3.0 TYPE WELL CATEGORIES

The following five Type Wells were found to differentiate drilling performance:

Shelf Normal Pressure

Shallow water Jack-up drilled wells with normal pressure, low density drilling fluids

Shelf Overpressure

Shallow water Jack-up drilled wells with overpressured intervals requiring higher density drilling fluids (generally 1,500 to 1,800 kg/m^3)

Shelf Geopressure

Shallow water Jack-up drilled wells with overpressured intervals requiring higher density drilling fluids (2,000 kg/m^3 or greater)

Deep Water Low Complexity

Deeper water (generally 1,000 to 2,000 meters) requiring a floating drilling rig. Well Complexity is defined as Low based on the need to run no more than two intermediate casing strings.

Deep Water High Complexity

Deeper water (generally 1,000 to 2,000 meters) requiring a floating drilling rig. Well Complexity is defined as High based on the need to run three or more intermediate casing strings. While not entirely consistent, the number of casing strings is determined by overpressure and well control challenges.

Table 2 – Type Well Categories

Well Name		Total Depth (mMDRT)	Water Depth (m)
Shelf Normal Pressure			
Dominion	J-14	3700	29.5
Queensland	M-88	4443	38
Panuke	F-09	3822	42
Margaree	F-70	3677	42.5
Marquis	L-35	4552	48
MarCoh	D-41	3625	43.4
Panuke	M-79	4598	43.5
Musquodoboit	E-23	3818	47.3
Shelf Overpressure			
Southampton	A-25	5058	47
Adamant	N-97	4183	16.9
Emma	N-03	4600	50.6
Mariner	I-85	5615	55.5
Cree	I-34	3945	57
Shelf Geopressure			
Onondaga	B-84	5019	59.7
Deep Water Low Complexity			
Torbrook	C-15	3606	1674.5
Annapolis	B-24	3503	1737
Balvenie	B-79	4763	1803
Deep Water High Complexity			
Crimson	F-81	6676	2091.5
Weymouth	A-45	6520	1689.7
Newburn	H-23	6070	977
Annapolis	G-24	6182	1711

Table 2 lists the sorted wells based on the above descriptions. Side track wells were eliminated from this grouping because they could not be directly compared to the “complete” wells. Also, note the well depths have been adjusted to actual drill depths versus planned depths.

Individual well performance is presented in the Appendix in the Type Well sections.

The wells were drilled by a number of operators using different drilling rigs as shown below:

Wells Drilled by Operator						
Operator	SNP	SOP	SGP	DWL	DWH	TOTAL
Encana/PanCdn	8	1		1	1	11
Mobil		2				2
Exxon		1				1
Imperial				1		1
Shell			1			1
Cdn Superior		1				1
Marathon				1	2	3
Chevron					1	1
TOTAL	8	5	1	3	4	21

Wells Drilled by Rig						
Rig	SNP	SOP	SGP	DWL	DWH	TOTAL
RG-3	1					1
RG-4	1					1
RG-5	5	3				8
RG-6	1					1
Galaxy 2		2	1			3
Erik Raude				2	1	3
W Navion				1	1	2
DW Millenium					1	1
DW Pathfinder					1	1
TOTAL	**8**	**5**	**1**	**3**	**4**	**21**

As can be seen, EnCana (or its predecessor company PanCanadian) drilled about half of the wells, with seven other operators responsible for the remainder. Of these, only two companies, Marathon (3 wells) and Mobil (2 wells), drilled multiple wells.

The most active drilling rig during this period was the harsh environment jack-up Rowan Gorilla 5 which drilled a total of 8 wells (6 for of which were for EnCana) on the shelf. A number of other rigs also drilled multiple wells, including the Galaxy 2 jack-up (3 wells), the Erik Raude fifth generation semi (3 wells), and the West Navion deepwater drillship (2 wells). A summary of rig utilization by operator is as follows:

Wells Drilled by Operator										
Rig Type	Jack-up					Semi				
Operator	RG-3	RG-4	RG-5	RG-6	Galaxy 2	E Raude	W Navion	Millenium	Pathfinder	TOTAL
Encana/PanCdn	1	1	6	1		2				11
Mobil					2					2
Exxon			1							1
Imperial						1				1
Shell					1					1
Cdn Superior			1							1
Marathon							2		1	3
Chevron								1		1
TOTAL	**1**	**1**	**8**	**1**	**3**	**3**	**2**	**1**	**1**	**21**

An overview of the key performance metrics for the wells is provided in Appendix 1–Table 1. The key metrics by well category are summarized as follows.

