Alvarado 12-7-95

DEC 07 1995

In Reply Refer To: MS 5232

Flextrend Development Company, L.L.C.
Attention: Mr. John H. Gray
7400 Texas Commerce Tower
600 Travis
Houston, Texas 77002

Gentlemen:

Pursuant to the authority granted by U.S.C. 1334(e) and 30 CFR 250.150(b) and (d), your application dated October 19, supplemented November 7, 9, and 30, 1995, for a pipeline right-of-way grant two-hundred feet (200') in width, for the installation, operation, and maintenance of an 18-inch pipeline bundle, 3.97 miles in length from Flextrend Development Company, L.L.C.'s (Flextrend) subsea pipeline skid at coordinates X = 1,796,959 and Y = 10,115,970 in Block 117, across Block 73, to Flextrend's Platform A in Block 72, all in Garden Banks, is hereby approved as proposed.

This proposed right-of-way grant has been assigned Right-of-Way Grant OCS-G 15983 and consists of the following pipelines:

Pipeline Segment No.	Size (inches)	Length (feet)	Service	From	To
10836	18	20,953	Structural Service Line	Pipeline Skid	Platform A
10837	3 1/2	20,953	Bulk Oil	Pipeline Skid	Platform A
10838	3 1/2	20,953	Bulk Oil	Pipeline Skid	Platform A
10839	3 1/2	20,953	Bulk Oil	Pipeline Skid	Platform A
10840	3 1/2	20,953	Bulk Oil	Pipeline Skid	Platform A

Leviathan Gas Pipeline Partners, L.P.'s Regional Oil Spill Contingency Plan, submitted on August 1, 1995, and Flextrend's certification of their ability to adequately respond to the projected potential worst-case discharge shall cover this pipeline operation.

Please be advised that there is an unidentified side-scan sonar target located in the southwest corner of Block 118, and a fault scarp located in Block 117, all in Garden Banks. Flextrend should exercise caution when conducting seafloor disturbance operations within these blocks.

G 15983

on MP 1/11/96

Based on our analysis of your application, the maximum allowable operating pressure for the 3 1/2-inch diameter pipelines will be 7,500 psig. Segment No. 10836 is the structural caisson and will not be subject to any operating pressure.

Sincerely,

(Orig. Sgd.) William H. Martin

Donald C. Howard
Regional Supervisor
Field Operations

bcc: 1502-01 (P/L OCS-G 15983) w/encls (KFaust) (MS 5232)
1502-01 (P/L OCS-G 15983) w/encls (microfilm) (MS 5033)
MS 5421 w/receipt
MS 5440
MS 5270 w/encls
MS 5232 Carto w/plat

MConner:jvl:12/06/95:Flextrnd.983

Supp # 3

G-15983

FLEXTREND DEVELOPMENT COMPANY L.L.C.

To: Mr.Mike Conner
Company: Minerals Management Service
Phone:
Fax: (504) 736-2426

From: Antoine Gautreaux Jr.

Phone: 713-224-7400
Fax: 713-547-5151

Date: 11/28/95
Pages including this cover page: 4

Comments:

Attached is the Lessee Notification Response summary sheet for the Tow Route. A full set is forthcoming in the mail The only one who has not responded is Exxon. I have attached the notification card which shows their response time expired Nov 20, 1995. They have been contacted by phone on numerous occasions but have not formally responded. All others have responded favorably, some with notification requirements in advance of the activity across the Block or Pipeline. This will be taken care of.
Also attached is the platform safety flow diagram for the GB 117 subsea wells you requested. The PSHL on the incoming flowlines will shut-in the PWV (production wing valve) on the subsea tree.
The USCG has been notified for a "Notice to Mariners" during the period of activity.
Your cooperation will allow us to proceed with our launch on schedule; the first week in December. Your assistance is greatly appreciated.

A. Gautreaux Jr.

LESSEE RESPONSE TO TOW ROUTE APPLICATION

28-Nov-95

COMPANY	Block /ROW	NO Objection	No Objection Conditional	Objection	Received Certified Receipt	Certified Mail Reciept #
Transcontinental Gas Pipeline	20", 30" Brazos A-101		VERB		10/19/95	Z 765 875 350
Tejas Power Corporation	20", MI 483		VERB		10/20/95	Z 765 875 452
Dalen / Enserch	6", MI 588		X		11/9/95	P 027 915 954
Tejas Power Corporation	20", MI 588		VERB		10/20/95	Z 765 875 452
Tejas Power Corporation	6", 16" MI 484		VERB		10/20/95	Z 765 875 452
	6", 16" MI 526					
Seagull Energy	MI 526				10/20/95	Z 765 875 460
Amerada Hess	MI 563	VERB			10/20/95	Z 765 875 443
ENRON	MI 557	X			10/20/95	Z 765 875 442
	MI 586					
Conoco Inc.	Brazos A-75	X			10/23/95	Z 765 875 362
Union Oil California	Brazos A-102		X		10/20/95	Z 765 875 445
	Brazos A-101					
Benton Oil & Gas	East Breaks 197	X			10/23/95	Z 765 875 446
BP Exploration	East Breaks 209	X			10/20/95	Z 309 277 693
Phillips Petroleum	East Breaks 167	X			10/20/95	P 309 277 694
Exxon USA	East Breaks 168				10/19/95	P 309 277 698
	Garden Banks 162					
ORYX	East Breaks169	X			10/23/95	P 309 277 699
	Garden Banks 224					
	Garden Banks 115					
Kerr McGee	East Breaks 173	X			10/23/95	P 309 277 700
Texaco Inc.	Garden Banks 225		X		10/20/95	Z 765 875 365
	Garden Banks 319					
Chevron	Garden Banks 322	VERB			11/9/95	P 027 915 955
	Garden Banks 323					
Hardy Oil & Gas	Garden Banks 240	VERB				Z 765 875 349
					11/10/95	COURIER ALSO

P 309 277 698

Receipt for Certified Mail
No Insurance Coverage Provided
Do not use for International Mail
(See Reverse)

Sent to Jeff McDonald	
Street and No. EXXON USA	
P.O. State and ZIP Code P.O. BOX 4697 HOUSTON, TX 77210-4697	
Certified Fee	1.00
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	1.00
Return Receipt Showing to Whom, Date, and Addressee's Address	
TOTAL Postage & Fees	$
Postmark or Date	

PS Form 3800, June 1991

11-14-95 Talked w/ Jeff McDonald and was referred to Jim McGrory (775-6096 Left voice mail message

11-20-95 called for Jim McGrory Left voice mail message

11-27-95 Called back to Jeff McDonald (713) 423-6944 Left voice mail message About inability to Reach Jim McGrory.

SENDER:
- Complete item 1 and/or 2 for additional services.
- Complete item 3, 4a, and 4b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write "*Return Receipt Requested*" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):
1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:
MR. JEFF MCDONALD
EXXON USA
P.O. BOX 4697
HOUSTON TX 77210-4697

4a. Article Number P 309 277 698

4b. Service Type
☐ Registered ☑ Certified
☐ Express Mail ☐ Insured
☐ Return Receipt for Merchandise ☐ COD

7. Date of Delivery OCT 19 1995

5. Received By: *(Print Name)*

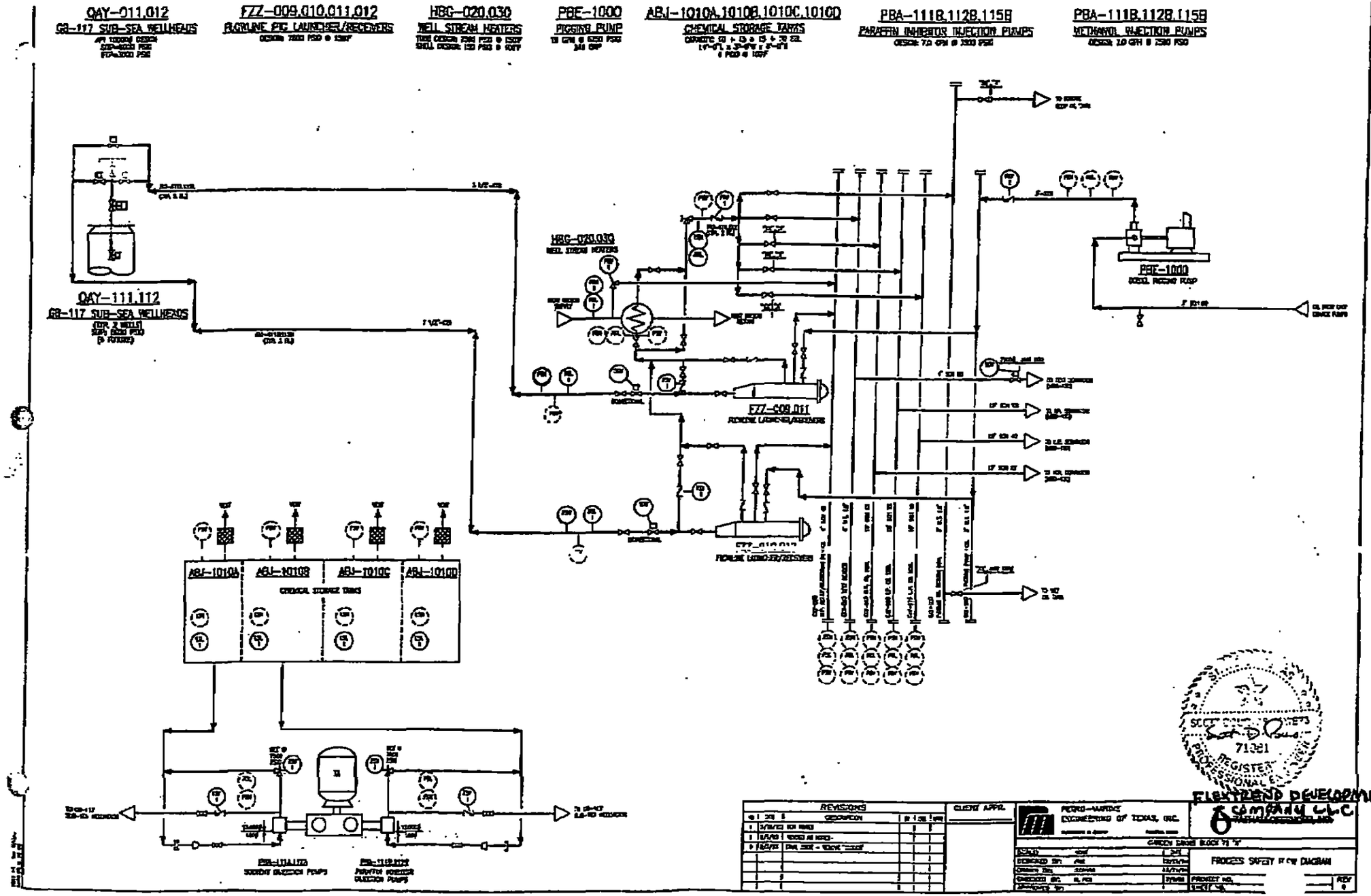
8. Addressee's Address *(Only if requested and fee is paid)*

6. Signature: *(Addressee or Agent)*
X

Is your RETURN ADDRESS completed on the reverse side?

Thank you for using Return Receipt Service.

PS Form 3811, December 1994 Domestic Return Receipt



FLEXTREND DEVELOPMENT COMPANY, L.L.C.

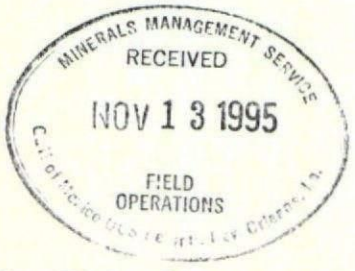
FLEXTRI) DEVELOPMENT COM NY, L.L.C.
SUBSIDIARY OF
LEVIATHAN GAS PIPELINE PARTNERS, L.P.

G-15983

November 9, 1995

Mr. Donald C. Howard
Regional Supervisor
Office of Field Operations
U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region
1201 Elmwood Park Blvd.
New Orleans, LA 70123-2394

Supplement #1
Kathy



Attn: Mr. Mike Conner
MS 5232

Re: **Supplemental Information for the Application for DOI Pipeline Right-of-Way as submitted October 19, 1995. Proposed Four 3.5 Inch O.D. Oil and Associated Gas Pipeline Bundle to be installed in and/or through Garden Banks Block 117, 73, and 72, OCS Federal Waters, Gulf of Mexico, Offshore Louisiana.**

Dear Mr. Conner:

The following is the additional information requested which is provided for clarification as a supplement to the aforementioned Right-of-Way Application. Also included are specific waiver requests.

With regards to the span mentioned in the Geohazard Report submitted, the results of the stress calculations for this span area are as follows.

The conclusion is that the bundle, static span stresses are within all allowable limits for installation, hydrotest and operational conditions. The stresses were analyzed from bottom profile data points spaced approximately each 35 feet from the Garden Banks 72 platform location to the Garden Banks 117 Subsea Well. The maximum combined stress along the bundled casing is associated with a small fault at approximately 17,200 feet along the infield route.

Maximum Combined Stress Absolute

Description	Submerged Wt. lbs./ft.	Location ft.	Max. Stress % SMYS
Installation	8.5	17106	20
Hydrotest	20.5	17386	24
Operation	13.6	17386	22

7400 TEXAS COMMERCE TOWER • 600 TRAVIS • HOUSTON, TEXAS 77002
(713) 224-7400 • FAX (713) 547-5135

Below are the engineering calculations for the design of the Cathodic Protection System proposed for the pipeline.

- The anodes to be used are Galvalum III standoff mounted to the sled.
- The anticipated life is 20 years.
- Assumed a maximum of 3% bare pipe.
- Current 0.006 amp/sq. ft.
- 22000' x 4.712' = 103,672.5 sq. ft. (surface area)
- Based on 3% bare total bare = 3110.2 sq. ft.
- 3110.2 sq. ft. bare x 0.006 amp/sq. ft. = 18.661 amps
- 20 year life x 9.5 #/amp-year = 190 #/amp
- 18.661 amps x 190 #/amp = 3545.6 lbs.
- Galvalum III ampere-hour output is 1060 ampere-hour per pound.

Install one (1) 2000# anode array on each sled (10 - 200# anodes per sled). Total anodes 4000#. Anode installation clamps are installed along the pipeline bundle if necessary to add anodes later in the operating life.

The addition of a PSHL on the incoming flowline to the Garden Banks 72 will be provided in lieu of the PSL as originally submitted.

Flextrend Development Company L.L.C. respectfully requests the following waivers.

> A waiver for the installation of the FSV on the departing segment of the flowline from the subsea tree to the flowline sled. The installation of an FSV would inhibit our ability to pump into the well should any injection requirements become necessary.

A waiver from the customary 8 hour hydrotest following the installation of the Coflexip flexible jumper between the subsea tree and the flowline sled. The flexible jumper will be completely hydrotested for 8 hours with appropriate charts and dead weight test documentation prior to shipment to the field for installation. Once installed and connected we request a waiver to perform a 1 hour leak test from the rig. The leak test would be performed at 9375 psi which is 1.25 times the rated working pressure of 7500 psi for 1 hour with the appropriate chart and dead weight test documentation.

If the above information meets with your approval, we would appreciate your issuing the necessary decision for the Right-of-Way at your earliest convenience. Inquiries concerning this application should be directed to Antoine Gautreaux or John Locantro at (713) 224-7400 or at our address.

