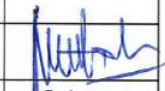





# Welland Pipeline Infrastructure Burial Analysis

BXX-ST-L-10000

Revision	Date	Description	Name		Signature
00	18/12/09	First Issue	R.Edwards		
01	4/1/10	Revision	K.Tucker		
02	5/2/09	PCP Approval	M.Hawkins		



## CONTENTS

Section	Page
<b>1 EXECUTIVE SUMMARY .....</b>	<b>3</b>
<b>2 INTRODUCTION.....</b>	<b>4</b>
<b>3 INFRASTRUCTURE DETAILS.....</b>	<b>5</b>
<b>4 DEPLOYED TECHNOLOGY .....</b>	<b>6</b>
4.1 1991 Survey.....	6
4.2 1994 Survey.....	6
4.3 2006 Survey.....	6
4.4 2009 Survey.....	6
<b>5 SUMMARY OF FINDINGS .....</b>	<b>8</b>
5.1 Individual Pipeline Summary .....	9
5.1.1 PL674 Welland-Thames Export Pipeline .....	9
5.1.2 PL676 Welland In-field Pipeline .....	10
5.1.3 PL677 Welland In-field Pipeline .....	10
5.1.4 PL678 Welland In-field Pipeline .....	10
5.1.5 PL679 Welland Umbilical .....	10
5.1.6 PL680 Welland Umbilical .....	11
5.1.7 PL681 Welland Umbilical .....	11
<b>APPENDIX A.....</b>	<b>12</b>



## 1 Executive Summary

Comparison of year on year surveys of the infrastructure indicates that the pipeline visibility is progressively becoming less evident, probably due increased weight since flooding of the main export line in 2003, deposits of sand and natural burial through tide and current motion.

Current status of infrastructure from 2009 acoustic survey is as follows:-

- No evidence of original trenching
- The pipelines and umbilicals are buried along their whole length
- Burial depth from top of pipe varies from 0.5m to >1.5m
- Only one short exposed section on 16" PL674 of 7m length
- There are no freespans on and pipelines or umbilicals
- There are various rock dump locations on pipelines totalling 1810m length
- There is only one 5m length rock dump on umbilical PL681

For operational integrity there would be no required remedial action and proposed next survey date would be 3-5 years time.

For decommissioning purposes, should any part of the infrastructure be left in situ, the remaining exposure should be buried and disconnected ends should be re-buried. Future survey frequencies would be dependant on results of the immediate post-decommissioning survey, followed by re-survey within 3 years.

