JIS G ½ Female Electrical Connection	•	•	•	•
Code	Terminal Blocks (optional – select one)	DP	HP	GP	AP
R1 ⁽⁹⁾	Integral Transient Protection (Only Available with E Electronics)	•	•	•	•
Code	Bolts for Flanges and Adaptors (optional – select one)	DP	HP	GP	AP
L3	ASTM A193-B7 Flange and Adaptor Bolts	•	•	•	•
L4	316 SST Flange and Adaptor Bolts	•	•	•	•
L5	ASTM A193-B7M Flange and Adaptor Bolts	•	•	•	•

(1) Not available with Output Codes L or M, or Option Codes Zx, V2, or V3.

(2) Not available with Output Codes J, L, M, or Option Codes Zx, V2, or V3.

(3) Not available with Output Codes G, L, M, or Option Codes Zx, V2, or V3.

(4) Not available with Output Code G or option Zx.

(5) Not available with Output Codes G, J, L, M, S, or option Zx.

(6) Not available with Output Codes G, J, L, M, or option Zx.

(7) Not available with Output Codes G, L, M, or option Zx.

(8) Valid with E4 approval, JIS Explosion-Proof. No other approvals apply.

(9) Not available with I1.

Model 1151 Alphaline® Pressure Transmitters

TABLE 6-5. (continued).

Code	Process Connections (optional) ⁽¹⁾	DP	HP	GP	AP
D1	Side Drain/Vent, Top	•	•	•	•
	316 SST	•	•	•	•
	Hastelloy	•	•	•	•
	Monel	•	•	•	•
D2	Side Drain/Vent, Bottom	•	•	•	•
	316 SST	•	•	•	•
	Hastelloy	•	•	•	•
	Monel	•	•	•	•
D3	Process Adaptors Deleted	•	•	•	•
	316 SST	•	•	•	•
	Hastelloy	•	•	•	•
	Monel	•	•	•	•
D9 ⁽²⁾	JIS Rc ¼ flanges and Rc ½ adapters	•	•	•	•
	316 SST	•	•	•	•
	Hastelloy	•	•	•	•
	Monel	•	•	•	•
D6	316 SST Low Side Blank Flange	—	—	•	•
K1 ⁽³⁾	Kynar insert, ¼–18 NPT	•	—	•	•
K2 ⁽³⁾	Kynar insert, ½–14 NPT	•	—	•	•
S1 ⁽⁴⁾	Attachment of One Remote Seal - See PDS 00813-0100-4016 for Ordering Information	•	—	•	—
S2 ⁽⁴⁾	Attachment of Two Remote Seals - See PDS 00813-0100-4016 for Ordering Information	•	—	—	—
S4 ⁽⁵⁾	Attachment of Integral Orifice Assembly - See PDS 00813-0100-4686 for Ordering Information	•	•	—	—
Code	Wetted O-ring Material	DP	HP	GP	AP
W2	Buna-N	•	•	•	•
W3	Ethylene-Propylene	•	•	•	•
W4	Aflas	•	•	•	•
W6 ⁽⁶⁾	Spring-loaded Teflon	•	—	•	•
Code	Procedures	DP	HP	GP	AP
P1	Hydrostatic Testing, 150% Maximum Working Pressure (125% for GP 10)	•	•	•	•
P2	Cleaning for Special Service	•	•	•	—
P3 ⁽⁷⁾	Cleaning for < 1 PPM Chlorine/Fluorine	•	•	•	•
P4	Calibrate at Line Pressure	•	•	—	•
P5	Calibrate at Specific Temperature	•	•	•	•
P7 ⁽⁸⁾	Improved Temperature Coefficient	•	•	•	•
P8 ⁽⁹⁾	Calibrate to 0.1% Accuracy	•	•	•	—
Code	Outputs	DP	HP	GP	AP
V1	Reverse Output	—	—	•	—
V2 ⁽¹⁰⁾	4–20 mV Test Signal	•	•	•	•
V3 ⁽¹⁰⁾	20–100 mV Test Signal	•	•	•	•
Z1 ⁽¹¹⁾	4-wire, 0–20 mA Output	•	•	•	•
Z2 ⁽¹¹⁾	4-wire, 0–16 mA Output	•	•	•	•
Z3 ⁽¹¹⁾	4-wire, 0–10 mA Output	•	•	•	•
Typical Model Number: 1151DP 4 S 52 B3 M1					

(1) Allowable combinations are: D1-D3-D6, D2-D3-D6, and D6-S1.

(2) Valid with E4, JIS Explosion Proof approval when used in combination with J1. No other approvals apply.

(3) The Maximum working pressure on this option is 300 psig.

(4) This options may only be used on ranges 4 through 8.

(5) This option has a maximum static pressure rating of 3,000 psi, and is available for factory assembly only without associated piping and is available only for ranges 2, 3, 4, and 5.

(6) Contains a Hastelloy spring that is wetted by the process; consult factory for Teflon O-ring without a spring (ranges 3-8 only).

(7) Flourolube grease on wetted O-rings.

(8) Not available on range 10: limited to 1,500 psi on range 9.

(9) Available only with stainless steel isolators and for span of 10 inH₂O and greater; available only with Output Codes E, G, L, or M; not available on AP or DR transmitters.

(10) Not available with Output Codes L or M.

(11) Not available with Option Codes Mx, Vx, Ix, or Ex, or Output Codes G, L, M.

TABLE 6-6. Model 1151 Spare Parts List.

Electronics – One spare part recommended for every 25 transmitters.		
Part Description	Item No.	Part Number
E Output Code, 4–20 mA dc Amplifier Circuit Board Calibration Circuit Board	4 6	01151-0137-0001 01151-0139-0001
G Output Code, 10–50 mA dc Amplifier Circuit Board Calibration Circuit Board	4 6	01151-0597-0001 01151-0139-0001
J Output Code, 4–20 mA dc, Square Root Amplifier Circuit Board Calibration Circuit Board	4 6	01151-0378-0001 01151-0377-0001
L Output Code, 0.8–3.2 V, Low Power Amplifier Circuit Board Calibration Circuit Board	4 6	01151-0507-0001 01151-0509-0001
M Output Code Amplifier Circuit Board Calibration Circuit Board	4 6	01151-0507-0002 01151-0509-0002
Sensor Modules (Silicon Fill)–One spare part recommended for every 50 transmitters.		
Part Description	Item No.	Part Number
Range 3 DP, GP (URL=30 inH₂O) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0011-0032 01151-0011-0033 01151-0011-0034 01151-0011-0035 01151-0011-0036
Range 4 DP, GP (URL=150 inH₂O) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0011-0042 01151-0011-0043 01151-0011-0044 01151-0011-0045 01151-0011-0046
Range 4 HP (URL=150 inH₂O) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0112-0042 01151-0112-0043 01151-0112-0044
Range 4 AP (URL=11 inH₂A) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0054-0042 01151-0054-0043 01151-0054-0044

(continued on next page)

TABLE 6-6. (continued).

Sensor Modules (Silicon Fill)–One spare part recommended for every 50 transmitters.		
Part Description	Item No.	Part Number
Range 5 DP, GP (URL=750 inH₂O) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0011-0052 01151-0011-0053 01151-0011-0054 01151-0011-0055 01151-0011-0056
Range 5 HP (URL=750 inH₂O) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0112-0052 01151-0112-0053 01151-0112-0054
Range 5 AP (URL=55 inH_gA) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0054-0052 01151-0054-0053 01151-0054-0054
Range 6 DP (URL=100 psid) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0041-0062 01151-0041-0063 01151-0041-0064 01151-0041-0065 01151-0041-0066
Range 6 GP (URL=100 psig) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0041-0162 01151-0041-0163 01151-0041-0164 01151-0041-0165 01151-0041-0166
Range 6 HP (URL=100 psid) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0112-0062 01151-0112-0063 01151-0112-0064
Range 6 AP (URL=100 psia) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0054-0062 01151-0054-0063 01151-0054-0064
Range 7 DP (URL=300 psid) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0041-0072 01151-0041-0073 01151-0041-0074 01151-0041-0075 01151-0041-0076
Range 7 GP (URL=300 psig) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0041-0172 01151-0041-0173 01151-0041-0174 01151-0041-0175 01151-0041-0176

(continued on next page)

TABLE 6-6. (continued).

Sensor Modules (Silicon Fill) (continued) –One spare part recommended for every 50 transmitters.		
Part Description	Item No.	Part Number
Range 7 HP (URL=300 psid) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0112-0072 01151-0112-0073 01151-0112-0074
Range 7 AP (URL=300 psia) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0054-0072 01151-0054-0073 01151-0054-0074
Range 8 DP (URL=1,000 psid) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0041-0082 01151-0041-0083 01151-0041-0084 01151-0041-0085 01151-0041-0086
Range 8 GP (URL=1,000 psig) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0041-0182 01151-0041-0183 01151-0041-0184 01151-0041-0185 01151-0041-0186
Range 8 AP (URL=1,000 psia) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0054-0082 01151-0054-0083 01151-0054-0084
Range 9 GP (URL=3,000 psig) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0112-0192 01151-0112-0193 01151-0112-0194
Range 10 GP (URL=6,000 psig) 316L SST <i>Hastelloy C-276</i> <i>Monel</i>	19	01151-0112-0002 01151-0112-0003 01151-0112-0004

(continued on next page)

TABLE 6-6. (continued).

Sensor Modules (Inert Fill)—One spare part recommended for every 50 transmitters.		
Part Description	Item No.	Part Number
Range 3 DP, GP (URL=30 inH₂O) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0230-0032 01151-0230-0033 01151-0230-0034 01151-0230-0035 01151-0230-0036
Range 4 DP, GP (URL=150 inH₂O) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0230-0042 01151-0230-0043 01151-0230-0044 01151-0230-0045 01151-0230-0046
Range 5 DP, GP (URL=750 inH₂O) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum Gold-plated <i>Monel</i>	19	01151-0230-0052 01151-0230-0053 01151-0230-0054 01151-0230-0055 01151-0230-0056
Range 6 DP (URL=100 psid) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum	19	01151-0230-0062 01151-0230-0063 01151-0230-0064 01151-0230-0065
Range 6 GP (URL=100 psig) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum	19	01151-0230-0162 01151-0230-0163 01151-0230-0164 01151-0230-0165
Range 7 DP (URL=300 psid) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum	19	01151-0230-0072 01151-0230-0073 01151-0230-0074 01151-0230-0075
Range 7 GP (URL=300 psig) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum	19	01151-0230-0172 01151-0230-0173 01151-0230-0174 01151-0230-0175
Range 8 DP (URL=1,000 psid) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum	19	01151-0230-0082 01151-0230-0083 01151-0230-0084 01151-0230-0085
Range 8 GP (URL=1,000 psig) 316L SST <i>Hastelloy C-276</i> <i>Monel</i> Tantalum	19	01151-0230-0182 01151-0230-0183 01151-0230-0184 01151-0230-0185

(continued on next page)

TABLE 6-6. (continued).

Housings, Covers, Flanges, And Valves – One spare part recommended for every 25 transmitters.		
Part Description	Item No.	Part Number
Electronics Housing	7	01151-0060-0007
Electronics Cover	1	01151-1045-0001
Process Flange Nickel-plated Carbon Steel Plated Carbon Steel 316 SST <i>Hastelloy C-276</i> <i>Monel</i>	17	01151-0236-0005 01151-0236-0001 01151-0213-0002 01151-0213-0004 01151-0213-0003
Process Flange for Side Drain/Vent Valve Nickel-plated Carbon Steel Plated Carbon Steel 316 SST <i>Hastelloy C-276</i> <i>Monel</i>		01151-0236-0015 01151-0236-0011 01151-0213-0012 01151-0213-0014 01151-0213-0013
Blank Flange Plated Carbon Steel	23	90043-0046-0001
Flange Adapter Nickel-plated Carbon Steel Plated Carbon Steel 316 SST <i>Hastelloy C-276</i> <i>Monel</i>	21	01151-0211-0005 90001-0033-0001 01151-0211-0002 01151-0211-0004 01151-0211-0003
DP and HP Valve Stem and Seat, 316 SST ⁽¹⁾	14,15	01151-0028-0022
GP and AP Valve Stem and Seat, 316 SST ⁽¹⁾	14,15	01151-0028-0012
DP and HP Valve Stem and Seat, 316 SST, <i>Hastelloy C</i> ⁽¹⁾	14,15	01151-0028-0023
GP and AP Valve Stem and Seat, 316 SST, <i>Hastelloy C</i> ⁽¹⁾	14,15	01151-0028-0013
DP and HP Valve Stem and Seat, 316 SST, <i>Monel</i> ⁽¹⁾	14,15	01151-0028-0024
GP and AP Valve Stem and Seat, 316 SST, <i>Monel</i> ⁽¹⁾	14,15	01151-0028-0014
Plug, 316 SST (used with side drain/vent)		C50246-0002
Plug, <i>Hastelloy C</i> (used with side drain/vent)		01151-0063-0001
Plug, <i>Monel</i> (used with side drain/vent)		01151-0063-0002
Hardware—One spare part recommended for every 50 transmitters.		
Part Description	Item No.	Part Number
Adjustment Kit Adjustment Screw O-ring for Adjustment Screw Retaining Ring	10 11 12	01151-0029-0001
O-ring for Adjustment Screw (pkg of 12)	11	01151-0032-0001
O-ring for Electronics Cover (pkg of 12)	2	01151-0033-0003
O-ring for Process Flange, <i>Viton</i> (pkg of 12)	18	01151-0034-0020
O-ring for Process Flange, <i>Viton</i> and Backup Ring (pkg of 4)	18	01151-0034-0014
O-ring for Process Flange, Buna-N (pkg of 12)	18	01151-0034-0002
O-ring for Process Flange, Buna-N and Backup Ring (pkg of 4)	18	01151-0034-0016
O-ring for Process Flange, Ethylene-propylene (pkg of 12)	18	01151-0034-0004
O-ring for Process Flange, Ethylene-propylene and Backup Ring (pkg of 4)	18	01151-0034-0015
O-ring for Process Flange, <i>Aflas</i> (pkg of 4) ⁽²⁾	18	01151-0034-0019
O-ring for Flange Adapter, <i>Viton</i> (pkg of 12)	20	01151-0035-0009

(continued on next page)

(1) Package contains quantity required for one transmitter.

(2) Kit contains enough parts for two differential or four gage/absolute transmitters. Backup rings are included.

TABLE 6-6. (continued).

Hardware (continued)—One spare part recommended for every 50 transmitters.		
Part Description	Item No.	Part Number
O-ring for Flange Adapter, Buna-N (pkg of 12)	20	01151-0035-0002
O-ring for Flange Adapter, Ethylene-propylene (pkg of 12)	20	01151-0035-0004
O-ring for Flange Adapter, <i>Aflas</i> (pkg of 12) ⁽¹⁾	20	01151-0035-0008
O-ring for Flange Adapter, <i>Teflon</i> with <i>Hastelloy C</i> Spring (pkg of 4)	20	01151-0034-0021
Electronics Assembly Hardware⁽²⁾		01151-0030-0001
Standoff	8	
Standoff	5	
Screw	9	
Screw	3	
Locknut		
DP and HP Flange Kits, Carbon Steel⁽¹⁾		01151-0031-0001
Bolt for Flange Adapter	22	(DP & HP Ranges 3–7) or
Bolt for Process Flange	13	01151-0031-0034
Nut for Process Flange	16	(DP Range 8)
GP and AP Flange Kits, Carbon Steel⁽¹⁾		01151-0031-0002
Bolt for Flange Adapter, Carbon Steel	22	(AP Ranges 4–7,
Bolt for Process Flange, Carbon Steel	13	GP Ranges 3–7)
Nut for Process Flange, Carbon Steel	16	or
		01151-0031-0035
		(AP & GP Range 8)
		or
		01151-0031-0003 (GP Range 9)
		or
		01151-0031-0019
		(GP Range 0)
DP and HP Flange Kits, 316 SST⁽¹⁾		01151-0031-0023
Bolt for Flange Adapter	22	(DP & HP Ranges 3–7) or
Bolt for Process Flange	13	01151-0031-0038
Nut for Process Flange	16	(DP Range 8)
GP and AP Flange Kits, 316 SST⁽¹⁾		01151-0031-0024
Bolt for Flange Adapter, 316 SST	22	(AP Ranges 4–7,
Bolt for Process Flange, 316 SST	13	GP Ranges 3–7)
Nut for Process Flange, 316 SST	16	or
		01151-0031-0039
		(AP & GP Range 8)
		or
		01151-0031-0025 (GP Range 9)
		or
		01151-0031-0026
		(GP Range 0)
DP and HP Flange Kits, ANSI 193-B7⁽¹⁾		01151-0031-0012
Bolt for Flange Adapter	22	(DP & HP Ranges 3–7) or
Bolt for Process Flange	13	01151-0031-0036
Nut for Process Flange	16	(DP Range 8)
GP and AP Flange Kits, ANSI 193-B7⁽¹⁾		01151-0031-0013
Bolt for Flange Adapter, ANSI 193-B7	22	(AP Ranges 4–7,
Bolt for Process Flange, ANSI 193-B7	13	GP Ranges 3–7)
Nut for Process Flange, ANSI 193-B7	16	or
		01151-0031-0037
		(AP & GP Range 8)
		or
		01151-0031-0014 (GP Range 9)
		or
		01151-0031-0022
		(GP Range 0)

(continued on next page)

(1) Part number is for package of 12 O-rings—only two required per transmitter.

(2) Package contains quantity required for one transmitter.

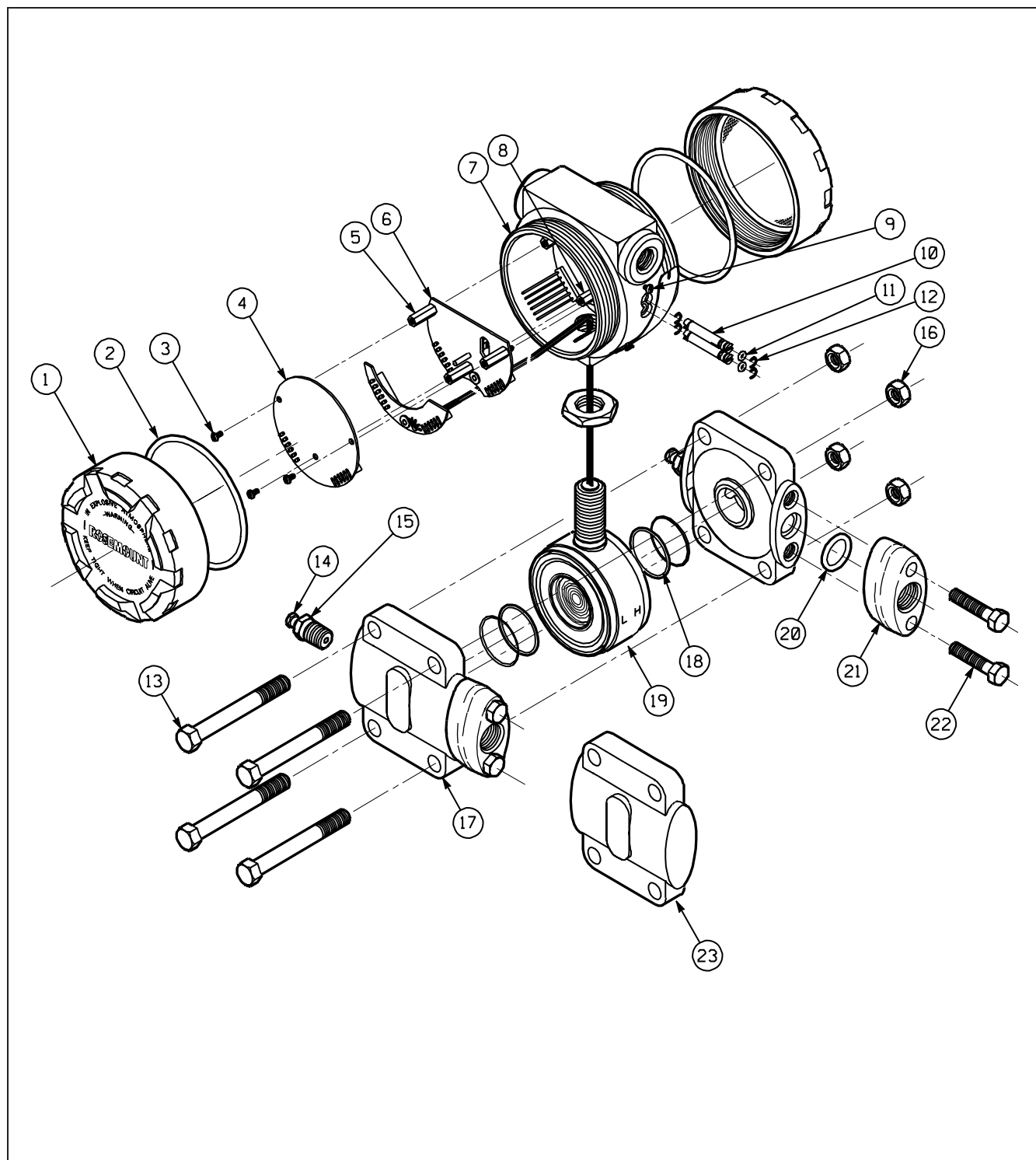
TABLE 6-6. (continued).

Indicating Meters		
Part Description	Item No.	Part Number
Analog Meter Kit, 4–20 mA dc, Linear Scale ⁽¹⁾		01151-1046-0007
Analog Meter Kit, 4–20 mA dc, Square Root, 0–100% Flow		01151-1046-0009
Analog Meter Kit, 10–50 mA dc, Linear Scale ⁽¹⁾		01151-1046-0011
Analog Meter Kit, 10–50 mA dc, Square Root, 0–100% Flow		01151-1046-0013
I.S. Approved Analog Meter Kit, 4–20 mA dc, Linear Scale ⁽¹⁾		01151-2615-0007
I.S. Approved Analog Meter Kit, 4–20 mA dc, Square Root, 0–100% Flow		01151-2615-0009
I.S. Approved Analog Meter Kit, 10–50 mA dc, Linear Scale ⁽¹⁾		01151-2615-0011
I.S. Approved Analog Meter Kit, 10–50 mA dc, Square Root, 0–100% Flow		01151-2615-0013
LCD Meter Kit, Linear, 0–100% Flow		01151-1046-0019
LCD Meter Kit, Square Root, 0–100% Flow		01151-1046-0021
Analog Meter, 4–20 mA dc, Linear Scale		01151-0687-0004
Analog Meter, 4–20 mA dc, Square Root, 0–100% Flow		01151-0687-0005
Analog Meter, 4–20 mA dc, Square Root, 0–10 √		01151-0687-0008
Analog Meter, 10–50 mA dc, Linear Scale		01151-0687-0006
Analog Meter, 10–50 mA dc, Square Root, 0–100% Flow		01151-0687-0007
Analog Meter, 10–50 mA dc, Square Root, 0–10 √		01151-0687-0009
I.S. Approved Analog Meter, 4–20 mA dc, Linear Scale		01151-2614-0004
I.S. Approved Analog Meter, 4–20 mA dc, Square Root, 0–100% Flow		01151-2614-0005
I.S. Approved Analog Meter, 4–20 mA dc, Square Root, 0–10 √		01151-2614-0008
I.S. Approved Analog Meter, 10–50 mA dc, Linear Scale		01151-2614-0006
I.S. Approved Analog Meter, 10–50 mA dc, Square Root, 0–100% Flow		01151-2614-0007
I.S. Approved Analog Meter, 10–50 mA dc, Square Root, 0–10 √		01151-2614-0009
Special Scale for Analog Meter		See note (1) below
LCD Meter, Linear, 0–100%		01151-1300-1000
LCD Meter, Square Root, 0–100% Flow		01151-1300-1001
LCD Meter, Special Configuration ⁽²⁾		01151-1300-1000
LCD Meter Engineering Unit Labels		01151-1351-1001
Mounting Hardware and Cover Assembly Kit		01151-1046-0005
Mounting Hardware Kit		01151-1046-0006
Cover Assembly Kit		01151-1047-0001
O-ring for Cover (pkg of 12)		01151-0033-0003
Mounting Brackets		
Part Description	Item No.	Part Number
B1—Right-angle Bracket for 2-in. Pipe Mounting		01151-0036-0001
B2—Right-angle Bracket for Panel Mounting		01151-0036-0004
B3—Flat Bracket for 2-in. Pipe Mounting		01151-0036-0005
B4—Bracket for 2-in. Pipe with Series 300 SST Bolts		01151-0036-0003
B5—Bracket for Panel with Series 300 SST Bolts		01151-0036-0006
B6—Flat Bracket for 2-in. Pipe with Series 300 SST Bolts		01151-0036-0007
B7—316 SST B1 Bracket with 316 SST Bolts		01151-0036-0021
B9—316 SST B3 Bracket with 316 SST Bolts		01151-0036-0022

(1) Meter kit includes meter, mounting hardware, and cover assembly. For meters with special scaling, order the appropriate meter and specify the scale desired. Mounting hardware and cover assembly must be ordered separately.

(2) To order a meter with a special configuration, order the appropriate meter and indicate configuration desired.
To order a special configuration LCD meter kit, order the meter, and the mounting hardware and cover assembly kit separately.

FIGURE 6-3. Model 1151 Analog
Pressure Transmitter Exploded View
with Item Numbers.



1151-1151A02A

Approval Drawings

Rosemount Drawing 01151-0214, Rev. V, 6 Sheets:
Index of Intrinsically Safe Barrier Systems and Entity Parameters for
444, 1135, 1144, 1151, and 2051 Transmitters and 751 Field Indicators.

Rosemount Drawing 01151-2575, Rev. C, 3 Sheets:
Index of CSA Intrinsically Safe Barrier Systems for Model 1151
Transmitters.

Rosemount Drawing 01151-2576, Rev. C, 2 Sheets:
Entity Drawing: 1151 SAA Intrinsic Safety Configuration.

REVISIONS						
LTR	DESCRIPTION	ECO. NO.	REV. BY	APPR	DATE	
P	Change entity parameters (Fm on re-exam) correct 444 CI	637376	WVR	WVR	9/28/90	
R	Add 1151 Low Power Barrier System, Model 751 LI to 0	638105		WVR	4/28/92	
T	1135, 1144, 1151 LI TO Ø	639039	SVC	WVR	1/21/91	
U	1151 LI TO 20; CI .01 AND .034	651426	SVC	WVR	12/11/92	
V	751 LI TO Ø	662242		QSE	11/17/94	

CONTENTS	
ENTITY APPROVALS	SHEETS 2 THRU 4
APPROVED PARAMETERS	SHEETS 2 THRU 3
CONNECTION DIAGRAMS	SHEET 4

MASTER

APPROVED SOURCES OF SUPPLY	
MFG	MFG. PART NO.

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.

TOLERANCES:

DECIMALS	FRACTIONS
± .1	11/32
XX ± .02	ANGLES
XXX ± .010	± 2°

Material purchased to this Rosemount Specification Control Drawing shall be required to meet all the specifications of this drawing. Any mention of manufacturer's part number within this drawing is for reference only. This is necessary to ensure design control of Rosemount's end product. It is Rosemount's intent to purchase your standard material whenever possible.

SPECIFICATION CONTROL DRAWING

PREPARED BY: <i>Nancy New</i>	DATE: <i>9/28/90</i>	ROSEMOUNT ® Measurement Control Analysis Valves	TITLE INDEX OF INTRINSICALLY SAFE BARRIER SYSTEMS & ENTITY PARAMETERS FOR 444, 1135, 1144, 1151 & 2051 TRANSMITTERS AND 751 FIELD INDICATORS
CHECKED BY: <i>WVR</i>	APPROVED BY Q.C.: 		
APPROVED BY ENG: <i>R. C. Rosemount</i>	APPROVED BY PURCH.: 	SIZE: A	CODE IDENT NO: 04274
FINAL APPROVAL CS: 	DRAWING NO: 01151-0214	SCALE: None	U/M: Each
		SHEET 1 OF 3	

ENTITY CONCEPT APPROVALS

The entity concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in combination as a system. The approved values of maximum open circuit voltage (V_{OC} or V_T) and maximum short circuit current (I_{SC} or I_T) for the associated apparatus must be less than or equal to the maximum safe input voltage (V_{MAX}) and input current (I_{MAX}) of the intrinsically safe apparatus. In addition, the approved maximum allowable connected capacitance (C_A) and inductance (L_A) of the associated apparatus must be greater than the maximum unprotected internal capacitance (C_I) and inductance (L_I) of the intrinsically safe apparatus. The approved entity concept parameters are as follows:

Model 444

Class I, Div. 1, Groups A and B

$$V_{MAX} = 40V$$

$$I_{MAX} = 165 \text{ mA}$$

$$C_I = 0.044\mu F$$

$$L_I = 0$$

V_{OC} or V_T is less than or equal to 40V

I_{SC} or I_T is less than or equal to 165 mA

C_A is greater than 0.044 μF

L_A is greater than 0

Class I, Div. 1, Groups C and D

$$V_{MAX} = 40V$$

$$I_{MAX} = 225 \text{ mA}$$

$$C_I = 0.044\mu F$$

$$L_I = 0$$

V_{OC} or V_T is less than or equal to 40V

I_{SC} or I_T is less than or equal to 225 mA

C_A is greater than 0.044 μF

L_A is greater than 0

Model 751

Class I, Div. 1, Groups A and B

$$V_{MAX} = 40V$$

$$I_{MAX} = 165 \text{ mA}$$

$$C_I = 0$$

$$L_I = 0$$

V_{OC} or V_T is less than or equal to 40V

I_{SC} or I_T is less than or equal to 165 mA

C_A is greater than 0

L_A is greater than 0

Class I, Div. 1, Groups C and D

$$V_{MAX} = 40V$$

$$I_{MAX} = 225 \text{ mA}$$

$$C_I = 0$$

$$L_I = 0$$

V_{OC} or V_T is less than or equal to 40V

I_{SC} or I_T is less than or equal to 225 mA

C_A is greater than 0

L_A is greater than 0

Rosemount Inc.
MINNEAPOLIS, MINNESOTA

DR.

ISSUE

SIZE
A

PSOM. NO.

DRAWING NO.

01151-0214

SCALE: NONE WT.

SHEET 2 OF 6

MASTER

Model 1151

Class I, Div. 1, Groups A and B

$V_{MAX} = 40V$
 $I_{MAX} = 165 \text{ mA}$
 $C_I(1151 \text{ Std}) = 0$
 $C_I(\text{Smart } 1151) = 0.024\mu F$
 $C_I(1151 \text{ Std w/R Option}) = 0.010\mu F$
 $C_I(1151 \text{ Smart w/R Option}) = 0.034\mu F$
 $L_I(1151 \text{ Std}) = 0$
 $L_I(1151 \text{ w/R Option}) = 20\mu H$

V_{OC} or V_T is less than or equal to 40V
 I_{SC} or I_T is less than or equal to 165 mA
 C_A is greater than 0
 C_A is greater than $0.024\mu F$
 C_A is greater than $0.010\mu F$
 C_A is greater than $0.034\mu F$
 L_A is greater than 0
 L_A is greater than $20\mu H$

Class I, Div. 1, Groups C and D

$V_{MAX} = 40V$
 $I_{MAX} = 225 \text{ mA}$
 $C_I(1151 \text{ Std}) = 0$
 $C_I(\text{Smart } 1151) = 0.024\mu F$
 $C_I(1151 \text{ Std w/R Option}) = 0.010\mu F$
 $C_I(1151 \text{ Smart w/R Option}) = 0.034\mu F$
 $L_I(1151 \text{ Std}) = 0$
 $L_I(1151 \text{ w/R Option}) = 20\mu H$

V_{OC} or V_T is less than or equal to 40V
 I_{SC} or I_T is less than or equal to 225 mA
 C_A is greater than 0
 C_A is greater than $0.024\mu F$
 C_A is greater than $0.010\mu F$
 C_A is greater than $0.034\mu F$
 L_A is greater than 0
 L_A is greater than $20\mu H$

Model 2051

Class I, Div. 1, Groups A and B

$V_{MAX} = 40V$
 $I_{MAX} = 165 \text{ mA}$
 $C_I = 0.012\mu F$
 $L_I = 480\mu H$

V_{OC} or V_T is less than or equal to 40V
 I_{SC} or I_T is less than or equal to 165 mA
 C_A is greater than $0.012\mu F$
 L_A is greater than $480\mu H$

Class I, Div. 1, Groups C and D

$V_{MAX} = 40V$
 $I_{MAX} = 225 \text{ mA}$
 $C_I = 0.012\mu F$
 $L_I = 480\mu H$

V_{OC} or V_T is less than or equal to 40V
 I_{SC} or I_T is less than or equal to 225 mA
 C_A is greater than $0.012\mu F$
 L_A is greater than $480\mu H$

Rosemount Inc.
MINNEAPOLIS, MINNESOTA

DR.

ISSUE

A

FSCM. NO.

DRAWING NO.

01151-0214

SCALE: NONE WT.