Sincerely,

John H. Gray
Chief Operating Officer

JHG:gab

Antoine\RowSupp

EDSI

MATERIALS TECHNOLOGY GROUP

MEMO

G-15983
Supplement #2
Kathy

Memo: 95M0501

Date: November 7, 1995

To: Mr. Barthe Leibe
Kvaerner - R. J. Brown

From: Fred McCasland

Subject: CATHODIC PROTECTION FOR TATHAM GB 72/117 BUNDLE

Cathodic protection for the external surfaces of bundle piping has traditionally been provided by zinc bracelet anodes evenly spaced along the length of the bundle. Anode spacing was determined by potential attenuation and weight distribution considerations.

Potential attenuation along a bundle is controlled primarily by the quality of the coating. High quality coating systems with few defects have low potential attenuation.

The coating system used on the TATHAM bundle is Fusion Bonded Epoxy (FBE) with abrasion coating on the bottom one half of the bundle. This coating system is very good. The conductance of FBE coating is 1×10^{-12} mhos or equivalent to a resistance of 10^{12} ohms.

Further, Galvalum III anodes, which cannot be cast directly to the casing, can provide roughly three times the driving potential of zinc anodes at one third of the weight.

Considering the quality of the coating system, the additional driving potential of Galvalum III anodes and the relative short length of bundle in this project, we performed potential attenuation calculations to determine if anodes could be installed at the sleds rather than along the bundle.

Our calculations indicate that the TATHAM bundle can be protected by placing anodes at each end of the bundle (at the sleds).

The attenuation model used to calculate attenuation along the pipe is widely used in industry. A paper published in National Association of Corrosion Engineers magazine "Materials Performance" that describes attenuation calculations is attached for your review.

The basics of out attenuation model are below.

Attenuation is caused by the following IR drops that are inherent in the system.

1. IR drop caused by current flow through the seawater
2. IR drop caused by the resistance of the pipe
3. IR drop caused by the polarization layer at coating defects.

The IR drop through seawater is approximately 0 and can be ignored. Therefore, attenuation can be approximated by the equation:

$$E_x = E_a * e^{-(\alpha x)}$$

E_x the potential at a distance x from the anodes
E_a the potential at the anode
α is the attenuation constant ($\sqrt{rg}$ = 2.9E-10)
r is the electrical resistance of the pipe (r=8.3E-9)
g is the conductance of the pipe coating (g=1E-12)

Our worst case is during polarization when approximately 6 ma of current will flow through the locations where the coating is damaged. We used 3% coating damage in the model because 3% is the coating quality specified in the cathodic protection standard. In this case we will need a driving potential of -920mv on the casing pipe at the sleds.

The cathodic protection systems for the sleds were designed for full protection with 400 pounds of Galvalum III anodes each. The addition of 2000 pounds of anodes on each sled will cause the sleds potential to increase and will cause current to flow from the sleds to the bundle piping thereby inducing an adequate protective potential on the bundle.

Attenuation Calculations for Subsea Pipelines Using Computer Modeling

Mike Haroun
CorrOcean USA Inc., 211 Highland Cross, Suite 117, Houston, TX 77073

Clark Weldon
Corrpro Companies Inc., 22820 I-45 N., Bldg. 7, Suite M, Spring, TX 77373

Pipelines equipped with a galvanic cathodic protection (CP) system may not be protected if the anodes are damaged or consumed. To increase their operational life, unprotected pipelines require CP retrofit. A mathematical model that performs potential and current density attenuations on a pipeline is discussed. The results of such modeling allow the engineer to optimize retrofit design by reducing anode material and installation costs.

In 1987, a comprehensive cathodic protection (CP) survey of selected in-field and export pipelines in the Gulf of Suez was conducted. The work included remote-operated vehicle (ROV)-assisted and towed "fish" close-interval potential surveys as well as the testing of electrical insulation at risers and shore landings.

The results of the survey indicated that all in-field pipelines were receiving CP at acceptable levels from anodes installed on associated platform jackets. Of the 10 export (platform to shore) pipelines, the survey results indicated that four were not receiving adequate CP over their entire lengths. The four pipelines not receiving CP in accordance with the –800 mV vs Ag/AgCl (silver/silver chloride reference electrode) criteria were retrofitted with new anodes. This article presents the results of the CP design and analysis based on the pipeline attenuation model.

Design Objective

The objective of the design was the development of the most cost-effective method for achieving and maintaining an adequate level of CP for the design life of the pipelines. Several design alternatives were evaluated, but it was found that a system using banks of sledded galvanic anodes spaced along the pipelines in conjunction with onshore protection was the most feasible technique for providing adequate CP. The major thrust of the design analysis was to determine the optimum anode bank spacing that would provide CP in accordance with industry criteria, at the lowest cost. Construction costs far outweigh material costs. Minimizing the number (not the size) of the anode sleds is critical to achieving the most economical design.

Design Criteria

A design life of 20 years was specified by the company for the retrofit CP system. The owner also specified a potential criterion of –800 mV vs Ag/AgCl. Other design criteria were:

- low maintenance;
- cost-effective installation;
- no pipeline shutdown;
- no onshore impressed current;
- maximum use of onsite labor; equipment, and materials; and
- reliance on existing platform jacket CP systems for partial pipeline protection.

Design Input Parameters

The input parameters used in the design of the CP retrofit system included water quality in the Gulf of Suez, maintenance current density, anode material, coating loss, and anode utilization factors.

Water Quality

Water quality parameters such as temperature, salinity, flow veloc-

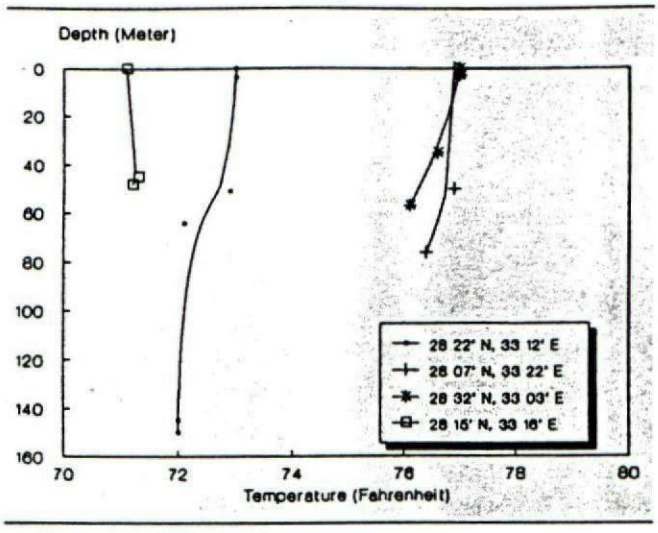


FIGURE 1
Water temperature profile in the Gulf of Suez area.

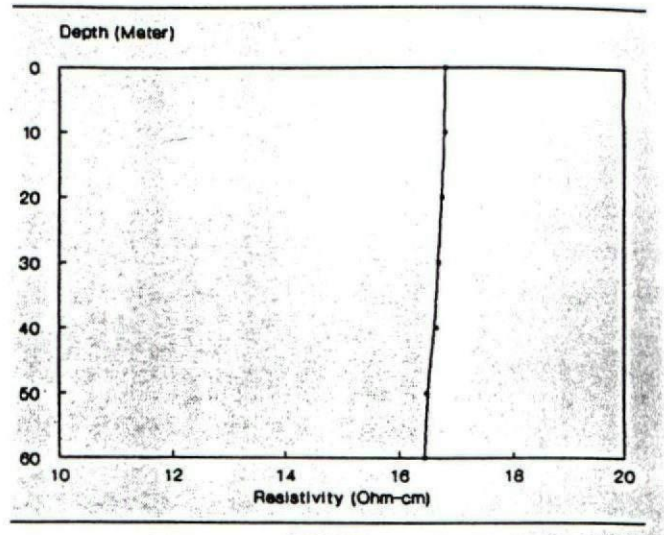


FIGURE 2
Resistivity profile in the Gulf of Suez area.

ity, and resistivity have a significant effect on current requirements for CP. Temperature and salinity data for the pipeline site were obtained from the National Oceanographic Data Center, a U.S. government agency which maintains an extensive worldwide oceanographic database.[1]

Water temperature and resistivity (calculated from the reported salinity and temperature) data are plotted vs depth in Figures 1 and 2. Salinity did not vary significantly with depth (40 to 42 ppt). The average resistivity for the water column from the surface to a depth of 60 m (200 ft) was 16.5 ohm-cm. This value was used in all design calculations. The reported water current velocities at the pipeline site averaged near 2 knots (3.75 km/h). Water turbulence was characterized as moderate.

Maintenance Current Density

Based on an evaluation of water quality data, current density requirements in the Gulf of Suez are comparable to those in the Persian Gulf, the Gulf of Mexico, and waters around India. NACE International[2] and Det Norske Veritas (DNV)[3] recommended maintenance current densities for these regions range from 54 to 86 mA/m^2 (5 to 8 mA/ft^2) for freely flowing seawater conditions on bare steel.

A maintenance design current density of 65 mA/m^2 (6 mA/ft^2) was used for the retrofit design based on this analysis. Weight coating and partial pipeline burial significantly reduce current density requirements over much of a pipeline surface. Thus, the 65 mA/m^2 design current density was conservative. A greater "percent bare" figure was used on the nonweight-coated 8-in. (20-cm) pipeline to account for the lack of protection to the corrosion control coating that concrete weight coating affords.

Anode Material

The recommended anode material is an indium-activated aluminum alloy which can be used effectively in both seawater and saline mud environments. The anode has the following chemical composition:

Indium	0.010
Zinc	2.8 to 6.5
Silicon	0.08 to 0.2
Copper	0.006
Iron	0.12
Others	0. 12
Aluminum	Remainder

The indium-activated alloys have a higher driving potential than similar mercury-activated alloys. This translates into a higher driving potential between the anode and the steel. This enhances the protection capability of the anode because it can provide more current to the steel for initial polarization and for subsequent maintenance current conditions. In addition, indium-activated aluminum anodes have an excellent performance history in seawater environments. The anode capacity is roughly 2,535 A-h/kg (1,150 A-h/lb) in seawater and 2,205 A-h/kg (1,000 A-h/lb) for anodes buried in mud. The anode capacity value used in the design was 2,205 A-h/kg. The lower anode capacity value provides a more conservative design, thus increasing the total weight of anodes required. However, if the anodes become buried, the anodes will still provide the necessary amount of current to meet the design criteria of the system.

Coating Loss Factor

Coating loss factors of 5% initial and 20% final were selected for the three weight-coated pipelines, and 10% was used for the nonweight-coated 8-in. pipeline. These values were selected based on evaluation of inspection results on nearby in-field pipelines, industry practice, and experience with other pipelines with similar coating systems.

Anode Utilization Factor

An industry standard aluminum alloy anode utilization factor of 90% was used for calculating anode weight requirements and the final current output.

Design Analysis

The design analysis required that each variable used in the CP retrofit calculations be examined closely. This

requirement was in accordance with our objective of reaching a conservative design which would lead to a design life that was acceptable to the company.

Coating Deterioration Rate

The pipeline coating was initially assumed to deteriorate linearly over the years from 5% at year 1 to 20% at year 20 (end of design life). Using this approach, the total number of ampere-years can be calculated based on the maintenance current density and the amount of exposed pipeline. However, a closer evaluation of the deterioration rate using an exponential function or a power function revealed that the assumption of linear behavior may not be adequate. Comparing the results from three coating deterioration curves over the 20-year life (Figure 3), it was determined that the power equation yielded the most conservative results. It required the highest number of ampere-years of current needed for protection.

Anode and Core Configuration

Based on an evaluation of the design objectives, standard platform-type aluminum anodes were selected for use in the retrofit design. This type of anode, which is typically cast over a steel pipe core, has a proven track record in similar applications. Platform-type anodes have additional features that make them ideal for this application:

- They are available in many sizes suitable for 20-year life designs.
- They are compatible with welded open-frame sled designs or direct burial.
- They are durable, not susceptible to mechanical damage.

The recommended anode is an Indium-activated aluminum anode with a net aluminum weight of 660 kg (1,454 lb) and a 10.2-cm (4-in.) steel core schedule 80. The anode was 335 cm (11 ft) long, 25.4 cm (10 in.) high, and 30.5 cm (12 in.) wide on average. A large anode was chosen to minimize sled fabrication, material costs, and anode-to-anode interference.

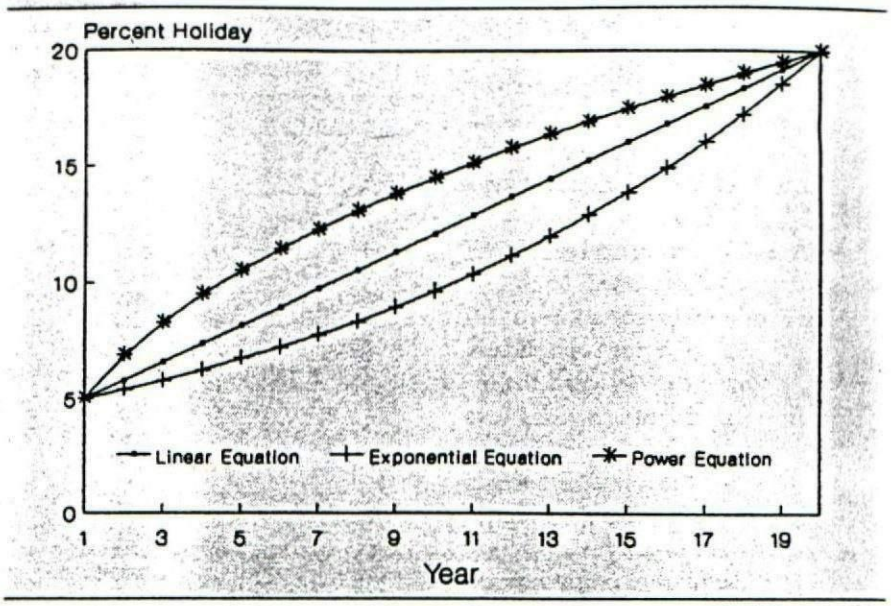


FIGURE 3
Coating deterioration over time.

TABLE 1
Offshore Pipeline CP Design Calculations

	10-in. Oil	8-in. Oil	18-in. LPG	18-in. Oil
Length (mile)	5.1387	4.760	7.717	11.446
(ft)	27,133	25,131	40,748	60,433
Diameter (in.)	10.75	8.625	18	18
Wall thickness (in.)	0.365	0.322	0.562	0.562
Schedule 40				
Outside surface area (ft²)	76,362	56,746	192,020	284,784
Initial coating breakdown (%)	5	10	5	5
Final coating breakdown (%)	20	20	20	20
Weight coated	Yes	No	Yes	Yes
Temperature (°F)	74	74	74	74
Design maintenance CD (mA/ft²)	6	6	6	6
Anode capacity (A-h/lb)	1,000	1,000	1,000	1,000
Utilization factor (%)	90	90	90	90
Total A-y				
Linear	1,145	1,021	2,880	4,272
Exponential	1,000	984	2,514	3,728
Power equations	1,294	1,129	3,253	4,825
Total anode weight (lb)	12,604	10,997	31,684	46,996
Anode weight (lb)	1,348	1,348	1,348	1,348
Number of anodes	10	8	24	35

[A]Conversion factors: 1 mile = 1.67 km; 1 ft = 0.3048 m; 1 in. = 2.54 cm; 1 ft² = 0.0929 m²; °F = 9/5 (°C) + 32; 1 lb = 2.2 kg.

TABLE 2
Calculated Average Initial Current Densities and Anode Sled Spacing on Four Pipelines

Pipeline	Initial Current Density		Maximum Sled Spacing	
	mA/m²	mA/ft²	m	ft
10-in. (26-cm) oil	344	32	2,438	8,000
8-in. (21-cm) oil	484	45	2,134	7,000
18-in. (46-cm) oil	194	18	3,048	10,000
18-in. LPG[A]	194	18	3,048	10,000

[A]LPG, liquified petroleum gas.