Well Category	Well Depth (m)			Well Time (Days spud-TD)			Effective ROP (m/day)			% NPT			No of Wait On Weather Days		
	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
SNP	3625	4598	4030	43	78	55	56	97	74	3%	21%	11%	0	3.6	1.2
SOP	3945	5408	4744	62	93	78	47	76	61	8%	31%	17%	0	4.7	1.4
SGP		5019			153			32			33%			0	
DWL	3496	4750	3949	45	89	62	20	57	40	24%	72%	54%	0	4.5	1.5
DWH	6070	6676	6362	63	195	113	25	73	50	14%	37%	27%	0	0.6	0.2
All Wells	3496	6676	4669	43	195	77	20	97	59	3%	72%	28%	0	4.7	1.0

Spud to TD time and effective Rates of Penetration (ROP) were calculated to compare drilling performance. As well complexity increased, drilling times also increased. ROP also supports this trend with the one exception being Deep Water Low complexity (DWL) primarily due to one well with extensive problem time – Annapolis B-24. Non-productive time comparison demonstrates the DWL category anomalous NPT percent for DWL wells at 54%. This is due to Annapolis B-24 having 72% NPT.

While drilling performance is a key factor affecting well cost, it is not the only factor. Regionally, local day rates for rigs and support services are influenced by availability and local competition as well as the region's operating expense environment. There are significant day rate variations between different areas. For example the IHS QUE$TOR cost estimation system currently (2Q 2011) indicates the following fully supported day rates for East Coast Canada, UK North Sea, Norway North Sea and the Gulf of Mexico:

Rig Type	East Coast Canada	UK Northern North Sea	Norway North Sea	Gulf of Mexico
Jack-up				
Rig Supported Day Rate (US$K)	$298	$185	$229	$95
Ratio to Canada	1	0.62	1.14	0.33
5th Generation Semi				
Rig Supported Day Rate (US$K)	$536	$534	$586	$540
Ratio to Canada	1	1	1.09	1.01

Table 3 compares the type well analyzed factors of average well depth, water depth, well time and technical limit time. Note the Geopressure type well is based on a single well Onondaga B-84.

Table 3 Type Well Group Drilling Performance Comparison

	Shelf Wells			Deep Water Wells	
	Normal Pressure	Overpressure	Geopressure	Low Complexity	High Complexity
Average Depth (mMDRT)	4035	4754	5020	3958	6366
Average Water Depth (m)	42	45	60	1738	1617
Average Well Time (days)	60	101	180	70	145
Technical Limit Time to TD (days)	32	57		36	79

Non-productive time can be an indication of the challenges of the harsh environment and/or due to the well itself. The analysis as provided in the End of Well Reports was accepted as reported. The category NPT percent was arithmetically averaged to generate an expected Type well NPT percent.

Table 4 – Type Well NPT presents the individual well % NPT and the Average % NPT for the Type wells.

NPT increases with overpressure and well complexity if Annapolis B-24 is removed from the Deep Water Low Complexity category. The 75% was due to rig repairs and a well control incident that resulted in well abandonment without testing the well. This well was re-drilled, Annapolis G-24, where the re-design then fit into the High Complexity well category.

The level of NPT that is commonly expected, and budgeted for, in an offshore exploration well is often between 25 and 35%. Outside of the deep water low complexity wells, the Nova Scotia wells are, on average, at or below the expected NPT. The Nova Scotia wells are consistent with this range or lower, particularly for the Shelf wells.