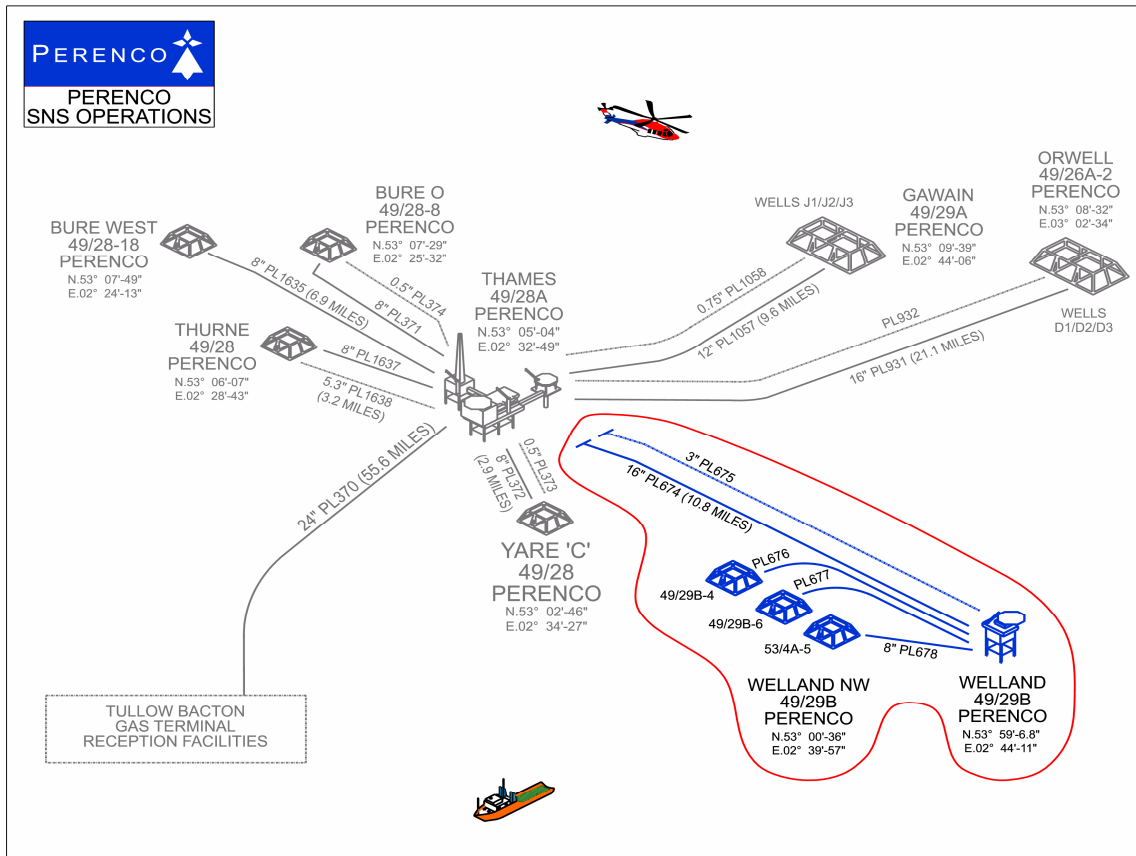


## **2 Introduction**

A comparison of the Welland pipeline burial condition has been undertaken to determine whether the pipeline is becoming more, or less, buried. The surveys utilized for this comparison span the period from 1991 to 2009, the surveys in 2006 and 2009 being subsequent to the pipeline's disconnection from Thames platform and it's static, de-pressured and flooded status.

### 3 Infrastructure Details

The Welland field is located in the Southern Basin of the UK Continental Shelf in blocks 49/29b and 53/4a, approximately 72 km off the coast of Norfolk in licence blocks P39 & P105



The disused pipeline and pipeline infrastructure components details are as follows :-

Pipeline & flowlines	DTI Number	Diameter	Length, km	Type of construction
Welland - Thames Export line	PL674	16"	17.5	X60 Grade Steel,
Welland - Thames MEG line	PL675	3"	17.5	X52 Grade Steel
Well 2 Subsea flowline	PL678	8"	4.2	X60 Grade Steel ,
Well 2 Subsea control umbilical & MEG line	PL681	4"	4.2	Sheathed plastic multicore
Well 3 Subsea flowline	PL676	8"	8.0	X60 Grade Steel ,
Well 3 Subsea control umbilical & MEG line	PL679	4"	8.0	Sheathed plastic multicore
Well 4 Subsea flowline	PL677	8"	5.8	X60 Grade Steel ,
Well 4 Subsea control umbilical incl MEG	PL680	4"	5.8	Sheathed plastic multicore

All Welland infrastructure pipelines and umbilicals are no longer in use. The export line has been disconnected at the Thames AW platform and flushed/flooded with seawater. At time of survey the flowlines to the subsea wellheads may retain residual pressure and contain hydrocarbon gas, liquid, water and MEG.



#### **4 Deployed Technology**

The detail acquired using modern techniques is far greater than that acquired in previous years, also accuracy in positioning has improved dramatically since the pipeline was laid. Echo-sounders used when the line was laid were single point sounders compared to those used today. Today's swath sounders provide far greater detail of the seabed itself, allowing easy identification of seabed features and any areas of exposure, rock-dumps etc.

It should be noted that only the 2006 survey was carried out using ROV and providing DoB continually along the route, the other surveys acquired DoB from Pinger and Pipe-liner systems, crossing the pipeline at regular intervals – perpendicular to the pipeline itself. This technique provides DoB at points along the line and for the purposes of the graphs these are the points of comparison. Trend lines have been overlaid on the graphs.