Anode Requirements

The number of anodes required to cathodically protect the pipelines over the design life was determined based on the design maintenance current density of 65 mA/m². This was achieved as follows:

- The outside surface area of the pipeline was calculated.
- Using the power equation to determine the percentage of holidays on the pipeline every year, the total number of ampere-years was calculated as the coating holiday factor times the outside surface area of the pipe times the maintenance current density.
- The total number of ampere-years was then divided by the anode capacity to calculate the total weight of anode material needed.
- The number of anodes was determined by dividing the total anode weight by the weight of an individual anode.

Table 1 enumerates the design calculations for determining the number of anodes needed for each pipeline based on a design maintenance current density of 65 mA/m².

Polarization Current Densities

Rapid initial polarization of the pipeline required substantially higher current densities than the 65 mA/m² required for maintenance. Additionally, designs providing a high initial current density polarize pipelines to a higher potential and thus reduce the anode output required for maintenance. Consequently, anode depletion is reduced and system life increases.

Average initial current densities for each pipeline were calculated using Dwight's equation for totally submerged anodes. The effects of interference between adjacent anodes were considered in the anode-to-earth resistance calculations. An initial driving potential of 400 mV was assumed based on an anodic potential of 1.05 V vs Ag/AgCl and a cathodic potential of 0.65 V vs Ag/AgCl. Initial current densities on sections of pipeline receiving CP current from existing sources will be less than that calculated. The calculated average initial current densities on each pipeline are shown in Table 2.

TABLE 3
Calculated Average Current Densities for the 18-in. Oil Pipeline

Year	Anode Radius (ft)	Anode Resistance		Driving Voltage (V)	Current (A)	Current Density (mA/ft²)
		Three Anodes (ohm)	Two Anodes (ohm)			
1	0.54	0.0188	0.0193	0.4	42	18.03
2	0.52	0.0188	0.0195	0.4	42	13.01
3	0.51	0.0189	0.0196	0.4	42	10.73
4	0.49	0.0190	0.0197	0.4	41	9.34
5	0.48	0.0191	0.0198	0.4	41	8.38
6	0.46	0.0192	0.0200	0.4	41	7.66
7	0.44	0.0193	0.0201	0.4	41	7.09
8	0.43	0.0194	0.0202	0.4	40	6.62
9	0.41	0.0195	0.0204	0.4	40	6.23
10	0.40	0.0196	0.0206	0.4	40	5.90
11	0.38	0.0197	0.0207	0.4	40	5.61
12	0.37	0.0198	0.0209	0.4	39	5.35
13	0.35	0.0199	0.0211	0.4	39	5.12
14	0.33	0.0200	0.0212	0.4	39	4.91
15	0.32	0.0202	0.0214	0.4	38	4.72
16	0.30	0.0203	0.0216	0.4	38	4.54
17	0.29	0.0204	0.0218	0.4	38	4.38
18	0.27	0.0206	0.0221	0.4	38	4.23
19	0.25	0.0208	0.0223	0.4	37	4.09
20	0.24	0.0209	0.0226	0.4	37	3.95

(A)See Table 1 for conversion factors.

The average current density calculations for the 18-in. oil pipeline are presented in Table 3. The relatively high initial current outputs are the result of a design using anodes with a high surface area-to-weight ratio. The lack of concrete on the 8-in. pipeline makes a difference here.

Current Attenuation—Computer Modeling

Accurate calculation of the optimum distance between CP current sources on each pipeline is critical to the success of a retrofit design. In seawater, the "throwing power" of a CP current source is limited primarily by attenuation due to the pipeline's return path resistance and coating quality (bare surface area). Thus, spacing between current sources on a large-diameter, well-coated pipeline should be greater than on a small-diameter, poorly coated pipeline.

A computer model designed to generate potential and current density distribution along the pipeline was used. The model uses McCoy's equation (a variation of Dwight's equation reflecting the type and shape of the anode being used) to determine the cathode resistance at coating flaws and uses Ohm's law to determine the IR drop along the pipeline. The model assumes that coating flaws are evenly spaced along the pipeline. The input data parameters used for the model calculation are:

- coating breakdown (%),
- burial in mud (%),
- total pipeline length (ft),
- outside pipeline diameter (ft),
- pipeline wall thickness (in.),
- distance between coating flaws (ft),
- seawater resistivity (ohm-cm),
- metal resistivity (ohm-cm), and
- polarization curve relating potential and current density for steel in seawater.

A minimum potential criterion of –800 mV vs Ag/AgCl for all points along the pipeline was used to determine maximum allowable anode sled spacing (Table 2). The maximum distance between anode sleds as determined from the computer model is shown in Figure 4.

Anode Sled Spacing—Notes

Traditionally, subsea pipelines have been equipped at installation with bracelet anodes spaced at intervals typically not exceeding 305 m

(1,000 ft). This spacing is intentionally conservative and reflects the low cost of "pre-lay" installed CP, rather than technical design considerations.

CP retrofit for pipelines requires a different design philosophy. Costs, particularly in deep water, often exceed initial installation costs. Thus, economic considerations demand that anode spacing be maximized while still providing complete protection. The mathematical model used for this design has been used successfully to predict anode spacing for two anode retrofits with anode spacing exceeding 1,524 m (5,000 ft).

Additionally, close-interval surveys have been performed on pipelines not equipped with functioning CP systems in the Gulf of Mexico and on the U.S. West Coast. These receive adequate CP from galvanic anodes associated with the adjoining platform jackets. In some cases, platform-based systems provide CP to pipelines in excess of 8 km (5 miles) long.

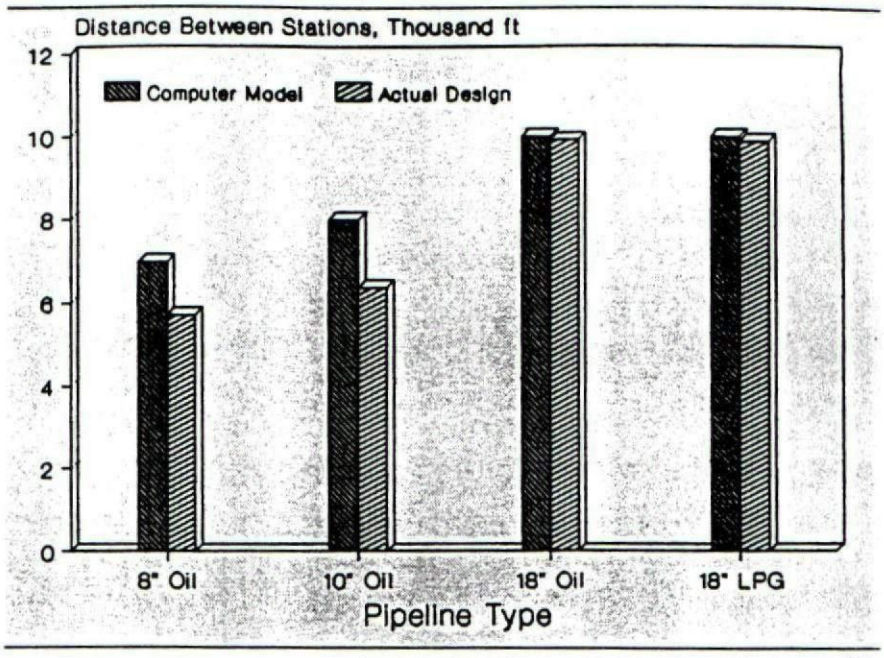


FIGURE 4
Maximum pipeline distance between anode stations. LPG, liquified petroleum gas.

Anode Sled Location

In addition to determining maximum spacing between anode sleds, several other factors must be considered with respect to sled location. These include:

- adjoining platform CP systems,
- onshore piping and other buried metal structures,
- near-shore site conditions, and
- anode sled design.

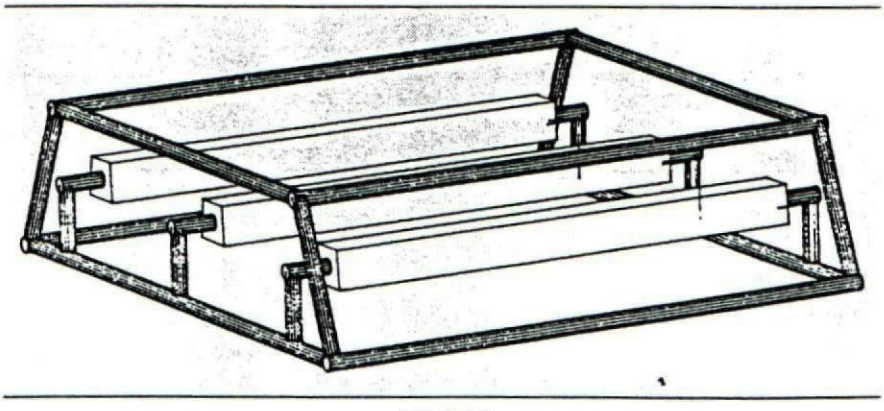


FIGURE 5
Schematic of the anode sled.

Platform CP Systems

Platforms provide protective current to their adjoining pipelines, including the four considered in this design. Two factors must be considered to properly evaluate the location of the anode sled nearest the platform on each pipeline: the throwing power of the platform CP system and the throwing power of the nearest anode sled.

Current throw from the platforms was evaluated by analysis of the 1987 close-interval survey data and by using the computer model used to determine spacing of the anode sleds. Examination of the 1987 data showed that potential values recorded with the test connection at the platform decreased (became more positive) with the distance from the platform to a point at which they stabilized. In all cases, potential values at this point were more negative than –800 mV vs Ag/AgCl.

Evaluation of current distribution from the platform CP system using the mathematical attenuation model discussed earlier in the report provided the same results as for the anode sleds. In all cases, the results of the model indicated a shorter throwing distance than the survey results would suggest.

The results of the attenuation model were used as the basis for the location of the sled nearest to the platform. The distance between the platform and the nearest sled reflects the combined throwing power of the platform and the anode sled. The distances used in the final design were 2,134 m (7,000 ft); 2,134 m (7,000 ft); and 10,000 m (3,048 ft) for the 8-,10-, and 18-in. pipelines, respectively.

Note that this pipeline retrofit design is based on the provision of protective current from adjoining platform jackets' CP systems. Platform anode retrofit may be required during the next 20 years to ensure that the pipeline retrofit meets design criteria over the entire retrofit design life.

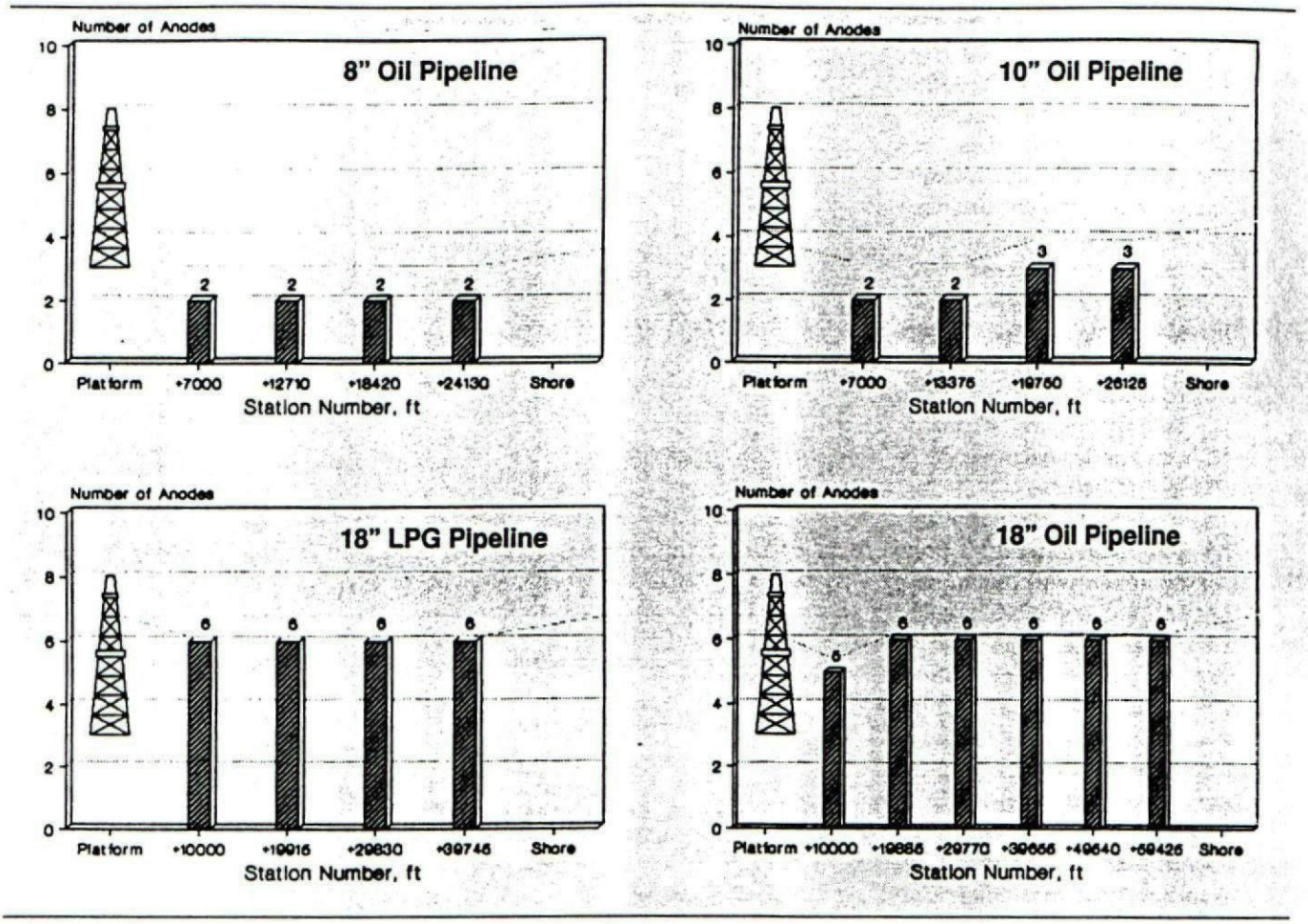


FIGURE 6
Anode station locations and numbers of anodes for the four pipelines.

Onshore Piping

Without CP from an onshore source, the onshore segments of pipeline and the associated electrically continuous terminal structures will exact a significant current drain from the offshore anode systems. The magnitude of this current drain is a function of the distance to the offshore anodes, the potential and size of the onshore drain source, and the pipe diameter.

To reduce or eliminate current drain from offshore anodes to onshore structures, we recommend installing a galvanic CP system composed of beds of magnesium anodes located at the pipelines' emergence point at the shoreline. These anodes will not provide CP to the entire onshore sections of pipeline and adjoining terminal structures, but they will reduce or eliminate current drain from the offshore anodes.

Near-Shore Site Conditions

Because of turbulence associated with near-shore wave action, shallow water conditions, and other hazards, the most inland anode sled on each pipeline will be located approximately 305 m from the shoreline.

Anode Sled Design

A computer-generated schematic of the basic sled design is presented in Figure 5. The sleds are made of welded steel pipe and consist of a rectangular base and an open box frame for protecting the anodes from mechanical damage. The sleds are equipped with steel plate triangular mud mats at each corner to prevent burial. One, two, or three platform-type anodes are welded directly to the base in a parallel configuration. The sleds are coated with a poly-enamel epoxy to reduce current drain from the anodes to the sled frame.

Two AWG #2/0 cables are attached to each sled frame by thermite weld or brazing. Additionally, the cables are mechanically secured to the sled frame to prevent damage to the thermite connection. The cables should be buried between the pipeline and sled to minimize damage.