The East Coast of Canada is a harsh weather operating environment which raises the suspicion that the floating rigs would be affected by the weather more so than the jack-ups. Extracting the Waiting On Weather (WOW) time for the well types, finds the floating operations were similar to the Shelf wells in duration averaging approximately 1 ¼ days.

Extracting the Waiting On Weather (WOW) time for the well types, suggests the floating operations were similar to the Shelf wells in duration averaging approximately 1¼ days. Because of this equality, a distinction of rig type could not be made. This low level of WOW is attributed to the improved marine capability of rigs and support vessels.

Table 4 – Type Well NPT

Well Name		% NPT
Shelf Normal Pressure		
Dominion	J-14	21%
Queensland	M-88	6%
Panuke	F-09	8%
Margaree	F-70	12%
Marquis	L-35	3%
MarCoh	D-41	9%
Panuke	M-79	18%
Musquodoboit	E-23	11%
	Average	11%
Shelf Overpressure		
Southampton	A-25	31%
Adamant	N-97	16%
Emma	N-03	8%
Mariner	I-85	19%
Cree	I-34	13%
	Average	17%
Shelf Geopressure		
Onondaga	B-84	33%
Deep Water Low Complexity		
Torbrook	C-15	66%
Annapolis	B-24	72%
Balvenie	B-79	24%
	Average	54%
	Excluding B-24	45%
Deep Water High Complexity		
Crimson	F-81	14%
Weymouth	A-45	33%
Newburn	H-23	23%
Annapolis	G-24	37%
	Average	27%

On average, WOW time is similar in all well types. Because Deep Water wells had higher NPT time, WOW is a lower percentage of NPT where it would normally be expected to have higher impact (Table 5).

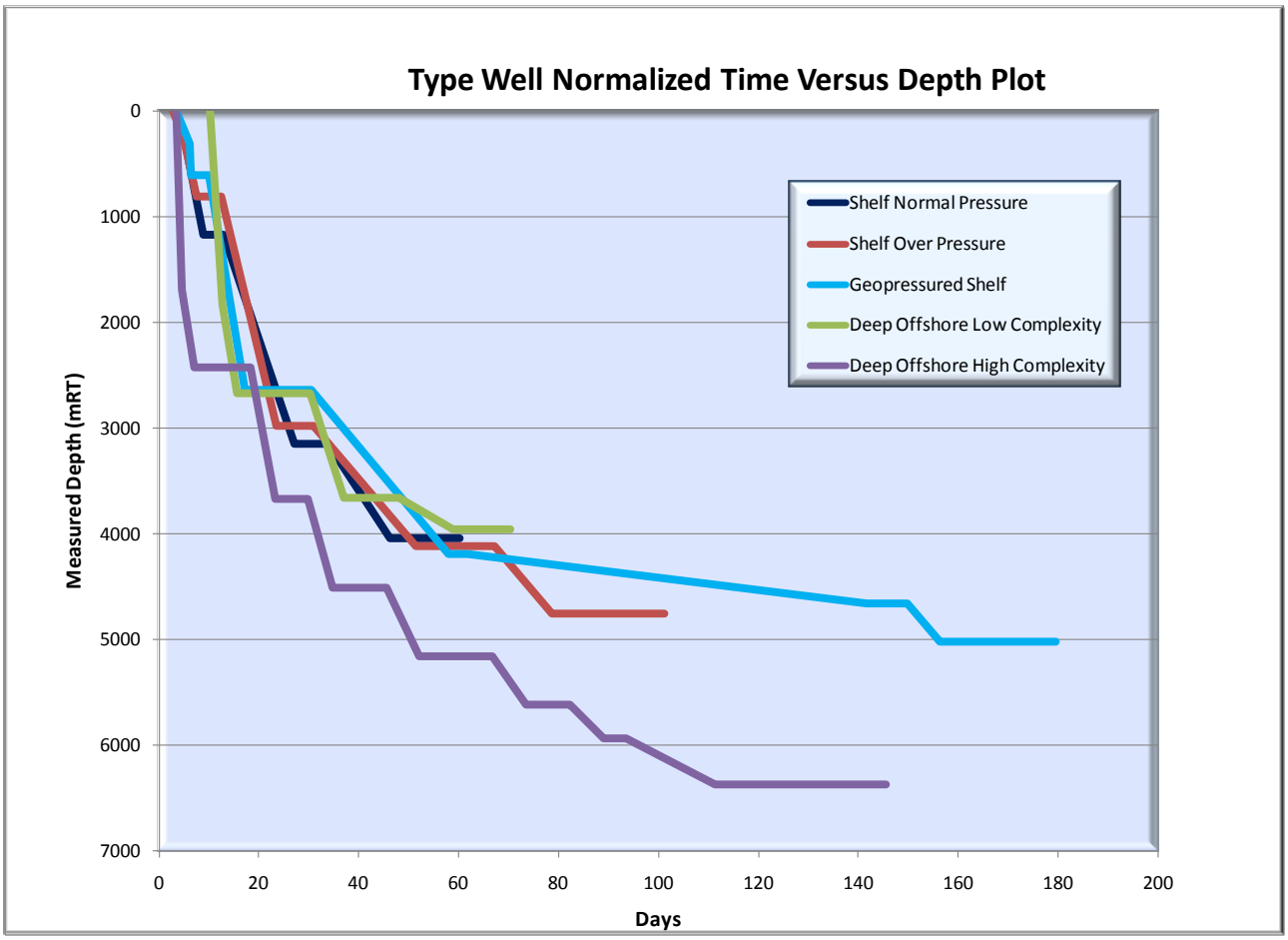
The Harsh Weather Environment was, therefore, not on average a significant factor in the Nova Scotia wells.