SHEET 3 OF 6

Model 1135

Class I, Div. 1, Groups A and B

$V_{MAX} = 40V$

$I_{MAX} = 165 \text{ mA}$

$C_I = 0.008\mu F$

$L_I = 0$

Class I, Div. 1, Groups C and D

$V_{MAX} = 40V$

$I_{MAX} = 225 \text{ mA}$

$C_I = 0.008\mu F$

$L_I = 0$

 V_{OC} or V_T is less than or equal to 40V I_{SC} or I_T is less than or equal to 165 mA C_A is greater than 0.0081F L_A is greater than 0 V_{OC} or V_T is less than or equal to 40V I_{SC} or I_T is less than or equal to 225 mA C_A is greater than 0.0081F L_A is greater than 0**Model 1144**

Class I, Div. 1, Groups A and B

$V_{MAX} = 40V$

$I_{MAX} = 165 \text{ mA}$

$C_I = 0$

$L_I = 0$

Class I, Div. 1, Groups C and D

$V_{MAX} = 40V$

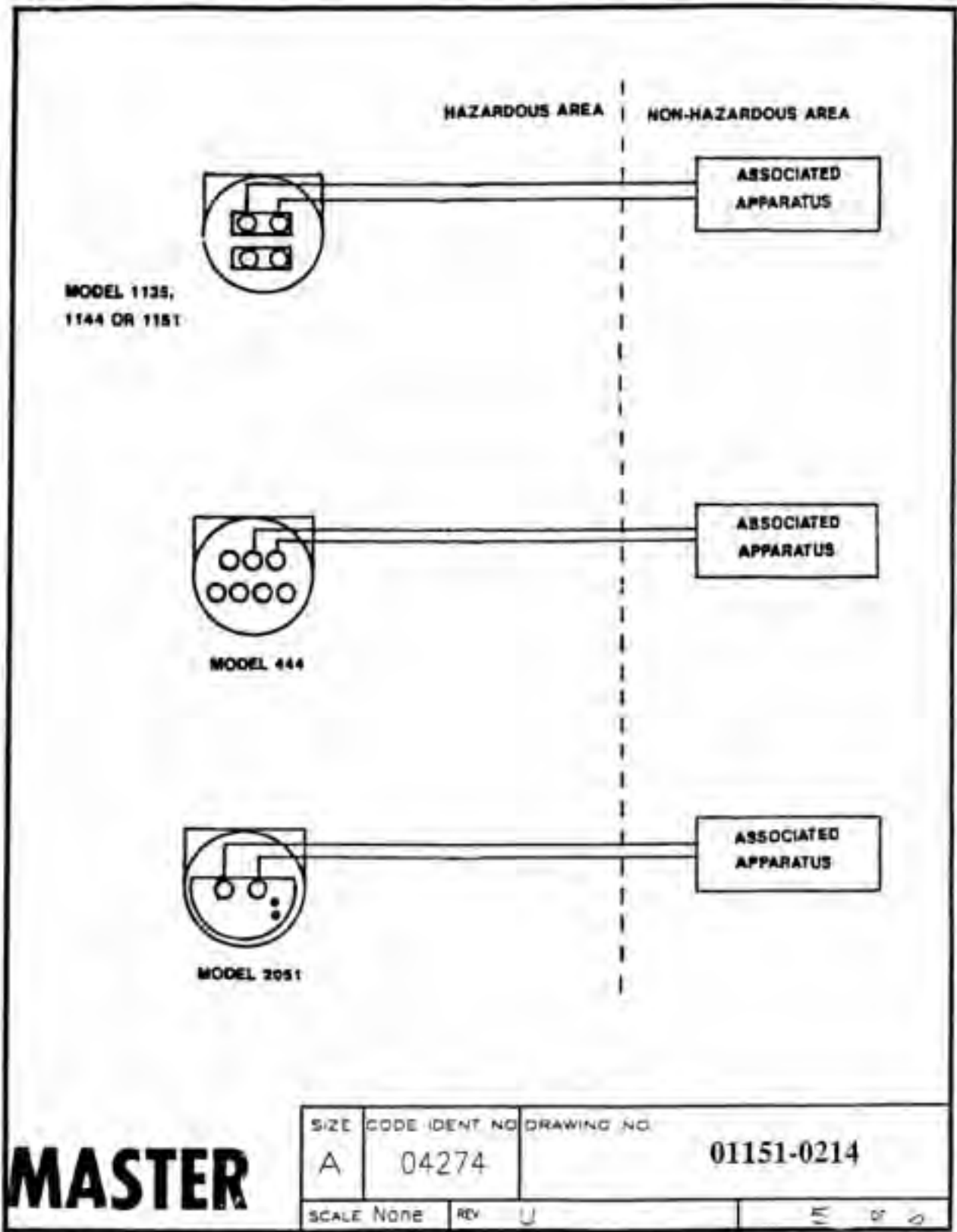
$I_{MAX} = 225 \text{ mA}$

$C_I = 0$

$L_I = 0$

 V_{OC} or V_T is less than or equal to 40V I_{SC} or I_T is less than or equal to 165 mA C_A is greater than 0 L_A is greater than 0 V_{OC} or V_T is less than or equal to 40V I_{SC} or I_T is less than or equal to 225 mA C_A is greater than 0 L_A is greater than 0

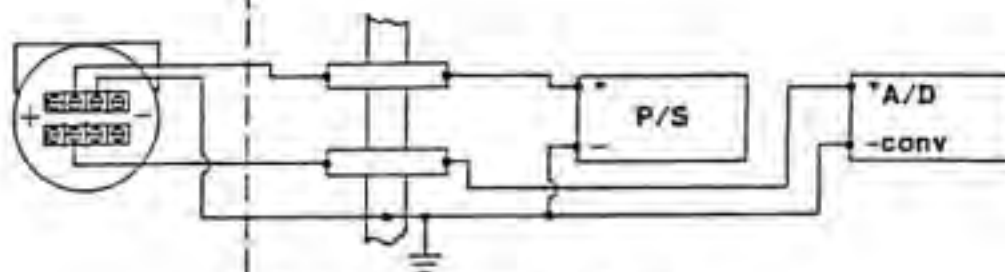
Rosemount Inc. MINNEAPOLIS, MINNESOTA		SIZE A	FSCM. NO.	DRAWING NO. 01151-0214
DR.		SCALE: NONE	WT.	SHEET 4 OF 6
ISSUE				



1151 — L & M CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS

HAZARDOUS AREA

NON-HAZARDOUS AREA

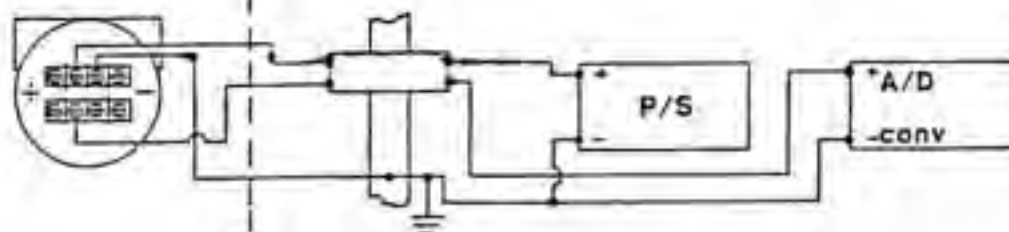


Two Single Channel Barriers

CIRCUIT DIAGRAM 1
(ONLY FOR USE WITH BARRIERS APPROVED IN THIS
CONFIGURATION)

HAZARDOUS AREA

NON-HAZARDOUS AREA



One Dual Channel Barrier

CIRCUIT DIAGRAM 2



SIZE	CODE IDENT NO	DRAWING NO
A	04274	01151-0214
SCALE NONE	REV U	OF 6

PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY BY _____ DATE _____	REVISIONS				
	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	A	NEW RELEASE	646666	W.C.R.	04/01/92
	B	150 ohms was 120 ohms	650816	J.J.B.	11/13/92
	C	150 ohms was 120 ohms (SHT 3)	652195	J.J.B.	1/29/93

CSA INTRINSICALLY SAFE APPROVAL

Exia

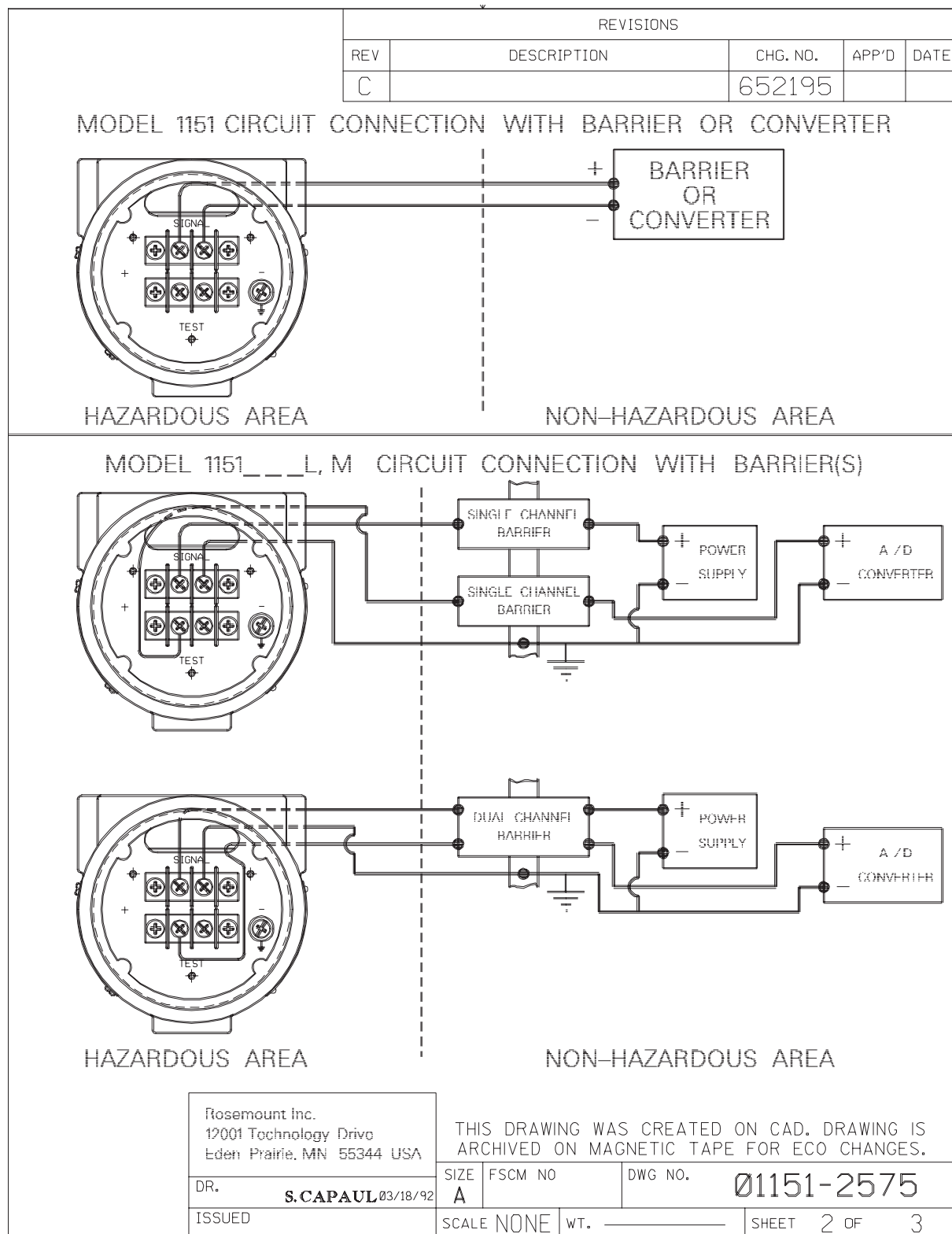
Intrinsically Safe /Securite Intrinseque

THE ROSEMOUNT MODEL 1151 PRESSURE TRANSMITTER IS APPROVED BY CSA AS
INTRINSICALLY SAFE FOR THE CLASS I, DIVISION 1 GROUPS AS INDICATED WHEN USED
WITH THE BARRIERS AND CONVERTERS LISTED BELOW AND CONNECTED AS SHOWN
IN THE ACCOMPANYING DIAGRAMS.

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV. 1
CSA Approved Safety Barrier	{ 30 V or less 330 ohms or more 28 V or less 300 ohms or more 22 V or less 180 ohms or more	Groups A, B, C, D
Foxboro Converter 2AS-I3I-CGB, 3AD-I3IA CS-E /CGB-A, 2AI-I3V-CGB, 3A2-I3D CS-E /CGB-A, 2AI-I2V-CGB, 3A2-I2D CS-E /CGB-A, 2AS-I2I-CGB, 3A4-I2DA CS-E /CGB-A, 3F4-I2DAI CS-E /CGB-A		Groups B, C, D
CSA Approved Safety Barrier	30 V or less 150 ohms or more	Groups C, D

THIS DRAWING WAS CREATED ON CAD. DRAWING IS
ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125 - TOLERANCES - DECIMALS FRACTIONS .X±.1 ±1/32 .XX±.02 ANGLES .XXX±.010 ±2°	CONTRACT NO. DR. S.CAPPAUL 03/18/92 CHK'D W.C. RAUTH 04/01/92 APP'D. W.C. RAUTH 04/01/92 APP'D. GOVT.	ROSEMOUNT® Measurement Control Analytical Valves Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA TITLE INDEX OF CSA INTRINSICALLY SAFE BARRIER SYSTEMS FOR MODEL 1151 TRANSMITTERS SIZE A FSCM NO. _____ SCALE N/A DWG NO. 01151-2575 WT. _____ SHEET 1 OF 3



Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

DR. **S. CAPAUL** 03/18/92

ISSUED

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ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.

SIZE
A

FSCM NO

DWG NO.

01151-2575

SCALE NONE

WT. _____

SHEET 2 OF

3

		REVISIONS			
REV		DESCRIPTION	CHG. NO.	APP'D	DATE
C			652195		

MODEL 1151___L, M CIRCUIT CONNECTION WITH BARRIER(S)
(CONTINUED)

APPROVED FOR CLASS I, DIVISION 1, GROUPS A, B, C, D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS; ONE WITH APPROVED SAFETY PARAMETERS OF 28 VOLTS OR LESS AND 300 OHMS OR MORE IN +POWER LINE, AND THE OTHER WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN +OUTPUT LINE.

-OR-

ONE CSA APPROVED DUAL CHANNEL SAFETY BARRIER WITH IDENTICAL APPROVED SAFETY PARAMETERS CONNECTED IN LIKE MANNER.

APPROVED FOR CLASS I, DIVISION 1, GROUPS C, D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS; ONE WITH APPROVED SAFETY PARAMETERS OF 30 VOLTS OR LESS AND 150 OHMS OR MORE IN +POWER LINE AND THE OTHER WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN +OUTPUT LINE.

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.			
DR. S. CAPAUL 03/30/92	SIZE A	FSCM NO	DWG NO. 01151-2575		
ISSUED	SCALE N/A	WT.	SHEET 3 OF 3		

Calibration	Operations that adjust for minor effects such as span shift and zero shift. These effects are usually caused by outside influences such as rotating a transmitter, or mounting a transmitter on its side. See Section 2 Installation.
Damping	Output function that increases the response time of the transmitter to smooth the output when there are rapid input variations. See Section 3 Calibration.
Lower Range Limit (LRL)	Lowest value of the measured variable that the transmitter can be configured to measure.
Lower Range Value (LRV)	Lowest value of the measured variable that the analog output of the transmitter is currently configured to measure.
Reranging	Configuration function that changes the transmitter 4 and 20 mA settings. See Section 3 Calibration.
Span	Algebraic difference between the upper and lower range values. See Section 3 Calibration.
Upper Range Limit (URL)	Highest value of the measured variable that the transmitter can be configured to measure.
Upper Range Value (URV)	Highest value of the measured variable that the analog output of the transmitter is currently configured to measure.
Zero Trim	A zero-based, one-point adjustment used in differential pressure applications to compensate for mounting position effects or zero shifts caused by static pressure. See Section 3 Calibration.

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Rosemount Inc.

8200 Market Boulevard
Chanhassen, MN 55317 USA
Tel 1-800-999-9307
Telex 4310012
Fax (612) 949-7001
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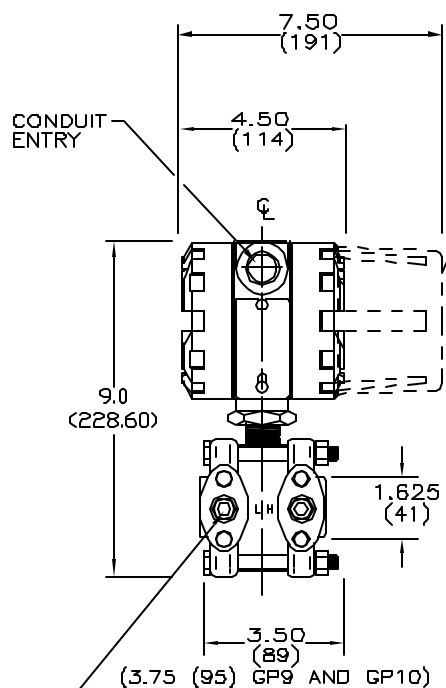
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REV. AA

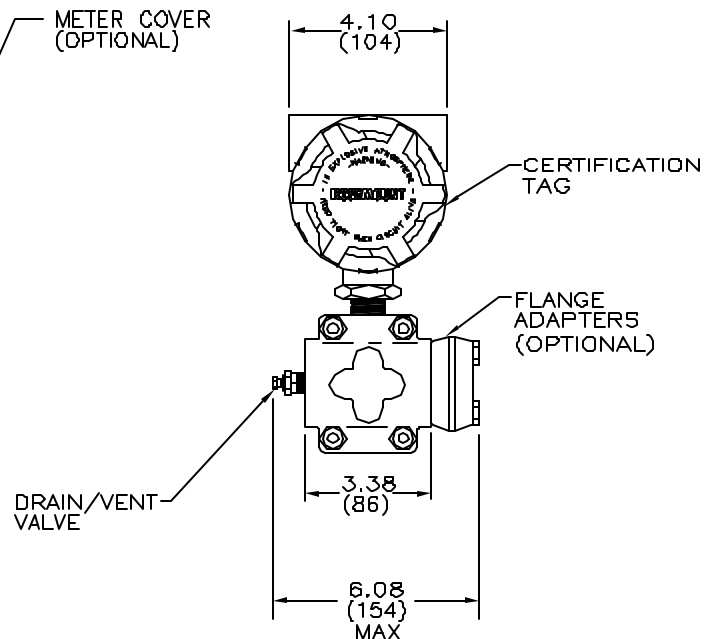
ROSEMOUNT®

FISHER-ROSEMOUNT™ Managing The Process Better.™

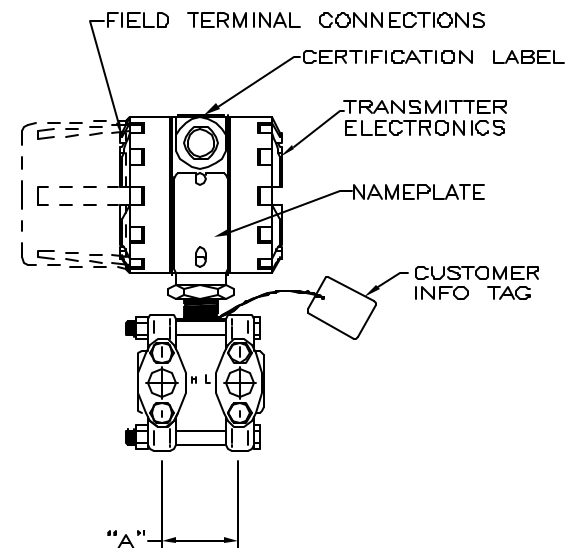
1151 PRESSURE TRANSMITTER



1/4-18 NPT PROCESS CONNECTION OR 1/2-14 NPT WITH OPTIONAL FLANGE ADAPTERS. ADAPTERS CAN BE ROTATED TO GIVE CONNECTION CENTERS OF 2.00(51), 2.125(54), OR 2.25(57)



REVISIONS					
ZONE	REV	DESCRIPTION	CHG.NO.	APP'D	DATE
	P	ADD OPTIONS. ADD MATERIAL CODES. CHANGE FIGURES.	B45344		
	AA	UPDATE AND ADD NEW SEALS.	RTC1005983		
	AC	UPDATE TO TYPE I DRAWING	RTC1014518		



MODEL NUMBER	DIMENSION "A"	
1151 RANGE 3-5	2.125	(54.0)
1151 RANGE 6,7	2.188	(55.6)
1151 RANGE 8	2.250	(57.2)
1151 RANGE 9	2.281	(57.9)
1151 RANGE 0	2.328	(59.1)

*UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES (MM)

*ALL DIMENSIONS ARE NOMINAL AND ARE FOR REFERENCE ONLY



TYPE I

ROSEMOUNT INC. CHANHASSEN, MINNESOTA

DR. JOHN ARMSTRONG 1/10/02
 APP'D. DRAWING B. HAGBOM 1/10/02
 APP'D. DRAWING
 APP'D. TAGGING
 APP'D. SPECIALS

TITLE
 DIMENSIONAL DRAWING FOR MODEL
 1151 PRESSURE TRANSMITTERS

SIZE A FSCM.NO. 04274 DRAWING NO. 01151-0466
 SCALE: NONE WT. SHEET 1 OF 1

TigermagEP

Technical Specifications

FM656

Obstructionless

Electromagnetic

Flowmeter



DESCRIPTION

The Model 656 is a microprocessor-based electromagnetic flowmeter designed to measure the flow of conductive liquids in full pipes. The sensor and the transmitter are integral and enclosed in a NEMA-7 explosion-proof housing. The sensor housing is made of steel.

A wide variety of liners and electrodes are available to allow you to tailor the meter to your process.

The Model 656's nonvolatile E²PROM memory and circuitry eliminates the need for a microprocessor backup battery. It is not necessary to reprogram if the electronic module is replaced or exchanged with electronics from another size flowmeter.

APPLICATIONS

The Model 656's high signal frequency makes it ideally suited to applications with high levels of inherent noise including: Process Chemicals, Heavy Sludges, Pulp & Paper Stock, Mining Slurries, Polymers, Acids, Alkalies, Sewage, Cooling Water. Nearly any conductive liquid can be measured.

CERTIFIED ACCURACY

Each TigermagEP™ is wet-flow calibrated in Sparling's Primary Flow Lab traceable to the National Institute of Standards and Technology. A certificate of accuracy is furnished with each meter.

PRINCIPLE OF OPERATION

The Model 656 magnetic flowmeter is based on Faraday's Law which states that the voltage induced in a conductor moving through a magnetic field is proportional to the velocity of that conductor. The magnetic flowmeter will measure liquids with conductivities greater than 5 micromhos.

STANDARD FEATURES

- Sampling frequency up to 100 Hz for accurate measurement of fluids with high levels of inherent noise
- Forward, reverse and net totalization
- Programmable high and low flow alarms
- Nonvolatile E²PROM memory
- Universal electronics module compatibility
- 2-line, 16 character backlit display
- Programming made easy with Mag-Command™
- User-selectable damping & low flow cutoff
- NEMA-4X & NEMA-7 explosion proof enclosure
- Approvals include: FM, CSA (std.)
- Rotatable modular display
- Empty pipe detection
- PZR - Positive Zero Return
- Standard 0.5% accuracy
- Sizes available from 0.5" - 72"



SPARLING



EASY TO READ BACKLIT ROTATABLE DISPLAY

The 16 character, 2-line backlit transmitter display is rotatable 360° in 90° increments ensuring easy reading in any orientation.

INSTALLATION

The meter must be mounted at a point in the line in which the pipe is always full of the process liquid under flowing conditions.

The meter may be equipped with ANSI 150 or 300 lb., AWWA, DIN, PN10 or 16, JIS 10K or 20K, or British Standard flanges.

Only three diameters of straight pipe length are required from the center of the meter to normal obstructions to obtain specified accuracies. In the smaller sizes all of the necessary straight pipe is contained within the meter itself.

E²PROM NONVOLATILE MEMORY

A backup battery is not required and there is no need to reprogram if the electronics module is replaced or exchanged. Meter identification (tube ID, serial number, K, offset, etc.) is stored on an E²PROM chip independent of transmitter electronics. The E²PROM chip has lifetime data retention.

EMPTY PIPE DETECTION - Standard

The Sparling TigermagEP™ is designed to detect absence or inadequate volume of process fluid in the pipe and will hold the output signal to 4 mA or zero. This feature does not require any hard wiring as it is a software selection. One of the most important values of this feature is that it prevents false totalization possible with other meters under partially filled pipe conditions.

EASE OF COMMUNICATIONS

The TigermagEP™ is programmable with Mag-Command or Hart Protocol. 4-20 mA, RS-232 or RS-485 outputs give you flexibility when interfacing with your distributed control system.

REMOTE MOUNTED TRANSMITTER

Remote mounting of the transmitter is required when pipe vibration is excessive, when flooding is possible or where high temperature conditions exist (over 212°F / 100°C).

The TigermagEP™ remote transmitter is housed in a NEMA-4X enclosure and features a larger sized (8mm) 16 digit 2-line backlit display. All power, coil and electrode connections are made within the transmitter enclosure and junction box. The meter is programmed using Mag-Command. Hall-effect switches which are energized from outside the enclosure. The enclosure can be wall mounted. An optional bracket for pipe mounting is available.

HI-Z CIRCUITRY

The Sparling TigermagEP™ provides superior performance in liquids which tend to deposit nonconductive coatings. Hi-Z™ circuitry produces a high input impedance to the transmitter's preamplifier (10¹² ohms). The impedance of the coating is negligible as compared to the impedance of the receiving instrument. The voltage drop across the electrode coating is also negligible eliminating the need for electrode cleaners.

TWO FLOW ALARMS

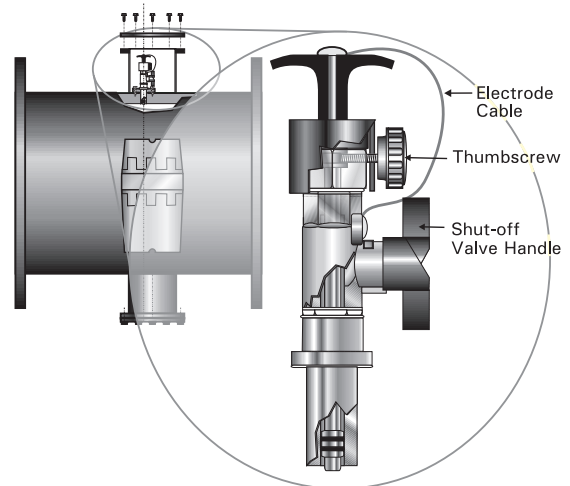
Fault alarms can be configured with alarm set points between 0-99% of flow for each alarm. Open collector output turns on above programmed set point.

PZR – Positive Zero Return

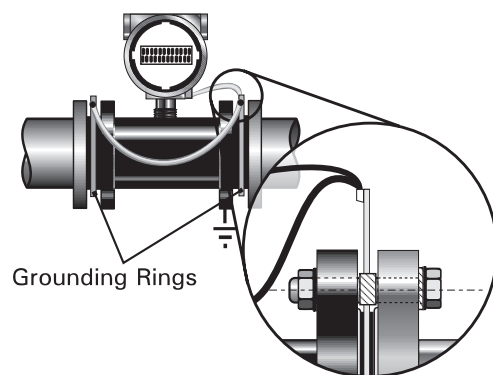
An electronic circuit is activated by an external contact closure when lines go empty or when a pump or valve is shut down, indicating to the meter that it should drive the output signal to 4 mA or zero.

REMOVABLE ELECTRODES (option)

Two configurations of removable electrodes are available in sizes 6" or greater for all FM656 meters. The first configuration allows removal of the electrode after the line has been depressurized and drained. Removal is performed with an 11/32" nut driver and a 3/4" socket wrench.



The second is the "hot-tap" electrode which allows electrode replacement while the system is still under pressure without disturbing the process flow. Removal can be easily performed with a phillips screwdriver and a crescent wrench. Special locking catches were designed to prevent high pressure accidents during electrode removal. The shut-off valve must be closed before the electrode may be removed.



GROUNDING

The use of grounding rings is recommended to ensure accuracy. Grounding rings are required if adjacent piping is lined or nonconductive. Pump noise or excessive RF should be minimized to achieve highest accuracy.

FLOW RATES & DIMENSIONS

Table 1 - Flow & Dimensions

Meter & mating flange size (inches)	Dimensions								Flowrates - GPM - Full Scale		
	A		B		C		D		1 fps.	3 fps.	33 fps.
	150 lb.	300 lb.	150 lb.	300 lb.	150 lb.	300 lb.	150 lb.	300 lb.			
0.5	4.00	4.00	3.50	3.75	9.50	9.62	9.25	9.37	0.6	1.7	18
1	4.00	4.00	4.25	4.88	10.19	10.50	9.94	10.25	2	6	66
1.5	4.00	4.00	5.00	5.12	10.88	11.44	10.63	11.19	5	15	174
2	4.00	4.00	6.00	6.50	11.69	11.89	11.44	11.64	9	27	303
3	6.00	6.00	7.50	8.25	13.00	13.40	12.75	13.15	20	60	664
4	6.00	6.00	9.00	10.00	14.38	14.88	14.13	14.63	35	107	1182
6	13.38	14.88	11.00	12.50	17.00	17.75	16.75	17.50	85	254	2800
8	13.38	15.40	13.50	14.25	19.40	19.78	19.15	19.53	145	436	4800
10	18.15	20.55	16.00	17.50	22.56	23.31	22.31	23.06	236	709	7800
12	19.40	21.78	19.00	20.50	25.00	25.75	24.75	25.50	333	1000	11000
14	21.38	23.75	21.00	23.00	26.67	27.67	26.42	27.42	409	1227	13500
16	23.38	25.88	23.50	25.50	28.97	29.97	28.72	29.72	545	1636	18000
18	27.25	29.88	25.00	28.00	31.14	32.64	30.89	32.39	667	2000	22000
20	27.63	30.40	27.50	30.50	33.39	34.89	33.14	34.64	879	2636	29000
24	32.75	35.75	32.00	36.00	37.44	39.44	37.19	39.19	1273	3818	42000
30	43.50	46.63	38.75	43.00	43.72	45.85	43.47	45.60	1909	5727	63000
36	47.75	50.85	46.00	50.00	50.20	52.20	49.95	51.95	2925	8775	96525
42	51.75	55.12	53.00	57.00	56.90	58.90	56.65	58.65	4040	12120	133320
48	51.75	55.38	59.50	65.00	63.05	65.80	62.80	65.55	5322	15966	175626
54	53.50	*	66.25	*	69.88	*	69.63	*	7144	21433	235800
60	65.50	*	73.00	*	76.75	*	76.50	*	8500	25500	280500
66	65.50	*	80.00	*	83.75	*	83.50	*	10300	31000	341000
72	72.75	*	86.50	*	90.00	*	89.75	*	12700	38100	419100

Dimensions for flanges. Allow 1/8" to 1/4" for lining thickness / Dimensions C & D ± .0125"

HOW TO ORDER A TIGERMAG EP MODEL 656

Base Model Number	FM-656 - TigermagEP	FM-656-03-31-1-0-1

Size

OD = 0.50", OF = 1", OG = 1.5", O2 = 2", **O3 = 3"**, O4 = 4", O6 = 6", O8 = 8", etc.