CP retrofit for pipelines requires a different design philosophy.

The two lead cables from each sled will be attached to the pipeline at a depleted anode. A simple clamp device attached to the lead wire by thermite weld is attached to the flat bar core of the depleted anode both mechanically and electrically. The sleds were designed to assure nonburial of the anodes, while

protecting the anodes from mechanical damage.

Based on the preceding factors, the recommended anode station locations for the four pipelines were calculated (Figure 6).

Final CP Design

The final design called for four anode stations on the 8- and 10-in. oil and the 18-in. liquified gas pipelines and for six stations on the 18-in. oil pipeline.

Two sleds are to be installed at each station.

The number of anodes required at each station, which was based on the total numbers of anode stations and individual anodes calculated earlier, is also shown in Figure 6. Three sled configurations using one, two, or three anodes each were used, depending on current and spacing needs.

Conclusion

The model used here provides answers to attenuation questions. Coupled with field polarization data, this new model is a valuable design tool. It allows the engineer to choose the optimum number of anodes to provide anode weight sufficient for the life of the pipeline and sufficient throwing power over long distances. This, in turn, will eliminate overprotection and unnecessary anode weight on the pipeline, resulting in materials and installation cost savings.

References

1. Oceanographic Data Report, National Oceanographic Data Center, Universal Building, Room 409, 1825 Connecticut Ave., NW, Washington, DC 20235.
2. NACE Standard RP0176, "Corrosion Control of Steel, Fixed Offshore Platforms Associated with Petroleum Production" (Houston, TX: NACE, 1983).
3. DNV Standard RP B401, "CP Design," Vol. B: Material Technology, Group B 400: Corrosion Technology (Hovik, Norway: Det Norske Veritas, 1986).

More information may be available in paper no. 530 presented at CORROSION/93 in New Orleans, Louisiana.

FLEXTREND DEVELOPMENT COMPANY, L.L.C.
SUBSIDIARY OF
LEVIATHAN GAS PIPELINE PARTNERS, L.P.

OFFSHORE CONTINENTAL SHELF PIPELINE ROW HOLDINGS

I certify, under penalty of law on behalf of Flextrend Development Company, L.L.C., who has identified and ensured by contract, or other means approved by the Minerals Management Service, the availability of private personnel and equipment to respond, to the maximum extent practicable, to the worst case discharge or substantial threat of discharge from a pipeline right-of-way holding.

John H. Gray
Signature

November 30, 1995
Date

John H. Gray
Name

Chief Operating Officer
Title

7400 TEXAS COMMERCE TOWER • 600 TRAVIS • HOUSTON, TEXAS 77002
(713) 224-7400 • FAX (713) 547-5135

G-15983

PREFACE

Kathy

SN 10836 18"
SN 10837 3"
SN 10838
SN 10839
SN 10840

D.O.I. RIGHT-OF-WAY PERMIT APPLICATION

As a matter of clarification, please be aware that TATHAM OFFSHORE INC. has designated FLEXTREND DEVELOPMENT COMPANY L.L.C. as Operator of the OCS G 12631 Garden Banks Block 117 and the OCS G 13363 Garden Banks Block 72 Leases. Please reference the attached Memo dated October 13,1995.

As a result, all applications have been filed under Flextrend Development Company L.L.C. Due to the fact that this assignment is so recent, the appropriate notification will be made to L.L.& E. in our response to their "Conditional No Objection" letter which is included in our Permit Application. L.L.& E. is the only Operator in our Right-of-Way requiring notification.

A. Gautreaux Jr.

Antoine Gautreaux Jr.
V.P. Operations

- Houston TX
- Houma, La.

TATHAM OFFSHORE, INC.
SUBSIDIARY OF
DEEPTECH INTERNATIONAL INC.

October 13, 1995

Mr. Donald Howard
United States Dept. of the Interior
Minerals Management Service
Gulf of Mexico, OCS Region
1201 Elmwood Park Blvd.
New Orleans, LA 70123-2394

Dear Sirs:

Tatham Offshore , Inc. has designated Flextrend Development Company , L.L.C. , as operator for the following OCS leases :

Viosca Knoll Block 817 OCS-G- 9743
Garden Bank Block 72 OCS-G-13363
Garden Bank Block 117 OCS-G-12631

Flextrend Development Co. L.L.C. will adhere to all previously approved permits, POEs, DOCDs, construction/fabrication permits and requirements, lease stipulations and will maintain all appropriate MMS bonding requirements . Flextrend Development Company , L.L.C. is a qualified operator (#1986) in the OCS of the Gulf of Mexico .

Should you have questions or comments please contact Gary Coburn at (713) 224-7400.

Sincerely,

Gary W. Coburn
Vice President

7400 TEXAS COMMERCE TOWER
600 TRAVIS
HOUSTON, TEXAS 77002
(713)224-7400 • TELEFAX (713)224-7574 • TELEX 798760

FLEXTR[illegible]D DEVELOPMENT COM[illegible]NY, L.L.C.
SUBSIDIARY OF
LEVIATHAN GAS PIPELINE PARTNERS, L.P.

G-15983
SN

October 19, 1995

Kathy

Mr. Donald C. Howard
Regional Supervisor
Office of Field Operations
U. S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region
1201 Elmwood Park Blvd.
New Orleans, LA 70123-2394

Attn: Mr. Mike Conner
MS 5232

Re: **Application for D.O.I. Pipeline Right-of-Way. Proposed Four, 3.5 Inch O.D. Oil and Associated Natural Gas Pipeline Bundle To Be Installed In and/or Through Blocks 117, 73 and 72, Garden Banks Area, OCS Federal Waters, Gulf of Mexico, Offshore Louisiana.**

Dear Mr. Conner:

Pursuant to the authority granted in Section 5(e) of the Outer Continental Shelf Lands Act (67 State. 462) (43 U.S.C. 1331), as amended (92 Sta. 629), and in compliance with the regulations contained in Title CFR, Part 256, Subpart N, Flextrend Development Company, L.L.C. ("Flextrend") is filing this application in quadruplicate for a right-of-way two hundred feed (200') in width for the construction, maintenance and operation of four 3.5 inch O.D. oil and associated natural gas pipelines. The four pipelines will be contained in an 18 inch O.D. bundle. Flextrend Development Company, L.L.C. agrees that said right-of-way, if approved, will be subject to the terms and conditions of said regulations.

This application (and any amendments made hereto) is made with our full knowledge and concurrence with the OCS Lands Act (43 U.S.C. 1331, et. seq.) as amended (P.L. 95-372), including the following: Sec. 5(e) addressing pipeline rights-of-way, requirements of the Federal Energy Regulatory Commission relating to notice of hearing, transportation and purchase of oil and gas without discrimination; Sec. 5(f)(1) addressing operation of pipeline in accordance with competitive principles, including open and nondiscriminatory access to both owner and non-owner shippers; Sec. 5(f)(e) which may allow exemption of the requirements in Sec. 5(f)(1); Sec. 5(e) addressing the assuring of maximum environmental protection, including the safest practices for pipeline installation; and Sec 5 (f) (1) (B) which may require expansion of throughput capacity of any pipeline except for the Gulf of Mexico or the Santa Barbara Channel.

7400 TEXAS COMMERCE TOWER • 600 TRAVIS • HOUSTON, TEXAS 77002
(713) 224-7400 • FAX (713) 547-5135

Additionally, we expressly agree that if any site, structure, or object of historical or archeological significance should be discovered during the conduct of any operations within the permitted right-of-way, we shall report immediately such findings to the supervisor, Gulf of Mexico OCS Region, and make every reasonable effort to preserve and protect the cultural resource from damage until said supervisor has given directions as to its preservation.

In accordance with applicable regulations, we have delivered a copy of the application and attachments thereto by Certified Mail, Return Receipt Requested, to each lessee whose lease, is so affected. A list of such lessees is attached (see Attachment "A") and copies of the return receipts showing date and signature as evidence of service upon such lessees or right-of-way or easement holders is included. The proposed route of the right-of-way does not adjoin or subsequently cross state submerged lands.

The 3.5 inch O.D. pipelines will be used to transport wellbore hydrocarbons from Flextrend's two Garden Banks Block 117 subsea wells through the flowline bundle to Flextrend's "A" platform located in Garden Banks Block 72 (see Attachment "B"). The design of the flowlines provides the flexibility of producing a well through either one or two of the lines. In the event a well is produced through two lines the safety system schematic depicting surface protection shall be provided on both lines.

The general scope of work shall include the re-entry and completion of the OCS-G 12631 Garden Banks 117 #1 well and the drilling and completion of the OCS-G 12631 Garden Banks 117 #2. The flowline bundle will be constructed on Matagorda Island, South Texas upon completion tested, then the 4.0 mile section bottom towed to the installation site and the subsea connections performed on the platform end. The flexible lines from the subsea tree to the pipeline sled will be installed upon completion of the tree installation. The entire pipeline shall then be hydrostatic tested as described within.

Enclosed is a check in the amount of $1,460.00 of which $1,400.00 covers the filing fee and the $60.00 covers the first year of rental on 4.0 statue miles of right-of-way.

In support of our application and for your review and use, the following maps, drawings and documents have been enclosed herewith and made a part hereof:

1. Vicinity Map, Drawing No. PER11703 (four (4) copies enclosed).

2. Route Plan Map and Profile Map, Drawing No. PER31703 Sheets 2-4 of 4 (four (4) copies enclosed).

3. Engineering and Hazard Survey (four (4) copies enclosed).

4. Flexible pipe structural drawing (Attachment "C").

5. Flowline bundle cross section (Attachment "D").

6. Pipeline Safety System Segment Schematic, Attachment "E" (four (4) copies enclosed).

7. Engineering calculations

Applicant agrees to be bound by the foregoing regulations, and further agrees to comply with the applicable stipulations as set forth in Title 30 CFR 250 (Subpart J) and that certain Letter to Lessees dated August 14, 1991.

Flextrend Development Company, L.L.C. certifies that the proposed activity described within complies with and will be conducted in a manner consistent with the State of Louisiana Approval Coastal Zone Management Program.

Design Criteria Data is as follows:

1. The product to be transported is 30^{o} API gravity crude oil and .600 specific gravity gas at 60^{o} F (Air = 1.0)

2. Characteristics of the installation require that the descriptive information addressed be segmented for clarification, (Reference Attachment E), therefore, the description of the pipe, coating and cathodic protection is as follows:

Segment A Platform Riser - This line shall be 4.0" O.D., 0.500" wall, Grade X65, 18.58#/ft. pipe. This segment shall be fusion bond epoxy coated 18 mil thick with a zinc primer and epoxy coating above water, installed as a bundle of four (4) lines inside a twenty (20") riser in the jacket. The splash zone area of the riser shall be protected with a 1/2" thick minimum coating of Splashtron.

Segment B This segment is a flowline bundle. Housed within the 18" O.D. 76#/ft. API 5L X65 casing are (4) 3.500" O.D. 9.2#/ft. API 5L X65 flowlines. Both the flowline and annulus line shall be coated with an 18 mil thick fusion bond epoxy and will be protected from corrosion inside the 18" O.D. casing. The annulus space of the casing shall be sealed and pressurized with nitrogen. The 18" O.D. protection casing, however, shall be coated with a fusion bond epoxy over which an abrasion resistant coating, Sigma Armor Compound 7490, 90 to 105 mils thick, shall be applied to protect the line during tow. Cathodic protection of the casing shall be provided by zinc sacrificial anodes on the sleds.

Segment C Flowline Sled to Subsea Tree - This line shall be Coflexip brand flexible piping. See "Attachment C" for structural details. This segment will not require separate cathodic protection and will be connected on each end with API 10000 RTJ flanges.

3. The length of the proposed pipeline is 3.97 miles.

4. The minimum and maximum water depths along the route of the proposed pipeline are 520 feet and 920 feet, respectively.

5. Corrosion protection shall be provided by sacrificial anodes designed for twenty (20) year life. The anodes shall be Galvalum III, 200 lb. standoff anodes.

6. The bulk specific gravity of the line, empty, is 1.08.

7. The design working pressure on the four lines is 7500 psi.

8. The operating pressure and capacity of the pipeline is 4700 psi, 5.0 mmcf and 7000 barrels condensate. High and low pressure sensors shall be maintained at 10% above and below the operating pressure.

9. Upon completion of installation, the pipeline shall be hydrostatically tested to 1.25 times the design working pressure (9375 psi) for eight (8) hours using seawater.

10. No pumps or compressors will be required in this installation.

11. The analysis of the transported product will be monitored and preventative internal corrosion measures such as pigging and/or inhibition treatment will be applied as necessary.

12. Flanges and Connectors

    a. All flange connections shall be API 10000 with a rated working pressure of 10000 psi.

13. The facilities on Garden Banks 72 are rated for 1440 psi working pressure.

Further, Flextrend Development Company, L.L.C. hereby agrees to keep open at all reasonable times for inspection by the Minerals Management Service, the area covered by this right-of-way and all improvements, structures, and fixtures thereon and all records, relative to the design, construction, operation, maintenance, and repairs, or investigations on or with regard to such area.

Please refer to your New Orleans Miscellaneous File No. 1986 for a copy of a resolution approved by the Board of Directors authorizing the undersigned to sign for and on behalf of Flextrend Development Company, L.L.C. Additionally, Flextrend Development Company, L.L.C. is in the process of submitting the $300,000 Right-of-Way Grant Bond, covering installation of right-of-way pipelines in Federal Waters, Gulf of Mexico.

If the above information meets with your approval, we would appreciate your issuing the necessary decision for the right-of-way at your earliest convenience. Inquiries concerning this application should be directed to Antoine Gautreaux or John Locantro at (713) 224-7400 or at our address.

Very truly yours,

John H. Gray
Chief Operating Officer

JHG:gab
Attachments

Antoine\MMSGB72 Pipeline R.O.W.

UNITED STATES
DEPARTMENT OF THE INTERIOR
MINERALS MANAGEMENT SERVICE

NONDISCRIMINATION IN EMPLOYMENT

As a condition precedent to the approval of the granting of the subject pipeline right-of-way, the grantee, Flextrend Development Company, L.L.C. hereby agrees and consents to the following stipulation which is to be incorporated into the application for said right-of-way.