The pipeline is located in a particularly flat area of the seabed with little sand-wave activity and away from the sandbanks along this coastline, thus experiencing less effect of shifting sand-wave and variation in seabed.

##### **4.1 1991 Survey**

This survey was carried out using Syledis positioning and pipeline crossings using a pinger were sparse, typically only every 1km.

##### **4.2 1994 Survey**

The 1994 survey was carried out utilizing similar equipment to 1991 although more crossings were carried out providing data every 500m along the route.

##### **4.3 2006 Survey**

This survey was carried out utilizing a Seaeye Surveyor ROV with a TSS 440 pipetracker mounted on the front. The ROV surveyed the length of the main pipeline and in-field pipelines acquiring Depth of Burial (DoB) information. There was evidence of many areas of rock dumping and the DoB was typically > 0.6 metres. DoB information provided a complete picture of the burial although there was one area around KP12.5 where the readings may be anomalous, the reading at this point has been interpolated.

##### **4.4 2009 Survey**

The 2009 survey was carried out using a Geopulse Sub-Bottom Profiler (SBP) towed behind the vessel. Crossings of the pipeline were made every 250m along the pipeline length, crossing the pipeline perpendicular to its direction of lay. The SBP records were then



## **WELLAND PIPELINE INFRASTRUCTURE BURIAL ANALYSIS**

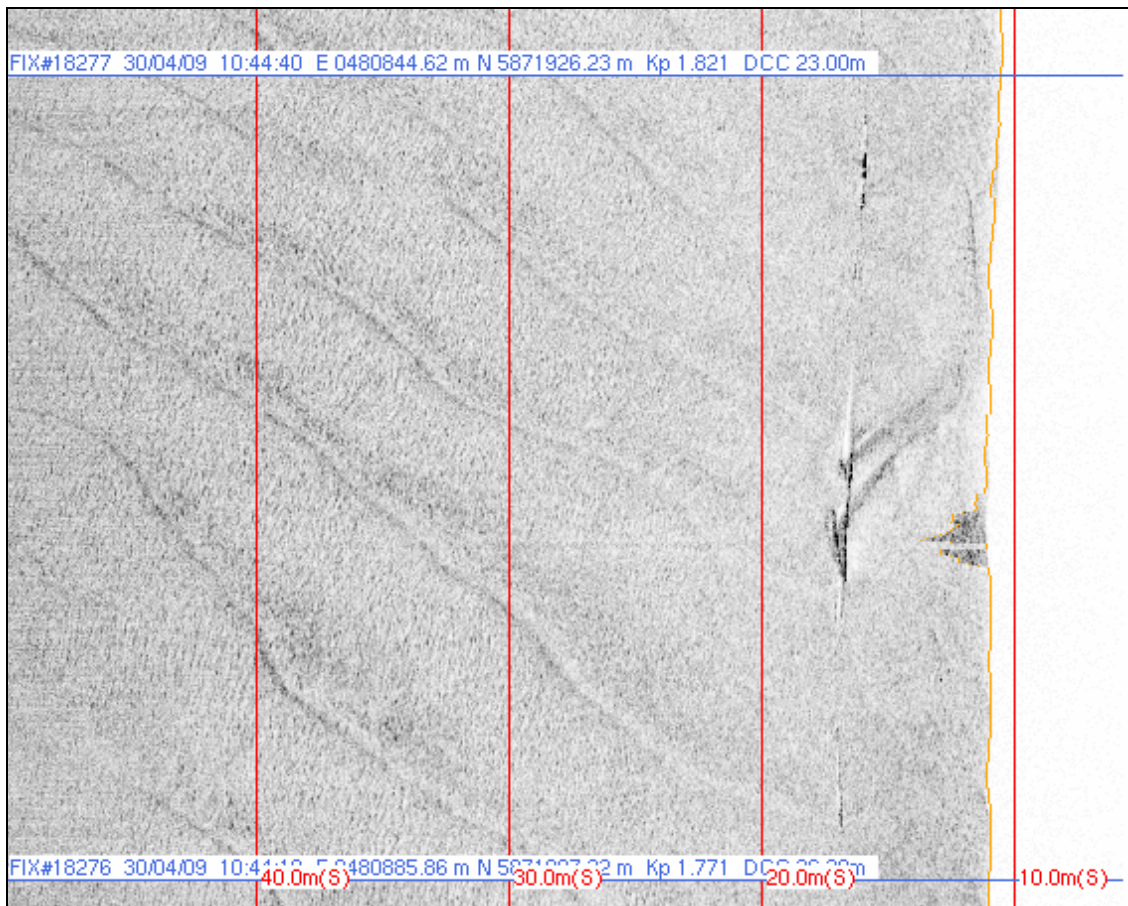
- 7 -

interpreted and the Top of Pipe (ToP) was calculated in relation to the seabed. Whilst the number of observations is naturally less using this technique, it does provide representative comparisons at fixed points along the route. NOTE: The depth of burial between these observed crossing points is interpolated, not measured, but typically we would expect the trend at the measured points to be apparent at the interpolated points also.

## 5 Summary of Findings

The graph in Appendix 1 illustrates the different depth of Burial (DoB) levels. Seabed depth has been determined from 2009 Multibeam Echo Soundings (MBES). Whilst there is still some evidence of the extensive rock dumping carried out over the years to stabilize the pipeline, the number of rock-dump exposures has reduced over time.