Table 3 - Liner Material

1 Hard Rubber (6" - 72")	3 Tefzel® (0.5" - 48")	6 Ceramic liner (0.5" - 2")
2 Soft Rubber (6" - 72")	5 Polyurethane (1" - 48")	9 Neoprene (6" - 72")

Table 4 - Electrode Material

1 316SS	4 Titanium	7 Platinum
2 Hastelloy C	5 Tantalum	8 Zirconium
3 316SS Bullet Nosed	6 Fused Platinum	9 Monel

Table 5 - Flange Rating

1 150 lb. flanges	4 PN 10 DIN	6 JIS 10K
3 300 lb. flanges	5 PN 16 DIN	7 JIS 20K

Table 6 - Transmitter and Mounting

- 0** Integral NEMA-4X/NEMA-7 enclosure
- 1 Remote NEMA-4X/NEMA-7 enclosure, 15' cable
- 3 Remote NEMA-4X/NEMA-7 enclosure, 15' cable, accidental submergence proof sensor
- 5 Remote NEMA-4X enclosure, 15' cable
- 6 Remote NEMA-4X encl., 15' cable, accidental submergence proof sensor
- 7 Remote NEMA-4X encl., 15' cable, permanent submergence proof sensor

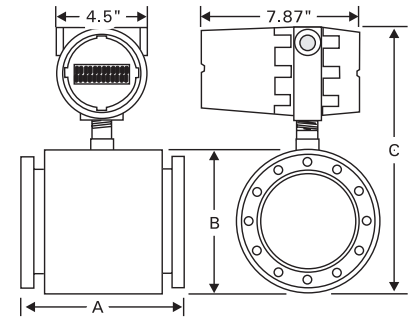
Table 7 - Power Supply*

- 0 77-265 VAC Power
- 1** **12-60 VDC Power**

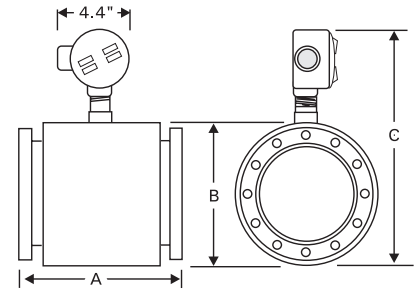
Special Notes for Construction

- ___ Hart® protocol (KP602 programmer available)
- ___ RS-485 Communications port
- ___ High temperature coils - required for temperatures over 266 °F
- ___ Requires remote mount option from Table 6
- ___ Ceramic max temp 420 °F / Tefzel® max temp 300 °F @ 100 psi
- ___ Hot Tap removable electrode design (6" & above only)
- ___ Removable electrode design (6" - 72")
- ___ Special cable length (over 15 feet - Max. 100 ft.)
- ___ Alarm with relay contacts (remote only)

Integral Mount Transmitter

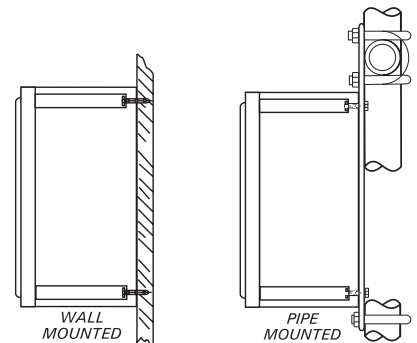
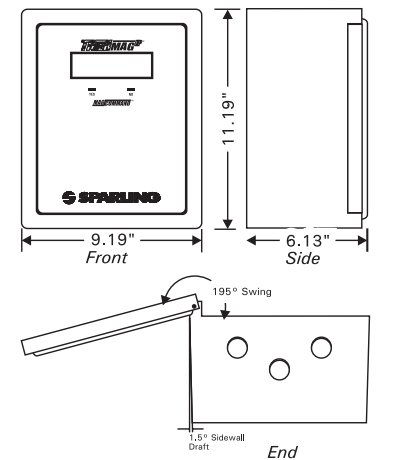


Remote Mount Transmitter



▲ Sensor

▼ Transmitter Enclosure (NEMA-4X)



STANDARD SPECIFICATIONS

Accuracy: (Frequency Output)	1.0"-72" 0.5% of flow rate (1-33 fps)
	0.5" 1% of flow rate (1-33 fps)
Temperature Effect:	±0.025 % FS/°C
Full Scale Ranges:	From 0-3 to 0-33 ft/sec.
Repeatability:	±0.1% full scale
Electrodes:	Stainless steel standard (others available)
Liner:	Ceramic (aluminum oxide 99.5%), Hard Rubber, Soft Rubber, Neoprene, Polyurethane or <i>Tefzel</i> ®
Outputs:	1) Isolated analog 4-20 mAdc into 800 ohms (std); 2) scaled pulse 24 Vdc with selectable 12.5/25/50/100 ms on time, max. freq. 60 Hz; 3) 0-1000 Hz freq., for 0-100% flow rate. 15 Vdc; 4) two flow alarms; 5) fault, with open collector; 6) RS232 communication; 7) flow direction with open collector; 8) Positive Zero Return (PZR) for external relay contacts. Outputs 2 & 3 can be open collector if required.
Mag-Command™:	Selection and change of meter parameters by magnetic probe without opening the enclosure.
Display:	2-Line, 16 Digit alphanumeric backlit display (rate and total) Modular, rotatable 360° in 90° increments.
Conductivity:	Minimum 5 micromhos/cm
Minimum Velocity:	0.3 fps (0.1 mps)
Power Requirements:	*77 - 265 Vac 50/60 Hz (12-60 Vdc optional)
Power Consumption:	Less than 20 Watts
Enclosures:	Transmitter: Cast aluminum epoxy coated. Integral (NEMA-7) or remote mounted (NEMA-4X). Sensor Housing: Fabricated steel, epoxy coated.
Electrical Rating:	FM - Class I, Div. 1, Groups B, C, D; Class II, Div. 1, Groups E, F, G (150 psi integral mount), CSA Approved for Class 1, Division 2
Preamp Impedance:	10 ¹² ohms minimum.
Ambient Temp:	-20° to 140°F (-30° to 60° C) Display darkens over 158°F (70°C)
End Connections:	150 lb. or 300 lb.
Sensor Tube:	304 Stainless Steel
Process Temp:	Integral Mount: Hard rubber, Soft rubber, Neoprene, Polyurethane/Food Grade Polyurethane -40 - 180°F <i>Tefzel</i> ®, Ceramic -40 - 212°F Remote Mount (opt) <i>Tefzel</i> ® (to 300 psi), Ceramic -40 - 266°F High Temp Coils (opt) <i>Tefzel</i> ® (to 100 psi) -40 - 300 °F Ceramic -40 - 420 °F
Selectable Damping:	0-99 sec.
Low Flow Cutoff:	Selectable 0-9% of FS.
Options:	• Remote Mounted NEMA -4X Enclosure • Remote Two-Stage Batching Transmitter • Electrode Materials: Titanium, Hastelloy C, Monel, Zirconium, Tantalum, Platinum, Fused Platinum (ceramic only) • Process Temperature to 420 °F (216 °C) (ceramic only) • 12-60 Vdc operation • Digital Communications (HART Protocol) • Accidental/Permanent Submergence Proof Sensor (remote mount only) • Removable Electrodes (6"-72" only) • Hot-Tap Removable Electrodes (6"-72" only) • RS-485 Communication • Alarm with relay contacts (remote mount only)

MODEL FM-656 SPECIFICATIONS

- The magnetic flowmeter shall be microprocessor-based, and flanged. It shall indicate, totalize, and transmit flow in full pipes.
- The magnetic flowmeter shall utilize DC bipolar pulsed coil excitation, operating at frequencies up to 100 Hz and automatically re-zeroing after every cycle.
- The accuracy shall be at least 0.5% of flow rate over a 33:1 turndown at all flow rates above 1 fps. Accuracy shall be verified by calibration in a flow laboratory traceable to the U.S. National Institute of Standards and Technology.
- The flow sensor liner shall be Ceramic, Hard Rubber, Soft Rubber, Neoprene, Polyurethane or *Tefzel*®. The housing shall be steel.
- The integrally-mounted flow sensor and transmitter shall be FM approved for Class I, Division 1 & 2, Groups B, C, D and Class II, Division 1, Groups E, F, G environments without use of air purge. CSA Approved for Class 1, Division 2.
- The electronics shall be integrally or remote mounted.
- When remote mounted, the flowmeter transmitter shall be furnished in a NEMA-4X enclosure box, with a larger 3/8" character, 2-line 16 digit backlit display and 15 feet of cable (standard). Batch controller option available.
- The flowmeter shall be suitable for operation at temperatures from -40°F to 266°F and at pressures from full vacuum to 740 psi. Temperatures to 420°F (optional).
- The flowmeter electrodes on ceramic liners shall be fused platinum and shall not require O-rings.
- The meter shall incorporate HI-Z circuitry. The preamplifier input impedance shall not be less than 10¹² ohms. External ultrasonic electrode cleaners shall not be acceptable.
- Available outputs shall be 1) Isolated analog 4-20 mAdc into 800 ohms (standard); 2) scaled pulse 24 Vdc with selectable 12.5/25/50/100 ms on time, max. freq. 60 Hz.; 3) 0-1000 Hz freq., for 0-100% flow rate. 15 Vdc; 4) two flow alarms; 5) fault, with open collector; 6) RS232 communication; 7) flow direction with open collector; 8) Positive Zero Return (PZR) for external relay contacts. Outputs 2 & 3 can be open collector if required.
- Low flow cutoff shall be selectable from 0-9% of FS and there shall be two flow alarms settable from 0-99% of span.
- A 2-line, 16 character backlit alphanumeric display shall indicate user-defined flow units and total flow. All menu advice and commands shall be visible on this display. The display shall be modular and rotatable 360°, in 90° increments. Characters shall be at least 0.125" high for ease of readability.
- The flowmeter shall incorporate the MAG-COMMAND feature allowing menu selection and changes to be made from outside the housing via Hall-effect sensors. It shall not be necessary to remove covers, panels or fasteners to accomplish calibration or program changes.
- The TigermagEP's unique diagnostic functions eliminate the need for a technician to carry test equipment or open the housing. Current ramp, complete coil check and true front-end input simulator may be activated in MAG-COMMAND without opening the enclosure.
- The meter software shall incorporate a password feature preventing inadvertent program changes.
- The meter shall feature nonvolatile E²PROM memory and universal electronics module compatibility between all TigermagEP meters.
- The flowmeter shall have a switching power supply having an operating range from 77 - 265 Vac 50/60 Hz (12-60 Vdc). Power consumption shall not exceed 20 Watts.
- All printed circuit boards shall be contained in a plug-in module and be interchangeable for any size without requiring test equipment.
- The flowmeter manufacturer shall have meters of the DC pulse type in similar flowing mediums for a minimum of five years.
- The flowmeter shall be warranted against defective workmanship or materials for a period of two years from date of shipment.
- Totalized flow and programmed configuration shall be maintained in memory for the meters lifetime.
- The flowmeter shall be MODEL 656 TigermagEP™ as manufactured by Sparling Instruments, Inc.



4097 N. Temple City Blvd. • P.O. Box 5988 • El Monte, CA USA 91731
Ph (626) 444-0571 • Fx (626) 452-0723
Internet: <http://www.sparlinginstruments.com> • E-mail: sales@sparlinginstruments.com



NUFLO™

MC-II™ Plus Weatherproof (WP) Flow Analyzer

The NuFlo™ MC-II™ Plus WP Flow Analyzer is a weatherproof instrument which provides a continuous display of instantaneous flow rate and accumulated total volume of liquid or gas based on a turbine flow meter input signal. It combines ease-of-use and functionality for a truly user-friendly flow analyzer.

The liquid crystal display simultaneously displays seven-digit totals and six-digit flow rates, as well as a selection of commonly used engineering units for rate and volume. The calibration is implemented by entering the calibration factor of the flow meter and selecting the desired units of measurement. It automatically calculates its own divisor. When used with a gas turbine meter, you input gas calculation parameters and the flow analyzer self-calculates the calibration factor for gas in standard cubic feet.

The unique combination of inputs and outputs allows flexibility of use in the field. The MC-II™ Plus WP Flow Analyzer connects to a turbine meter using quick disconnects. It takes the turbine meter signal directly in, without the use of pre-amplifiers. A remote reset input allows the volume to be cleared via a remote computer. The user can select either a 4-20 mA output or an amplified flow meter frequency output to feed to remote equipment.

Features

- Magnetic pickup input
- Simultaneous indication of rate and volume
- 7-digit volume, 6-digit rate
- Analog output – loop powered
- Volumetric pulse output – optically isolated

Display

- 7-digits for total
- 6-digits for rate
- Character height – 0.300-in.
- Update period: 2 seconds
- Units of measurement
 - BBL, GAL, M3, and MCF for volume
 - BPD, GPM, M3/D, and MCF/D for rate
- User defined units implemented by entering a divisor and rate multiplier



Calibration

Liquid flow meter calibration:

- User enters calibration factor of meter and selects units of measurement.

Gas flow meter calibration:

- User enters calibration factor of meter, pressure and temperature parameters, and Fpv.

Input

Turbine Meter Input:

- Front panel keypad configurable sensitivity adjustment
- Sensitivity adjustment range: 20 mV P-P to 120 mV P-P
- Frequency range: 15 to 3500 Hz
- Frequency measurement accuracy: 0.015% of reading

Remote Reset Input

- Optically isolated (bi-directional) input
- Supply range: 3.0 - 30 VDC
- Minimum contact duration: 130 mS

Outputs

Analog Output:

- 4-20 mA, loop powered (two-wire)
- 16-bit resolution
- Accuracy: 0.05% of FS @ 25°C, 50 PPM/°C temperature drift
- Loop drop: 8.0 VDC
- Calibration via Keypad
 - Zero and Full Scale Engineering Values
 - Hardware (DAC) Calibration
- Battery backup
- Update period: 1 second

Volumetric Pulse Output:

- Optically isolated open-collector output
- Output rating: 40 mA maximum @ 30 VDC
- Software configurable pulse width duration and pulse representation
 - Pulse width duration: 65, 130, 195, 260, 520, 1040 milliseconds
 - Pulse representation: 0.001, 0.01, 0.1, 1, 10, 100 volume units

Amp & Square Output:

- Open-drain transistor output of turbine meter input signal
- Output rating: 50 mA @ 30 VDC
(analog output and amp & square outputs are mutually exclusive – choose one or the other.)

Packaging

- Weather proof fiberglass enclosure
- Instruments mounts atop turbine meter
- Optional remote mount bracket permits mounting to a 2-in. pole

Power Supply Options

- Internal lithium battery – 2 year minimum life
- External power supply (8 to 30 VDC reverse polarity protection)
- Internal battery backup
- Loop powered (4-20 reverse polarity protected) internal battery backup

Environmental

Operating Temperature Range:

- -40°F to +167°F (-40°C to +75°C)

Humidity:

- 0 - 90% non-condensing

WARRANTY-LIMITATION OF LIABILITY: Seller warrants only title to the product, supplies, and materials and that, except to software, the same are free from defects in workmanship and materials for a period of one (1) year from the date of delivery. Seller does not warranty that software is free from error or that software will run in an uninterrupted fashion. Seller provides all software "as is". THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE WHICH EXTEND BEYOND THOSE STATED IN THE IMMEDIATELY PRECEDING SENTENCE. Seller's liability and Buyer's exclusive remedy in any case of action (whether in contract, tort, breach of warranty or otherwise) arising out of the sale or use of any product, software, supplies, or materials is expressly limited to the replacement of such products, software, supplies, or materials on their return to Seller or, at Seller's option, to the allowance to the customer of credit for the cost of such items. In no event shall Seller be liable for special, incidental, indirect, punitive or consequential damages. Seller does not warranty in any way products, software, supplies, and materials not manufactured by Seller, and such will be sold only with the warranties that are given by the manufacturer thereof. Seller will pass only through to its purchaser of such items the warranty granted to it by the manufacturer.

MEASUREMENT SYSTEMS

Formerly: NuFlo Measurement Systems • Barton Instrument Systems • Caldon, Inc.

HOUSTON
HEAD OFFICE | **281.582.9500**

NORTH
AMERICA | **1.800.654.3760**
ms-us@c-a-m.com

ASIA
PACIFIC | **603.2287.1039**
ms-asiapacific@c-a-m.com

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MIDDLE EAST
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ms-uk@c-a-m.com

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Part Number:

321559

Item Description:

L6700-3-SS-141750-1-GR2-6

Operating Pressure: Atmospheric
Operating Temperature:
Ambient

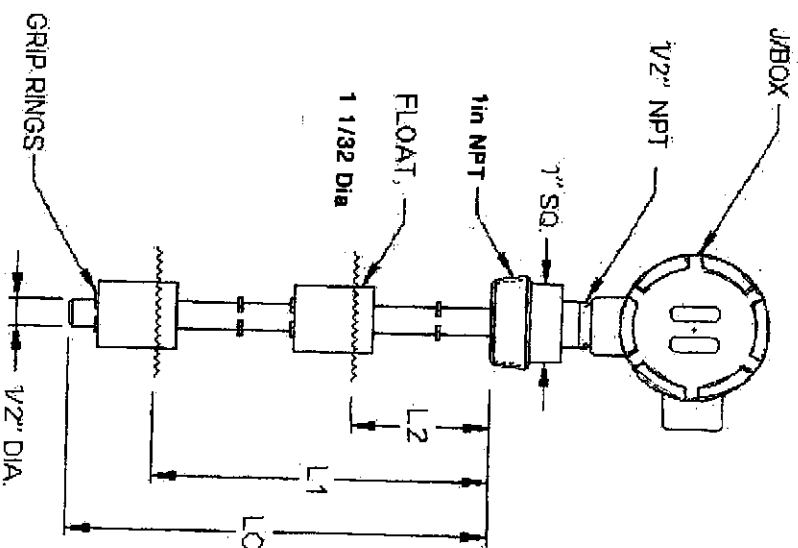
Specific Gravity: .75 - 1.6

Stem & Mounting Material:
Stainless Steel

Float Material: Stainless Steel

Nema 4 Junction Box

LSHH-201



Dimensions in inches

L2 = 24"	N.O.
L1 = 34"	N.O.
L0 = 36"	

Feature material cost price image

Part Number:

321570

Item Description:

LS700-3-66-141750-2-GR2-36

Operating Pressure: Atmospheric

Operating Temperature:

Ambient

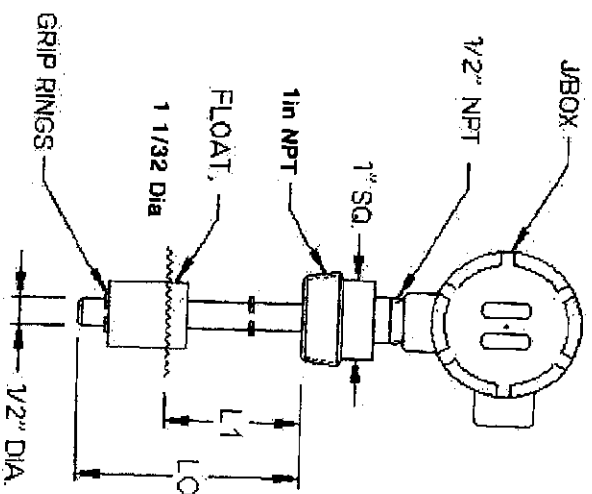
Specific Gravity: 75 - 1.6

Stem & Mounting Material:

Stainless Steel

Float material: Stainless Steel

Nema 4 Junction Box



Dimensions in Inches

L1= 6"	N.C.
LO= 8"	

LSH 201 / LSL 201



Echotel® Model 338 Non-Contact Ultrasonic Two-Wire Transmitter for Level, Volume, or Open Channel Flow

DESCRIPTION

Echotel Model 338 is a two-wire, loop-powered non-contact transmitter for liquid level, volume, and open channel flow measurement. Featuring advanced digital signal processing and a powerful transducer, this versatile transmitter provides exceptional measurement performance in a wide variety of applications.

The plug-in liquid crystal display module is used for setup and configuration, and displays level, volume, flow and temperature, as well as diagnostic information. A bar graph displays echo strength from the return signal, or tank level as a percentage of span.

The 80 kHz transducer has an extremely narrow 5 degree conical beam angle. This highly collimated beam ensures a reliable ultrasonic signal, even in tanks with internal obstructions, turbulence, and other application difficulties.

FEATURES

- Plug-in 6-digit alphanumeric LCD module with custom graphics display
- 4–20 mA output with 600 Ω load
- Advanced digital signal processing assures reliable measurement in difficult applications
- Dual function bar graph displays echo signal strength or tank level
- 80 kHz transducer with 20 feet (6 meter) range
- Narrow, 5 degree beam angle provides excellent performance in tanks with obstructions
- Fixed target suppression to eliminate interference from in-tank obstructions
- Common tank shapes and 32-point linearization table for volume calculations
- Extensive support of flume and weir calculations for open channel flow
- Two totalizers for flow, one resettable, and one non-resettable



APPLICATIONS

- Sump, well, tank and open channel measurement
- Water and Wastewater treatment facilities
- General industrial applications
- Chemical storage tanks
- Vessels with highly viscous media
- Paint, ink and solvent tanks
- Food and beverage vessels
- Batch and day tanks

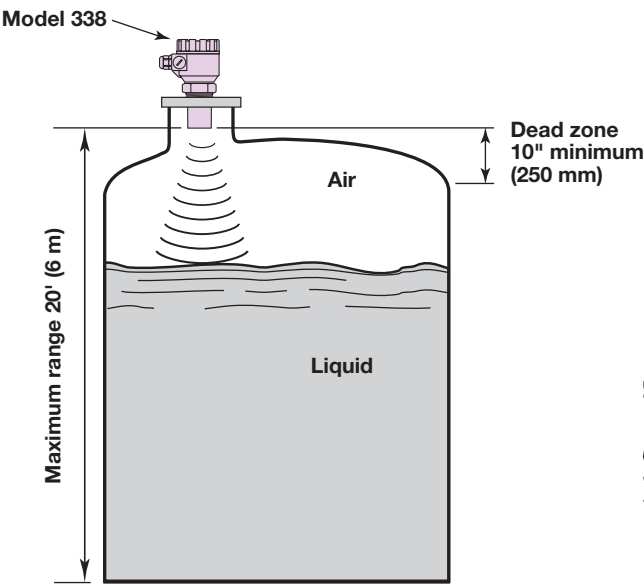
TECHNOLOGY

Non-contact ultrasonic level technology is a proven method for accurate liquid level measurement. This technology features the ability to measure the level or volume of the fluid without making physical contact with the material. This is especially important in applications containing corrosive materials, suspended solids or coating media.

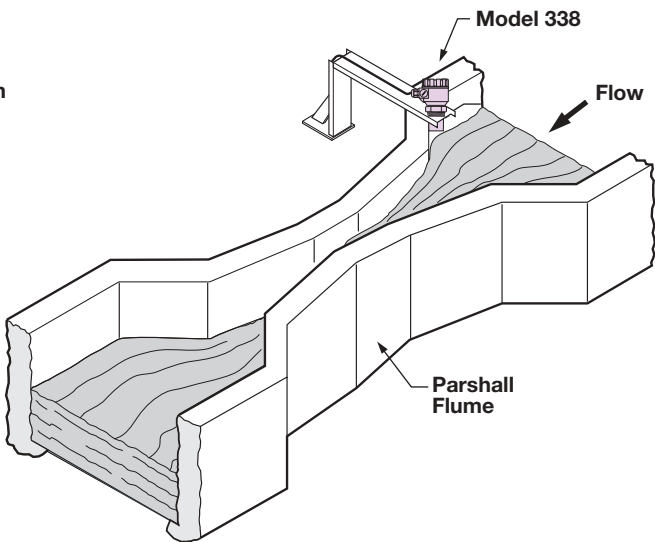
The level measurement is made by emitting an ultrasonic pulse from the transducer and measuring the time required for the echo to reflect from the liquid surface and return to the transducer. The powerful electronics measure the time of the round trip pulse and, by

knowing the speed of sound, calculate the distance. Since speed of sound is temperature dependent, the transducer also measures the temperature in the vessel to provide compensation for changing temperature.

By inputting the type and geometry of the vessel, the intelligent electronics can calculate the liquid volume in the vessel. In a similar operation, the Model 338 can perform open channel flow measurement by converting the level reading into units of volume per time. Common tank shapes, flumes, and weirs are stored in the 338 software. A 32-point linearization table is also available for unusual tanks or primary flow elements.



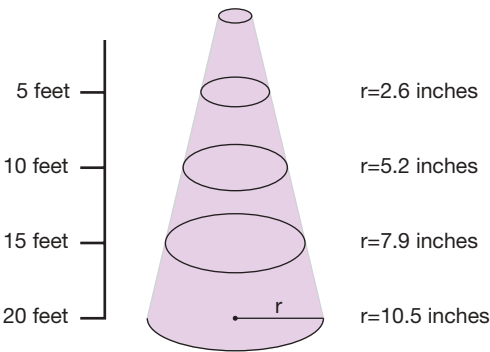
Typical Mounting – Level/Volume



Typical Mounting – Open Channel Flow

PERFORMANCE

Model 338 Transmitters are high performance units that feature a powerful 80 kHz transducer, highly collimated beam angles, and advanced digital signal processing. These features allow the 338 to accurately track the liquid level in difficult applications involving agitation and light foam. The extremely narrow 5° beam angle, shown on the right, allows the 338 to be used in applications where other units with wider beam angles fail due to false reflections in the tank.

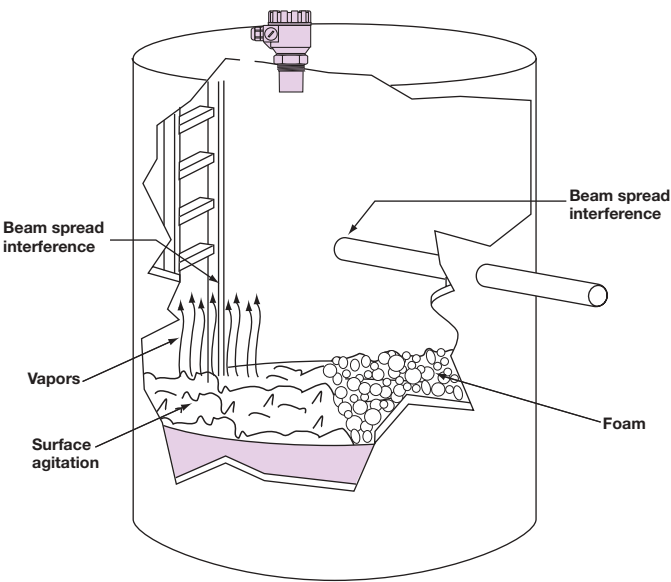


Beam Radius vs. Distance

MEASUREMENT RANGE CALCULATIONS

Ultrasonic non-contact transmitters are typically rated for a maximum range in ideal conditions. Experience has shown that maximum range must be reduced for certain factors. Although the maximum range rating is somewhat conservative, each application must be evaluated for specific conditions in the tank.

Several application parameters that affect ultrasonic performance are shown in the tank at the right. Each of these parameters is assigned a Performance Multiplier in the chart below. Multiply the maximum potential range (20 feet) of the Model 338 by each of the applicable Performance Multipliers to calculate the maximum allowable range for the application.



OPERATING PARAMETER	CONDITION	PERFORMANCE MULTIPLIER
SURFACE AGITATION: Surface agitation or waves can degrade the performance. Moderate agitation results in only slight degradation of performance. The worst case is when the surface is a good reflector, but in the wrong direction.	Smooth, glass-like surface	1.0
	Slight agitation, chopiness	0.9
	Heavy agitation	0.8
	Slight vortex	0.7
VAPORS AND STEAM: Vapors can cause problems when the liquid process temperature is well above the temperature of the airspace. The greater the difference, the more expected vapor problems. The problems result from condensation or layering in the sound path, both of which attenuate the sound signal, and degrade performance. If a vent is used, be sure that it is well away from the transducer.	No condensation	1.0
	Little condensation	0.9
	Much condensation/ foggy appearance	0.8
BEAM SPREAD INTERFERENCE: It is recommended that no obstructions, such as ladder rungs, fill pipes, support struts, etc., be allowed within the 7° ultrasonic beam. If an obstruction is unavoidable, make it as far away as possible from the transducer. Interference from agitator blades is only an intermittent interference that usually has little effect on performance. A special software algorithm can also help suppress false echoes from agitator blades that are within the beam angle.	No interference within 3.5° half beam angle	1.0
	Agitator at speed less than 60 RPM	1.0
	Agitator at speed greater than 60 RPM ...	Consult factory
	Interference outside 2°, far from transducer (in bottom third of range)	0.8
	Interference outside 2°, near to transducer (in top third of range)	0.5
FOAM: Foam can attenuate the ultrasound and render the system inoperative. If possible, moving the transducer to an area in the tank where there is less foam will improve the performance. Thick, heavy-density foams can sometimes produce a reflection from the top of the foam. The multipliers shown at right are general guidelines. For further assistance consult the factory.	No foam	1.0
	Light froth, less than 0.25" thick	0.8
	Light foam, less than 0.5" thick	0.5
	Light foam, more than 1" thick	0.1

EXAMPLE: A slightly agitated 12' tank with no condensation, no interference, and a light froth on the surface.

Maximum allowable range: $20' \times 0.9 \times 1.0 \times 1.0 \times 0.8 = 14.4$ feet

Since the maximum allowable range is 14.4 feet, the 338 is suitable for this 12 foot tank.

338 MODEL NUMBER

Quick shipment, usually within one week after factory receipt of a purchase order, through the Expedite Ship Plan (ESP).

BASIC MODEL NUMBER

338-P53A-G5P

338

Integrally mounted transmitter with 80 kHz transducer, plastic housing, polypropylene transducer

ELECTRONICS HOUSING

P

Plastic (PBT) NEMA 6

INPUT POWER

5

12 to 36 VDC

SIGNAL OUTPUT

3

4–20 mA (600 Ω load)

ACCESSORIES

A

Digital display / programming module

AGENCY APPROVALS

G

General purpose NEMA 6

MOUNTING

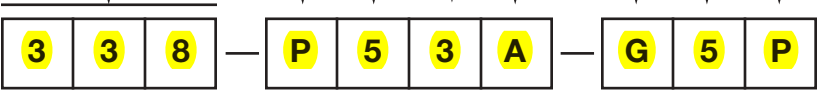
5

2" NPT

TRANSDUCER

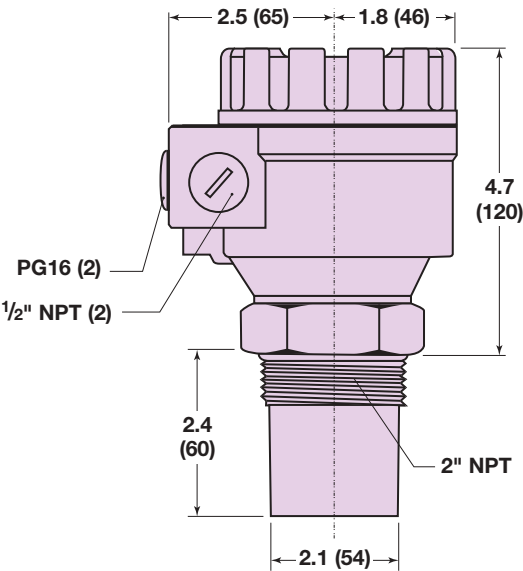
P

Polypropylene NEMA 6P



DIMENSIONAL INFORMATION

INCHES (MM)



SPECIFICATIONS

Power supply	12 to 36 VDC
Power consumption	48 to 720 mW
Maximum range	20 feet (6 meters)
Dead zone	10 inches (250 mm)
Frequency	80 kHz
Output signal	4–20 mA isolated
Loop resistance	630 Ω @ 24 VDC (20 mA), 570 Ω @ 24 VDC (22 mA)
Diagnostic alarm	Adjustable 3.6 mA, 22 mA, or HOLD (NAMUR NE 43)
Damping	Adjustable 0–60 seconds
User Interface	
Keypad	4-button menu-driven data entry
Display	Removable 6-digit custom LCD module with dual function bar graph
LED status indication	Echo strength and power
Process connection	2 inch NPT or BSP (flanges optionally available)
Process temperature	-22° to +195° F (-30° to +90° C)
Ambient temperature	-22° to +140° F (-30° to 60° C)
LCD module temperature	-13° to + 140° F (-25° to +60° C)
Process pressure	Atmospheric to 44 psi (3 bar)
Ultrasonic beam angle	5 degrees conical
Temperature compensation	Automatic over the operating temperature range of the transducer
Accuracy	$\pm 0.2\%$ of the measured distance, plus 0.05% of the range
Resolution	.04 inches (1 mm)
Enclosure	Plastic (PBT), NEMA 6 (IP 67)
Transducer	Polypropylene, NEMA 6P (IP 68)
Cable entry	Two – ½" NPT and Two – PG16
Weight	1.8 lbs. (.8 kg)



These units have been tested to EN 50081-2 and EN 50082-2 and are in compliance with the EMC Directive 89/336/EEC.

CUSTOM GRAPHICS LCD DISPLAY MODULE

The Model 338 is configured through the use of a custom graphics LCD display module. This 6-character alphanumeric display is used in conjunction with 4 push buttons on the side of the module, to perform all set-up and data entry. A wide selection of level, volume, and open channel flow units may be selected.

The LCD module features a bar graph for quick visual indication of echo signal strength or the tank level. Operational status icons provide continuous diagnostic information on the performance of the transmitter. After unit configuration is completed the LCD module can either be removed, or remain in the housing for continuous display of all measurement data.



QUALITY



The quality assurance system in place at Magnetrol guarantees the highest level of quality throughout the company. Magnetrol is committed to providing full customer satisfaction both in quality products and quality service.

Magnetrol's quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.

ESP

Expedite Ship Plan

The Echotel Model 338 Ultrasonic Level Transmitter is available for quick shipment, usually within one week after factory receipt of a purchase order, through the Expedite Ship Plan (ESP).

The model is color coded in the selection data charts.

ESP service may not apply to orders of ten units or more. Contact your local representative for lead times on larger volume orders, as well as other products and options.

WARRANTY



All Magnetrol electronic level and flow controls are warranted free of defects in materials or workmanship for one full year from the date of original factory shipment.

If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol will repair or

replace the control at no cost to the purchaser (or owner) other than transportation.

Magnetrol shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of equipment. There are no other warranties expressed or implied, except special written warranties covering some Magnetrol products.



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145 Jardin Drive, Units 1 & 2 • Concord, Ontario Canada L4K 1X7 • 905-738-9600 • Fax 905-738-1306
Heikensstraat 6 • B 9240 Zele, Belgium • 052 45.11.11 • Fax 052 45.09.93
Regent Business Ctr., Jubilee Rd. • Burgess Hill, Sussex RH15 9TL U.K. • 01444-871313 • Fax 01444-871317

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BULLETIN: 51-139.2
EFFECTIVE: May 2005
SUPERSEDES: July 2004

PILGRIM
38 Union Street
East Walpole, MA 02032

FAX COVERSHEET

Company: *BKSCO*

From: Peter Bilafer
Extension: 20

To: *Ed Tierney President*

Fax Number: 508-668-4181

Fax Number: *714-242-1419*

Telephone: 508-668-3500
800-536-7990

Number of Pages: *6*

Date: *10/29/07*

Reference: *Boeing SSFL*

Ed,

*Here are the submittals you requested
Any question call me*

Regards,

PJ
Peter J. Bilafer
Executive Vice President

ASHCROFT®

Duralife® Pressure Gauge
Type 1009, ASME B 40.1
Grade 1A ($\pm 1\%$ of span)

DESIGNED FOR SAFETY AND LONGER LIFE

- 5-year limited warranty
- Patented PowerFlex™ movement isolates movement from shock and vibration for longer life
- All stainless, all-welded construction for long life
- ASME Grade 1A, 1% accuracy full scale
- True Zero™ pointer indication – no stop pin to mask false zero reading – ensures safety and process control

The following Table is *not* for conversion purposes.

STANDARD RANGES (SI/US)

Pressure psi	kg/cm ² - bar	kPa
0/15	0/1	0/100
0/30	0/1.6	0/160
0/60	0/2.5	0/250
0/100	0/4	0/400
0/160	0/6	0/600
0/200	0/10	0/1000
0/300	0/16	0/1600
0/400	0/25	0/2500
0/600	0/40	0/4000
0/800	0/60	0/6000
0/1000	0/100	0/10,000
0/1500	0/160	0/16,000
0/2000	0/250	0/25,000
0/3000	0/400	0/40,000
0/4000	0/600	0/60,000
0/5000	0/1000	0/100,000
0/6000		
0/7500		
0/10,000		
0/15,000		
Vacuum		
30 in./0 in.Hg	-1/0	-100/0
Compound		
30 in.Hg/15 psi	-1/0/1.5	-100/0/150
30 in.Hg/30 psi	-1/0/3	-100/0/300
30 in.Hg/60 psi	-1/0/5	-100/0/500
30 in.Hg/100 psi	-1/0/9	-100/0/900
30 in.Hg/150 psi	-1/0/15	-100/0/1500
30 in.Hg/300 psi	-1/0/24	-100/0/2400

- New PLUS!™ Performance Option:
 - Liquid-filled performance in a dry gauge
 - Fights vibration and pulsations without liquid-fill headaches
 - Order as option XLL

OTHER FEATURES:

Available in 2½" and 3½" dial sizes, Duralife® pressure gauges are liquid fillable and field convertible for panel mounting. Both zero and span adjustments are standard.

The gauge is available dry, liquid-filled weatherproof or hermetically sealed and now with PLUS!™ performance option. A five year limited warranty is standard with the Type 1009 Duralife® gauge.



BOURDON SYSTEM SELECTION⁽¹⁾

Ordering Code	Bourdon Tube & Tip Material ⁽¹⁾	Socket Material	Tube Type	Range Selection Limits (psi)	NPT Conn. ⁽⁶⁾
AW	316 stainless steel	Bronze	C-Tube	Vac/600	¼
AW	316 stainless steel	Bronze	Helical	1000	¼
SW	316 stainless steel	316 stainless steel	C-Tube	Vac/600	½ & ¾ ⁽²⁾
SW	316 stainless steel	316 stainless steel	Helical	800/15,000	½ & ¾ ⁽²⁾

(1) For selection of the correct Bourdon system material, see the media application table on page 253.