During the performance of this grant the grantee agrees as follows:

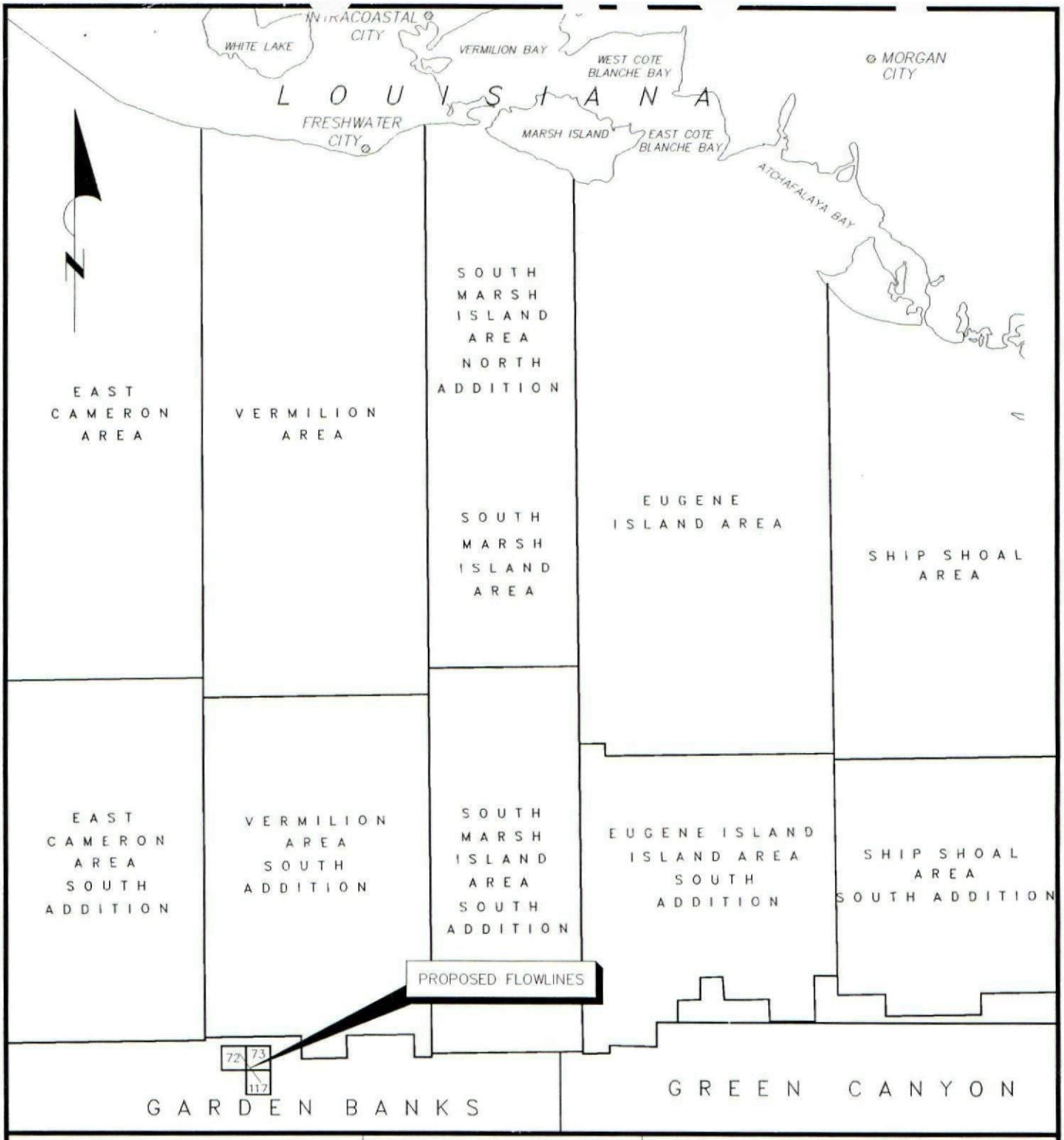
> During the performance under this grant, the grantee shall fully comply with paragraphs (1) through (7) of Section 202 of Executive Order 11246, as amended (reprinted in 41 CFR 60-1.4(a)), which are for the purpose of preventing discrimination against persons on the basis of race, color, religion, sex or national origin. Paragraphs (1) through (7) of Section 202 of Executive Order 11246, as amended, are incorporated in this grant by reference.

John H Gray

Signature of Grantee
John H. Gray
Chief Operating Officer

Oct 19, 1995

Date



BEST AVAILABLE COPY

DATUM:	NAD 27
SPHEROID:	CLARKE 1866
PROJECTION:	UTM
ZONE:	15

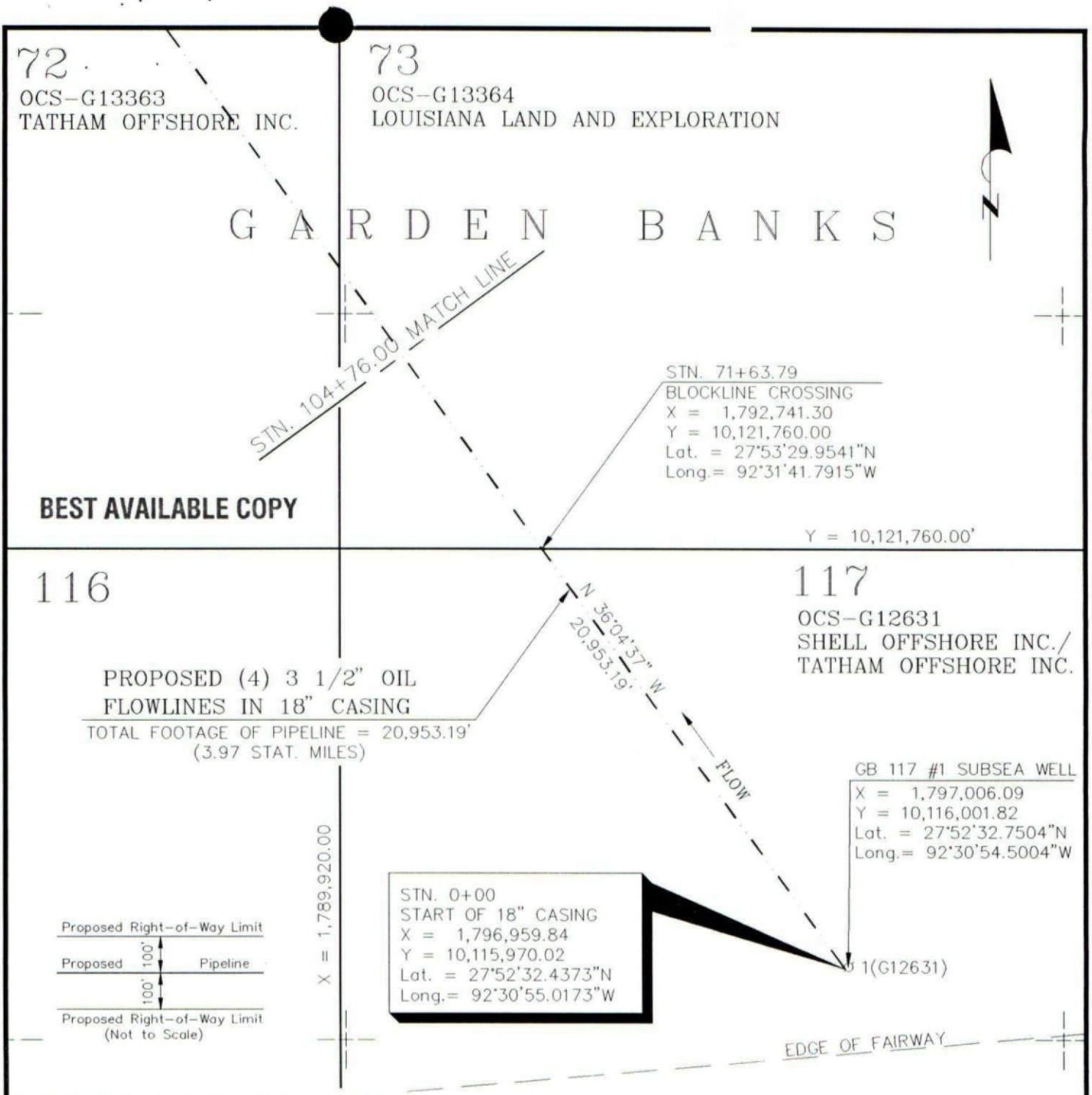
NCS INTERNATIONAL

FLEXTREND DEVELOPMENT CO., L.L.C.
VICINITY MAP

PROPOSED (4) 3 1/2" OIL FLOWLINES IN 18" CASING
GB 117 #1 SUBSEA WELL
TO GB 72 'A' PROP. PLAT.
GARDEN BANKS
SHEET 1 OF 4

DATE	SCALE	JOB No. / DP No.
9/5/95	1/1,100,000	JOB No. 1929-DT DP No. 1703

DWG. No. PER11703



Design characteristics of this pipeline are in accordance with applicable regulations.

I hereby certify that this plat has been prepared following generally accepted professional standards for proposed offshore pipelines.

STATE OF TEXAS REGISTERED KEITH A. CODD 4669 PROFESSIONAL LAND SURVEYOR

Keith A. Codd

Keith A. Codd, Reg. No. 4669
Keith A. Codd Surveying

9/5/95
Date

DATUM:	NAD 27
SPHEROID:	CLARKE 1866
PROJECTION:	UTM
ZONE: 15	

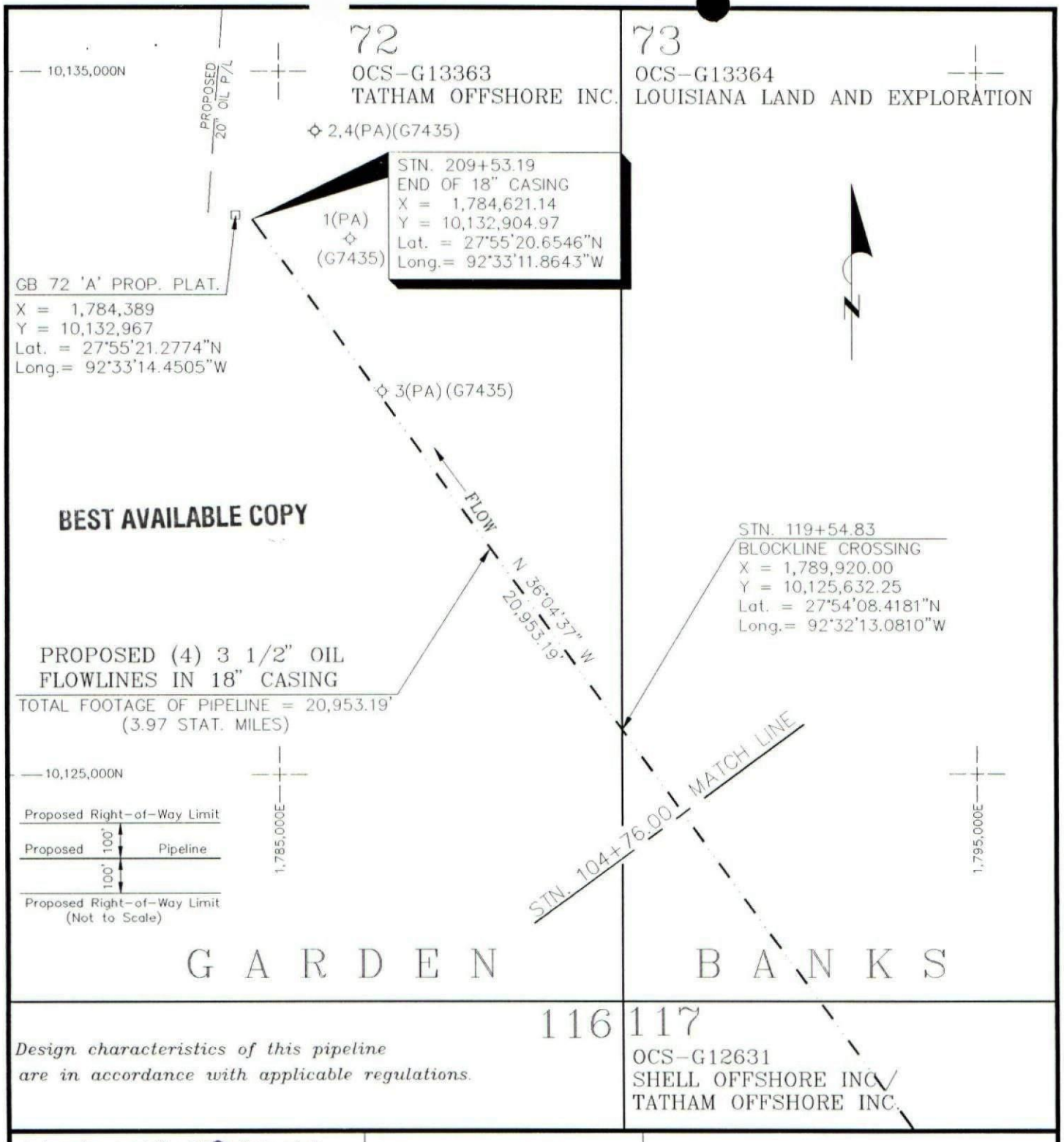
NCS INTERNATIONAL

FLEXTREND DEVELOPMENT CO., L.L.C.

PROPOSED (4) 3 1/2" OIL
FLOWLINES IN 18" CASING
GB 117 #1 SUBSEA WELL
TO GB 72 'A' PROP. PLAT.
GARDEN BANKS
SHEET 2 OF 4

DATE	SCALE	JOB No. / DP No.
9/5/95	1" = 2000'	JOB No. 1929-DT DP No. 1703

DWG. No. PER31703



Design characteristics of this pipeline are in accordance with applicable regulations.

I hereby certify that this plat has been prepared following generally accepted professional standards for proposed offshore pipelines.

STATE OF TEXAS REGISTERED KEITH A. CODD 4669 PROFESSIONAL LAND SURVEYOR

Keith A. Codd

Keith A. Codd, Jr., Reg. No. 4669
Keith Codd Surveying

9/5/95
Date

DATUM:	NAD 27
SPHEROID:	CLARKE 1866
PROJECTION:	UTM
ZONE:	15

NCS INTERNATIONAL

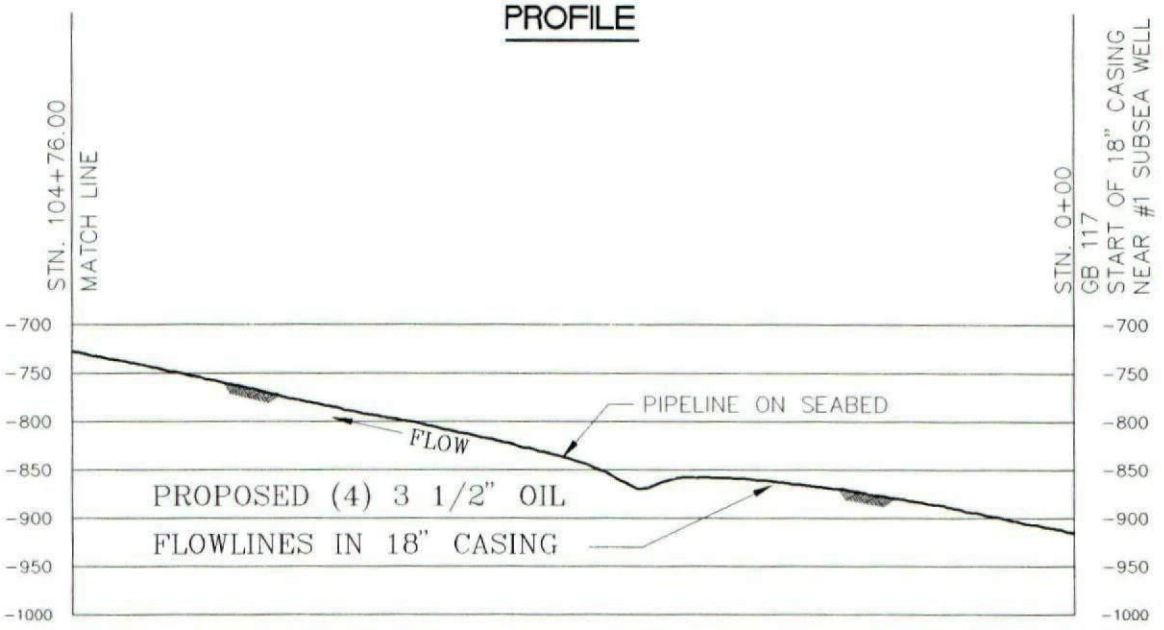
FLEXTREND DEVELOPMENT CO., L.L.C.