In previous surveys there has been evidence of some pipeline exposure (e.g. 2006 survey), there was only one instance in 2009 (KP 1.775 – see SSS image), this appears to be due to localized trawler activity or anchor placement. The image below shows the pipeline exposure with trails leading away from the exposed section (6m long) indicating something being dragged over the pipeline at this point, thus creating the localized exposure. This was reported on the 2006 ROV inspection as a section where the piggybacked MEG line was separated from the 16" line and exposed, the 16" line being still buried.



Comparing the profiles from the various surveys it appears that the pipeline is becoming more buried (or covered by sand) at the Welland platform end. From KP 9.000 approx, as the pipeline nears Thames platform the DoB tends to match that found in 2006, this is possibly due to a harder sand base and less deposits. The DoB in this area however is still typically > 1.0 metre.



The trend overall however is that the pipeline visibility is progressively becoming less evident, probably due increased weight since flooding in 2003 and to deposits of sand and natural burial through tide and current motion.

## 5.1 Individual Pipeline Summary

Please note that, due to the relative proximity of the three umbilicals and the associated large overlap of the SSS lines, the summaries for the umbilicals below only include events that directly relate to each route, even though other events may have been observed within the survey corridor. The full events listing in the appendix includes events which fall within the survey corridor even though these may be closer to another route. Refer to the alignment charts for further clarification.

### 5.1.1 PL674 Welland-Thames Export Pipeline

PL674 was surveyed on both sides over a distance (based on KP range) of 16.965km. Complete sidescan and multibeam coverage of the route was achieved. A full events listing is available if required, a summary of which is as follows:

- Depth of Burial:** 42 contacts were made with the average depth of the pipeline between 1 and 1.5m. A full DOB listing is available if required.
- Exposures:** One exposure was detected between KP 1.775 and KP 1.782 with a length of 7m, as shown below in Figure 1..
- Freespans:** No freespans were detected.
- Rock Dumps:** 194 areas of rock dump intervention were detected, with a total length of 1,235m. The longest was 113m.
- Other:** One protective structure was detected at KP -0.013.