(2) ¼ NPT available 3¼" lower SW system only.

(3) Type 1009 gauges may be ordered with metric single-scale dial: kPa, bar or kg/cm².

(4) Dual-scale dials will be supplied with standard metric inner scale and equivalent psi outer scale or with standard psi inner scale and equivalent metric outer scale—please specify.

(5) Special logos and scales available upon request.

(6) ¼" JIS, BSP or DIN threads available on SW systems.

Tag No.'s PI-200, PI-201, PI-202, PI-207
 PI-208

model 35-1009SWL-02L-60psig

Tag No. PI-209

model 35-1009SWL02L-160 psig

Tag No. PI-215

model 25-1009SW-02L-30 psig (Dry)

TO ORDER THIS 1009 DURALIFE PRESSURE GAUGE:

Select:

1. Dial size—2½", 3½"
 2. Case type—1009
 3. Tube and socket material
 4. Liquid filled (glycerin), leave blank if dry
 5. Connection size—¼ (01), ½ (02) ¾ (04)
 6. Connection location—Lower (L), Back (B)
 7. Optional Features—see page 249
 8. Standard pressure range—1000 psi
- Accessories: see pages 243-248

3½ and 2½

SW

L =

02

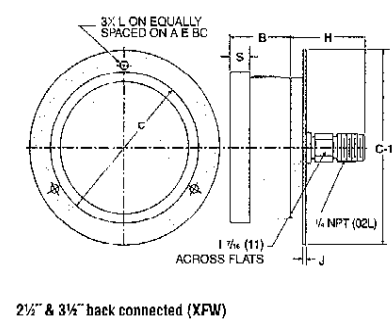
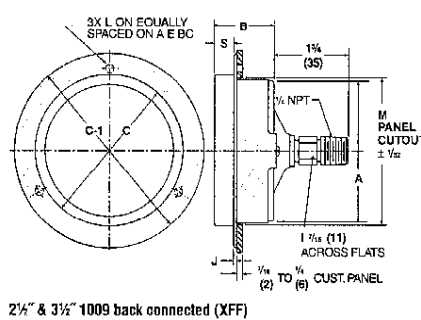
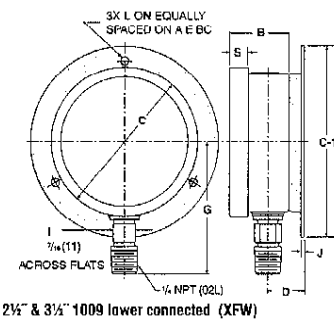
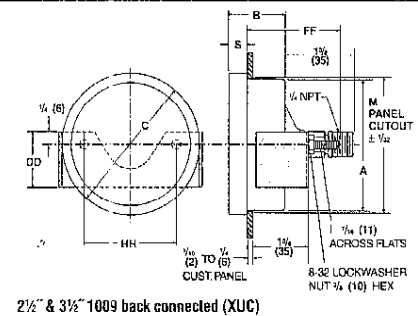
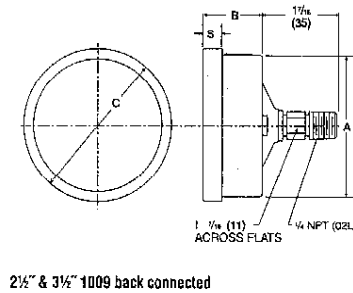
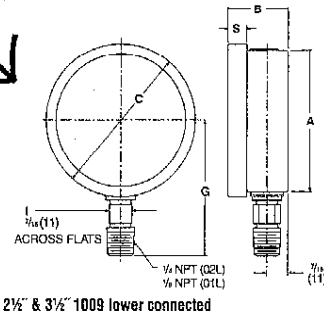
L

Liquid filled SWL = Liquid filled

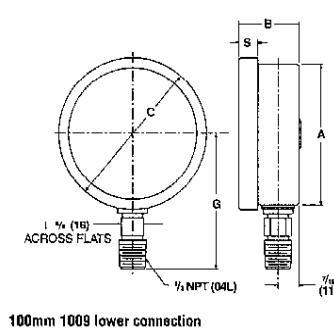
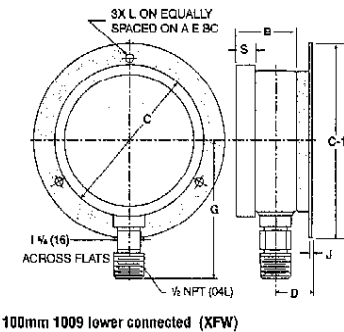
Dimensions

Ashcroft® Stainless Steel Case Pressure Gauges

Case Type 1009 – 2½" & 3½"



Case Type 1009 – 100mm



Gauge Size	A	B	C	C-1	D	DD	E	FF	G	H	HH	I	J	L	M	S	Weight Dry	Weight LF
2½ (63)	2 21/32 (67)	1 3/16 (30)	2 7/8 (73)	3 11/16 (94)	3/4 (19)	1 1/8 (29)	3 3/8 (79)	1 11/16 (43)	2 9/16 (65)	1 1/32 (28)	2 1/16 (52)	7/16 (11)	1/16 (2)	5/32 (4)	2 11/16 (68)	3/8 (10)	.26# .12kg	.50# .32kg
3½ (100)	3 19/32 (91)	1 9/32 (33)	3 31/32 (100)	5 7/32 (133)	7/8 (22)	1 1/32 (26.4)	4 9/16 (106)	1 29/32 (48)	3 (76)	3 (76)	2 13/32 (61)	7/16 (11)	5/32 (4)	7/32 (6)	3 1/32 (93)	1 5/32 (12)	.44# .20kg	.88# .40kg
(100)	3 19/32 (91)	1 19/32 (40)	3 31/32 (100)	5 7/32 (133)	7/8 (22)		4 9/16 (116)		3 11/16 (94)			5/8 (16)	5/32 (4)	7/32 (6)		1 5/32 (12)	.50# .23kg	.97# .45kg

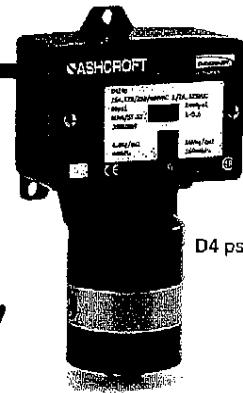
Note: Dimensions in brackets () are millimeters.

ORDER INFORMATION

B-SERIES PRESSURE AND DIFFERENTIAL PRESSURE SWITCH MODEL NUMBER:

To specify the exact switch desired, select entries from appropriate tables as shown in example below.

1 2 3 4 5
D4 23 V 60 PSID set pt 25 psid



D4 psid model shown

1 - ENCLOSURE

B4	Pressure switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
B7	Pressure switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.
D4	Differential pressure switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
D7	Differential pressure switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.

3 - ACTUATOR SEAL

Code and Material	Process Temperature Limits °F ⁽⁹⁾	Range			
		Vac. H ₂ O	0-600 psi	1000 psi	3000 psi
B - Buna-N	0 to 150	•	•	•	•
V - Viton	20 to 300	•	•	•	•
T - Teflon	0 to 150	•	•	•	•
S - 316L ⁽⁸⁾	0 to 300	•	•	•	•
P - Monel ⁽⁸⁾	0 to 300	•	•	•	•

4 - OPTIONS

Use table from page 10

5 - RANGE

Select from table on page 4

2 - SWITCH ELEMENT SELECTION

Order Code	Switch Elements UL/CSA Listed SPDT	
20 ⁽⁷⁾	Narrow deadband ac	15A, 125/250 Vac
21	Ammonia service	5A, 125/250 Vac
22 ⁽⁶⁾	Hermetically sealed switch, narrow deadband	5A, 125/250 Vac
23	Heavy duty ac	22A, 125/250 Vac
24 ⁽¹⁾	General purpose	15A, 125/250/480 Vac 1/2A, 125 Vdc 1/4A, 250 Vdc; 6A, 30 Vdc
25 ⁽²⁾	Heavy duty dc	10A, 125 Vac or dc, 1/8 HP, 125 Vac or dc
26 ⁽⁷⁾	Sealed environment proof	15A, 125/250 Vac
27	High temperature 300°F	15A, 125/250 Vac
28 ⁽⁵⁾	Manual reset trip on increasing	15A, 125/250 Vac
29 ⁽⁵⁾	Manual reset trip on decreasing	15A, 125/250 Vac
31	Low level (gold) contacts	1A, 125 Vac
32	Hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
42	Hermetically sealed switch, gold contacts	1A, 125 Vac
50	Variable deadband	15A, 125/250 Vac
UL/CSA Listed Dual (2 SPDT)		
61 ⁽⁷⁾	Dual narrow deadband	15A, 125/250 Vac
62 ⁽⁷⁾	Dual sealed environment proof	15A, 125/250 Vac
63	Dual high temp. 300°F	15A, 125/250 Vac
64	Dual general purpose	15A, 125/250/480 Vac 1/2A, 125 Vdc 1/4A, 250 Vdc
65	Dual ammonia service	5A, 125/250 Vac
67 ^(4,5)	Dual hermetically sealed switch, narrow deadband	5A, 125/250 Vac
68 ⁽⁴⁾	Dual hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
71 ⁽⁴⁾	Dual hermetically sealed switch, gold contacts	1A, 125 Vac

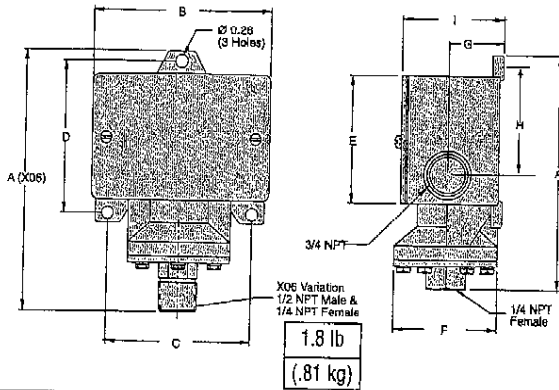
NOTES:

- Standard switch.
- Not available with psid ranges.
- Dual switches are 2 SPDT snap-action switches, not independently adjustable.
- Wires cannot be terminated inside B400 switch enclosure.
- Not available with type 700 enclosure.
- Estimated dc. rating, 2.5A, 28 Vdc (not UL listed).
- Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
- Available on pressure only.
- Ambient operating temperature limits -20 to 150°F; all styles, setpoint shift of ±1% of range per 50°F temperature change is normal. Switches are calibrated at 70°F reference.

Tag No. DPS-200

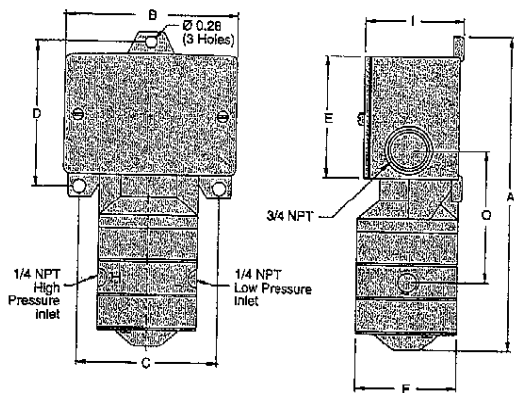
TYPE 400 DIMENSIONS

Pressure switch – psi ranges



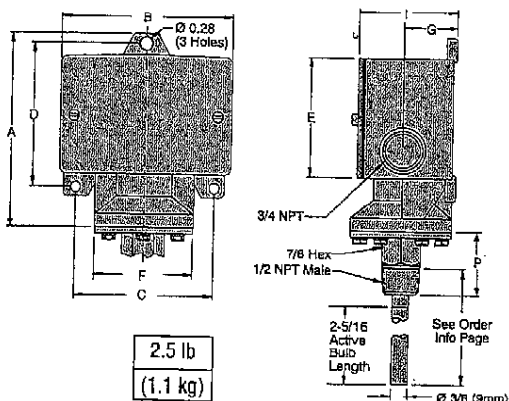
A (X06)	A	B	C	D	E	F	G	H	I
5 ⁷ / ₈	5 ¹ / ₈	4	3 ¹ / ₄	3 ⁵ / ₁₆	2 ³ / ₄	2 ⁵ / ₁₆	1 ¹ / ₄	2 ¹ / ₃₂	2 ⁵ / ₁₆
(149)	(130)	(102)	(83)	(84)	(70)	(59)	(32)	(61)	(59)

Differential pressure switch – psi differential ranges



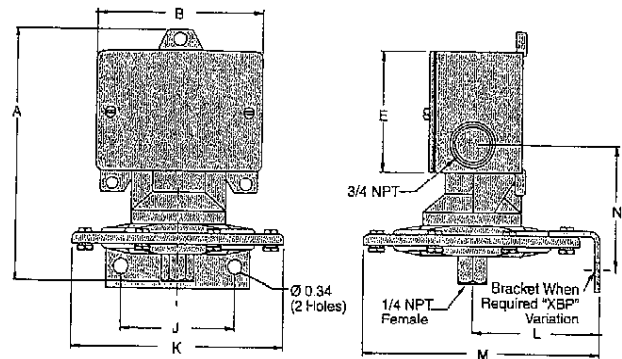
A	B	C	D	E	F	I	O
7 ⁷ / ₃₂	4	3 ¹ / ₄	3 ⁵ / ₁₆	2 ³ / ₄	2 ⁵ / ₁₆	2 ⁵ / ₁₆	3
(182)	(102)	(83)	(84)	(70)	(59)	(59)	(56)

Temperature switch – direct mount



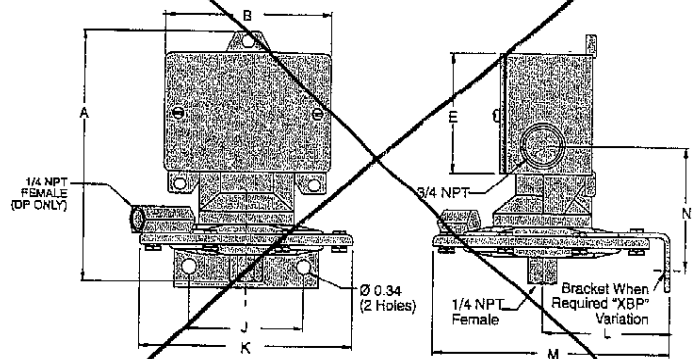
A	B	C	D	E	F	G	I	P
4 ¹ / ₁₆	4	3 ¹ / ₄	3 ⁵ / ₁₆	2 ³ / ₄	2 ⁵ / ₁₆	1 ¹ / ₄	2 ⁵ / ₁₆	1 ⁵ / ₁₆
(119)	(102)	(83)	(84)	(70)	(59)	(32)	(59)	(33)

Pressure switch – inches of water ranges



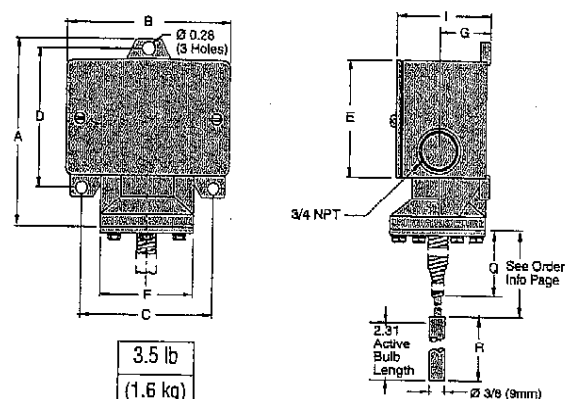
A	B	E	J	K	L	M	N
5 ²⁵ / ₃₂	4	2 ³ / ₄	2 ²⁵ / ₃₂	5 ¹ / ₈	3 ¹ / ₁₆	5 ¹ / ₁₆	2 ²⁷ / ₃₂
(147)	(102)	(70)	(71)	(130)	(78)	(145)	(72)

Differential pressure switch – inches of water ranges



A	B	E	J	K	L	M	N
5 ²⁵ / ₃₂	4	2 ³ / ₄	2 ²⁵ / ₃₂	5 ¹ / ₈	3 ¹ / ₁₆	5 ¹ / ₁₆	2 ²⁷ / ₃₂
(147)	(102)	(70)	(71)	(130)	(78)	(145)	(72)

Temperature switch – remote mount



A	B	C	D	E	F	G	I	Q	R
4 ¹ / ₁₆	4	3 ¹ / ₄	3 ⁵ / ₁₆	2 ³ / ₄	2 ⁵ / ₁₆	1 ¹ / ₄	2 ⁵ / ₁₆	3	3
(119)	(102)	(83)	(84)	(70)	(59)	(32)	(59)	(76)	(76)

PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

B-Series pressure, differential pressure and vacuum switches use two different actuators depending on setpoint requirements. For setpoints between 2 and 3000 psi, the simple, rugged diaphragm-sealed piston actuator is used. This design features high reliability and choice of actuator seal materials for virtually every application. An optional welded design is also available for setpoints up to 1000 psi for maximum reliability. This design is available in 316

SS or Monel. Differential pressure models use a unique, dual diaphragm-sealed piston design that features very high static operating pressures and small size.

For setpoints between 4.5 and 150 inches of H₂O, a large diaphragm is used for increased sensitivity in both pressure and differential pressure designs with good choice of materials of construction.

All standard models feature ± 1 percent of range setpoint repeatability and a minimum of 400 percent of range proof pressures.

These standard designs perform well in applications where shock and vibration could be a problem and may be used in conjunction with Ashcroft diaphragm seals in extreme services such as slurries or abrasive process fluids.

PRESSURE/VACUUM SWITCHES

Nominal Range ⁽¹⁾			Overpressure Ratings		Approximate Deadband ⁽²⁾ Switch Element				
			Proof psi	Burst psi	20, 26, 27	21, 24, 31	50	22	32
Vacuum									
-30" Hg	-760mm Hg	-100 kPa	500	1000	0.3-0.7	1.5-3.0	0.5-2.2	0.4-1.5	2.1-4.2
Compound									
-15" H ₂ O/ 15" H ₂ O	-375mm H ₂ O/ 375mm H ₂ O	-3.7 kPa/ 3.7 kPa	20	35	0.15-75/ 0.15-75	1.5-2.5/ 1.5-2.5	0.45-2.0/ 0.45-2.0	0.5-1.2/ 0.5-1.2	2.1-3.5/ 2.1-3.5
-30" H ₂ O/ 30" H ₂ O	-760mm H ₂ O/ 760mm H ₂ O	-7.5 kPa/ 7.5 kPa	20	35	0.30-60/ 0.30-60	1.5-2.5/ 1.5-2.5	0.45-2.0/ 0.45-2.0	0.5-1.5/ 0.5-1.5	2.1-3.5/ 2.1-3.5
-30" Hg/ 15 psi	-760mm Hg/ 1.0 kg/cm ²	-100 kPa/ 100 kPa	500	1000	0.5-1.0/ 0.3-0.7	2.0-3.0/ 0.5-1.5	0.75-2.5/ 0.5-1.0	0.7-1.8/ 0.7-1.4	2.8-4.2/ 0.7-2.1
-30" Hg/ 30 psi	-760mm Hg/ 2.0 kg/cm ²	-100 kPa/ 200 kPa	500	1000	1.0-1.5/ 0.3-0.8	3.0-6.0/ 1.0-2.0	1.2-4.5/ 0.7-1.5	1.4-2.4/ 0.4-1.3	4.2-8.4/ 1.4-2.8
-30" Hg/ 60 psi	-760mm Hg/ 4.0 kg/cm ²	-100 kPa/ 400 kPa	500	1000	2.0-3.0/ 0.7-1.5	5.0-9.0/ 3.0-5.0	2.5-7.0/ 1.1-4.0	2.8-4.5/ 1.0-2.3	7.0-12.0/ 4.2-7.0
Pressure									
10" H ₂ O	250mm H ₂ O	2.5 kPa	20	35	0.2-0.5	1.0-2.0	0.35-1.5	0.4-1.0	1.4-2.8
30" H ₂ O	750mm H ₂ O	7.5 kPa	20	35	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60" H ₂ O	1500mm H ₂ O	15 kPa	20	35	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100" H ₂ O	2500mm H ₂ O	25 kPa	20	35	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150" H ₂ O	3750mm H ₂ O	37 kPa	20	35	1.0-2.5	4.5-8.5	1.7-6.5	2.0-6.0	6.0-12.0
15 psi	1.0 kg/cm ²	100 kPa	2400	3000	0.1-0.35	0.5-1.5	0.2-1.0	0.4-1.0	0.7-2.1
30 psi	2.0 kg/cm ²	200 kPa	2400	3000	0.1-0.50	0.5-1.5	0.3-1.0	0.4-1.0	0.7-2.1
60 psi	4.0 kg/cm ²	400 kPa	2400	3000	0.3-1.0	1.0-3.5	0.7-2.5	0.6-2.0	1.4-5.0
100 psi	7.0 kg/cm ²	700 kPa	2400	3000	0.5-1.7	1.5-5.0	1.1-3.5	1.0-4.5	2.1-7.0
200 psi	14 kg/cm ²	1400 kPa	2400	3000	1-3	5-13	2-9	3.0-7.5	7.0-18.2
400 psi	28 kg/cm ²	2800 kPa	2400	3000	4-7.5	5-24	5.5-15	4.0-11.0	7.0-33.6
600 psi	42 kg/cm ²	4200 kPa	2400	3000	4-11	9-30	7-20	5.0-23.0	12.6-42
1000 psi	70 kg/cm ²	7000 kPa	12000	18000	7-30	30-110	18-70	15-80	42-154
3000 psi	210 kg/cm ²	2100 kPa	12000	18000	15-60	80-235	37-160	30.0-230	112-329

DIFFERENTIAL PRESSURE SWITCHES

Nominal Range ⁽¹⁾			Pressure Ratings		Approximate Deadband ⁽²⁾ Switch Element				
			Static Working Pressure	Proof psi	20, 26, 27	21, 24, 31	50	22	32
30" H ₂ O	750mm H ₂ O	7.5 kPa	5.4	21.6	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60" H ₂ O	1500mm H ₂ O	15 kPa	5.4	21.6	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100" H ₂ O	2500mm H ₂ O	25 kPa	5.4	21.6	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150" H ₂ O	3750mm H ₂ O	37 kPa	5.4	21.6	1.0-2.5	4.5-8.5	1.8-6.5	2.0-6.0	6.3-12.0
15 psid	1.0 kg/cm ²	100 kPa	500	2000	0.5-1.0	2.0-5.0	0.7-3.5	0.7-1.4	2.8-7.0
30 psid	2.0 kg/cm ²	200 kPa	500	2000	1.0-2.0	2.0-5.0	1.5-3.5	1.4-2.8	2.8-7.0
60 psid	4.0 kg/cm ²	400 kPa	500	2000	2.0-4.0	3.0-6.0	3.0-4.5	2.8-5.6	4.2-8.5
100 psid	7.0 kg/cm ²	700 kPa	1000	4000	4.0-10.0	11.0-20.0	7.0-15.0	6.0-14.0	16.0-28.0
200 psid	14.0 kg/cm ²	1400 kPa	1000	4000	5.0-15.0	12.0-40.0	10.0-26.0	7.0-21.0	17.0-56.0
400 psid	28.0 kg/cm ²	2800 kPa	1000	8000	10.0-20.0	20.0-60.0	15.0-40.0	14.0-28.0	28.0-84.0
600 psid	42.0 kg/cm ²	4200 kPa	1000	8000	20.0-40.0	80.0-150.0	30.0-115.0	30.0-56.0	112.0-210.0

Values shown are for zero static working pressure.

NOTES:

1 Switches may generally be set between 15% and 100% of nominal range on increasing pressure. Consult factory for applications where setpoints must be lower.

2 All deadbands are given in English units as shown in the nominal range column. Deadbands shown are for switches with Buna N diaphragm. Approximate deadbands for optional diaphragms:

Viton: Multiply Buna N value by 1.4
Teflon: Multiply Buna N value by 1.2
Stainless Steel: Multiply Buna N value by 1.7
Monel: Multiply Buna N value by 1.7
Dual Switch Element: Multiply single switch element value by 1.6 for approximate deadband.

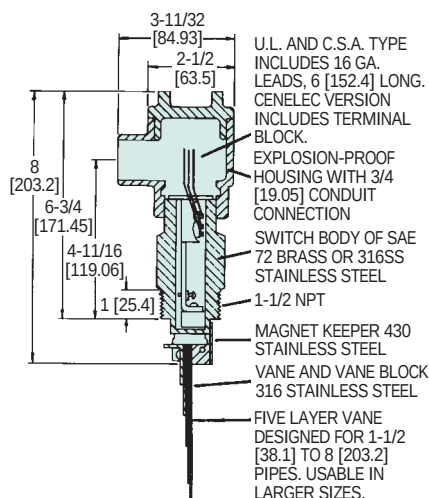
Series
V4

Flotect® Vane Operated Flow Switch

Field Adjustable — Dependable Protection Against Flow Variation or Stopping in Pipelines for Fluids, Gases and Flowing Solids



Flow



Rugged and reliable the Series V4 Flotect® flow switch operates automatically to protect equipment and pipeline systems against damage from reduction or loss of flow. The V4 is time tested being installed in thousands of pipelines and processing plants around the world. A unique magnetically actuated switching design gives superior performance. There are no bellows, springs, or seals to fail. Instead, a free-swinging vane attracts a magnet within the solid metal switch body, actuating a snap switch by means of a simple lever arm.

FEATURES

- Leak proof body machined from bar stock
- Choice of custom vane calibrated for your application, Model V4, or field adjustable multilayer vane, Model V4-2-U (see set point chart)
- Weatherproof, designed to meet NEMA 4
- Explosion-proof (listing included in specifications)
- Installs directly and easily into pipeline with a thredolet, tee, or flange (see application drawings)
- Can be used in pipes 1-1/2" and up
- Electrical assembly can be easily replaced without removing the unit from installation so that the process does not have to be shut down
- High pressure rating of 1000 psig (69 bar) with the brass body and 2000 psig (138 bar) with the 316 SS body

APPLICATIONS

- Protects pumps, motors and other equipment against low or no flow
- Controls sequential operation of pumps
- Automatically starts auxiliary pumps and engines
- Stops liquid cooled engines, machines and processing when coolant flow is interrupted
- Shuts down burner when air flow through heating coil fails
- Controls dampers according to flow

SPECIFICATIONS

Service: Gases or liquids compatible with wetted materials.

Wetted Materials:

Vane: 316 SS.

Body: Brass or 316 SS standard.

Magnet Keeper: 430 SS standard, 316 SS optional.

Options: Other materials also available, consult factory (e.g. PVC, Hastelloy, Nickel, Monel, Titanium).

Temperature Limit: -4 to 275°F (-20 to 135°C) standard, MT high temperature option 400°F (205°C) [MT option not UL, CSA, ATEX, or SAA].

Pressure Limit: Brass body 1000 psig (69 bar), 316 SS body 2000 psig (138 bar), optional 5000 psig (345 bar) available with 316 SS body and SPDT switch only.

Enclosure Rating: Weatherproof and Explosion-proof. Listed with UL and CSA for Class I, Groups C and D; Class II, Groups E, F, and G.

ATEX **CE 0344** **Ex** II 2 G EEx d IIB T6 -20°C ≤ Tamb ≤ 75°C

EC-Type Certificate No.: KEMA 03ATEX 2383

SAA: Exd II C T6 (T amb=60°C). Zone I. Also FM approved.

Switch Type: SPDT snap switch standard, DPDT snap switch optional.

Electrical Rating: UL, FM, ATEX and SAA models 10A @ 125/250 VAC (V~). CSA models: 5A @ 125/250 VAC (V~); 5A res., 3A ind. @ 30 VDC (V---). MV option: 1A @ 125 VAC (V~); 1A res., .5A ind. @ 30 VDC (V---). MT option: 5A @ 125/250 VAC (V~). [MT and MV option not UL, CSA, FM, ATEX or SAA].

Electrical Connections: UL and CSA models: 16 AWG, 6" (152 mm) long. ATEX and SAA unit: Terminal block.

Conduit Connection: 3/4" female NPT.

Process Connection: 1-1/2" male NPT.

Mounting Orientation: Within 5° of vertical for proper operation. Units for horizontal installation (vertical pipe with up flow) available.

Set Point Adjustment: For universal vane: five vane combinations.

Weight: 4 lb 8 oz (1.9 kg).

Agency Approvals: UL, CSA, CE, FM, SAA, and ATEX.

Model	Description
V4-2-U	Brass body, universal vane
~~V4-SS-2-U~~	~~316SS* body, universal vane~~
~~V4~~	~~Brass body, custom vane~~
~~V4-SS~~	~~316SS* body, custom vane~~

*316SS body with 430SS magnet keeper.

Options (add as a suffix to the model number):

-D, DPDT contacts

-MV, Gold Plated Contacts, options for dry circuits

(see electrical rating in specification, no listings or approvals)

-MT, High Temperature, option rated 400° F (204° C)

(see electrical rating in specifications, no listings or approvals)

-TRI (increasing flow), -TRD (decreasing flow), Time Delay Relay,

option with 2 SPDT contacts, adjustable from 0-1 to 0-31 minutes.

(no listings or approvals)

-316, 316 SS Magnet Keeper, option to replace standard 430 SS

-SAA, SAA listed construction

-V, Vertical Up Flow, option for upward flow in vertical pipe

-AT, ATEX listed construction

Consult factory for price and availability of fittings for V4 installation. Thredolets, bushings, and tees are available in a variety of sizes and materials.

For custom vane models, please supply factory with following information: pipe size, flow direction (horizontal, up), mounting, pressure, temperature, specific gravity, flow rates (maximum normal, actuation/deactuation*), etc.

*When both values are supplied, note which is critical.

V4 Universal Vane Flow Charts

Values shown in both charts are nominal. If normal flows exceed actuation rates by less than 10%, custom vanes are recommended. Figures are based on standard vertical installation in a 1-1/2" Threaded Branch Connection in a horizontal run of pipe.

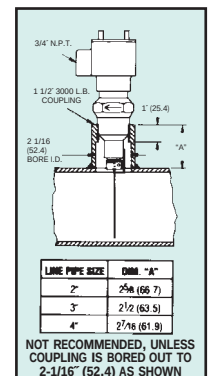
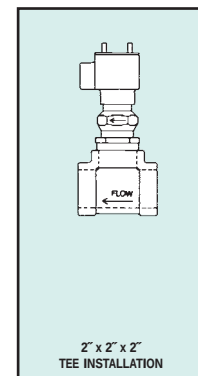
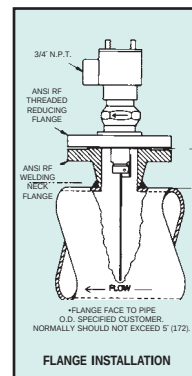
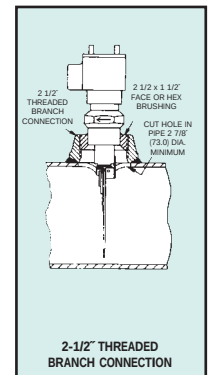
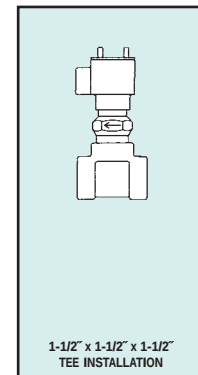
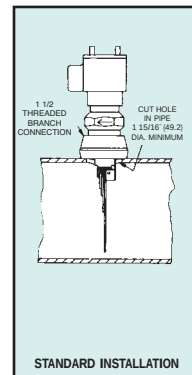
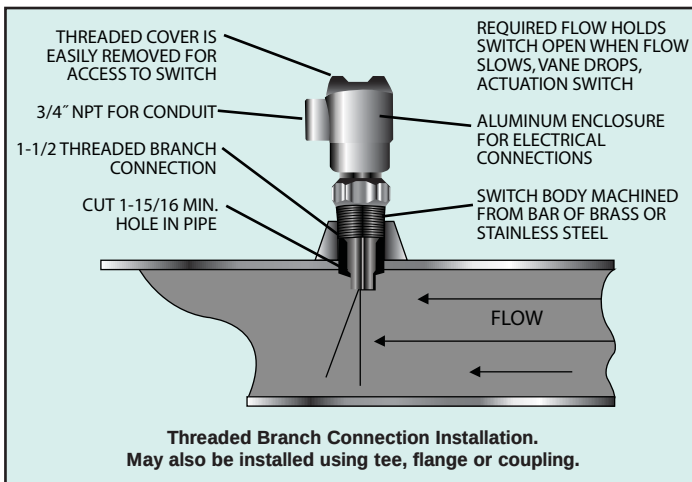
APPROXIMATE ACTUATION/DEACTUATION FLOW RATES FOR COLD WATER. UPPER FIGURES IN GPM. LOWER FIGURES IN LPM												
VANE LAYERS	1.5"PIPE	2"PIPE	3"PIPE	4"PIPE	6"PIPE	8"PIPE	10"PIPE	12"PIPE	14"PIPE	16"PIPE	18"PIPE	20"PIPE
1	7-3 26.67-11.67	15-8 56.7-30	45-22 167-83.3	95-40 367-150	210-120 800-450	375-175 1417-667	600-300 2267-1133	900-450 3400-1700	1200-600 4550-2267	1400-800 5300-3033	2000-1000 7567-3783	2400-1200 9083-4550
1&2		7-4 26.7-15	23-14 86.7-53.3	50-35 190-132	130-90 500-333	230-150 867-567	450-250 1700-950	650-350 2467-1317	900-500 3400-1900	1200-650 4550-2467	1450-800 5483-3033	1800-1000 6817-3783
1,2,&3			11-7 41.7-26.7	27-19 102-71.7	80-60 300-233	160-115 600-433	300-180 1133-683	450-275 1700-1033	600-350 2267-1317	750-450 2750-2083	1000-600 3783-2267	1200-700 4550-2650
1,2,3,&4				17-12 65-45	60-45 233-167	120-90 450-333	230-150 867-567	310-200 1167-750	430-280 1633-1067	550-360 2083-1367	700-450 2650-1700	850-550 3217-2083
1,2,3,4,&5					40-30 152-113	80-65 300-250	135-100 517-383	200-140 750-533	290-200 1100-750	360-250 1367-950	460-325 1733-1233	575-400 2183-1517

Actuation rates are based on cold water at a specific gravity of 1.0. For fluids of different specific gravity, actuation rates may be approximated by dividing the rate shown by the square root of the specific gravity.