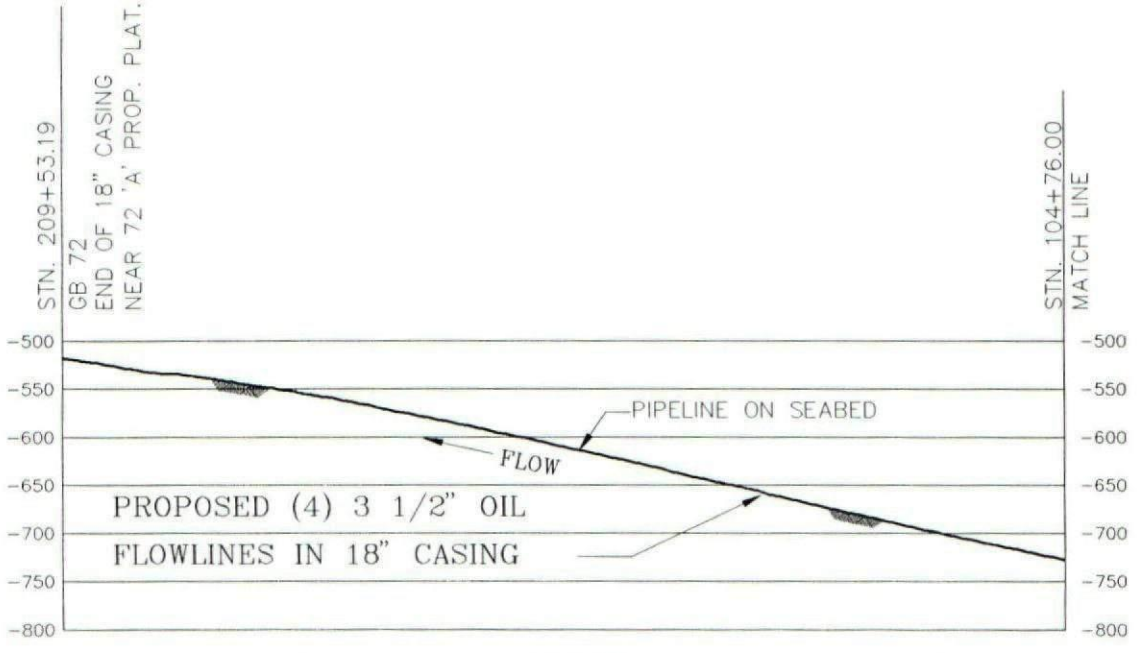
PROPOSED (4) 3 1/2" OIL FLOWLINES IN 18" CASING
GB 117 #1 SUBSEA WELL
TO GB 72 'A' PROP. PLAT.
GARDEN BANKS
SHEET 3 OF 4

DATE	SCALE	JOB No. / DP No.
9/5/95	1" = 2000'	JOB No. 1929-DT DP No. 1703

DWG. No. PER21703

PROFILE





SCALE:
VERT. 1" = 2000'
HORIZ. 1" = 200'

DATUM:	NAD 27
SPHEROID:	CLARKE 1866
PROJECTION:	UTM
ZONE:	15

NCS INTERNATIONAL

FLEXTREND DEVELOPMENT CO., L.L.C.

PROPOSED (4) 3 1/2" OIL
FLOWLINES IN 18" CASING
GB 117 #1 SUBSEA WELL
TO GB 72 'A' PROP. PLAT.
GARDEN BANKS
SHEET 4 OF 4

DATE	SCALE	JOB No. / DP No.
9/5/95	1" = 2000'	JOB No. 1929-DT DP No. 1703

DWG. No. PER41703

LL&E

THE LOUISIANA LAND AND EXPLORATION COMPANY
2950 NORTH LOOP WEST, SUITE 1200
HOUSTON, TEXAS 77092-8862
(713) 957-6400

October 10, 1995

ATTACHMENT "A"

Tatham Offshore, Inc.
7400 Texas Commerce Tower
600 Travis
Houston, Texas 77002

Attention: Mr. Antoine Gautreaux, Jr.
Vice President - Operations

RE: **TATHAM OFFSHORE, INC.**
RIGHT-OF-WAY CRUDE OIL PIPELINE BUNDLE
IN AND/OR THROUGH EUGENE ISLAND BLOCK 73
GULF OF MEXICO AREA, OFFSHORE LOUISIANA

GARDEN BANKS

Gentlemen:

By letter with attached exhibits dated September 12, 1995, you advised The Louisiana Land and Exploration (LL&E) of your intention to install the above-referenced oil pipeline bundle (four 3 1/2-inch oil pipelines inside an 18-inch casing) that will cross Garden Banks Block 73/OCS-G 13364, which is operated by LL&E. The proposed pipeline will cross Lease OCS-G 13364 at two points as follows:

(1)	X = 1,792,741.30 Y = 10,121,760.00	(2)	X = 1,789,920.00 Y = 10,125,632.25

Please be advised that LL&E has **NO OBJECTION** to this proposal, subject to the following conditions:

1. Tatham Offshore, Inc. shall secure all necessary permits from all governmental agencies having jurisdiction thereof for the installation, maintenance and operation of the proposed pipeline.

2. The operations conducted by Tatham Offshore, Inc. shall be at no cost or expense to LL&E, and shall not interfere with LL&E's operations in the area.

3. Tatham Offshore, Inc. shall defend, indemnify and hold LL&E harmless from and against any and all claims or liability for property and environmental damage, and personal injury or death, caused by the installation, maintenance and operation of the proposed pipeline, regardless of the alleged negligence of LL&E or otherwise.

4. Tatham Offshore, Inc. shall be required to locate and marks its pipeline in the event of LL&E desired drilling/construction activities in the vicinity of the Tatham Offshore, Inc. pipeline.

5. Tatham Offshore, Inc. shall furnish LL&E with "as built" plats of their installation showing the actual location thereof.

If the foregoing is acceptable kindly indicate your agreement thereto by signing in the space provided below and returning one copy of this letter to the attention of Ms. Kay L. Morgan at the letterhead address.

Sincerely,

THE LOUISIANA LAND AND EXPLORATION COMPANY

By: _____
M. K. Williams
Division Land Manager

Date: October 10, 1995
/klm

AGREED TO AND ACCEPTED THIS
19 DAY OF Oct 1995

~~**TATHAM OFFSHORE, INC.**~~ FLEXTREND DEVELOPMENT COMPANY, L.L.C.

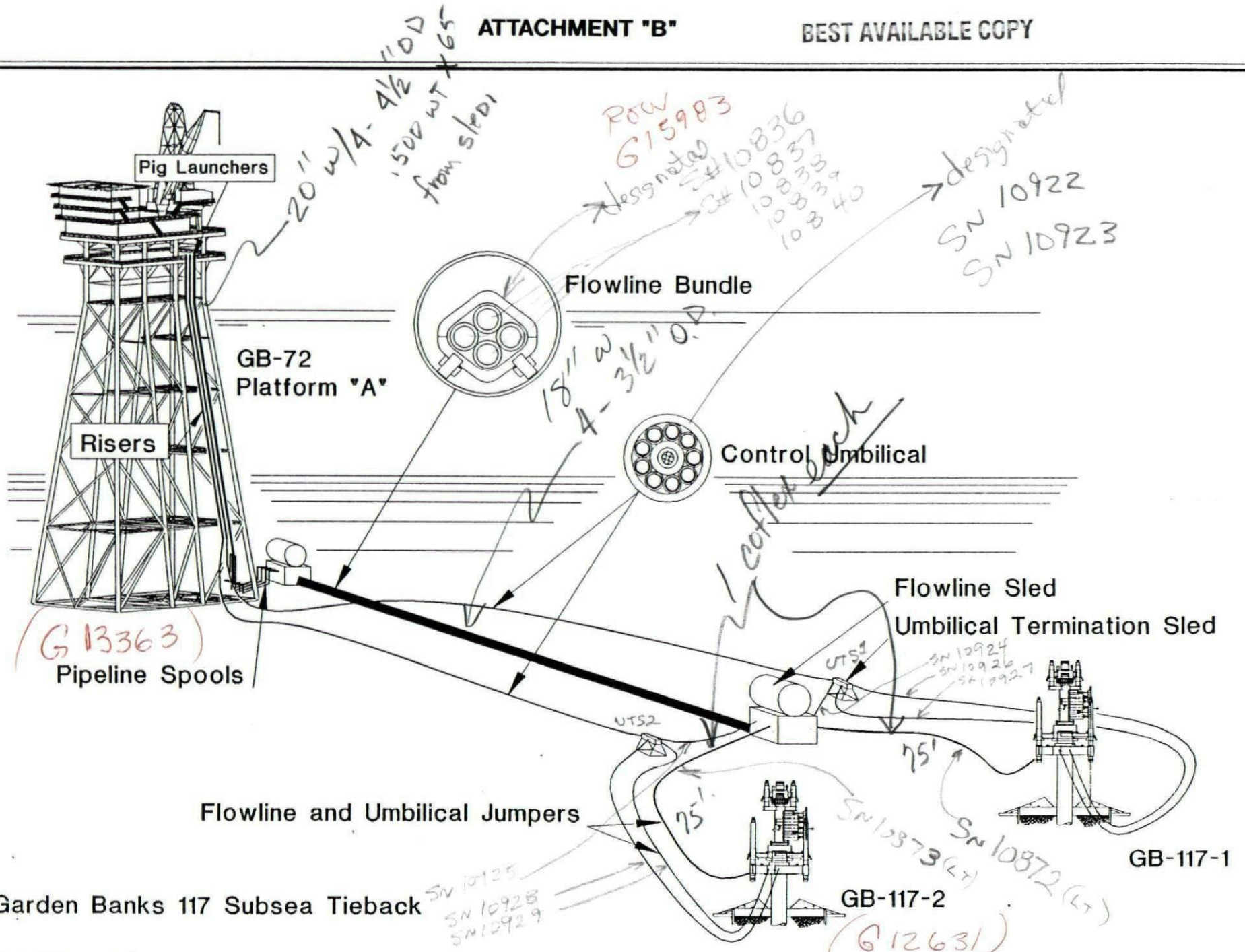
By: _____

Date: Oct 19, 1995

cc - United States Department of the Interior
Minerals Management Service (MS 5232)
Gulf of Mexico OCS Region
Attention Mr. Mike Connor
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394

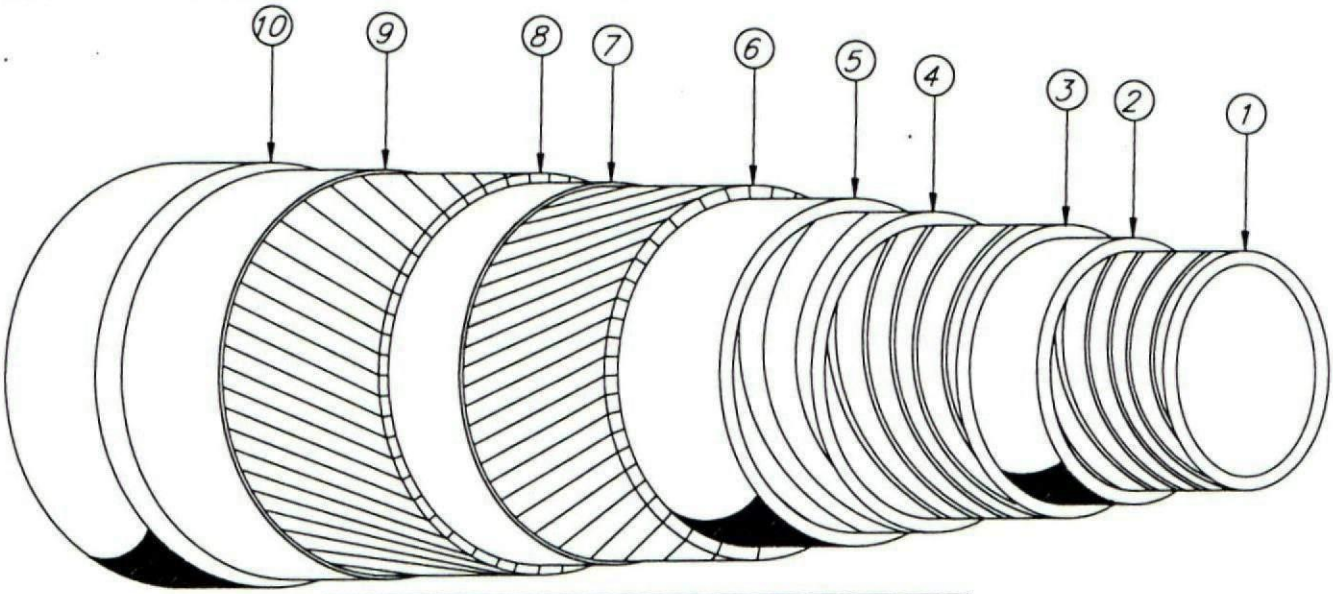
ATTACHMENT "B"

BEST AVAILABLE COPY



Garden Banks 117 Subsea Tieback

File: MPC\abb, 623-11
Date: October 17, 1995



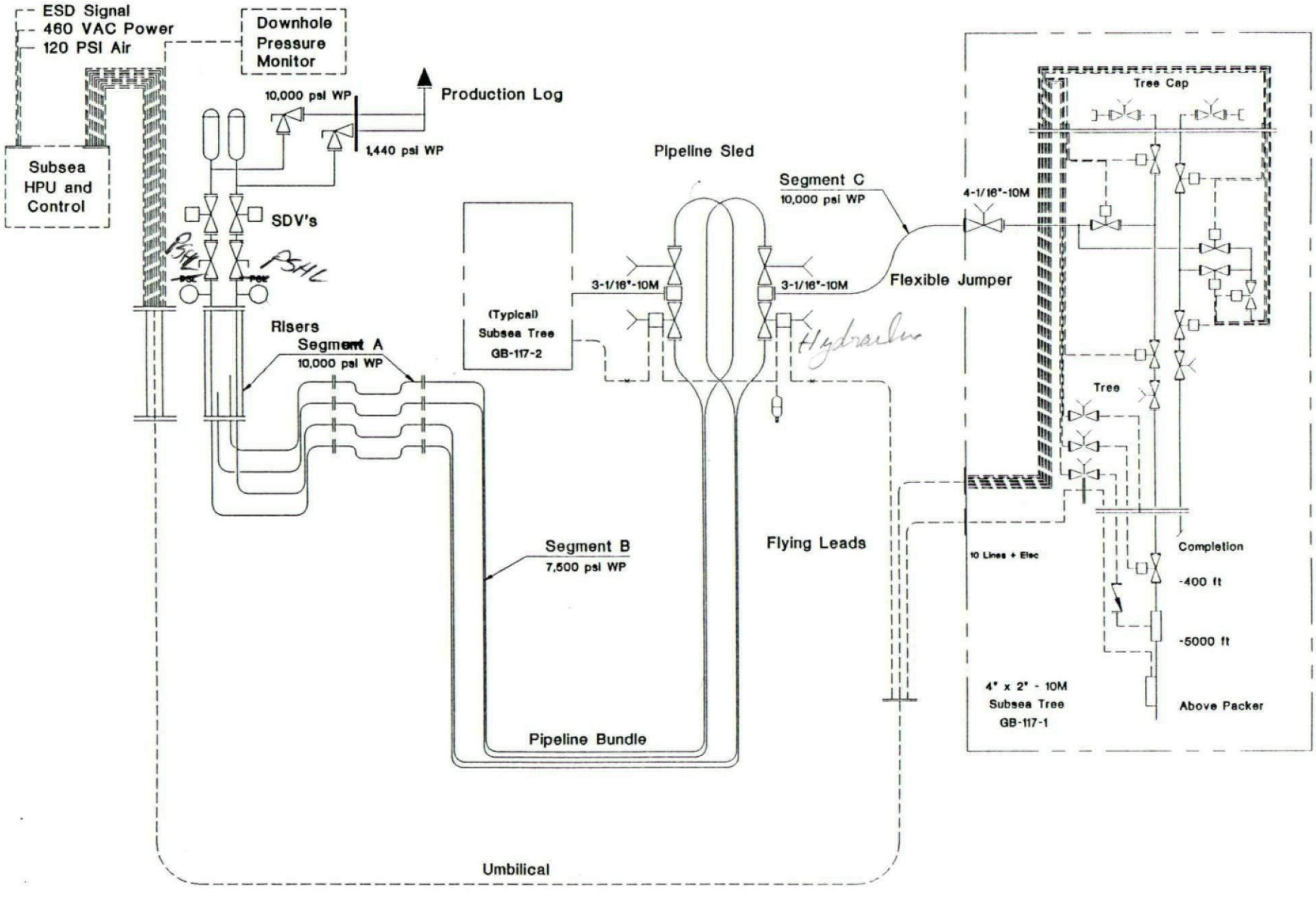
LAYER DESCRIPTION	
10	POLYAMID EXTERNAL SHEATH
9	FABRIC TAPE
8	SECOND ARMOR LAYER
7	RILSAN ANTI-WEAR TAPE
6	FIRST ARMOR LAYER
5	RILSAN ANTI-WEAR SHEATH
4	SPIRAL
3	ZETA WIRE
2	RILSAN PRESSURE SHEATH
1	INTERLOCKED CARCASS