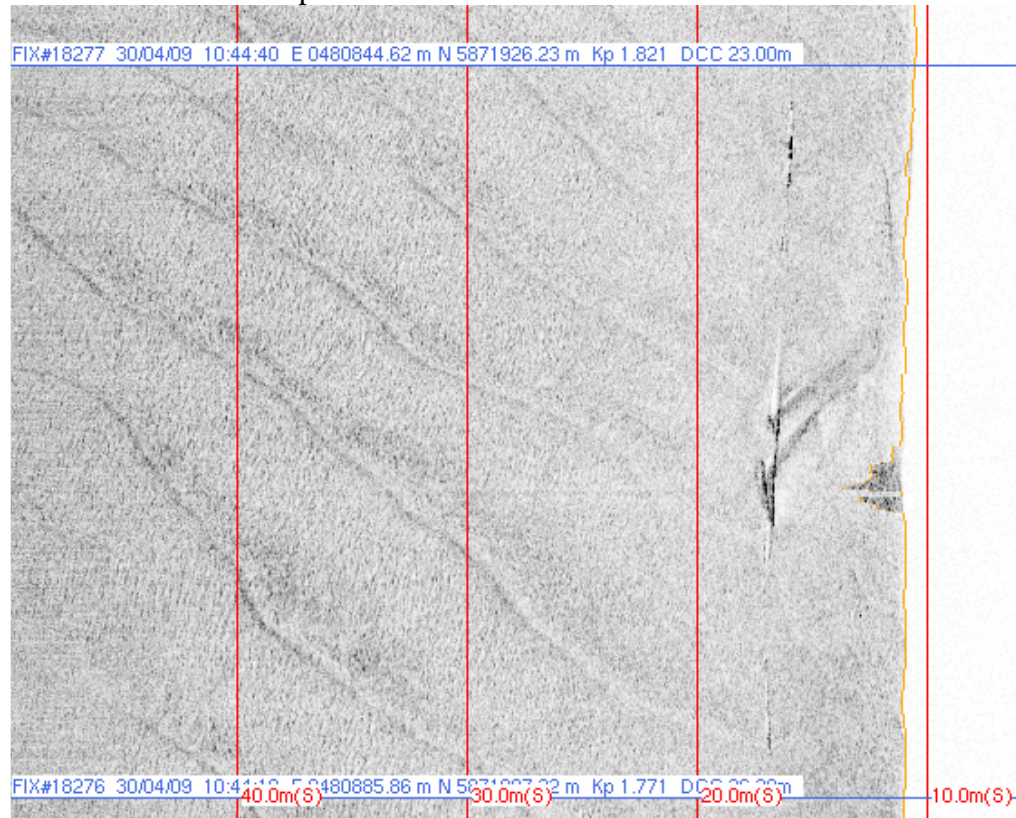


Figure 1: SSS record showing pipeline exposure at KP 1.775



### 5.1.2 PL676 Welland In-field Pipeline

PL676 was surveyed on both sides over a distance (based on KP range) of 7.662km. Complete sidescan and multibeam coverage of the route was achieved. A full events listing is available if required, a summary of which is as follows:

**Depth of Burial:** Only three contacts were made with the pipeline, at depths of 1.0m, 0.7m and 0.9m. A full DOB listing is available if required.

**Exposures:** No exposures were detected.

**Freespans:** No freespans were detected.

**Rock Dumps:** 12 areas of rock dump intervention were detected, with a total length of 112m. The longest was 28m.

**Other:** Two protective structures were detected at KP -0.040 and KP 7.693.

### 5.1.3 PL677 Welland In-field Pipeline

PL677 was surveyed on both sides over a distance (based on KP range) of 5.520km. Complete sidescan and multibeam coverage of the route was achieved. A full events listing is available if required, a summary of which is as follows:

**Depth of Burial:** Only three contacts were made with the pipeline, at depths of 0.9m, 1.3m and 1.5m. A full DOB listing is available if required.

**Exposures:** No exposures were detected.

**Freespans:** No freespans were detected.

**Rock Dumps:** 16 areas of rock dump intervention were detected, with a total length of 215m. The longest was 44m.

**Other:** One protective structure was detected at KP 5.521.

### 5.1.4 PL678 Welland In-field Pipeline

PL678 was surveyed on both sides over a distance (based on KP range) of 3.683km. Complete sidescan and multibeam coverage of the route was achieved. A full events listing is available if required, a summary of which is as follows:

**Depth of Burial:** The pipe position and depth of burial was not able to be determined

**Exposures:** No exposures were detected.

**Freespans:** No freespans were detected.

**Rock Dumps:** 20 areas of rock dump intervention were detected, with a total length of 243m. The longest was 76m.

**Other:** One protective structure was detected at KP 3.926.

### 5.1.5 PL679 Welland Umbilical

PL679 was surveyed on both sides over a distance (based on KP range) of 6.730km. Complete sidescan and multibeam coverage of the route was achieved. A full events listing is available if required, a summary of which is as follows:



**Depth of Burial:** The umbilical positions and depth of burial was not able to be determined

**Exposures:** No exposures were detected.

**Freespans:** No freespans were detected.

**Rock Dumps:** No rock dumps were detected.

**Other:** No other events were detected.

#### 5.1.6 PL680 Welland Umbilical

PL680 was surveyed on both sides over a distance (based on KP range) of 8.600km. Complete sidescan and multibeam coverage of the route was achieved. A full events listing is available if required, a summary of which is as follows:

**Depth of Burial:** The umbilical positions and depth of burial was not able to be determined

**Exposures:** No exposures were detected.

**Freespans:** No freespans were detected.

**Rock Dumps:** No rock dumps were detected.

**Other:** One boulder was detected at KP 4.611.

#### 5.1.7 PL681 Welland Umbilical

PL681 was surveyed on both sides over a distance (based on KP range) of 4.745km. Complete sidescan and multibeam coverage of the route was achieved. A full events listing is available if required, a summary of which is as follows:

**Depth of Burial:** The umbilical positions and depth of burial was not able to be determined

**Exposures:** No exposures were detected.

**Freespans:** No freespans were detected.

**Rock Dumps:** One rock dump of 5m was detected at KP 0.112.

**Other:** One item of hard debris was detected at KP 1.554. Three items of unspecified debris were detected at KPs 1.664, 1.676 and 1.712.



# WELLAND PIPELINE INFRASTRUCTURE BURIAL ANALYSIS

- 12 -

## Appendix A - Welland 16" PL674 Export Line Historic Burial Comparison

KP	Depth (09)	1991 DoB	1994 DoB	2006 DoB	2009 DoB	
0.500	36.400		1.0	0.7	1.6	Interpolated
1.000	36.200	1.0	0.8	1.2	1.6	
1.500	34.700		1.5	0.8	1.5	
1.775			0.3	0.0	0.0	Exposure of MEG Line
2.000	34.600	1.0	0.9	1.4	1.5	
2.500	34.400		0.8	0.8	1.5	
3.000	34.800		0.5	0.8	1.0	
3.500	35.200		0.7	0.7	1.4	
4.000	35.600	0.5	1.0	1.0	1.2	
4.500	35.800		0.7	0.9	1.2	
5.000	36.000	0.5	0.9	0.9	1.2	
5.500	35.600		0.9	0.8	1.4	
6.000	35.300	0.5	0.6	0.9	1.3	Interpolated
6.500	35.200		0.3	0.9	1.3	Interpolated
7.000	36.000	1.0	1.0	1.0	1.3	Interpolated
7.500	35.600		0.8	0.7	1.2	
8.000	35.400	1.0	1.0	1.0	1.1	Interpolated
8.500	34.800		1.1	1.1	1.1	Interpolated
9.000	33.000		1.5	1.3	1.1	Interpolated
9.500	33.800		0.5	0.8	1.0	
10.000	33.700	1.0	0.7	0.9	1.0	
10.500	33.700		0.8	0.8	0.9	
11.000	33.300	1.0	0.8	0.8	1.4	
11.500	33.500		1.2	0.8	1.0	
12.000	33.500		0.7	1.0	0.8	Interpolated
12.500	33.800		1.0	0.9	0.6	
13.000	33.500	0.5	0.9	0.8	1.2	
13.500	33.500		0.8	0.8	1.4	
14.000	33.000		0.8	0.7	1.5	
14.500	33.100		0.6	1.0	0.8	
15.000	32.800		0.9	1.3	1.0	Interpolated
15.500	34.000		1.3	1.3	1.1	
16.000	34.200	1.0	0.8	1.0	1.0	
16.500	33.000		0.8	1.0	1.3	Interpolated
17.000	31.500		0.5	1.0	1.6	