APPROXIMATE ACTUATION/DEACTUATION FLOW RATES FOR AIR. UPPER FIGURES IN SCFM. LOWER FIGURES IN LPS												
VANE LAYERS	1.5"PIPE	2"PIPE	3"PIPE	4"PIPE	6"PIPE	8"PIPE	10"PIPE	12"PIPE	14"PIPE	16"PIPE	18"PIPE	20"PIPE
1	32-17 15-8	65-32 30-20	210-105 100-50	400-200 190-90	950-475 450-220	1550-850 730-400	2400-1300 1100-600	3450-1900 1600-900	4700-2600 2200-1200	6400-3500 3000-1700	8000-4400 3800-2100	10000-5500 4700-2600
1&2		23-13 10-6	120-70 60-30	195-140 90-70	550-375 260-180	1100-700 520-330	1850-1200 870-570	2700-1750 1300-800	3400-2200 1600-1000	4800-3100 2300-1500	6000-3900 2800-1800	7400-4800 3500-2300
1,2,&3			60-48 30-20	135-100 60-50	375-265 180-130	725-500 340-240	1200-850 570-400	1850-1300 870-610	2600-1800 1200-800	3350-2350 1600-1100	4300-3000 2000-1400	5300-3700 2500-1700
1,2,3,&4				65-50 30-20	260-200 120-90	500-400 240-190	875-700 410-330	1250-1000 590-470	1900-1500 900-710	2500-2000 1200-900	3100-2500 1500-1200	3900-3100 1800-1500
1,2,3,4,&5					130-100 60-50	310-250 150-120	650-525 310-250	1000-800 470-380	1600-1250 760-590	2200-1750 1040-830	2800-2250 1300-1100	3550-2850 1700-1300

Actuation rates are based on air at standard conditions. For gases at other pressures, temperatures, or specific gravities, consult factory for equivalent flow approximations.

APPLICATION DRAWINGS FOR FLOTECT® AUTOMATIC FLOW SWITCHES



APPENDIX C

EQUIPMENT CUTSHEETS – PARTICULATE FILTERS



CONSTRUCTION IN ACCORDANCE WITH A.S.M.E. CODE
SECTION VIII, DIV. 1,
FOR UNFIRE PRESSURE VESSELS
MAX. ALLOWABLE WORKING PRESSURE 150 PSI
HYDROSTATIC TEST PRESSURE 195 PSI
MAX. DESIGN TEMP. 500° F
MIN. DESIGN METAL TEMP. 20° F

PONG/PENG FELT FILTER BAGS



Providing Consistent Performance

The FSI PONG filter bag is one of the most versatile and popular bags on the market. Made from a non-inserted polypropylene felt with a glazed surface finish, the standard bag incorporates the PolyWeld® welded seam design. The Polyloc® ring provides hermetic sealing, preventing steel ring bypass problems. And the welded seam eliminates unfiltered liquid bypass occurring due to needle holes. The PENG filter bag is made from non-inserted polyester, and can be ordered with the polyester Polyloc ring.

These bags come in a variety of sizes and ring seals to suit your vessel requirements.

Standard Bag Sizes (Continued)

	
SIZE 3r	SIZE 4r
Diameter: 4" (10.2 cm)	Diameter: 4" (10.2 cm)
Length: 8.25" (20.9 cm)	Length: 14" (35.5 cm)
Compatible with FSI Filter Model FSP/FSPN-20 and the BEN-13.	Compatible with FSI Filter Model FSP/FSPN-35 and the BEN-14.

HOW TO ORDER

Example: **BPONG10P2PC**

Type of Filter:

B = Bag

Material:

PE = Felt, Polyester

PO = Felt, Polypropylene

HT = Felt, High Temp.

TPE = Felt, Teflon

N = Felt, Nylon

N = Non-inserted felt

I = Inserted felt

G = Glazed finish (felt)

F = Fuzzy finish
(polyester felt only)

Micron Rating:

PO: 1, 3, 5, 10, 25, 50, and 100

PE: 1, 3, 5, 10, 25, 50, 75, 100, 200

(refer to Pg. 11 for other felt materials)

Cover:

P = Plain (no cover)

PEM = Polyester multifilament

NMO = Nylon monofilament

Size:

1: 7" x 16"

2: 7" x 32"

3: 4" x 8.25"

4: 4" x 14"

5: 6 7/8" x 34"

6: 6 7/8" x 16 1/2"

7: 5 1/2" x 16"

8: 5 1/2" x 22"

9: 5 1/2" x 33"

Ring:

P = Polyloc

N = Nylon Polyloc

S = Snap fit metal

SSS = Stainless steel snap fit

CO = Commercial steel ring

COP = Commercial plastic ring

RP = Ronningen-Petter snap fit

RPP = Ronningen-Petter plastic ring

RPF = Ronningen-Petter flange

PE = Polyester Polyloc

C = Cuno

Suffix:

WE** = Welded seam construction

A = Auto construction

C = Cotton handle

W = DI Washed

LOOPS = Loops

N = Nylon handle

R = Reverse collar

NOTE:

* = Sizes 5, 6, available with S ring only.

** = Available in Sizes 1 and 2, Polypropylene and Polyester non-inserted only.

BAGS

BPONG10P1PWE

Bag filter, 10 micron #2

APPENDIX D

EQUIPMENT CUTSHEETS – GREEN SAND FILTERS

KF Series Multimedia Filters

SIEMENS

Siemens Water Technologies KF series multimedia filters reduce the amount of suspended solids in the feed water by filtering the water through a multi-layered filter bed. KF series multimedia filter performance for turbidity or particulate removal depends on the flow rate and size of the particulates. At 10 gpm/ft², 90% turbidity removal is typical, while at 8 gpm/ft², 96% turbidity removal is typical. These ratings are valid for particle sizes of 40 microns and larger. Removal of particulates smaller than 40 micron can be achieved by operating at lower flow rates and/or by utilizing a polymer feed to coagulate the smaller particles.



Multimedia Filters Feature:

- Top mounted 7 day timeclock with 5-cycle multiport control valve
- Automatic backwash and rinse capable
- 5 layers of media for optimal sediment holding capacity
- Single corrosion resistant fiberglass vessel
- Brass control valve includes fixed and self adjusting flow regulations

Specifications

Tank Size D x H (in)	Pipe Size (in)	Service Flow gpm (m³/hr)		Backwash Flow gpm (m³/hr)	Media Vol (ft³)
		Commercial* Service Flow	RO-Feed** Service Flow		
10 x 40	1.0	5 (1.1)	4 (0.9)	8 (1.8)	1.0
12 x 52	1.0 1.5	8 (1.8)	6.4 (1.4)	12 (2.7)	1.6
14 x 65	1.0 1.5	10 (2.3)	8 (1.8)	15 (3.4)	2.1
16 x 65	1.0 1.5	14 (3.2)	11.2 (2.5)	20 (4.5)	2.9
18 x 65	1.0 1.5	18 (4.1)	14.4 (3.3)	25 (5.7)	4.0
21 x 62	1.5 2.0	24 (5.5)	19.2 (4.4)	35 (7.9)	4.9
24 x 72	2.0	32 (7.3)	25.6 (5.8)	45 (10.2)	6.9
30 x 72	2.0	49 (11.1)	39.2 (8.9)	70 (15.9)	10.0
36 x 72	2.0	70 (15.9)	56 (12.7)	100 (22.7)	14.5

* Flow is based on approximately 10 gpm/ft².

**Flow is based on approximately 8 gpm/ft².

Dimensions

Tank Size D x H (in)	Overall Dimensions L x D x H (in)	Shipping Weight lb (kg)
10 x 40	10 x 10 x 50	160 (73)
12 x 52	12 x 12 x 63	320 (146)
14 x 65	14 x 14 x 76	469 (213)
16 x 65	16 x 16 x 76	630 (286)
18 x 65	18 x 18 x 76	670 (304)
21 x 62	21 x 21 x 74	1110 (504)
24 x 72	24 x 24 x 90	1500 (681)
30 x 72	30 x 30 x 96	1570 (713)
36 x 72	36 x 36 x 97	2130 (967)

Design Parameters:

Configuration	Simplex
Feed Water Temperature	45-100°F (7-38° C)
Feed Pressure	30-100 psig +/- 5 psig
Maximum Inlet Turbidity	30 NTU
Sizing	10 gpm/ft²
Bed Depth	30 - 37"
Freeboard	65- 100%
Capacities	0.5 lb./ft³ (approximate)
Backwash	15 gpm/ft²

The information provided in this brochure contains merely general descriptions or characteristics of performance which in actual case of use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

Siemens
Water Technologies
10 Technology Drive
Lowell, MA 01851
Technical Support: 800.875.7873 ext 5000
Customer Support: 800.466.7873
Phone: 978.934.9349 ext 5000
Fax: 978.441.6025
www.siemens.com/water

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PWS-KFMF-DS-0307
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APPENDIX E

EQUIPMENT CUTSHEETS – ION EXCHANGE VESSELS



SPECIFICATION - IX48HF-ST

IX48HF single tanks are designed to treat a wide range of contaminated process streams. The vessels are equipped with under drains capable of a nominal flowrate of 250 gpm and a maximum flowrate of 350 gpm. All piping and valves are field configured for series, parallel or vessel isolation flows.

EACH VESSEL:

Vessel Diameter	48"
Side Shell Height	60"
Overall Height (Appx)	96"
Maximum Working Pressure	75 psi@150 Deg F
ASME Code Stamped	No
Seismic	Zone 4
Material	Carbon Steel
Vessel Volume	600 gal
Media Volume	30 cuft
Manway: Elliptical type at side shell	12" x 16"
Elliptical type upper head	12" x 16"
Supports	Tube Channel
Lifting	Lifting Lugs
Interior Surface Coating.....	3M ScotchKote 134 10-15 mil DFT min
Exterior Surface Primer	Rust Preventive Epoxy 4-6 mil DFT min
Exterior Surface Coating.....	High Build Polyurethane 3-4 mil DFT min
Standard Colors.....	Blue

UNDERDRAIN:

External Ring Header.....	3" SCH 40 Carbon Steel w/4" discharge
Screens	8 ea. 316 Stainless Steel V-Wire Screens 2"D x 10"L

VALVES

Process	4" Butterfly, Cast Iron Body w/Al-Brnz Disk, Manual Lever
Resin Transfer	2" Flanged 316 Stainless Steel Full Port Ball Valve
Vent	1/2" Ball Valve

SHIPPING WEIGHT

Vessel Shipping Weight.....	1,800 lb
Resin Weight.....	1,500 lb
Vessel Operating Weight.....	6,900 lb

	8	7	6	5	4	3	2	1

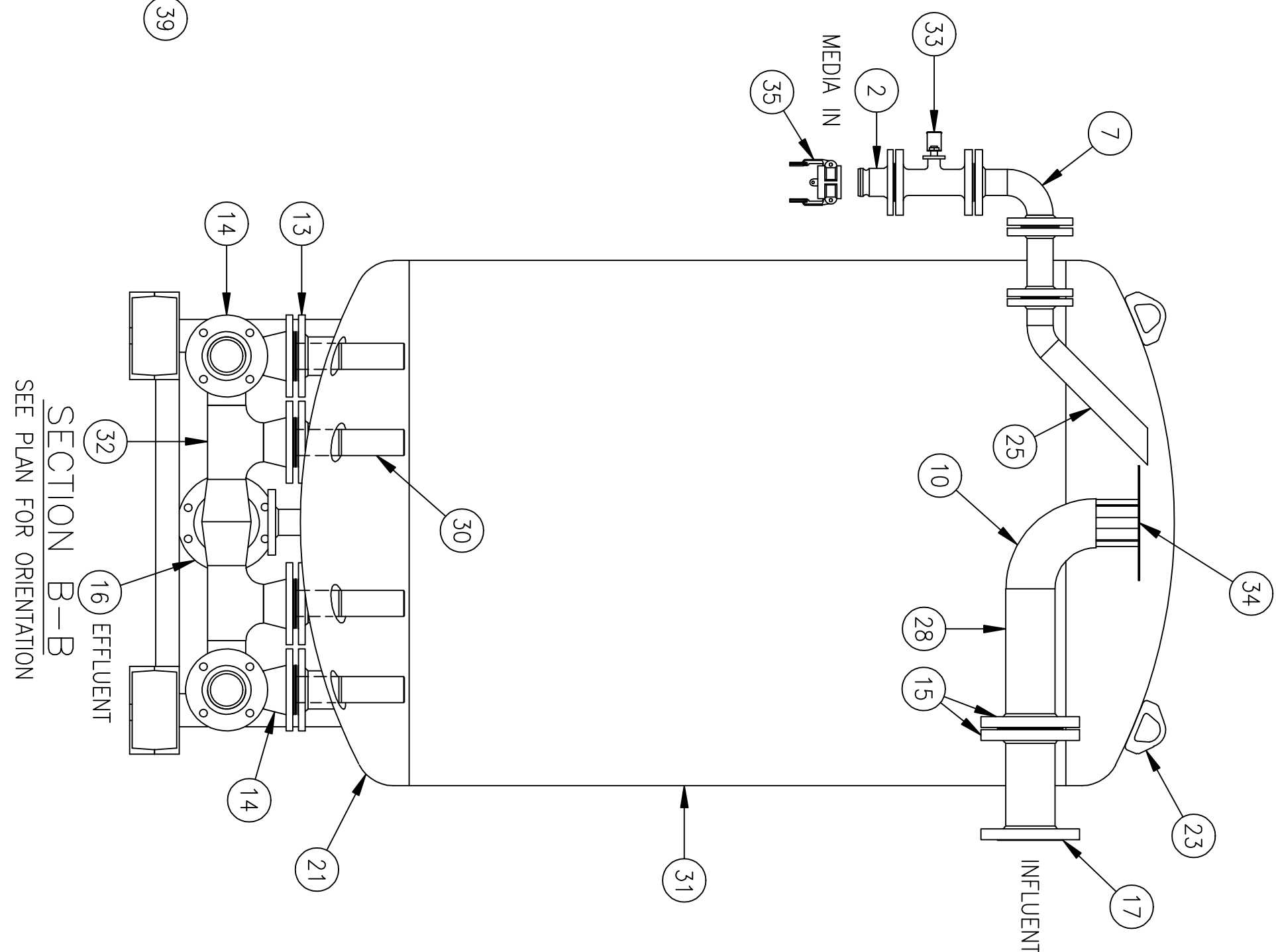
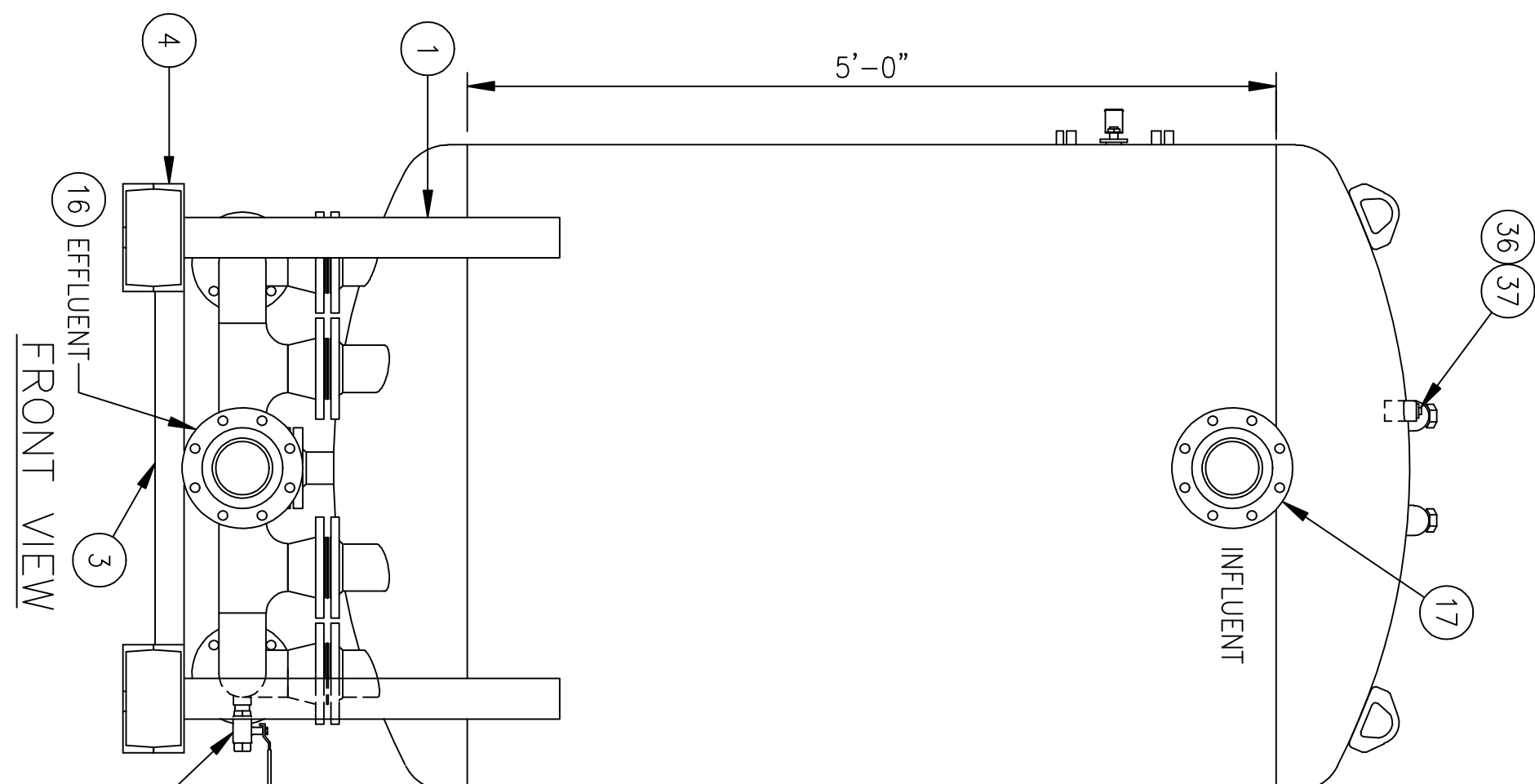
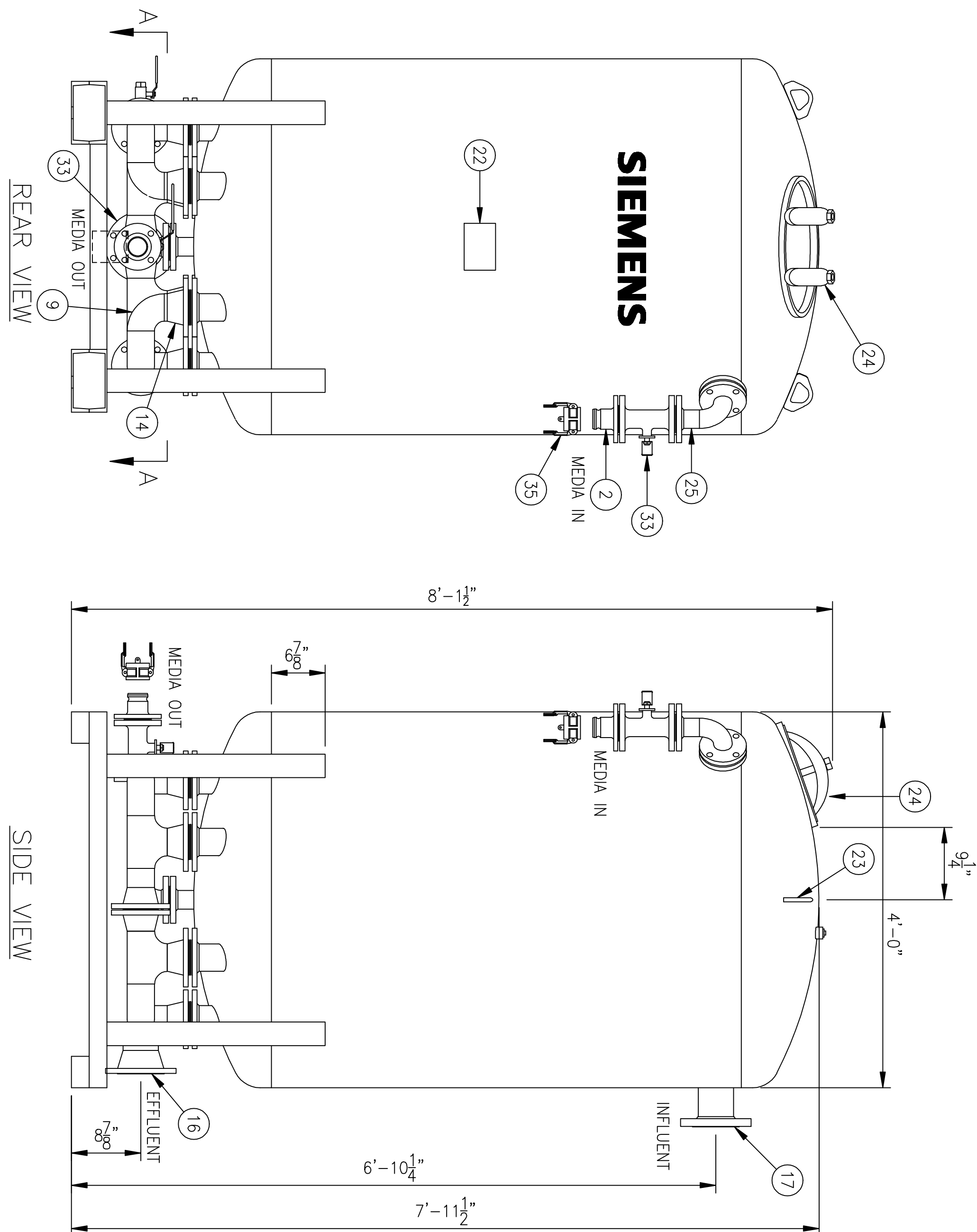
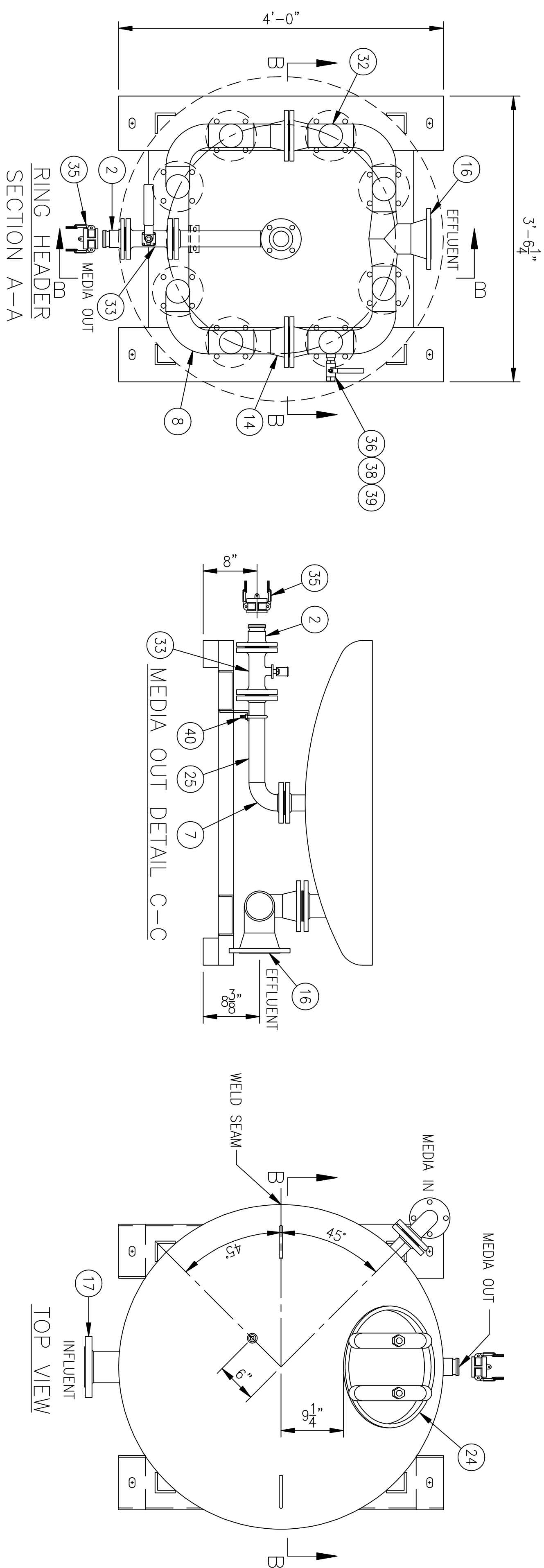
SCHEDULED MATERIALS		
TAG	DESCRIPTION	QTY
1	Angle: 3" x 3" x 3/8" Steel	9'
2	Corn Lock: 2" Alum. x Flanged	2
3	Channel: C6 x 8.2 A36	3'
4	Channel: C8 x 11.5 A36	10'
5	Concentric Reducer: 4" x 3" CS sch/40	2
6	Elbow: 2" 304 SS sch/10 45 deg	1
7	Elbow: 2" 304 SS sch/10 90 deg	2
8	Elbow: 3" CS sch/40 L/R	4
9	Elbow: 3" CS sch/40 S/R	2
10	Elbow: 4" 304 SS sch/10 90 deg	1
11	Flange: 2" 304 SS 150# S/O	6
12	Flange: 2" CS 150# S/O	2
13	Flange: 3" CS 150# S/O	8
14	Flange: 3" CS 150# W/N	12
15	Flange: 4" 304 SS 150# S/O	1
16	Flange: 4" CS 150# W/N	2
17	Flange: 4" CS 150# S/O	1
18	Gasket: 2" Red Rubber Ring	3
19	Gasket: 3" Red Rubber Ring	18
20	Gasket: 4" Red Rubber Ring	1
21	Head: 48" O.D. CS 1&D 3/16" thick	1
22	I.D. Plate	1
23	Lifting Lug: Series 2-900-LUD small	1
24	Monoway: 12" x 16" Elliptical 1/2" x 3" Ring	2
25	Pipe: 2" 304 SS sch/10	5'
26	Pipe: 2" CS sch/40	1'
27	Pipe: 3" CS sch/40	6'
28	Pipe: 4" 304 SS sch/10	2'
29	Pipe: 4" CS sch/40	2'
30	Seal: 2" nom 316 SS .010 Slot	8
31	Shell: 48" O.D. x 60" long x 3/16" thick	1
32	Tee: 3" CS sch/40 weld	8
33	Valve: 2" 316 SS Full Port Ball Flanged	1
34	Diffuser: 4" 304 SS	1
35	Dust Cap: 2" Alum Corn Lock	1
36	Coupler: 3/4" 304 SS Full NPT	2
37	Plug: 3/4" Galv. NPT	1
38	Nipple: 3/4" 316 SS Close NPT	1
39	Valve: 3/4" Bronze/Chrome Ball NPT	1
40	U-Bolt: 2" Hot Dipped Galv.	1

1. DESIGN DATA:
48" DIAMETER PRESSURE VESSEL-100 PSIG(MAX)
@ 150°F-NOT ASME CODE STAMPED
FOR WATER USE ONLY
MAXIMUM FLOW RATE:340 GPM
MAXIMUM CAPACITY: 60 C.F.

2. MATERIAL:
HEADS: 48" O.D. STD. F & D NON CODE 3/16" THICKNESS C.S.
SHELL: 3/16" THK. 48" OD x 60" LONG C.S.
SKID: SA 36-HR

3. SURFACE PREPARATION:
INTERIOR:
SANDBLAST: SSPC-SP-5 WHITE METAL
ABRASIVE: GARNET OR GRIT - PROFILE: 1.5-2 MILS
COATING: 3M BRAND SCOTCHKOTE 134
THICKNESS: 10-15 DFT - COLOR: GREEN
EXTERIOR:
SANDBLAST: SSPC-SP-10 NEAR WHITE METAL
ABRASIVE: GARNET OR GRIT - PROFILE: 1.5-2 MILS
PRIMER COAT: RUST PREVENTATIVE EPOXY PRIMER
THICKNESS: 4-6 DFT - COLOR: RED
FINISH COAT: HIGH BUILD POLYURETHANE
THICKNESS: 3-4 DFT - COLOR: BLUE (FED. I.D.#15052)

4. EST. WEIGHTS
1710 LBS. - EMPTY VESSEL
5460 LBS. - WITH RESIN
8065 LBS. - OPERATING

[illegible]

GENERAL TECHNOLOGIES

Tel: 816-590-9641 | Fax: 253-663-9333

Web: <http://gtspc.com/ixchange/> | Email: sales@gtspc.com

D890 (Formerly D203) — Cl, WQA/NSF-61 Certified STRONG BASE ANION NITRATE SELECTIVE ION EXCHANGE RESIN

(Designed for use in highly selective nitrate removal applications)

Product Description	Typical Physical, Chemical & Operating Characteristics	
D890 (Cl form) resin is highly nitrate-selective due to its unique functional group. In fact, it has higher affinity for monovalent anions (e.g., nitrate) than for di- or tri-valent anions. This is the opposite of the standard Type I and Type II anion resins such as A307 and A302. In many water treatment applications, D890 is less selective for sulfate than nitrate and nitrate dumping is eliminated. Certain chemical and wastewater treatment processes require a high capacity for monovalent anions than for divalent or trivalent anions. Because of its unique nature, D890 reverses the electro-selectivity of standard anion resins, and offers preferential removal of anions of lower valence. Particularly, the product can be highly effective in the removal of nitrate in water and wastewater treatment applications even with the presence of high sulfates.	Polymer Structure	Polystyrene cross-linked with Divinylbenzene
	Physical Form and Appearance	Tough spherical beads
	Whole Bead Count	90% Min.
	Functional Groups	$R-N-R_3^+ X^-$
	Ionic Form (as shipped)	Cl ⁻
	Shipping Weight, approx.	675 g/l (42 lb./ft. ³)
	Mesh Size (US Std.)	16-50
	Moisture retention, Cl ⁻ form	50 - 65%
	Total Exchange Capacity	1.0 meq/mL
	pH Range	0-14

CHEMICAL AND THERMAL STABILITY

D890 resin is insoluble in dilute or moderately concentrated acids, alkalies, and in all common solvents. However, exposure to significant amounts of free chlorine, “hypochlorite” ions, or other strong oxidizing agents over long periods of time will eventually break down the crosslinking. This will tend to increase the moisture retention of the resin, decreasing its mechanical strength, as well as generating small amounts of extractable break-down products. It is thermally stable to higher than 75 °C (170 °F) in the chloride form.

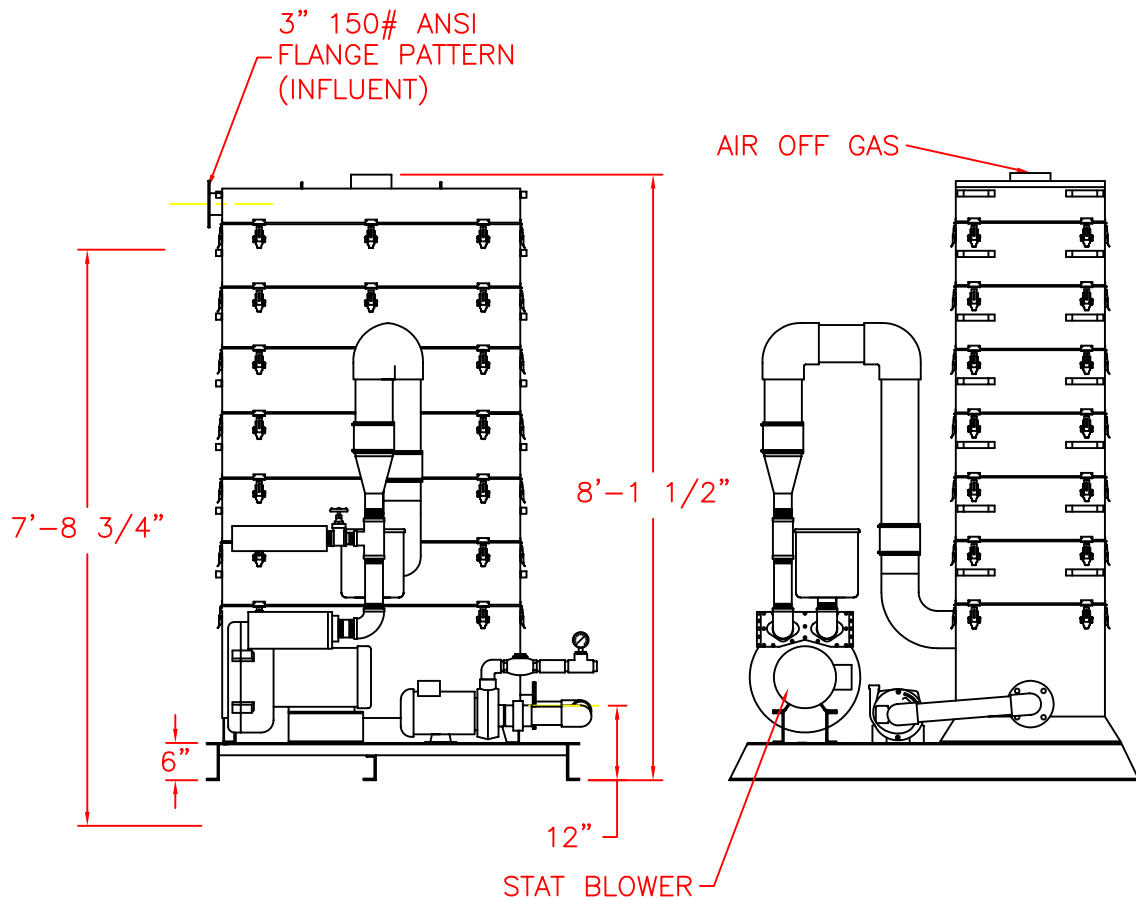
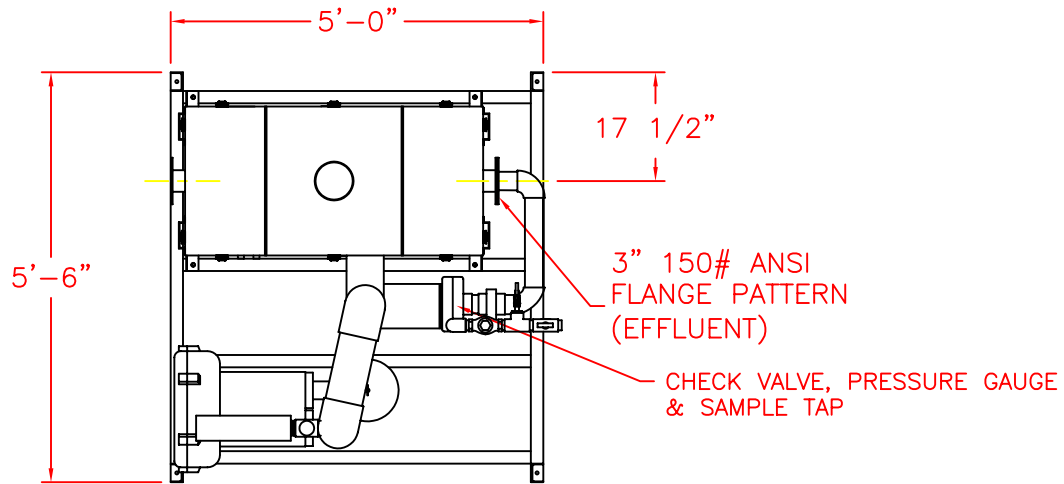


This resin has been tested and certified by WQA according to NSF/ANSI 61 for material requirements only

APPENDIX F

EQUIPMENT CUTSHEETS – AIR STRIPPER

STAT 80
W/PUMP DOWN



NOTE: Adjust overall height by 10 1/4" for each aeration tray added or deleted.
Influent flange on the same side as effluent with odd number of trays.