ATTACHMENT "C"

CHARACTERISTICS		IMPERIAL	METRIC
DIAMETER:	inside	3.00 in.	76.20 mm
	outside	5.57 in.	141.50 mm
WEIGHT:	in air empty	29.20 lbf/ft	43.45 kgf/m
	in sea water empty	18.37 lbf/ft	27.33 kgf/m
PRESSURE:	Nominal bursting	23840 psi	1644 bars
	Hydrostatic collapse	3360 psi	231 bars
DAMAGING PULL:	in straight line	307317 lbf	1367.21 kN
MINIMUM BENDING RADIUS:	for storage	3.02 ft	0.92 m

COFLEXIP	3" 10,000 psi DESIGN PRESSURE STRUCTURE 76.4122	9/13/95	D.B. LAND
		0764122	

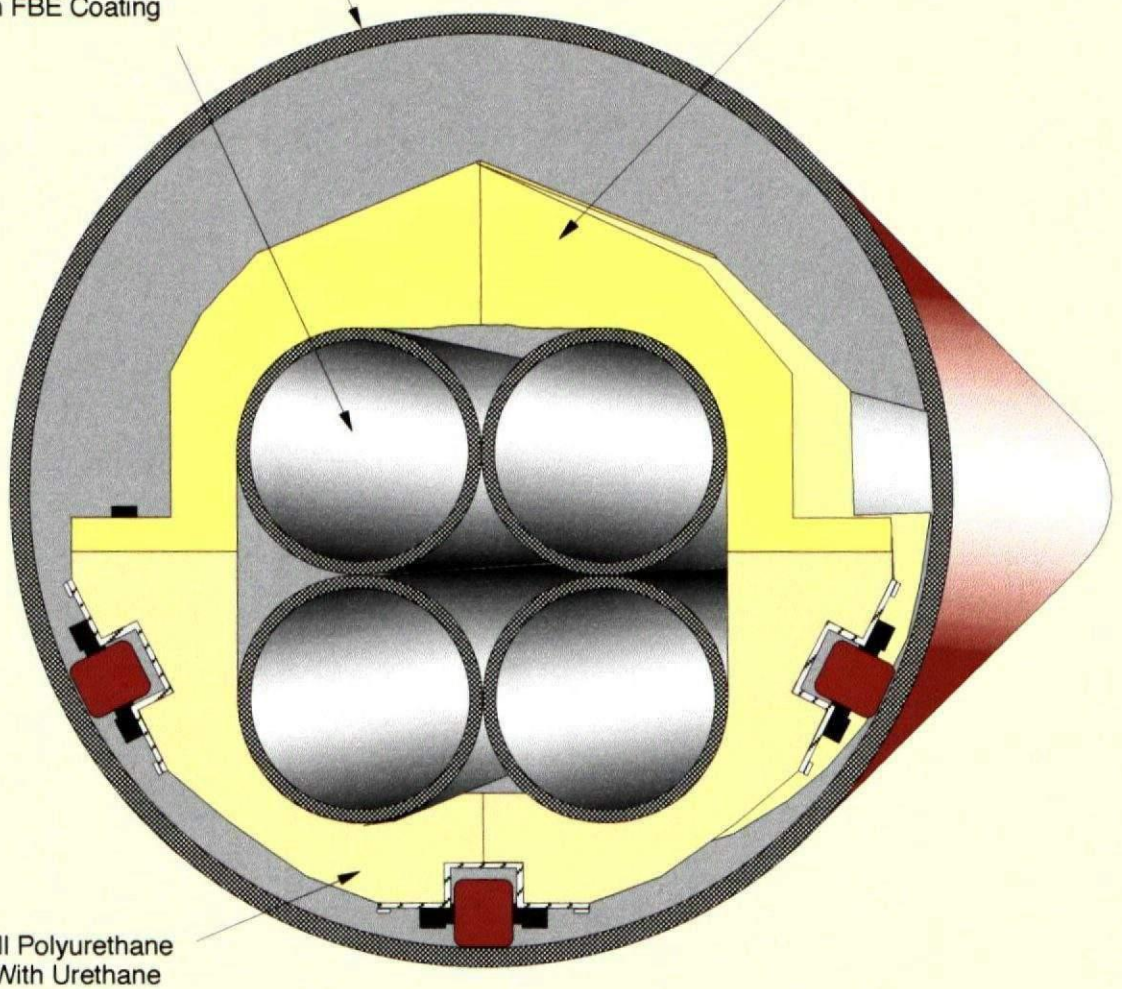
ATTACHMENT "E"



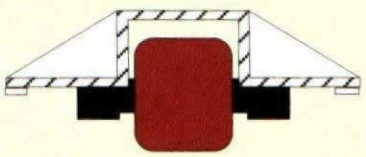
File: MPC\abb, 623-10
Issue Date: 14 October 1995

Garden Banks 117 Subsea Tieback

ATTACHMENT "D"



The 2" Open Cell Polyurethane
Insulation Section is not Shown



Typical Urethane Roller

PROJECT: GARDEN BANKS BLOCKS 72/117 PIPELINE DEVELOPMENT		TITLE: ISOMETRIC VIEW OF A TYPICAL 3.5" FLOWLINE BUNDLED IN A 18" CASING	
CLIENT: FLEXTREND DEVELOPMENT COMPANY, L.L.C.	CLIENT SIGN.	DRAWN BY: MAC	SCALE: AS SHOWN
HOUSTON, TEXAS — Kvaerner - R.J.Brown — KVAERNER	CLIENT JOB NO. KRJB JOB NO. 2127600	DESIGNED BY: RJB	DATE: 6/95
		CHECKED BY: JGB	LEAD ENGR.:
		PROJ. MANAGER: BL	PROJ ENGR.: BLM
		FIGURE NO. Flx 603	REVISION NO.

Steady Integrator for Multiphase Pipe Lines and wells = SIMPL

+--------------------------------+
| Version 3.64 Updated 12-18-89 |
+--------------------------------+

COMPANY / CLIENT NAME = Flextrend
INPUT FILE = flextren.dat DATE = 10-12-1995 TIME = 17:19:35
Hydraulic Analysis for Flowline Bundle

SIMPL INPUT DATA

GENERAL DATA

FORWARD CALCULATION DIRECTION
DOMINANT FLUID = OIL
FLOWING TEMPERATURES CALCULATED
HEAT TRANSFER COEFFICIENTS CALCULATED
ACCELERATION GRADIENT INCLUDED
PALMER HOLDUP CORRECTION APPLIED

STARTING CONDITIONS

TEMPERATURE(F)= 180
PRESSURE(psia)= 7500
OIL RATE(bbl/day   )= 2500
GAS/OIL RATIO(std ft3/bbl   )= 1000
WATER CUT(Volume %   )= 0

PIPE OR TUBING DATA

PIPE OR TUBING: 1

OUTSIDE DIAMETER(inch)= 3.5
WALL THICKNESS(inch)= .281
ROUGHNESS(inch)= .0018
THERMAL CONDUCTIVITY(Btu/hr-ft-F)= .02
END FOOT-POST OR TMD= 22000
INCLINATION(FROM HORIZONTAL) ANGLE(Deg)= 1.12
BEGGS & BRILL DP & HOLDUP METHOD
NUMBER OF CALCULATION SEGMENTS= 10

AMBIENT CONDITIONS

?E OR TUBING: 1

INSULATION THICKNESS(inch)= 0
INSULATION THERMAL CONDUCTIVITY(Btu/hr-ft-F)= 0
AIR VELOCITY(mi/hr)=0.02

AIR TEMPERATURE(F)= 45

PVT DATA

OIL GRAVITY(Deg. API)= 29.48
GAS GRAVITY(fraction, Dry Air = 1)= .569
SEPARATOR TEMPERATURE(F)= 60
SEPARATOR PRESSURE(psia)= 14.7

NITROGEN, N2 (mol %)= .13
CARBON DIOXIDE, CO2 (mol %)= .21
HYDROGEN SULFIDE, H2S (mol %)= 0

Steady Integrator for Multiphase Pipe Lines and wells = SIMPL

| Version 3.64 Updated 12-18-89 |

COMPANY / CLIENT NAME = Flextrend
INPUT FILE = flextren.dat DATE = 10-12-1995 TIME = 17:19:39
Hydraulic Analysis for Flowline Bundle

SIMPL OUTPUT

DISTANCE (ft)	PRESSURE (psia)	TEMP (F)	FLOW PATTERN	LIQUID HOLDUP SEG(bbl)	LIQUID HOLDUP ACC(bbl)	MIX VELOCITY (ft/sec)
0.000	7500.0	180.0		0.0	0	0.0
2200.000	7469.5	178.3	LIQ	18.4	18	5.0
4400.000	7439.0	176.5	LIQ	18.4	37	5.0
6600.000	7408.4	174.8	LIQ	18.4	55	5.0
8800.000	7377.8	173.2	LIQ	18.4	74	5.0
11000.000	7347.1	171.5	LIQ	18.4	92	5.0
13200.000	7316.4	169.9	LIQ	18.4	111	5.0
15400.000	7285.7	168.3	LIQ	18.4	129	5.0
17600.000	7254.9	166.7	LIQ	18.4	148	5.0
19800.000	7224.1	165.1	LIQ	18.4	166	5.0
21999.999	7193.2	163.6	LIQ	18.4	184	5.0

Steady Integrator for Multiphase Pipe Lines and wells = SIMPL

| Version 3.64 Updated 12-18-89 |

All rights reserved

Steady Integrator for Multiphase Pipe Lines and wells = SIMPL

+--------------------------------+
| Version 3.64 Updated 12-18-89 |
+--------------------------------+

COMPANY / CLIENT NAME = Flextrend
INPUT FILE = flextren.dat DATE = 10-12-1995 TIME = 17:01:24
Hydraulic Analysis for Flowline Bundle

SIMPL INPUT DATA

GENERAL DATA

FORWARD CALCULATION DIRECTION
DOMINANT FLUID = OIL
FLOWING TEMPERATURES CALCULATED
HEAT TRANSFER COEFFICIENTS CALCULATED
ACCELERATION GRADIENT INCLUDED
PALMER HOLDUP CORRECTION APPLIED

STARTING CONDITIONS

TEMPERATURE(F)= 180
PRESSURE(psia)= 7500
OIL RATE(bbl/day)= 5000
GAS/OIL RATIO(std ft3/bbl)= 1000
WATER CUT(Volume %)= 0

PIPE OR TUBING DATA

PIPE OR TUBING: 1

OUTSIDE DIAMETER(inch)= 3.5
WALL THICKNESS(inch)= .281
ROUGHNESS(inch)= .0018
THERMAL CONDUCTIVITY(Btu/hr-ft-F)= .02
END FOOT-POST OR TMD= 22000
INCLINATION(FROM HORIZONTAL) ANGLE(Deg)= 1.12
BEGGS & BRILL DP & HOLDUP METHOD
NUMBER OF CALCULATION SEGMENTS= 10

AMBIENT CONDITIONS

PE OR TUBING: 1

INSULATION THICKNESS(inch)= 0
INSULATION THERMAL CONDUCTIVITY(Btu/hr-ft-F)= 0
AIR VELOCITY(mi/hr)=0.02

AIR TEMPERATURE(F)= 45

PVT DATA

OIL GRAVITY(Deg. API)= 29.48
GAS GRAVITY(fraction, Dry Air = 1)= .569
SEPARATOR TEMPERATURE(F)= 60
SEPARATOR PRESSURE(psia)= 14.7

NITROGEN, N2 (mol %)= .13
CARBON DIOXIDE, CO2 (mol %)= .21
HYDROGEN SULFIDE, H2S (mol %)= 0

Steady Integrator for Multiphase Pipe Lines and wells = SIMPL

| Version 3.64 Updated 12-18-89 |

COMPANY / CLIENT NAME = Flextrend
INPUT FILE = flextren.dat DATE = 10-12-1995 TIME = 17:01:28
Hydraulic Analysis for Flowline Bundle

SIMPL OUTPUT

DISTANCE (ft)	PRESSURE (psia)	TEMP (F)	FLOW PATTERN	LIQUID HOLDUP SEG(bbl)	LIQUID HOLDUP ACC(bbl)	MIX VELOCITY (ft/sec)
0.000	7500.0	180.0		0.0	0	0.0
2200.000	7425.5	179.1	LIQ	18.4	18	10.1
4400.000	7350.9	178.3	LIQ	18.4	37	10.1
6600.000	7276.3	177.4	LIQ	18.4	55	10.1
8800.000	7201.6	176.5	LIQ	18.4	74	10.1
11000.000	7127.0	175.7	LIQ	18.4	92	10.1
13200.000	7052.2	174.8	LIQ	18.4	111	10.1
15400.000	6952.0	174.0	DIST	16.9	128	10.1
17600.000	6850.6	173.2	DIST	16.8	144	10.1
19800.000	6748.3	172.3	DIST	16.7	161	10.1
21999.999	6645.8	171.5	DIST	16.6	178	10.2

Steady Integrator for Multiphase Pipe Lines and wells = SIMPL

| Version 3.64 Updated 12-18-89 |

All rights reserved

Steady Integrator for Multiphase Pipe Lines and wells = SIMPL

+---------------------------------+
| Version 3.64 Updated 12-18-89 |
+---------------------------------+

COMPANY / CLIENT NAME = Flextrend
INPUT FILE = flextren.dat DATE = 10-12-1995 TIME = 17:03:37
Hydraulic Analysis for Flowline Bundle

SIMPL INPUT DATA

GENERAL DATA

FORWARD CALCULATION DIRECTION
DOMINANT FLUID = OIL
FLOWING TEMPERATURES CALCULATED
HEAT TRANSFER COEFFICIENTS CALCULATED
ACCELERATION GRADIENT INCLUDED
PALMER HOLDUP CORRECTION APPLIED

STARTING CONDITIONS

TEMPERATURE(F)= 180
PRESSURE(psia)= 7500
OIL RATE(bbl/day   )= 10000
GAS/OIL RATIO(std ft3/bbl   )= 1000
WATER CUT(Volume %   )= 0

PIPE OR TUBING DATA

PIPE OR TUBING: 1

OUTSIDE DIAMETER(inch)= 3.5
WALL THICKNESS(inch)= .281
ROUGHNESS(inch)= .0018
THERMAL CONDUCTIVITY(Btu/hr-ft-F)= .02
END FOOT-POST OR TMD= 22000
INCLINATION(FROM HORIZONTAL) ANGLE(Deg)= 1.12
BEGGS & BRILL DP & HOLDUP METHOD
NUMBER OF CALCULATION SEGMENTS= 10