EN 909 & CP 909

Sealed Regenerative Blower w/ Explosion-Proof Motor

FEATURES

- Manufactured in the USA – ISO 9001 compliant
- Maximum flow: 600 SCFM
- Maximum pressure: 120 IWG
- Maximum vacuum: 100 IWG
- Standard motor: 15 HP, explosion-proof
- Cast aluminum blower housing, cover, impeller & manifold; cast iron flanges (threaded); teflon lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

MOTOR OPTIONS

- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepower for application-specific needs

BLOWER OPTIONS

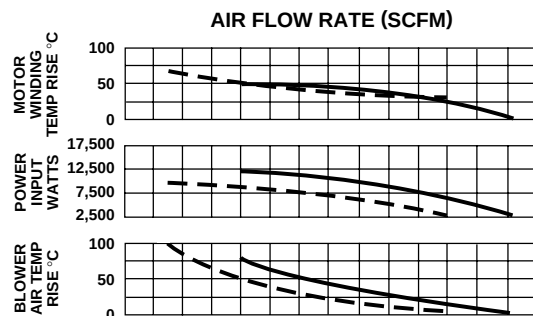
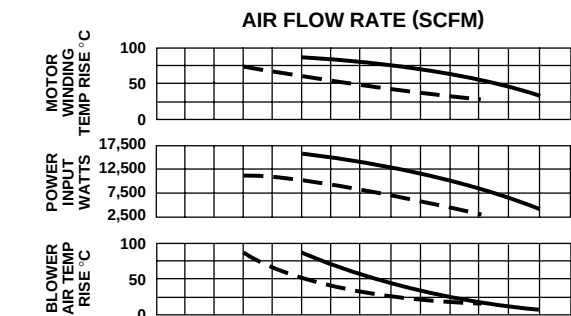
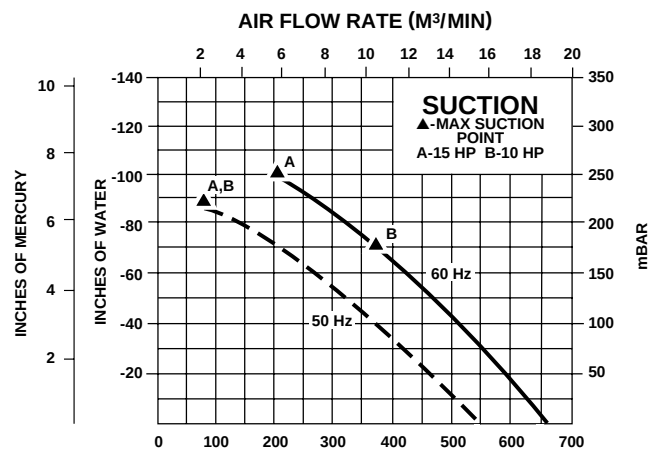
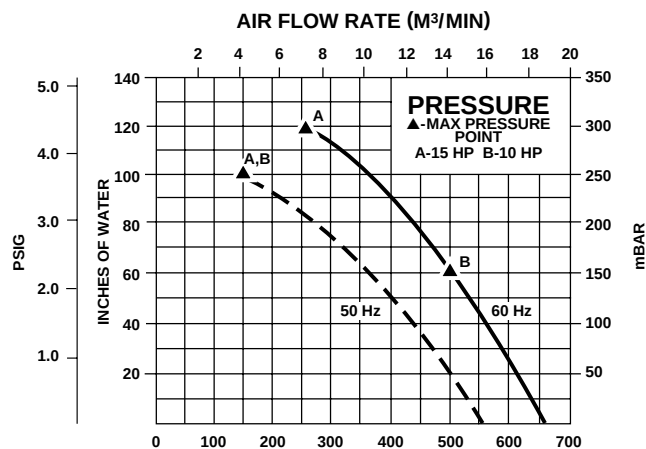
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES (See Catalog Accessory Section)

- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package



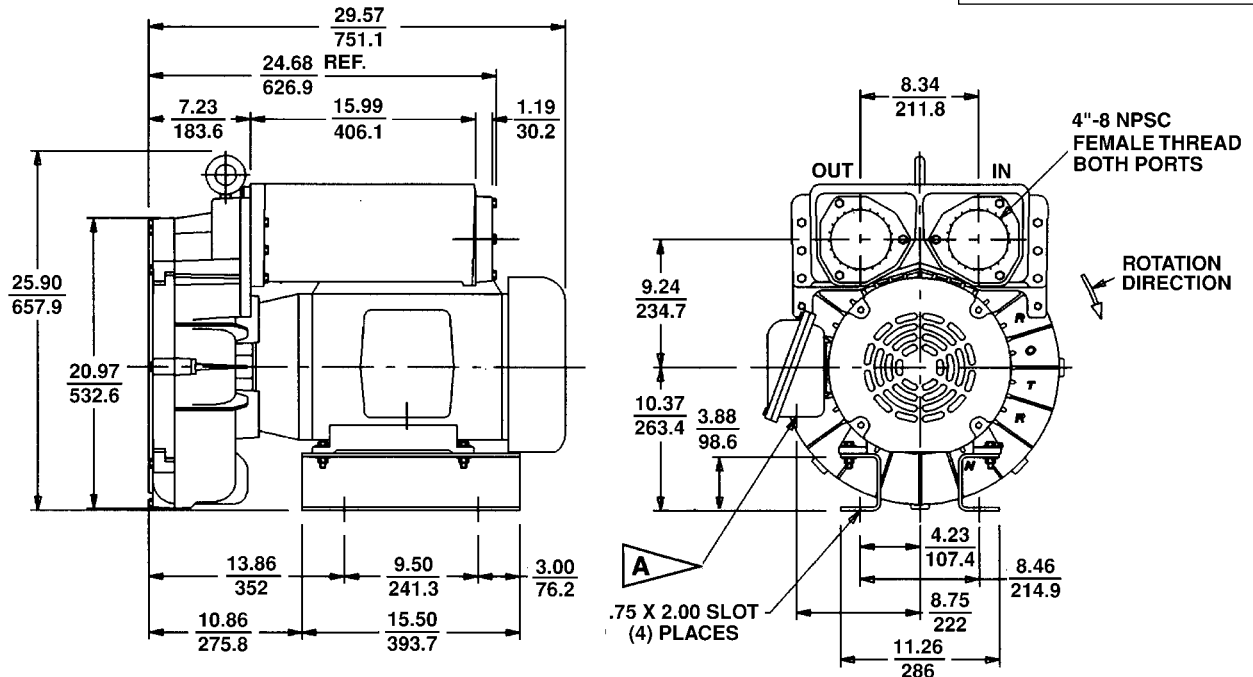
BLOWER PERFORMANCE AT STANDARD CONDITIONS



Rev. 2/01

Sealed Regenerative Blower w/ Explosion-Proof Motor

Scale CAD drawing available upon request.



DIMENSIONS: $\frac{\text{IN}}{\text{MM}}$
TOLERANCES: .XX $\pm$ $\frac{.1}{2.5}$
(UNLESS OTHERWISE NOTED)

A 1.25" NPT CONDUIT CONNECTION AT 6 O'CLOCK POSITION

SPECIFICATIONS

MODEL	EN909BG72WL		EN909BG86WL	EN909BD72WL	CP909GA72WLR
Part No.	038629		038634	080071	038982
Motor Enclosure – Shaft Material	Explosion-proof – CS		Explosion-proof – CS	Explosion-proof – CS	Chem XP – SS
Horsepower	15		15	10	Same as EN909BG72WL – 038629 except add Chemical Processing (CP) features from catalog inside front cover
Phase – Frequency ¹	Three - 60 Hz		Three - 60 Hz	Three - 60 Hz	
Voltage ¹	230	460	575	230	
Motor Nameplate Amps	36	18	14.4	24	
Max. Blower Amps ³	44	22	18	26	
Inrush Amps	240	120	100	162	
Starter Size	2	2	2	2	
Service Factor	1.0		1.0	1.0	
Thermal Protection ²	Class B - Pilot Duty		Class B - Pilot Duty	Class B - Pilot Duty	
XP Motor Class – Group	I-D, II-F&G		I-D, II-F&G	I-D, II-F&G	
Shipping Weight	584 lb (265 kg)		584 lb (265 kg)	564 lb (256 kg)	

¹ Rotron motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a $\pm 10\%$ voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

² Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

³ Maximum blower amps corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.



DRC, Inc.
6704 Bleck Drive
Rockford, MN 55373
Phone: 763-565-3000
Fax: 763-565-3001

Company / customer

Project description

Drawing number

Carbonair

STAT 80 Control Panel

14221

Project name

Place of installation

Responsible for project

Part feature

Santa Susana STAT 80

AH

Created on

2007.05.17

Edit date

2007.09.21

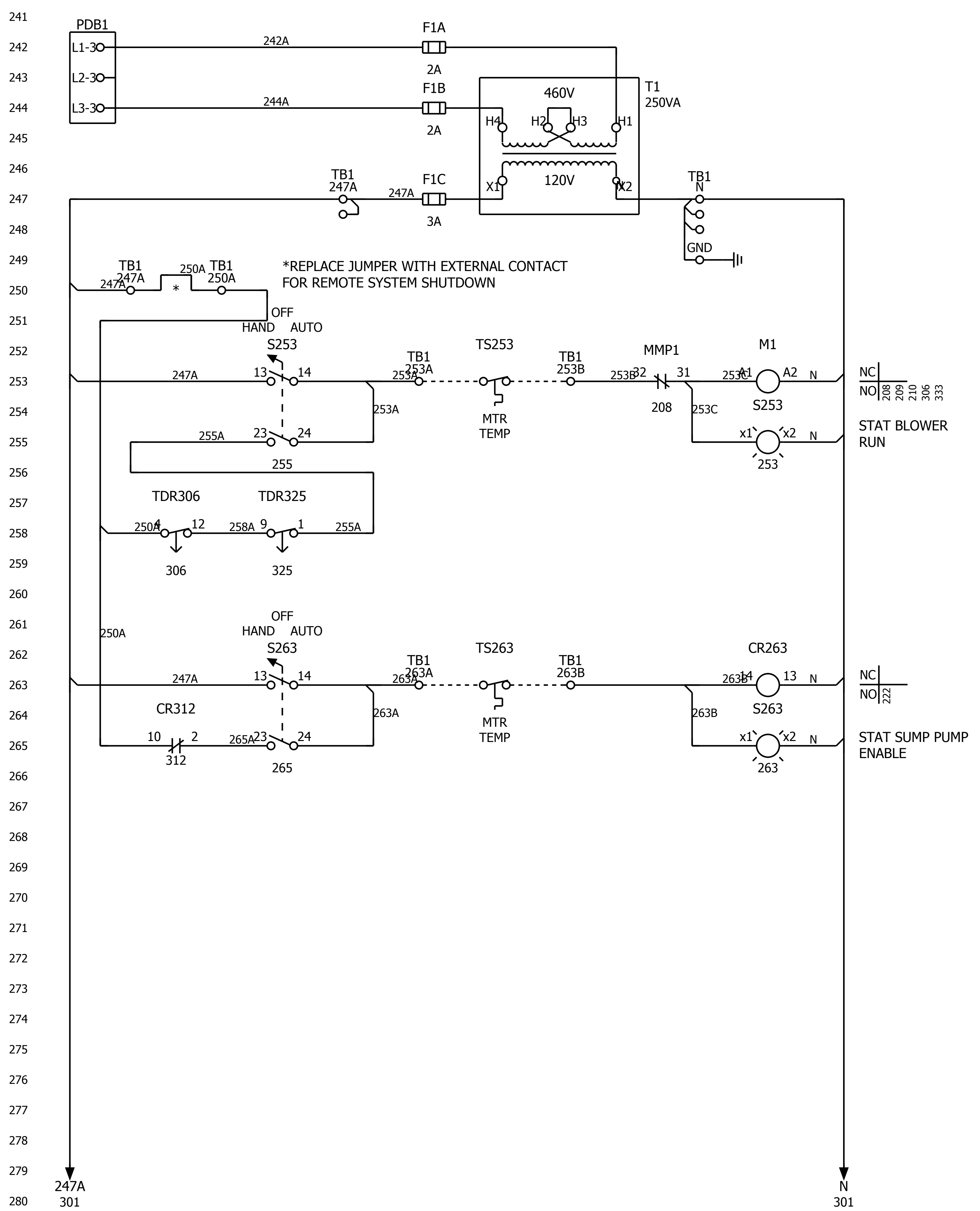
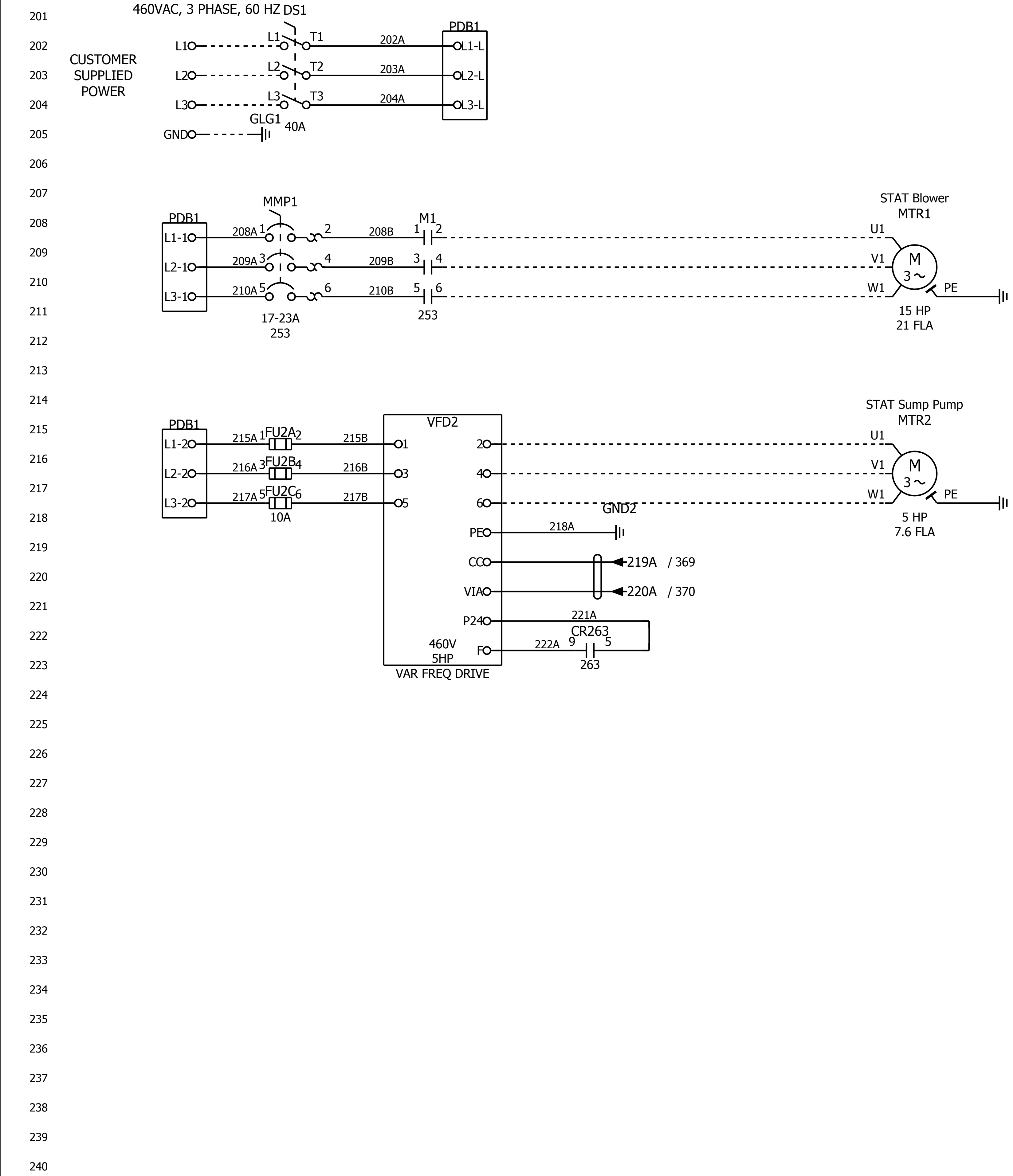
by (short name)

HeinenA

Number of pages

4





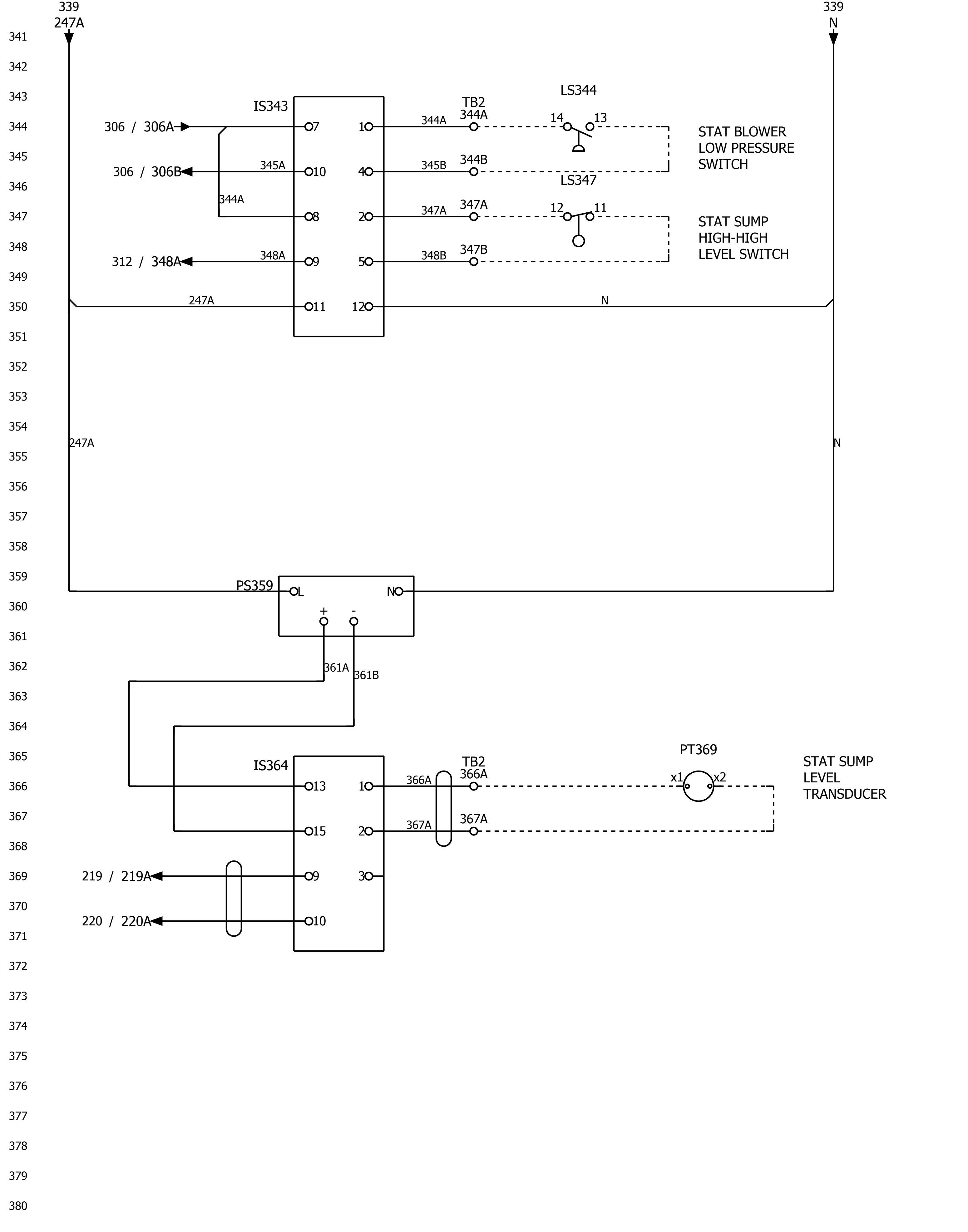
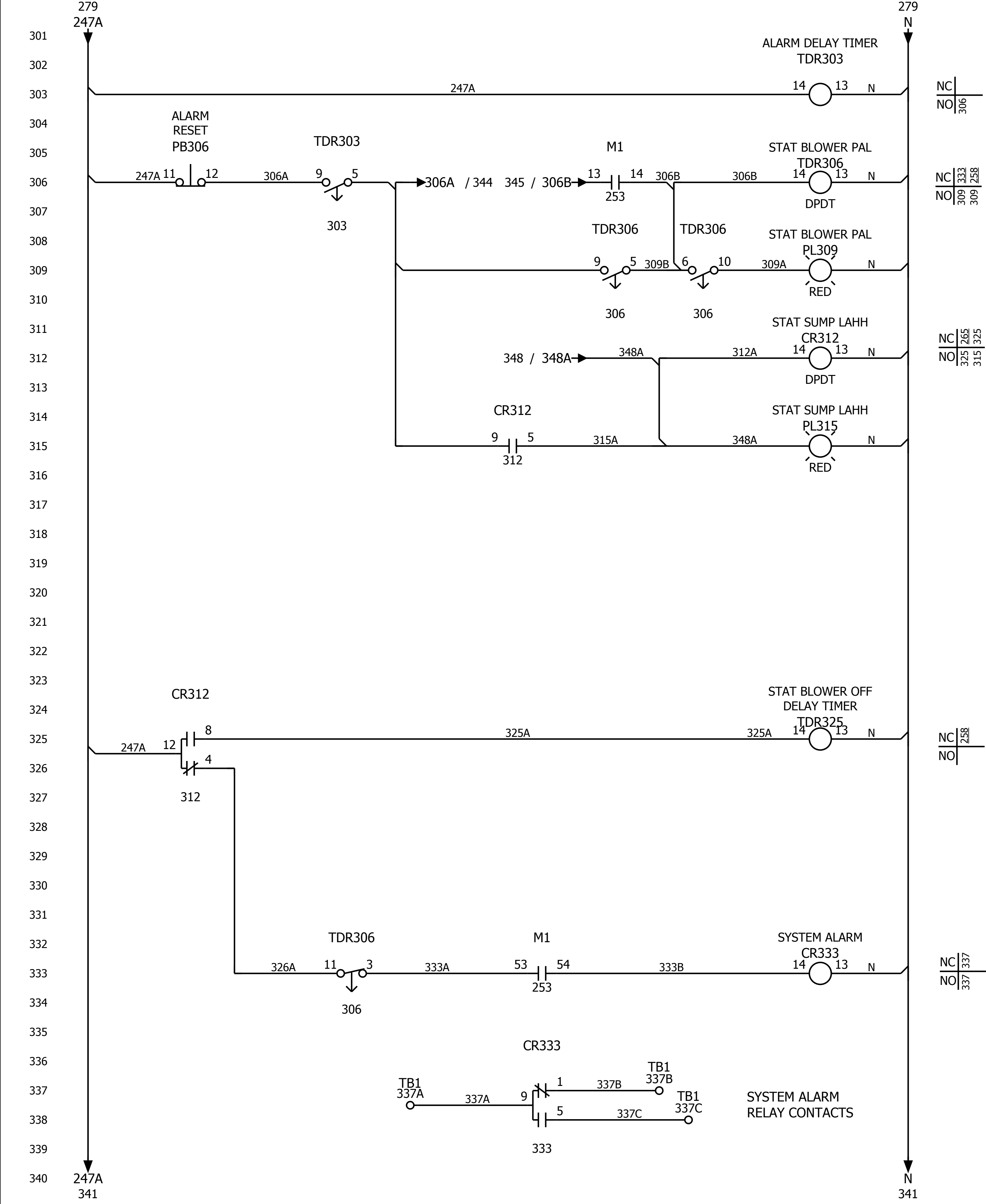
Project name
Santa Susana STAT 80

Drawing number
???

Carbonair

DRC, Inc.
Rockford, MN

Modification	Date	Name	Ed. by	Date	Name	Original	Higher-level function		City
			Appr	2007.05.17	HeinenA	Replacement for			+
				2007.09.21		Replaced by	Commission		Pg 2
						Previous page	1	Total no. of pages 4	Next page 3



Project name
Santa Susana STAT 80

Drawing number
??? Carbonair

DRC, Inc.
Rockford, MN

Modification	Date	Name	Ed. by	Date	Name	Original	Higher-level function =	City
			Appr	2007.05.17	HeinenA	Replacement for		Pg 3
				2007.09.21		Replaced by Previous page		Next page 4
Total no. of pages 2							Commission 4	Page Group 4

STAT BLOWER
LOW PRESSURE

R

STAT SLURP
HS-HL LEVEL

R

STAT BLOWER

OFF
HAND AUTO

STAT SLURP PUMP

OFF
HAND AUTO

Modification	Date	Name		Date	Name	Original	Panel layout	Higher-level function	City
			Ed. by	2007.05.17		Replacement for		=	+
			Appr	2007.09.21	HeinenA	Replaced by	Commission		Pg 4
						Previous page	3 Total no. of pages	4 Page Group	4 Next page

APPENDIX G

EQUIPMENT CUTSHEETS – LIQUID CARBON VESSELS

PV2000

SPECIFICATION SUMMARY

PV2000 Liquid Phase Vessels are designed to treat a wide range of contaminated process streams. The adsorbers are equipped with underdrains capable of maximum flow rate of 100 GPM.

EACH VESSEL:

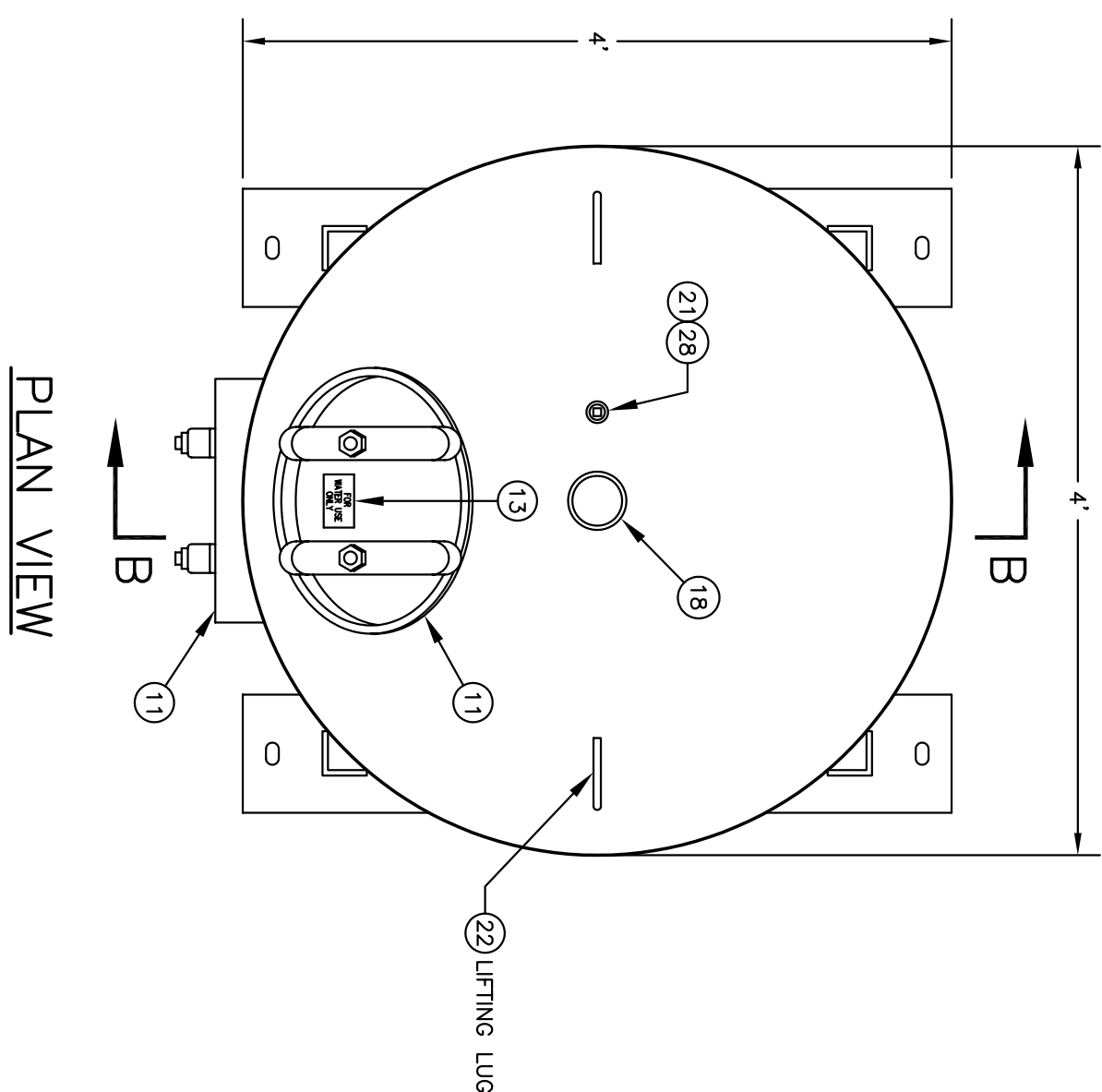
Vessel Diameter	48"
Side Shell Height.....	72"
Overall Height (Approx.).....	8'-8"
Total Empty Weight / Vessel	1190 lbs
Maximum Working Pressure	125 psi @ 150 °F
Elliptical Manway at Head.....	11" x 15"
Vessel Volume	660 gal.
Carbon Capacity	2000 lbs.
Carbon Bed Volume-Typical	68 Ft ³
Maximum Flow	100 GPM
Empty Bed Contact Time	5.1 min/vessel @ 100 GPM
Design Criteria	ASME
Code Stamping	None
Material	Carbon Steel
Supports.....	Skid mounted
Lifting.....	Lifting Lugs
Seismic.....	Zone 4
Interior Surface Prep	SSPC-SP5
Linning.....	3M ScotchKote 134, 10-15 mil min dft
Exterior Primer	Rust Preventative Epoxy 3 mil min dft
Exterior Coating	High Solids Urethane 3mil min dft
Standard Color	Blue (Federal Standard 15052)

UNDERDRAINS:

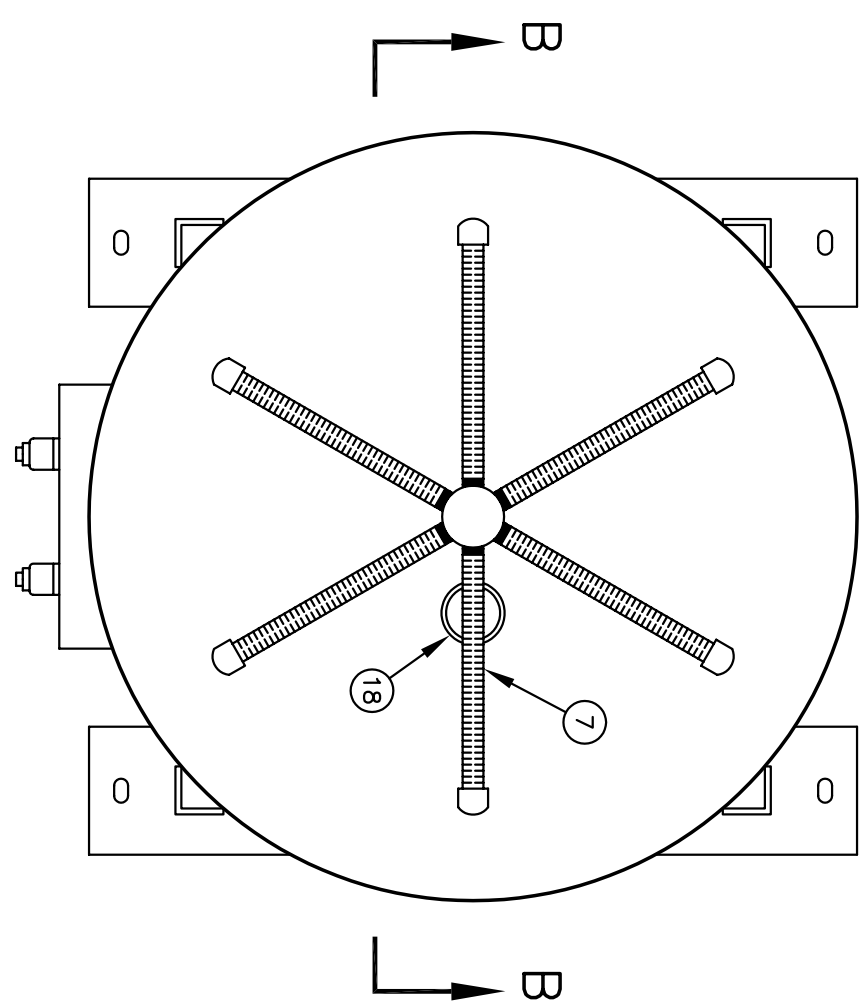
Lateral	Sch 80 PVC Sloted Pipe .015

WEIGHT:

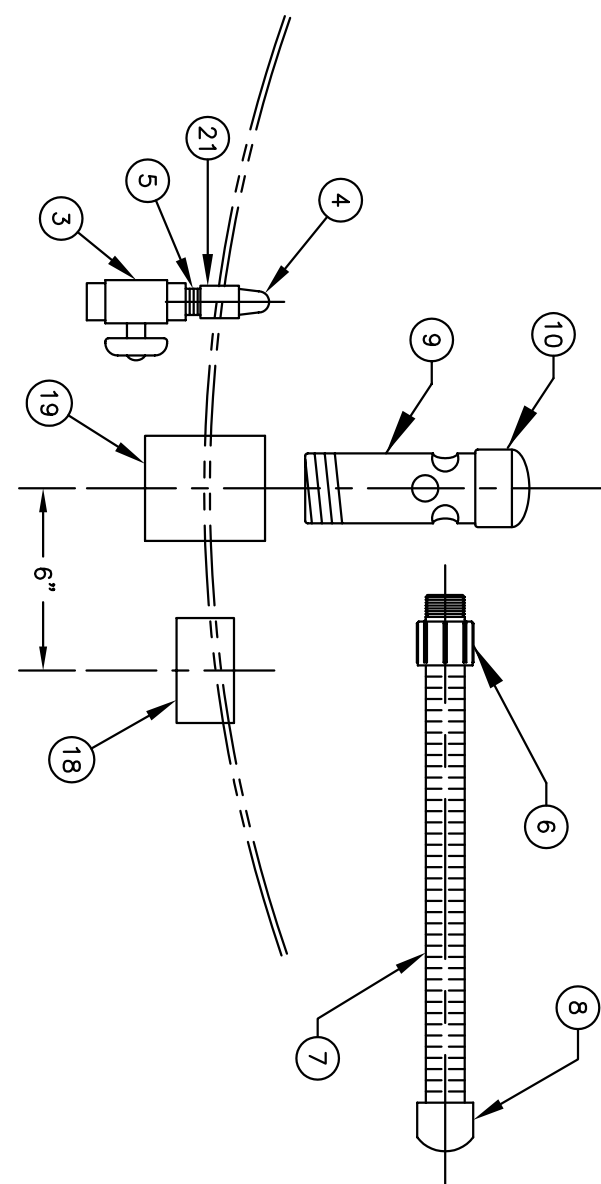
Vessel	1190 lb
Shipping weight (vessel with carbon)	3,190 lb
Operating Weight (carbon one vessel)	7,500 lb



PLAN VIEW



SECTION "A-A"



ENLARGED SECTION VIEW B-B
UNDERDRAIN ASSEMBLY--(SEPARATED)

SCHEDULED MATERIALS		QTY	UNIT	NUMBER
TAG DESCRIPTION				
1	Shell .48" dia. x 1/2" long 1/4" thick CS	1	SH1	1341
2	Shell .48" dia. x 3/8" CS F60	1	SH2	1342
3	Ball Valve .3/4" Bronze NPT	1	TV003	11003
4	Ball Valve .3/4" CS NPT	1	TV002	11002
5	Nipple 3/4" 316 SS Close	1	UN001	11001
6	Adapter 1" PVC sch/80 PVC 1/2"	6	UA001	11006
7	Pipe Slotted 1" sch/80 PVC x 15' long	6	UA003	11003
8	Cop. 3/4" sch/80 PVC Slip	6	UA002	11002
9	Cop. 3/4" sch/80 PVC Slip	6	UA004	11004
10	Cop. 3" PVC sch/80 PVC 1-1/2" long	1	UA005	11005
11	Manway 12" x 16" Elliptical	2	MA001	11001
12	10' TAC 760	1	CT004	11004
13	Decal: CARBON SERVICE White w/ Blue Letters 4x12"	1	NA	11001
14	Decal: PV-SEFMS White Major	2	NA	11002
15	Decal: PV-SEFMS White Letters	2	NA	11003
16	Decal: STEPSN White Major w/ Blue Letters	2	NA	11004
17	Decal: STEPSN White Major w/ Blue Letters	2	NA	11005
18	Decal: STEPSN White Major w/ Blue Letters	1	NA	11006
19	Coupling 3" 304 SS Full	1	CO028	11028
20	Angle: 3" x 3" x 3/8"	8	AX3X3/8	11038
21	Coupling: 3/4" 304 SS Full	2	CO031	11031
22	Ufing Lugs Small Series 17-000-LUG	2	CO032	11032
23	Ufing Lugs Small Series 17-000-LUG	2	CO032	11032
24	Channel: C8 x 11.5 x .48" long	4	CBX11.5	11041
25	Channel: C8 x 11.5 x .48" long	2	CBX11.5	11042
26	Plate: C5-10 gal min. 1/2" dia	3	BO079	11079
27	Plate: C5-10 gal min. 1/2" dia	1	BO079	11079
28	Plate: 3/4" Galv.	1	BO15	11015
29				
30				

SCHEDULED MATERIALS

NOTES:

- DESIGN DATA:
48" DIAMETER PRESSURE VESSEL-125 PSIG(MAX)
NOT ASME CODE STAMPED
FOR WATER USE ONLY
MAXIMUM FLOW RATE: 100 GPM
MAXIMUM CARBON CAPACITY: 2000 LBS. ACTIVATED CARBON

MATERIAL

MATERIAL:
HEADS: STD. F & D NON CODE 3/8" THICKNESS C.S.
SHELL: 1/4" THK. 48" OD x 72" LONG C.S.
SKID: SA 36-HR

3. SURFACE PREPARATION:

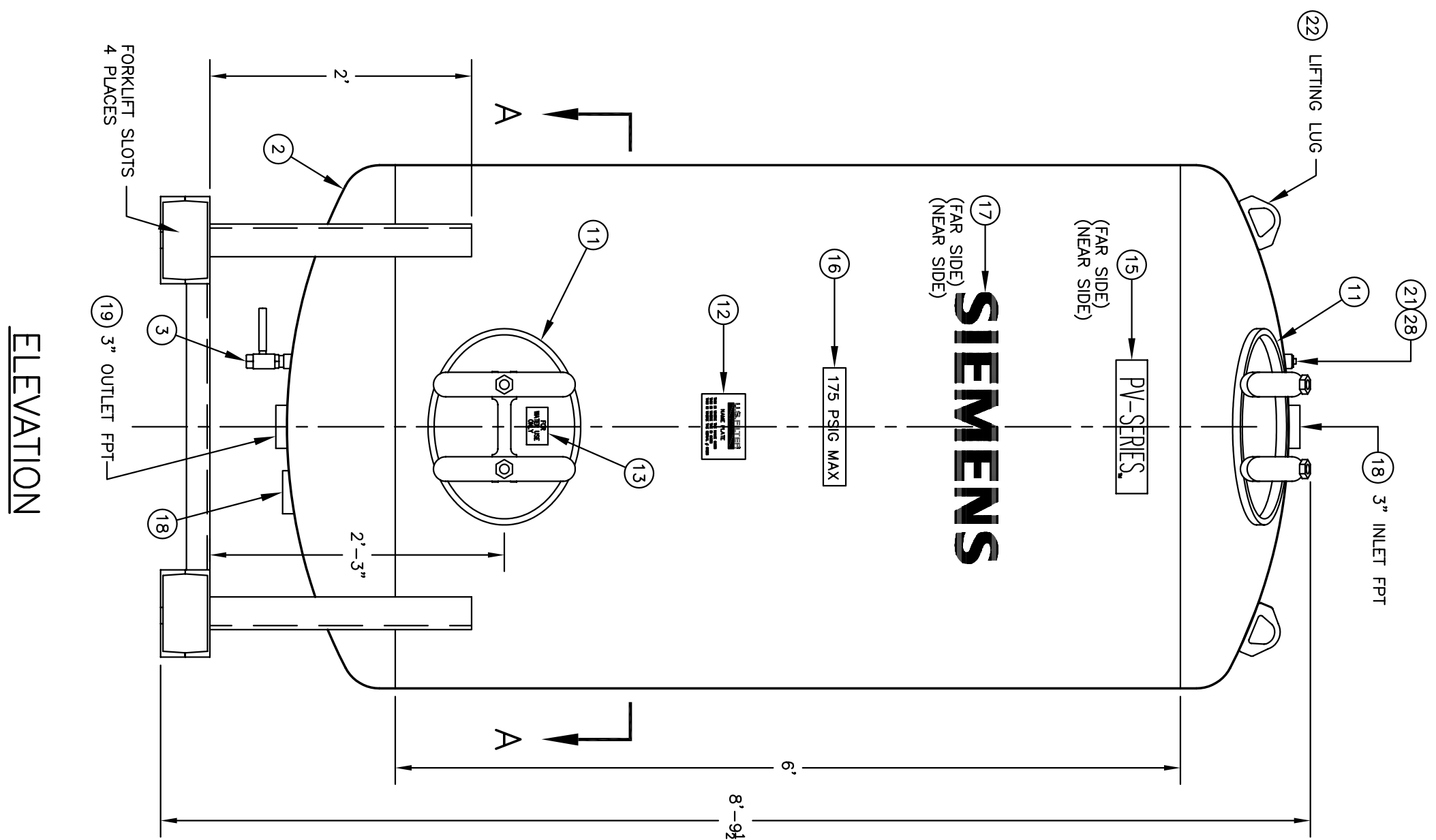
SANDBLAST: SSPC-SP-5 WHITE METAL
COATING: 3M BRAND SCOTCHKOTE 134
THICKNESS: 10-15 DFTM - COLOR: GREEN

EXTENDER:
PRIMER COAT: SSPC-SP-10 NEAR WHITE METAL
THICKNESS: 4-6 DFTM - COLOR: RED
FINISH COAT: HIGH BUILD POLYURETHANE
THICKNESS: 3-4 DFTM - COLOR: BLUE (RED, ID.#15052)

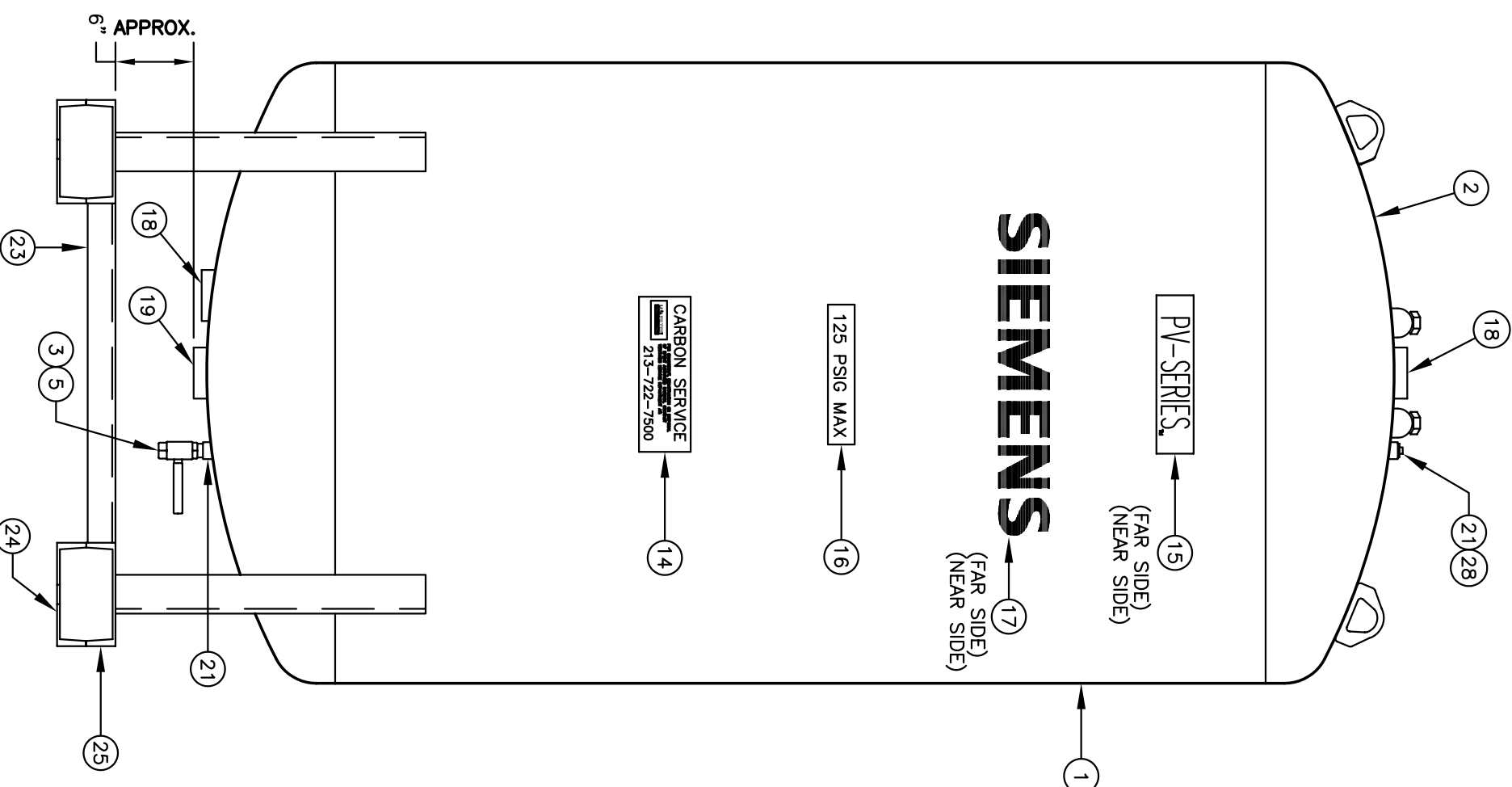
4. LIFTING REQUIREMENTS:

EST. WEIGHTS:

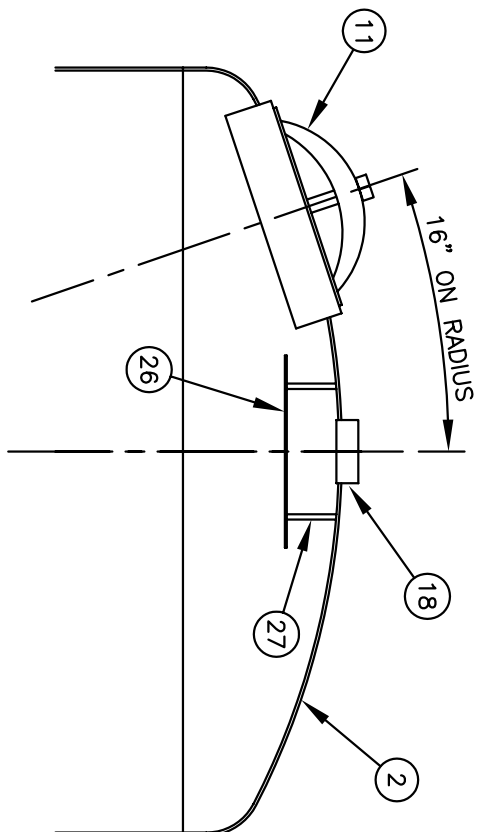
1353 LBS.	-	EMPTY VESSEL
3353 LBS.	-	WITH CARBON
7653 LBS.	-	OPERATING



ELEVATION



REAR ELEVATION



HEAD SECTION B-B

TITLE		P/2000 125 PSI SINGLE TANK	
DESIGNER		JMA	
DATE		10-18-07	
CHECKER			
DATE			
ENGINEER			
DATE			
MANAGER			
DATE			
FILE			
SCALE: 1"=1'			
PROJECT		CODE	
DRAWING		P/2000-1-57-S1-0	
SHEET		1 OF 1	
REV		0	
CLIENT		HARGIS – BOEING SANTA SUSANNA	
SIEMENS		Water Technologies RED BLUFF, CA	

WESTATES AquaCarb™ 830

WESTATES AquaCarb™ 1240

COAL BASED GRANULAR ACTIVATED CARBON

(FORMERLY KG-401 and KG-502)

GRANULAR ACTIVATED CARBONS FOR USE IN MUNICIPAL, INDUSTRIAL AND REMEDIAL WATER TREATMENT APPLICATIONS



DESCRIPTION AND APPLICATIONS

AquaCarb™ 830 and AquaCarb™ 1240 are high activity granular activated carbons manufactured from selected grades of bituminous coal. Manufactured by direct activation, they exhibit exceptional hardness and attrition resistance and have become a cost effective choice for use in municipal, industrial and remedial water treatment applications. These high surface area microporous carbons have been specifically developed for the removal of a broad range of organic contaminants from potable, waste and process waters.

- ANSI/NSF Standard 61 classified for use in potable water applications
- Fully conforms to physical, performance and leachability requirements established by ANSI/AWWA B604-96 (which includes the Food Chemical Codex requirements)
- A detailed quality assurance program guarantees consistent quality from lot to lot and shipment to shipment

QUALITY CONTROL

All AquaCarb™ activated carbons are extensively quality checked at our State of California certified environmental and carbon testing laboratory located in Los Angeles, CA. USFilter's laboratory is fully equipped to provide complete quality control analyses using ASTM standard test methods in order to assure the consistent quality of all AquaCarb™ carbons.

Our technical staff offers hands-on guidance in selecting the most appropriate system, operating conditions and carbon to meet your needs. For more information, contact your nearest USFilter representative.

USFilter

WESTATES AquaCarb™ 830

WESTATES AquaCarb™ 1240

COAL BASED GRANULAR ACTIVATED CARBON

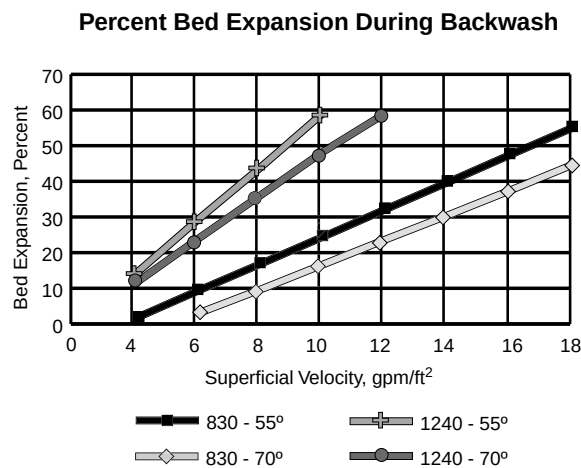
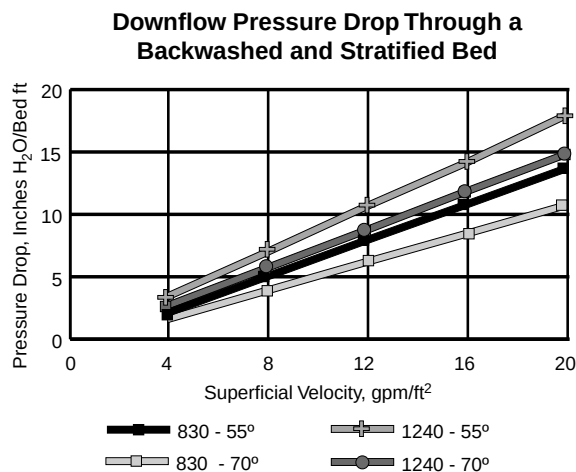
(FORMERLY KG-401 and KG-502)

SPECIFICATIONS/TYPICAL PROPERTIES

Specification	AquaCarb™ 830	AquaCarb™ 1240
Mesh Size	8 x 30	12 x 40
Effective Size, mm	0.8 - 1.1	0.55 - 0.75
Uniformity Coefficient	2.1 (max)	1.9 (max)
Iodine No., mgI ₂ /g	900 (min)	1000 (min)
Hardness No., wt. %	95 (min)	93 (min)
Abrasion No., wt. %	80 (min)	80 (min)
Apparent Density, g/cc	0.47 - 0.52	0.47 - 0.54

Safety Note: Wet activated carbon readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

All information presented herein is believed reliable and in accordance with accepted engineering practices. USFilter makes no warranties as to the completeness of this information. Users are responsible for evaluating individual product suitability for specific applications. USFilter assumes no liability whatsoever for any special, indirect or consequential damages arising from the sale, resale or misuse of its products.



USFilter

Baytown, TX 800.659.1723
 Los Angeles, CA 800.659.1771
 Oakland, CA 800.659.1718
 Warren, NJ 800.659.1717

www.usfwestates.com

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a **VIVENDI**
water company

APPENDIX H

EQUIPMENT CUTSHEETS – VAPOR CARBON VESSELS

VSC2000

SPECIFICATION SUMMARY

VSC2000 Vapor Phase Filter is designed to treat a wide range of contaminated process streams. With piping and valves can be configured for series, parallel, or vessel isolation flows. The adsorber is equipped with a carbon retention system capable of maximum flow rate of 600 cfm.

EACH VESSEL:

Vessel Diameter	48"
Side Shell Height.....	72"
Overall Height (Approx.).....	8'
Total Empty Weight / Vessel	1170 lbs
Maximum Pressure	14.9 psig
Maximum Vacuum	15 in Hg
Maximum Working Temperature	140 °F
Manway at head.....	18" dia
Vessel Volume	660 gal.
Carbon Capacity	2000 lbs.
Carbon Bed Volume-Typical	68 Ft ³
Maximum Flow	600cfm
Material	Carbon Steel
Supports.....	Skid mounted
Lifting.....	Lifting Lugs
Seismic.....	Zone 4
Interior Surface Coating	3M ScotchKote 134, 10-15 mil min dft
Exterior Surface Primer	Rust Preventative Epoxy 3 mil min dft
Exterior Surface Coating	High Solids Urethane 3mil min dft
Standard Color	White (Federal Standard 17925)

CONNECTIONS:

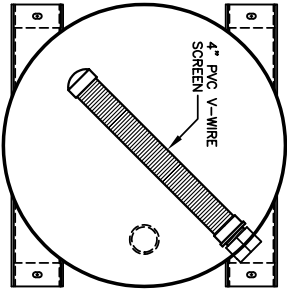
Influent and Effluent 4" FNPT (SS)

SCREEN:

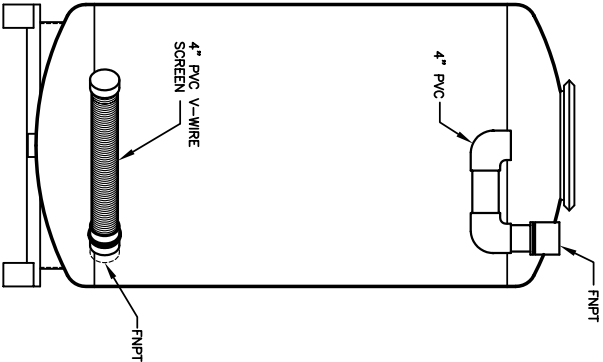
Lateral 4" x 36" PVC V-Wire

WEIGHT:

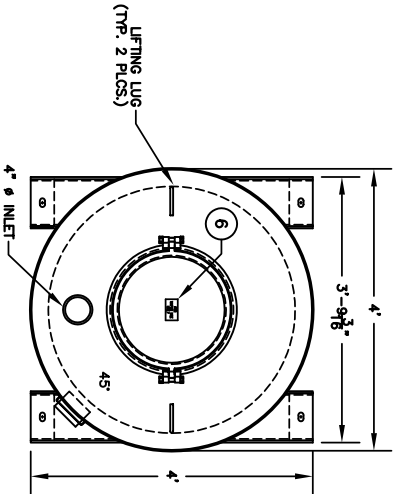
Shipping weight (vessel)	1,170 lb
Weight (vessel & carbon)	3,170 lb
Operating Weight	3,170 lb



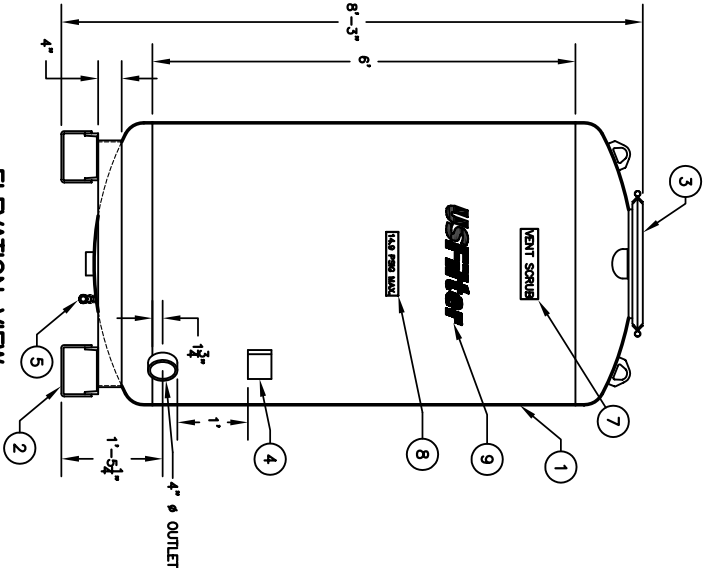
INTERNAL PLAN VIEW



INTERNAL ELEVATION



PLAN VIEW



ELEVATION VIEW

LIST OF COMPONENTS		
ITEM QTY	DESCRIPTION	PART NUMBER
1 1	TANK ASSEMBLY	SEE SHEET 2
2 1	SKID ASSEMBLY	SEE SHEET 3
3 1	MANWAY ASSEMBLY, 18" DIA.	SEE SHEET 4
4 1	PLATE, I.D. & SERIAL NUMBER	C1034
5 1	BRONZE BALL VALVE, 3/4"	1003
6 1	DECAL, "FOR VAPOR USE ONLY", 2 1/2" x 4 1/4"	N/A
7 2	DECAL, "VENT-SCRUB", WHITE INK/LAR	N/A
8 2	DECAL, "14.9 PSIG MAX", WHITE INK/LAR	N/A
9 2	DECAL, "USFILTER/WESTATES" WHITE INK/LAR W/BLUE LETTERS	N/A

NOTES:

1. DESIGN DATA:
48" DIAMETER PRESSURE VESSEL-14.9 PSIG(MAX)
VACUUM RATING - 15" HG
Ø 120°F--NOT ASME CODE STAMPED FOR VAPOR USE ONLY
2000 LBS. ACTIVATED CARBON

2. MATERIAL:

- HEADS - SA 36-HR
SHELL - SA 36-HR
SKID - SA 36-HR

3. SURFACE PREPARATION:

INTERIOR:

- SANDBLAST: SSPC-SP-5 WHITE METAL
ABRASIVE: GARNET OR GRIT - PROFILE: 1.5-2 MILLS
COATING: 3M BRAND SCOTCHKOTE 134
THICKNESS: 10-15 DFMIT - COLOR: GREEN

EXTERIOR:

- SANDBLAST: SSPC-SP-10 NEAR WHITE METAL
ABRASIVE: GARNET OR GRIT - PROFILE: 1.5-2 MILLS
PRIMER COAT: RUST PREVENTATIVE EPOXY PRIMER
THICKNESS: 4-6 DFMIT - COLOR: RED
FINISH COAT: HIGH BUILD POLYURETHANE
THICKNESS: 3-4 DFMIT - COLOR: WHITE (FED. I.D.#17925)

4. LIFTING REQUIREMENTS:

- 5200 LBS. MINIMUM RATING.
EST. WEIGHTS:
1170 LBS. - EMPTY VESSEL
3170 LBS. - WITH CARBON

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DESIGNER	DATE
AAA	7-17-03
CHECKER	DATE
ENGINEER	DATE
MANAGER	DATE
FILE:	
SCALE:	NONE

TITLE	VSC2000
GENERAL ASSEMBLY	
CLIENT	
PROJECT	VSC2000SHEET1.DWG
DRAWING	1 OF 5
SHEET	REV



USFILTER/WESTATES
RED BLUFF, CA
1-800-795-2664

WESTATES VOCarb™ 48C**COCONUT SHELL BASED GRANULAR ACTIVATED CARBON**

(FORMERLY CC-601)

**COCONUT SHELL BASED
GRANULAR ACTIVATED
CARBONS FOR GAS PHASE
ADSORPTION APPLICATIONS****DESCRIPTION**

VOCarb™ 48C is a high activity granular activated carbon (GAC) manufactured from selected grades of coconut shells and is designed for use in a wide variety of gas phase adsorption applications. The granular shape of this carbon maximizes its geometric surface area, significantly increasing surface and pore diffusion rates and thereby increasing the effectiveness of this carbon for the adsorption of VOCs at short contact times. VOCarb™ 48C's very high surface areas and predominately microporous pore size distribution further enhance the effectiveness of this coconut shell based carbon. Not only do VOCarb™ carbons have a high VOC adsorption capacity but they also have a high retentivity that allows these carbons to hold onto and prevent desorption of previously adsorbed organic compounds. The granular shape of VOCarb™ 48C results in excellent gas contacting but still allows the carbon bed to operate at relatively low pressure drops. The high density and superior hardness of VOCarb™ 48C provides excellent resistance to dust and fines formation.

APPLICATIONS

Cost effective VOCarb™ activated carbons developed by USFilter have been demonstrated to provide superior performance in an extensive array of gas phase treatment applications. VOCarb™ activated carbons are available for:

- Chemical process applications
- VOC control from air strippers, soil vapor extraction and air sparge systems
- Control of tank vent emissions
- HVAC
- Odor control
- Solvent recovery of low boiling point solvents
- Use as a catalyst/catalyst support

FEATURES AND BENEFITS

- Exceptionally high VOC adsorption capacity
- Excellent VOC retentivity characteristics, works well for the adsorption of small molecules
- Superior hardness minimizes attrition losses during handling, use and service
- Cost effective
- Easily reactivated for recycle and reuse
- Low pressure drop characteristics
- Backed by technical support and a strong QA/QC program

USFilter

WESTATES VOCarb™ 48C**COCONUT SHELL BASED GRANULAR ACTIVATED CARBON**

(FORMERLY CC-601)

SPECIFICATIONS

Carbon Type	Coconut Shell
Mesh Size, U.S. Sieve	4 x 8
Larger than 4 mesh, max. wt. %	5
Smaller than 8 mesh, wt. %	5
Hardness No.	95 min
Butane Activity ⁽¹⁾	23.5 min
Moisture Content, wt. %	3 max

TYPICAL PROPERTIES

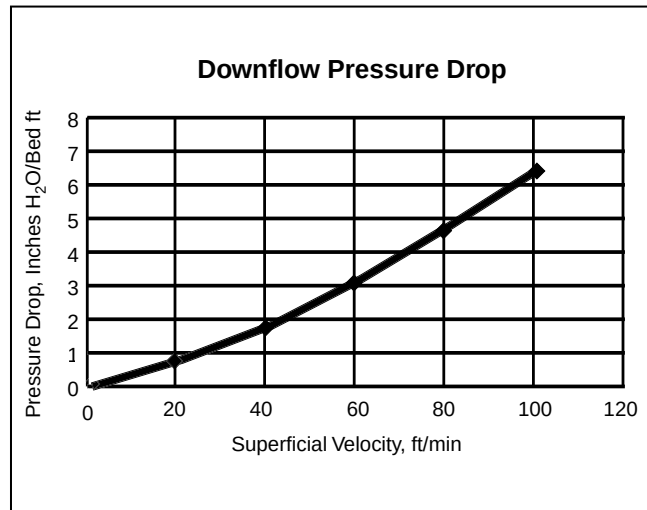
Surface Area (B.E.T.) m ² /g	1100 - 1250
CTC Activity	60
Apparent Density, lb/ft ³	28 - 31
Apparent Density, g/cc	0.45 - 0.50

⁽¹⁾Butane activity (D5742) has been adopted by ASTM as a replacement for CTC activity (D3467) as a test method for estimating the micropore volume of an activated carbon.

QUALITY CONTROL

All VOCarb™ activated carbons are extensively quality checked at our State of California certified environmental and carbon testing laboratory located in Los Angeles, CA. USFilter's laboratory is fully equipped to provide complete quality control analyses using ASTM standard test methods in order to assure the consistent quality of all VOCarb™ carbons.

Our technical staff offers hands-on guidance in selecting the most appropriate system, operating conditions and carbon to meet your needs. For more information, contact your nearest USFilter representative.



Safety Note: Under certain conditions, some compounds may oxidize, decompose or polymerize in the presence of activated carbon causing a carbon bed temperature rise that is sufficient to cause ignition. Particular care must be exercised when compounds that have a peroxide-forming tendency are being adsorbed. In addition the adsorption of VOCs will lead to the generation of heat within a carbon bed. These heats of reaction and adsorption need to be properly dissipated in order to fully assure the safe operation of the bed.

Wet activated carbon readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

All information presented herein is believed reliable and in accordance with accepted engineering practices. USFilter makes no warranties as to the completeness of this information. Users are responsible for evaluating individual product suitability for specific applications. USFilter assumes no liability whatsoever for any special, indirect or consequential damages arising from the sale, resale or misuse of its products.

USFilter

Baytown, TX 800.659.1723
 Los Angeles, CA 800.659.1771
 Oakland, CA 800.659.1718
 Warren, NJ 800.659.1717

www.usfwestates.com

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APPENDIX I

EQUIPMENT CUTSHEETS – UV/H₂O₂ SYSTEM

RAYOX® MODULAR TREATMENT SYSTEM

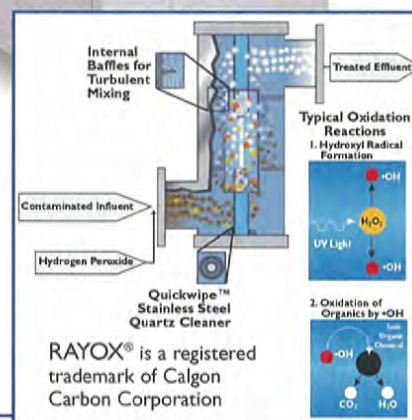
Model 30 (30kW System)

Overview

The RAYOX® advanced oxidation system supplied by Calgon Carbon Corporation destroys dissolved organic contaminants in water. In this system, a proprietary high-powered, medium-pressure lamp emits high energy UV radiation through a quartz sleeve into the contaminated water. An oxidizing agent, typically hydrogen peroxide, is added to the contaminated water and is activated by the UV light to form oxidizing species called hydroxyl radicals, via:



The hydroxyl radical then reacts with the dissolved contaminants, initiating a rapid cascade of oxidation reactions that ultimately fully oxidizes (mineralizes) the contaminants. The success of the system is based on the fact that the rate constants for the reaction of $\cdot\text{OH}$ radicals with most organic pollutants are very high. The hydroxyl radical typically reacts a million to a billion times faster than chemical oxidants such as ozone and hydrogen peroxide. In addition, many organic contaminants are split into smaller components by the direct absorption of UV light in the UV-C spectral range emitted by proprietary medium-pressure UV lamps. The RAYOX® system and its components are covered by numerous patents.