AMBIENT CONDITIONS

PE OR TUBING: 1

INSULATION THICKNESS(inch)= 0
INSULATION THERMAL CONDUCTIVITY(Btu/hr-ft-F)= 0
AIR VELOCITY(mi/hr)=0.02

AIR TEMPERATURE(F)= 45

PVT DATA

OIL GRAVITY(Deg. API)= 29.48
GAS GRAVITY(fraction, Dry Air = 1)= .569
SEPARATOR TEMPERATURE(F)= 60
SEPARATOR PRESSURE(psia)= 14.7

NITROGEN, N2 (mol %)= .13
CARBON DIOXIDE, CO2 (mol %)= .21
HYDROGEN SULFIDE, H2S (mol %)= 0

Steady Integrator for Multiphase Pipe Lines and wells = SIMPL

+---------------------------------+
| Version 3.64 Updated 12-18-89 |
+---------------------------------+

COMPANY / CLIENT NAME = Flextrend
INPUT FILE = flextren.dat DATE = 10-12-1995 TIME = 17:03:41
Hydraulic Analysis for Flowline Bundle

SIMPL OUTPUT

DISTANCE (ft)	PRESSURE (psia)	TEMP (F)	FLOW PATTERN	LIQUID HOLDUP SEG(bbl)	LIQUID HOLDUP ACC(bbl)	MIX VELOCITY (ft/sec)
0.000	7500.0	180.0		0.0	0	0.0
2200.000	7270.1	179.6	LIQ	18.4	18	20.2
4400.000	7040.4	179.1	LIQ	18.4	37	20.2
6600.000	6713.4	178.7	DIST	16.7	54	20.3
8800.000	6383.1	178.2	DIST	16.4	70	20.4
11000.000	6049.0	177.8	DIST	16.1	86	20.6
13200.000	5710.7	177.3	DIST	15.7	102	20.8
15400.000	5367.2	176.9	DIST	15.4	117	21.0
17600.000	5017.7	176.4	DIST	15.0	132	21.3
19800.000	4661.1	175.9	DIST	14.6	147	21.6
21999.999	4295.7	175.4	DIST	14.1	161	22.0

Steady Integrator for Multiphase Pipe Lines and wells = SIMPL

+---------------------------------+
| Version 3.64 Updated 12-18-89 |
+---------------------------------+

All rights reserved

UNITED STATES GOVERNMENT
MEMORANDUM

November 30, 1995

To: Chief, Plans and Pipeline Section, Field Operations, GOM OCS Region (MS 5230)

From: Chief, Environmental Operations Section, Leasing and Environment, GOM OCS Region (MS 5440)

Subject: National Environmental Policy Act Review for Pipeline Right-of-Way Application OCS-G 15983

Our National Environmental Policy Act (NEPA) review of the subject action is complete. Environmental protective measure(s), if any, identified to avoid or mitigate potential impacts associated with the action were included as part of the NEPA analysis and are shown on the attached Categorical Exclusion Review (CER).

for Jerry Brashier

Attachment

cc: 102-01a ENV 5-4c (MS 5440)
Lease OCS-G 15983 POD File w/CER (MS 5032)

DMoran:skp:G-15983

Action No. OCS-G 15983

United States Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

NEPA CATEGORICAL EXCLUSION REVIEW

The Categorical Exclusion Review (CER) evaluated the proposed action(s) and determined that it meets the categorical exclusion criteria as defined by 516 DM 2.3A(1) which states "(a) The action or group of actions would have no significant effect on the quality of the human environment, and (b) The action or group of actions would not involve unresolved conflicts concerning alternative uses of available resources." The exclusion of this activity from future environmental analysis is conditioned on the imposition of the following mitigative measure(s). These measures are to ensure environmental protection, consistent environmental policy, and safety as required by the NEPA.

Environmental Protective Measures

The following measure was identified in the plan/application by the lessee/operator submitting the proposal: None.

The measures identified by MMS during the plan/application review or in the lease stipulation were:

1. The operator will contact Headquarters, ACC/DOSR, Detachment 1, Operations Headquarters, Air Combat Command, Attention: Lt.Col. Turner or MSgt. Ross, Offutt AFB, Nebraska 68113-5550, telephone: (402) 294-2334 regarding control of electromagnetic emissions and operations of boat and/or aircraft traffic into the designated Military Warning Area W-602 or enter into an agreement with the military installation.

2. Our analyses indicate that there is a potential geologic hazard problem. Appropriate measures to mitigate potential impacts will be required of the lessee. (Cautions for the unidentified side-scan sonar target in the southwest corner of Garden Banks Block 118 and for a scarp in northwest Garden Banks Block 117).

3. Caution shall be exercised in tracking the rear of the tow so as to avoid potential impacts on sensitive underwater features identified along the tow route, i.e., Applebaum Bank, West Flower Garden Bank, Geyer Bank, Elvers Bank, and McGrail Bank.

Action No. OCS-G 15983

Exclusion Determination

The proposed action was evaluated and reviewed against the CER exception criteria defined by 516 DM 2.3.A(3). With inclusion of the above mitigation, it does not represent an exception to the categorical exclusions. Therefore, preparation of an EA is not required.

11/30/95
Date

Dave Moreen
Preparer

12/1/95
Date

Chief, Environmental
Operations Section

PIPELINE RIGHT-OF-WAY APPLICATION "ENGINEERING CHECKLIST"

MINERALS MANAGEMENT SERVICE
GOM REGIONAL OFFICE

Date: 11/27/95

OCS-G 15983

A. Description of pipeline and location of proposed route (i.e., size of pipe, product to be transported, from where to where, platform number, name, block number, area, and distance in feet and miles):

B. Safety Flow Schematic - Verify that the information shown on the safety flow schematic diagram contains the following:

✓ 1. Pressure source is drawn into the schematic with the following:

a. source (i.e., name) Wells

b. design working pressure SITPmax = 6100

c. high-low pressure sensor settings High = 10% > MOP ≤ MAOP
Lo = 10% < MOP

✓ 2. "ANSI" ratings of all valves, flanges, and fittings between the source and the connecting pipeline are shown. API 10000

N/A 3. Pressure relief valves, where applicable, are shown with the setting set no higher than the maximum working pressure (MWP) of the vessel.

✓ 4. If the maximum input source pressure is greater than the maximum allowable operating pressure (MAOP) of the pipeline, redundant safety equipment is required.

N/A 5. MAOP of proposed pipeline does not exceed MAOP of connecting pipeline.

N/A 6. The pipeline leaving the platform receiving production from the platform is equipped with high-low pressure sensors to directly or indirectly shut-in the well or wells on the platform.

✓ 7. The pipeline delivering production to the production facilities on the platform is equipped with an automatic fail-close valve tied into the automatic and remote shut-in system.

N/A 8. The pipeline crossing the platform which does not deliver production to the platform, but which may or may not receive production from the platform, is equipped with high-low pressure sensors connected to an automatic fail-close valve located in the upstream portion of the pipeline at the platform. In addition, the sensors are tied into either the platform's automatic and remote shut-in system or an independent remote shut-in system.

✓ 9. The pipeline boarding the platform/pipeline is equipped with a check valve.

No 10. The pipeline leaving the platform is equipped with a check valve.

✓ 11. The high-low pressure sensors on the departing pipeline is located upstream of the check valve.

✓ 12. Where applicable, high-low sensors are located downstream of the back pressure regulator.

✓ 13. If there is liquid injection into the line, are pumps associated with the injection? (Yes or No) Bulk

✓ 14. Direction of flow indicated.

✓ 15. Pipe specifications (i.e., size, grade, weight, and wall thickness).

✓ 16. Total length of proposed pipeline (feet and miles).

N/A 17. MAOP of connecting pipeline.

✓ 18. Statement that design meets or exceeds DOT Regulations 192 or 195, as applicable, and/or applicable OCS orders, registered engineer's seal, registration number, date, and signature.

✓ 19. Area and block number of proposed pipeline/platform.

✓ 20. Cathodic protection specifications.

C. Design Information - Verify that the pipeline design information given in the application and/or on the data sheet is complete and correct:

✓ 1. Product to be transported: Bulk

✓ 2. Pipeline, riser, and subsea valve assembly specifications:

(1) Size 3½ Wall Thickness .281 Grade X65 Weight 9.2 lbs/ft.

(2) Size _____ Wall Thickness _____ Grade _____ Weight _____ lbs/ft.

(3) Size _____ Wall Thickness _____ Grade _____ Weight _____ lbs/ft.

b. Riser:

(1) Size 4 Wall Thickness .50 Grade X65 Weight — lbs/ft.

(2) Size _____ Wall Thickness _____ Grade _____ Weight _____ lbs/ft.

(3) Size _____ Wall Thickness _____ Grade _____ Weight _____ lbs/ft.

c. Subsea valve assembly:

(1) Size _____ Wall Thickness _____ Grade _____ Weight _____ lbs/ft.

(2) Size _____ Wall Thickness _____ Grade _____ Weight _____ lbs/ft.

✓ 3. Water depth: Maximum 920 Minimum 520

✓ 4. Type of corrosion protection:

N/A a. Impressed current system

✓ b. Sacrificial anode system

(1) Type of anode Gal III

(2) Spacing interval 20953 ft.

(3) Weight of unit anode given by applicant 4000# lbs. ea.

N/A c. If platform anodes are used, are they considered adequate?

Yes _____ No _____

✓ d. If pipeline anodes are used: N/A

Formula: $Le_{p/l} = 3.82 \times 10^4 \times W^o/DIR =$

$\frac{3.82 \times 10^4 (4000)}{3.5 (20953)(7.6)} = 2.74$

Where:

W^o = Weight of Anode unit (lbs)
D = Dia. of pipe (inches)
I = Separation between anodes (ft.)
R = the following lbs/amp/year (Rate of Consumption)
Aluminum or Galvalum = 7.6
Zinc = 26
Magnesium = 17.5

See application - all in P/L SKIDS

Does the calculated life expectancy equal or exceed 20 years?

Yes ✓ No _____

✓ 5. Description of protective coating:

a. Pipeline 3½" ⇒ 18 mils FBE / 18" ⇒ 18 mils FBE (+ sealed w/ NITROGEN)

b. Riser

c. Subsea valve assembly

N/A 6. Description of weighted coating:

a. Preconcrete coating _____

b. Density of concrete _____ PCF

c. Thickness of concrete _____

d. Thickness of asphalt _____

✓ 7. Calculate the specific gravity (one of the following formulae may be used)

See application

a. For epoxy coating: $SG = 2.865W/D^2$

b. Density comparison with fluid material: $SG = \frac{W+P}{\frac{A}{R}}$

c. Lines with a specific thickness of concrete:

$$SG = \frac{RC}{R} + \frac{K_2}{(T-K_1)^2}\left(\frac{W+P}{K_3} - \frac{RC}{R}\right)$$

d. Lines having two coatings of enamel and a felt wrap, or only asphaltmastic coating:

$$SG = \frac{W+P}{K_3}$$

Where:
SG = specific gravity
RC = density of concrete (lb/cu. ft.)
K_1, K_2, K_3 = coefficients
T = thickness of concrete coating (inches)
W = weight of bare pipe (lb/ft)
P = weight of coating
R = density of fluid material (lb/cu. ft.): i.e., sea water = 64 lbs/cu. ft.
D = diameter of pipe (inches)
A = cross-sectional area

8. Given specific gravity

a. 1.08 b. _____ c. _____ G = .569

9. Gravity or density of product(s) _____ C = 29.48° API

10. Design capacity of pipeline 5MMSCFD / 7000 BCPD

11. Given Hydrostatic Test Pressure: Line Pipe 9375 Hold Time 8 hrs.

Preinstallation Test _____ Riser _____ Hold Time _____ hrs.

Recommended maximum hydrostatic body test for ANSI valves, flanges, and fittings are as follows:

ANSI 300 - 1,100 psig
ANSI 400 - 1,450 psig
ANSI 600 - 2,175 psig
ANSI 900 - 3,250 psig
ANSI 1,500 - 5,400 psig

Note: Minimum hold times:

Gas =	Line Pipe = 8 hrs. Riser = 4 hrs. (pretest) or DOT 192.507(c)	Liquid =	4 hrs. @ 125% of MOP Plus 4 hrs. @ 110% if leak inspection is not visable during test

✓ 12. Maximum Allowable Operating Pressure (MAOP) of line pipe:

$$MAOP = \frac{2\,st \times F \times E \times T}{D}$$

Note: F = .72; E = 1; T = 1

a. MAOP = $\frac{2(65000)(.281) \times .72}{3.5} = 7514$

b. MAOP =

c. MAOP =

✓ 13. MAOP of riser pipe.

Note: F = .50 for risers on natural gas transmission lines.
Note: F = .60 for risers on liquid pipelines.

a. MAOP = $\frac{2(65000)(.500) \times .6}{4.0} = 9750$

b. MAOP =

✓ 14. MAOP of flanges, fittings, and valves:

2.4 x ANSI rating = 10,000 psi

15. MAOP of proposed pipeline as determined in accordance with Title 49 CFR Part 195 or 192, as applicable, is 7,500 psig.

✓ 16. Items 12, 13, and 14 above are equal to or more than the maximum allowable working pressure (MAWP) of source.

✓ 17. Verify: 1.25 maximum source pressure (MSP) $\leq$ hydrostatic test pressure (HTP) $\leq$ .95 (smaller IP @ SMYS of items 12 or 13 above)

6160 $\leq$ 9375 $\leq$ 9914

Note: The recommended limit of test as a percentage of internal pressure @ specificed minimum yield strength is equal to 95%:

$$IP\ @\ SMYS = \frac{2 \times s \times t}{D} = \frac{12}{.72} \times .95 = 9914$$

✓ 18. Verify MAOP does not exceed the lowest of the following:

a. Suomerged components: HTP/1.25 = $9375/1.25 = 7500$

b. Riser: HTP/1.5 =

_____19. Valve guard: Yes ____ No ____

D. Installation Requirements:

N/A 1. All pipelines will be installed or laid to a minimum of three feet below the level of the mudline out to and including the 200 foot water depth, except at pipeline crossings. Any deviation must be justified at the time of application.

N/A 2. All valves and taps must be provided with a minimum of three feet of actual cover either with soil or sandbags or jetted to a minimum of three feet below the mudline. If MMS approved valve protection covers are used, the valves and taps are NOT required to have a minimum of three feet of actual cover or jetted three feet below the mudline. However, the top of the valve protection cover shall not protrude above the level of the mudline. Any deviation must be justified at the time of application.

E. Pipeline Crossings:

N/A 1. All pipeline crossings in water depths up to and including 200 feet shall be cement-bagged with a minimum of 18 inches between the lines with the uppermost line having a minimum of 3 feet of cover in the form of cement bags installed so as to provide a three foot horizontal to a one foot vertical (3:1) slope with a crown width that is one and one-half (1½) times the pipe diameter. Any deviation must be justified at the time of application.

N/A 2. All pipeline crossings in water depths greater than 200 feet shall be cement bagged with a minimum of 18 inches between the lines and installed so as to provide a three foot horizontal to a one foot vertical (3:1) slope. Any deviation must be justified at the time of application.

F. Construction Information:

_____ 1. Proposed construction commencement date 12/7/95

_____ 2. Method of construction LAY

_____ 3. Method of burial N/A

_____ 4. Time required to lay pipe 3

_____ 5. Time required to complete project

G. Applicant complies with current OCS pipeline guidelines:

Yes _____ No _____