System Specifications

- Configuration: 1 x 30 kW Reactor
- Power Supply: 480 VAC, 3ph, 60 Hz (alternate power supplies available)
- Control System: PLC AB Micrologix
- Shipping Weight: 2,500 lbs/1,150 kg
- Materials: Wetted Parts - 316SS, Quartz, Fluoropolymers
- External Parts - Epoxy Coated Steel, 316SS
- 48" L x 49" W x 88" H

Model Features

- Skid-Mounted Module
- Proven, Fully Automated PLC System Control
- Patented, Field Proven Lamp Cleaning Device
- OSHA Approved
- NEC Compliant
- CSA Approved
- 3,000 Hour Lamp Warranty
- State-of-the-Art Lamp Power Supply
- Safety Interlock Switches
- Easy Installation
- Upgrade for outdoor installation available

Equipment and Systems

Visit our website at www.calgoncarbon.com, or call 800-422-7266 to learn more about our complete range of products and services, and obtain local contact information.

ES-LEOTR30-0704

RAYOX® MODULAR TREATMENT SYSTEM

Model 30 (30kW System)

The Customer's Problem

The Kelly Air Force base in San Antonio, Texas, needed to remediate multiple groundwater contaminants including DCA, DCE, TCE, and vinyl Chloride.

The United States Air Force contracted with a major engineering company to assess various technologies, including air stripping, activated carbon and UV Oxidation.

Due to the presence of vinyl chloride, air stripping was ruled out because of stringent air regulations.

Calgon Carbon's Solution

UV Oxidation was selected as the technology to be used for the groundwater remediation. Calgon Carbon Corporation was awarded a contract to lease a 30kW trailer-mounted RAYOX® unit to demonstrate UV Oxidation technology at several well sites on the base. The results formed the basis of the full scale design.

The Air Force proceeded with groundwater remediation at two well sites on the base, Zone 1 and Zone 2. Calgon Carbon Corporation was awarded the contract for both treatment systems on the basis of cost and technical merit.

The destruction of DCE controlled the design of Zone 1, while the destruction of 1,1-DCA controlled the design of Zone 2. The systems were delivered in the summer of 1993.

Site Characteristics

Kelly Air Force Base, San Antonio Texas

Zone 1

- Flow: 130 gpm
- Influent:
 - 1,2-DCE - 1,200 ppb (total)
 - TCE - 130 ppb
 - Vinyl Chloride - 120 ppb
- Effluent:
 - 1,2-DCE - < 70 ppb cis,
 - < 100 ppb trans
 - TCE - < 5 ppb
 - Vinyl Chloride - < 2 ppb
- System: Model 90 (90 kW total)
- O&M Cost: \$1.34/1,000 gal

Zone 2

- Flow: 200 gpm
- Influent:
 - 1,1-DCA - 40 ppb
 - 1,2-DCA - 20 ppb
 - 1,2-DCE - 300 ppb (total)
 - TCE - 170 ppb
 - PCE - 200 ppb
 - Vinyl Chloride - 240 ppb
- Effluent:
 - 1,1-DCA - < 3.5 ppb
 - 1,2-DCA - < 5 ppb
 - 1,2-DCE - < 70 ppb cis
 - < 100 ppb trans
 - TCE - < 5 ppb
 - PCE - < 5 ppb
 - Vinyl Chloride - < 2 ppb
- System: 3 x Model 90 (270 kW total)
- O&M cost: \$1.98/1,000 gallons

Hydrogen Peroxide Supply

Calgon Carbon offers full service and supply of various grades and concentrations of Hydrogen Peroxide solutions. Designed around each customer's individual needs, this service ensures that the scheduling of all deliveries is done to provide an uninterrupted supply of Hydrogen Peroxide.

Calgon Carbon also offers a telemetry system that provides hands-off management through remote monitoring and local display of tank levels. This fully comprehensive system offers reports detailing the tank level, amount of delivered and consumed product as well as dosing rates recorded on a daily basis. This, in time, provides historical data on usage allowing for effective budgeting and supply management. The installation

of this monitoring system allows us to schedule prompt and adequate deliveries specific to your tank level requirements.

All deliveries and system components adhere to stiff OSHA requirements and industry guidelines. The technicians and drivers used are fully certified and authorized for peroxide handling. Our technicians have been dealing in peroxide supply for over ten years.

Calgon Carbon can provide on-site inventory monitoring and scheduling of deliveries when it is convenient for you. Calgon Carbon also has the largest network of producers and distributors in North America, which means we will always have product available when you need it.

Visit our website at www.calgoncarbon.com



CALGON CARBON CORPORATION
Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA USA 15230-0717
1-800-422-7266
Tel: 412-787-6700
Fx: 412-787-6713

**Chemviron
Carbon**

European Operations of Calgon
Carbon Corporation
Zoning Industriel C de Feluy
B-7181 Feluy, Belgium
Tel: + 32 (0) 64 51 18 11
Fx: + 32 (0) 64 54 15 91

Your local office



ES-LEOTR30-0704

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APPENDIX J

EQUIPMENT CUTSHEETS - ASAHII/AMERICA POLY FLO PIPING

Poly-Flo Double Containment Submittal



Submitted by
Asahi/America, Inc.

A. General

The following is a submittal from Asahi/America, Inc. on the Poly-Flo Double containment project. The submittal is inclusive all fittings, pipe and joining required for a Poly-Flo system

B. Materials

1.0 Resin

The pipe and fittings shall be of the same resin material for both the inner and outer piping.

PolyPropylene

Black UV stabilized block co-polymer polypropylene shall meet the requirements of ASTM D4101. Material shall provide weathering resistance for outdoor use without further coating, covering or wrapping.

HDPE

High-density polyethylene shall meet the requirements of ASTM D3408 cell declassification 345434C or 355434C. All related accessories shall be made from the same resin.

Elastomers shall be selected by the designer with regard to the compatibility of the fluid service anticipated. O-rings must be inspected during installation to verify surface quality, and as with all sealing materials, periodic inspections may be appropriate. Stainless steel bolts, nuts and washers are recommended for flange assemblies.

HDPE Physical Properties

Characteristic	Standard	Units	Value
Density	ASTM D1505	g/cm ³	0.957
Tensile Strength at Yield	ASTM D 638	psi	3500
Ultimate Tensile Strength	ASTM D 638	psi	5000
Elongation at Break	ASTM D 638	%	>800
Flexural Strength 2% Secant	ASTM D 790	psi	136,000
Environmental Stress Crack	ASTM D 1693	hours	>10,000
Brittleness Temperature	ASTM D 746	°F	<-180
Vicat Softening Temp	ASTM D 1525	° F	255
Thermal Expansion		in/in °F	1.1 x 10 ⁻⁴
Material Classification	ASTM D1238	Type III	Class C

Co-Polymer Polypropylene Physical Properties

Characteristic	Standard	Units	Value
Density	ISO/R 1183	g/cm ³	0.905
Tensile Strength at Yield	ASTM D 638	psi	3046
Ultimate Tensile Strength	ASTM D 638	psi	5800
Elongation at Break	ASTM D 638	%	800
Modulus of Elasticity	ISO 178	psi	116,000
Impact Strength	ISO/R 179	ft lb/in	Zero break
Thermal Expansion		in/in °F	8.33 x 10 ⁻⁵
Heat deflection temp	ISO 75 Method A	° F	113
Vicat Softening Temp	ISO 306	° F / ° C	257/125

2.0 Product Configuration

All pipe shall be one-piece double-wall extruded simultaneously. The primary pipe shall be integral with the secondary pipe via connecting ribs, which are continuous down the entire length of each section of pipe. No centralizing clips, spiders, disks or supports shall be allowed.

Molded double containment fittings shall be of unitary construction. Permanent alignment of the inner and outer fittings shall be maintained via molded-in ribs. The ends of both the inner and outer fittings shall be flush (in one plane). Molded-in supports shall be set back from the ends of the fittings to allow mixing of any fluids in the annular space. Not all fittings are required to be molded.

Fabricated fittings shall be allowed where molded fittings are not available. All Fabricated fittings are required to be assembled utilizing butt fusion only. The manufacturer shall provide pressure ratings on fabricated fittings. Consult manufacturer drawings for availability and construction method of each part.

Identical wall thickness for the inner and outer walls are mandatory for each size.

Termination of the double containment shall be conducted utilizing a termination flange or Female, Metric socket or IPS spigot adapter.

3.0 Pressure Rating

Pipe and fittings shall be rated for 100 psi in all sizes and materials at 73°F.

Inner and outer fittings shall both be rated for 100 psi, including all termination fittings, transition fittings and drainage fittings.

C. Execution

1.0 Joining Methods

All field welding shall be butt welded per the general guidelines of ASTM D2657 for polyolefin piping, and in general accordance with the manufacturer's printed guidelines.

Mechanical connections in polypropylene can be conducted utilizing a double wall flange adapter. A double wall flange shall be connected to a double wall o-ring flange for proper sealing. Double wall flanges are only available in Polypropylene.

2.0 Installation and Support

Installation procedures shall be as per the manufacturer's written specifications. Pipe support spacing must be adequate to prevent any appearance of sagging. Standard design practice for single wall thermoplastic piping with regard to expansion and contraction shall be followed. Valves and other auxiliary items shall be independently supported.

Support Spacing		
Size	Black Polypro	HDPE
1x2	65	81
2x3	78	100
4x6	112	112

Support spacing is based on S.G of 1.0

Correction factors must be used for denser fluids as follows: 0.90 for S.G = 1.25, 0.85 for S.G = 1.50, 0.75 for S.G = 1.75 and 0.70 for S.G = 2.0

Above based on water at 68 °F

Support Spacing Temperature correction factor

Temperature (°F)	Polypropylene	HDPE
73	1.0	1.0
100	0.94	0.95
140	0.86	0.86
180	0.76	NA
200	NA	NA

3.0 System Testing

Pressure Systems

To fully test both the inner and outer containment for full pressure rating a hydrostatic test of both the inner and outer pipes shall be performed as outlined in the Uniform Plumbing Code Section 318 as directed by the local Administrative Authority. Specifically, a water pressure test at 1.5 times (150%) the normal working pressure of the inner pipe should be applied to both the inner and outer walls in separate tests.

To avoid a possible leak in the carrier from contaminating the containment space with water, a 5 to 10 psi air test can be first conducted a quick check of the system. See requirements for safety below.

To avoid moisture in the containment an air test can be conducted on the containment pipe. Pressure test is recommended at 5 psi and shall not exceed 10 psi. The inner carrier pipe shall be full of water and under pressure to avoid any possible collapse.

When testing with air on both the carrier and containment piping the ambient temperature should be above 32 °F and extra safety precautions for personnel shall be put in place during the test

Drainage Systems

For systems in drainage applications a hydrostatic test of 1.5x the working pressure is recommended for the carrier pipe. To avoid moisture in the containment an air test can be conducted on the containment pipe. Pressure test is recommended at 5 psi and shall not exceed 10 psi. The inner carrier pipe shall be full of water and under pressure to avoid any possible collapse. When testing with air the ambient temperature should be above 32 °F and extra safety precautions for personnel shall be put in place during the test.

4.0 Leak Detection

Leak detection shall be provided to monitor the integrity of the secondary containment in compliance with the local administrative authority.

Float switch adapter fittings shall be spaced as deemed appropriate by the responsible designer, allowing the use of either magnetic reed switches or optical probes as sensing devices. These shall be wired to a suitable alarm system.

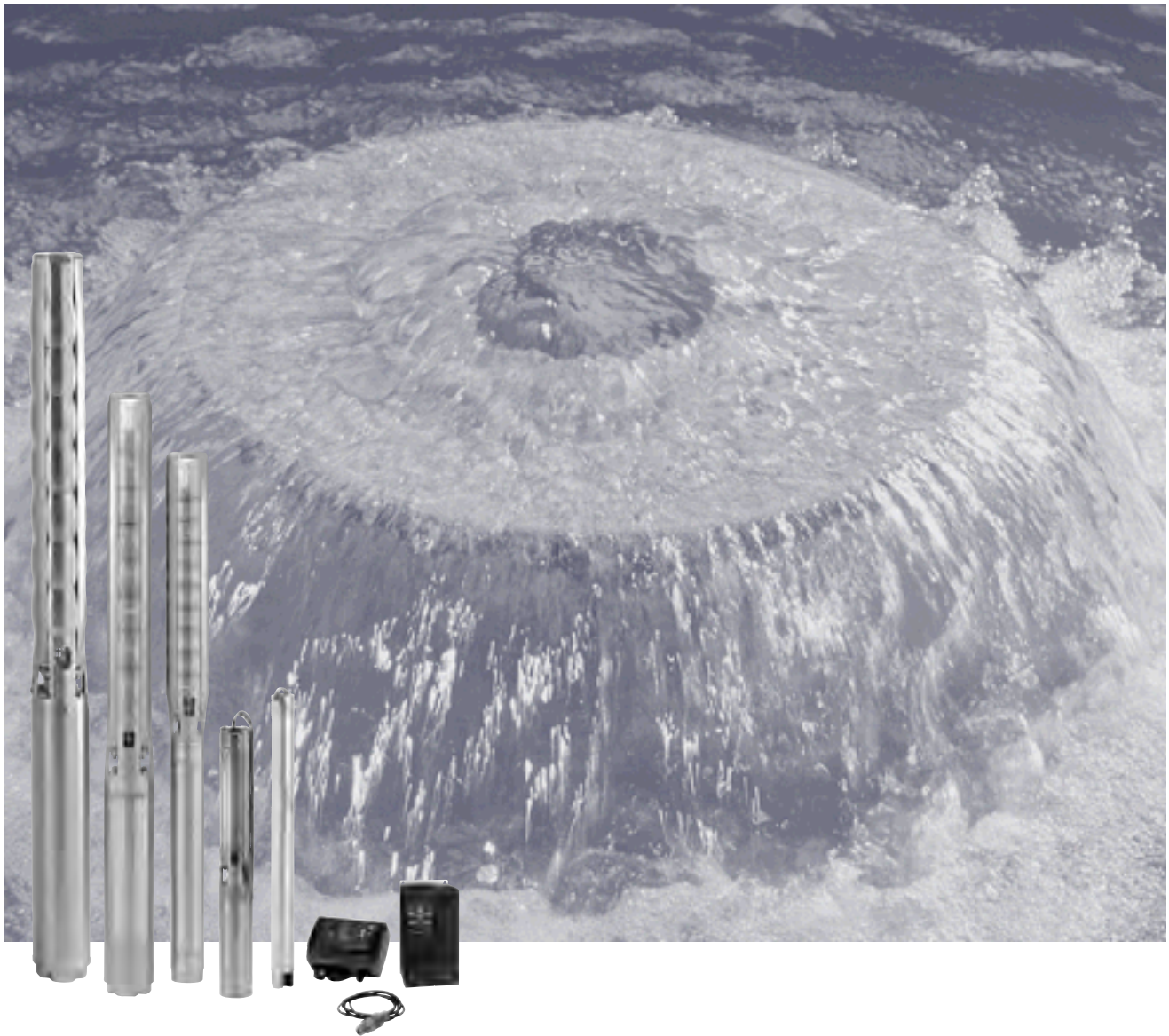
Periodic test filling of the secondary containment (annular space) with water shall be performed at the float switch location only. Suitable water connections and drainage provisions shall be provided at the float switch locations to test and drain the sensors.

APPENDIX K

EQUIPMENT CUTSHEETS – SUBMERSIBLE PUMPS

SQ, SQE, SP

Stainless steel submersible pumps and accessories
60 Hz



Mission

- to successfully develop, produce, and sell high quality pumps and pumping systems worldwide, contributing to a better quality of life and healthier environment



Bjerringbro, Denmark



Fresno, California



Olathe, Kansas



Monterrey, Mexico



Allentown, Pennsylvania



Oakville, Ontario

- One of the 3 largest pump companies in the world with over 11,000 employees worldwide
- World headquarters in Denmark
- North American headquarters in Kansas City - Manufacturing in Fresno, California
- 60 companies in 40 countries
- More than 10 million pumps produced annually worldwide
- North American companies operating in USA, Canada and Mexico
- Continuous reinvestment in growth and development enables the company to
BE responsible, **THINK** ahead, and **INNOVATE**

Submittal Data Sheet



Company name: _____

Prepared by: _____

Phone number: () - _____

Fax number: () - _____

Date: _____ Page 1 of: _____

Quote number: _____

Client Information

Project title: _____	Client name: _____
Reference number: _____	Client number: _____
Client contact: _____	Client phone no: () - _____

Location Information

For: _____	Unit: _____
Site: _____	Service: _____
Address: _____	City: _____ State: _____ Zip Code: _____

Technical Data

Flow (GPM) _____

Head (Ft) _____

Motor _____

Max Fluid Temp _____

Min Fluid Temp _____

Max Working Pressure _____

Min Required Inlet Pressure _____

Connection Type and Size _____

Motor Information

HP: _____

Phase: _____

Voltage: _____

Enclosure: _____

Pump Information

Model Information from Type Key and Codes: _____	
Quantity Required: _____	Example: SP 150S
Minimum required flow: _____	NPSH required at duty point: _____
Product Guide additional information pages	
Materials page number: _____	Performance curve page number: _____
Technical data page number: _____	Motor data page number: _____

Custom-built pump information (optional): _____

Additional Information

GRUNDFOS STAINLESS STEEL PUMPS
FOR GROUNDWATER APPLICATIONS

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Features & Benefits
SP, SQ/SQE Type Keys

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Performance Curves

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Performance Curves

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Grundfos 4-Inch SECTION 4
Stainless Steel Submersible Pumps
Sizing & Selection Charts
Performance Curves & Technical Data

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Stainless Steel Submersible Pumps
Performance Curves & Technical Data

Groundwater Accessories SECTION 5-38

Technical & Pump Selection Information SECTION 6

Submittal Data Sheet SECTION 6-12

GRUNDFOS STAINLESS STEEL PUMPS

STAINLESS STEEL CONSTRUCTION

Grundfos submersibles feature rugged and durable stainless steel construction for all vital pump components. Impellers, diffusers, shafts, vanes, cable guards, couplings...even the nuts and bolts are stainless steel. Grundfos' 4-inch pump systems include the stainless steel pump, motor, and control box and are delivered ready to install.

Computer-aided design and manufacturing techniques ensure that each *pump* is built to exacting tolerance and performs to industry-leading standards. Grundfos state-of-the-art production equipment includes extensive use of robotics and advanced quality assurance procedures. You can rely on quality Grundfos' groundwater products for outstanding pump performance and best value.

SUBMERSIBLES

4-INCH and LARGER WELLS

The 4-inch submersibles line covers all flow requirements from 1.2 to 95 gpm and heads to 2000 feet. This broad range ensures proper pump selection for all domestic groundwater system applications.

6, 8, & 10-INCH and LARGER WELLS

For high flow requirements, this submersible line includes 6, 8, and 10-inch models for flows up to 1,400 gpm and heads to 2100 feet.

Grundfos offers 18 models of submersible pumps designed for domestic and industrial applications with flow rates from five to 1,400 gpm. Horsepower range extends from 1/3 hp to 250 hp. These pumps are marketed through more than 300 distributors and nearly 2,000 dealers nationwide.



THE STAINLESS STEEL ADVANTAGE

TOP PUMP PERFORMANCE

Grundfos pumps are built to work hard with every component designed for maximum hydraulic efficiency. With the inherently smooth surfaces of fabricated stainless steel, peak performance is maintained over many years of service.

RELIABLE OPERATION

Highly advanced design and manufacturing techniques minimize the number of moving parts. This, plus Grundfos' use of rugged stainless steel construction, make GRUNDFOS groundwater pumps the toughest, most reliable pumps on the market. With Grundfos you can rely on getting the water you need, when you need it.

LONG PUMP LIFE

Stainless steel is the best available material to resist wear and corrosion in water system applications. Compare Grundfos' stainless steel construction to the best the other manufactures have to offer. Grundfos stainless steel pumps are designed to operate efficiently and effectively for a long, long time.

SQ/SQE SUBMERSIBLE PUMPS

3-Inch SQ/SQE Submersible Well Pumps 3-Inch and Larger Wells

SQ/SQE pumps are suitable for both continuous and intermittent operation for a variety of applications:

- Domestic water supply
- Small waterworks
- Irrigation
- Tank applications

SQ, SQE pumps offer the following features:

- Dry-Run protection
- High efficiency pump and motor
- Protection against up-thrust
- Soft-start
- Over-voltage and under-voltage protection
- Overload protection
- Over-temperature protection
- High starting torque

Additionally, the SQE pumps offer:

- Constant pressure control
- Variable speed
- Electronic control and communication

The SQ and SQE pump models incorporate an innovative motor design. With the use of permanent-magnet technology within the motor, the SQ/SQE pumps deliver unmatched performance. By combining permanent-magnet motors and Grundfos's own micro frequency converter, we are now able to control and communicate with the pump in ways never before possible. A few of the features that

come out of this combination are Constant Pressure Control, Soft-Start, and integrated Dry-Run protection. These are just a few of the many features that the SQ/SQE pumps can offer.

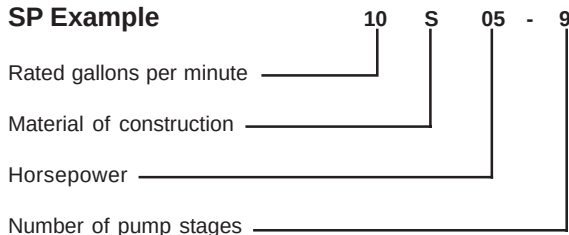
The SQ pump models operate at a constant speed much like today's conventional pumps. The difference between it and traditional pumps is you get all the benefits of an electronically controlled permanent-magnet motor that cannot be accomplished with a conventional induction motor. The SQ pumps are available for single phase power. They use a simple 2-wire design making installation easy.

The SQE uses the Grundfos "Smart Motor". Like the SQ model, we still use the high efficiency permanent magnet motor, but we give this motor the ability to communicate. The "Smart Motor" communicates via the CU301 status box through the power leads. It is not necessary to run any additional wires down the well. By being able to communicate with the pump you can have Constant Pressure Control and the ability to change the pump performance while the pump is installed in the well. Like the SQ motor, this is also a 2-wire motor designed for single-phase operation.

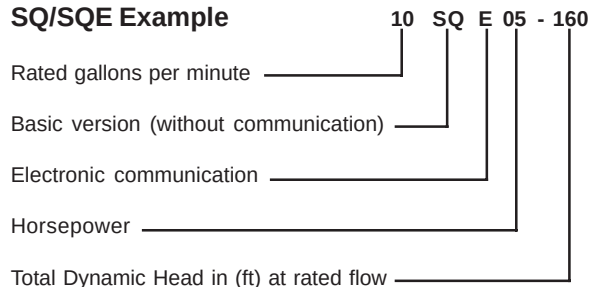


TYPE KEYS

SP Example



SQ/SQE Example



APPENDIX L

EQUIPMENT CUTSHEETS – LEVEL CONTROLLERS

Series 67

Multi-Function Control

Duplex Pump System Control

- ▶ Inverse or Direct Acting, Field Selectable
- ▶ Solid State Reliability
- ▶ Compact Size
- ▶ Four Independent Channels – 2 Single, 2 Differential
- ▶ Field Adjustable, Sensitivity and Mode Selection
- ▶ LED Channel Indicators
- ▶ Built-in Silence/Acknowledge Circuit
- ▶ U.L. “Intrinsically Safe”

Warrick's Series 67 four channel level control is an ideal solution to liquid level problems in hazardous applications for the sewage, waste water, chemical and groundwater remediation industries.

Connected to floats or conductance probes this versatile control provides simplex or duplex pump/solenoid valve control; automatic or manual alternation; high and/or low level alarms with silence/acknowledge capabilities.

The Series 67 can be used in hazardous applications as an intrinsically safe interface to non-powered contacts and sensors such as push button operators, limit, temperature, pressure and vacuum switches.

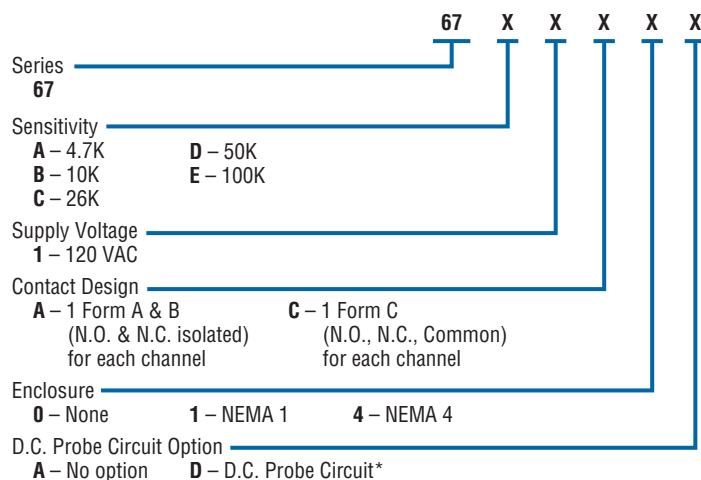
Designed for hazardous applications, its low cost, integrated features and compact size also make it ideal for non-hazardous applications.

Specifications

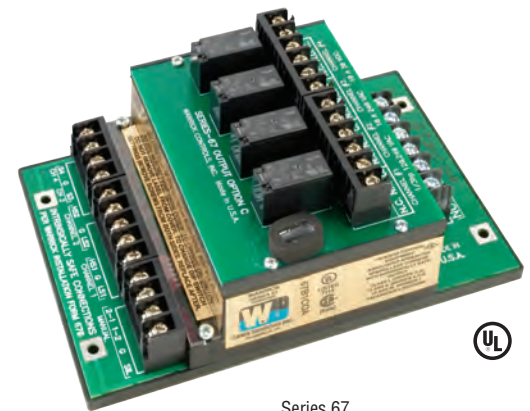
Contact Design	Standard N.O., N.C. (form C); Optional N.O., N.C.
Contact Rating (30VDC, 120/240VAC)	10 amp (style C); 5 amp (style A)
Primary Voltage	120 VAC, 50/60 Hz
Secondary Voltage	12 VAC @ 6mA RMS
Sensitivity	4.7K - 100K ohms maximum specific resistance, factory set
Temperature	-40°F to +150°F (-40°C to +65°C)
Approvals	U.L. 913 File # E44570

How to Order

Use the **Bold** characters from the chart below to construct a product code.



*Eliminates short cycles

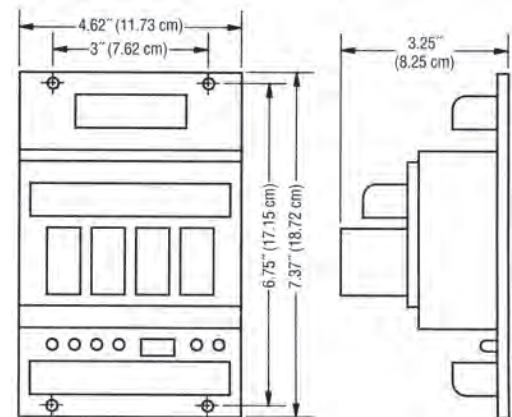


Series 67

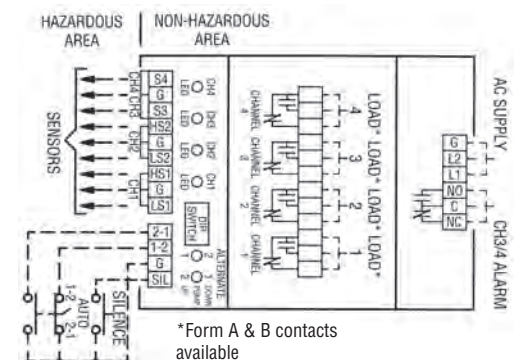
Applications

- Hazardous Atmospheres
- Multiple Functions
- Simplex or Duplex
- High/Low Level Alarms
- Auto or Manual Alternation
- Pump/Solenoid Valves
- Sewage Lift Stations
- Wastewater Treatment
- Chemical Plants
- Groundwater Remediation

Dimensions



Wiring



See Our Interstitial Tank Monitoring Products on page A-22.



APPENDIX M
GETS START-UP CHECKLIST



Boeing Remediation System Startup Checklist

This Boeing Startup Checklist is to set forth a procedure to initiate operation of the remediation systems following initial construction, major system modifications, or extended periods of shutdown. This checklist is intended to identify common procedures for remediation system startup and is not intended to be all inclusive. In addition to this checklist a site specific procedure will need to be identified in accordance with the system design and approved by Boeing personnel.

The completed checklist is to be emailed to the Boeing Engineer for electronic approval prior to initiating startup procedures.

Project Name: [Project name]

Project Location: [Description]

Project Number: [Project Number]

Brief Description of the Remediation System:

[Process Description]

Administrative:

Yes	No	
☐	☐	Contractor's notice of substantial completion received?
☐	☐	Any punch list items remaining that will affect startup/safety?
☐	☐	Certificate of Mechanical Completion issued from Boeing representative?
☐	☐	Current contact name, company, and phone number displayed on compound?
☐	☐	All safety labeling completed?
☐	☐	Has proper signage been posted for hazard and process communication (Hazcom placards, flow direction, normally open/closed tagging)?
☐	☐	Health and Safety Plan on-site?
☐	☐	OMM Plan prepared or scheduled for delivery?
☐	☐	Map to hospital and directions posted in visible area?
☐	☐	First aide kit available on-site?
☐	☐	Fire extinguisher mounted with sign?
☐	☐	Eye wash station available on-site with sign?
☐	☐	Communication device present for emergencies?
☐	☐	List of emergency contacts posted? List contacts below:
		Emergency Contact 1: [Name, Title, Company, & Phone Number]
		Emergency Contact 2: [Name, Title, Company, & Phone Number]
		Emergency Contact 3: [Name, Title, Company, & Phone Number]
		Emergency Contact 4: [Name, Title, Company, & Phone Number]
☐	☐	Operator training complete? If yes specify date completed
		[Description]
☐	☐	Personnel have emergency dash cards for site?
☐	☐	All pressure testing complete and all temporary testing equipment removed?
☐	☐	All required City/County/State inspection completed and signed off? If yes, specify Agency, date of inspection.
		[Agency/Name/Title/Telephone #] [Date]
		[Agency/Name/Title/Telephone #] [Date]
		[Agency/Name/Title/Telephone #] [Date]
		[Agency/Name/Title/Telephone #] [Date]

- ☐ ☐ Are copies of discharge permit(s) posted at the appropriate locations? If yes, specify Permits, permit numbers, and condition(s).
- | | | |
|-----------------|--------------|-------------------------------|
| [Permit Agency] | [Permit No.] | [Conditions, List Separately] |
| [Permit Agency] | [Permit No.] | [Conditions, List Separately] |
| [Permit Agency] | [Permit No.] | [Conditions, List Separately] |
| [Permit Agency] | [Permit No.] | [Conditions, List Separately] |
- ☐ ☐ Does system equipment match permit descriptions
- ☐ ☐ Have stakeholders been notified and appropriate notifications been made for system startup? If yes, specify parties notified. [Description]
- ☐ ☐ MSDS available for all hazardous compounds present on site?
- ☐ ☐ Are effectiveness/optimization plans/meetings identified?
- ☐ ☐ Contracting in place for routine and non-routine OMM?
- ☐ ☐ Performance metrics developed for system operation with project manager and engineering team?
- ☐ ☐ Field forms, data tracking, and documentation spreadsheets developed (Boeing standardized monthly report)?

Action Items for Pre-Startup Administrative Inspection:

Item #	Correction Required	Date Corrected
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]

Mechanical:

Yes	No
- ☐ ☐ Visually inspect flow path from extraction wells to treatment system to ensure that all valves are in correct operating position, and that connections are correctly made and system components/instrumentation installed.
- ☐ ☐ Visually inspect flow path through treatment system to ensure that all valves are in correct operating position, and that connections are correctly made and system components/instrumentation installed.
- ☐ ☐ Visually inspect flow path through treatment system to ensure that all valves are in correct operating position, and that connections are correctly made and system components/instrumentation installed.
- ☐ ☐ Confirm appropriate media has been installed in treatment vessels per manufacturers specifications, including any pretreatment prior to system operation
- ☐ ☐ Confirm equipment has been installed per manufacturer's specifications, and all required lubrication, leveling, tie downs have been completed.
- ☐ ☐ Confirm supports and support clamps are tightened per manufacturer's specifications.

- ☐ ☐ Following startup visually inspect all piping/valves/equipment connections/instrumentation for leaks.
- ☐ ☐ Other, specify.
[Description]

Action Items for Pre-Startup Mechanical Inspection:

Item #	Correction Required	Date Corrected
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]

Electrical/Control:

Yes	No	
☐	☐	Conduct insulation testing completed on all power conductors
☐	☐	Visually inspect electrical terminations on end devices and equipment. Verify completed in accordance with design drawings and specification and connections are tight
☐	☐	Verify all grounding connections
☐	☐	Verify all breakers appropriately labeled
☐	☐	Lockout/tagout kit posted on control panel
☐	☐	Verify all equipment hand switches are in "OFF" position and energize system.
☐	☐	Verify motor rotation on all rotating equipment, by operating in "HAND" mode and compare to appropriate operating curve.
☐	☐	Verify all valving is in appropriate position to all instrumentation
☐	☐	Trip/test all system alarms. Verify appropriate system shutdown/call out.
☐	☐	Begin startup in phased sequence in accordance with all equipment manufacturers' recommendations and in accordance with the system design. Following system equilibration, test power failure shutdowns by turning off breaker(s) and allowing an orderly shutdown of the system.
☐	☐	Verify telemetry operating as intended
☐	☐	Other, specify. [Description]

Action Items for Pre-Startup Electrical Inspection:

Item #	Correction Required	Date Corrected
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]
[Number]	[Description]	[Date]

Approvals:

O&M Engineer/Project Manager: [Name, Title, & Company]

Field Engineer: [Name, Title, & Company]

Boeing Engineer: [Name & Title]

Date

[Date]

[Date]

[Date]