Table 5 – Wait on Weather / NPT

Well Name	WOW Days	% NPT
Shelf Normal Pressure	1.2	24.8
Shelf Overpressure	1.4	6.8
Shelf Geopressure	0.0	0
Deep Water Low Complexity	1.5	3
Deep Water High Complexity	0.2	0.3

3.1 Cost Analysis

The cost of the Nova Scotia wells given similar drilling times to other regions can be significantly different because of the local rig and services cost environment. To compare regions, a time consistent cost data basis is required. Normalized well times were developed for the five type wells and presented in the following time versus depth plot.



IHS QUE$TOR™, an industry-leading software tool for capital and operating cost-estimation, was used to estimate the costs of the Nova Scotia type wells. QUE$TOR maintains an up to date cost data base and

a drilling performance data base to estimate drilling times and costs. While it will provide a time estimate for a selected well depth, the times were over ridden by the type well normalized times. The following table presents the current expected costs for the five type wells.

Table 6 – Type Well Cost Analysis

Type Well	Shelf Normal Pressure	Shelf Over-pressure	Shelf Geo-pressure	Deep Water Low Complexity	Deep Water High Complexity
Days	60	101	180	70	145
Cost (MM Can$)	$35	$52	$83	$66	$121
Rig Type	Jack-Up			5th Generation Semi	

While drilling performance is a main factor affecting well cost, it is not the only factor. Regionally, local day rates for rigs and support services are influence by availability and local competition as well as the regions operating expense environment. Day rates for a jack-up and a 5th generation semi-submersible drilling rig were extracted using QUE$TOR for:

- East Coast Canada
- UK North Sea
- Norway North Sea
- Gulf of Mexico

The Gulf of Mexico was included, not as a harsh environment analog but as the low cost comparator. The following two tables present the individual rig and support services rates for the 4 regions.

Table 7 – Support Service Rates – Jack-Up

INSTALLATION	East Coast Canada	N. North Sea (U.K.)		N. North Sea (Norway)		Gulf of Mexico	
Jack-Up	**UNIT RATE US$**	**UNIT RATE US$**	**Ratio to Canada**	**UNIT RATE US$**	**Ratio to Canada**	**UNIT RATE US$**	**Ratio to Canada**
Jack up bare rig charter	$217,099	$108,527	0.500	$255,822	1.178	$31,000	0.143
Jack up drill crew	$25,360	$26,977	1.064	$28,436	1.121	$20,900	0.824
Jack up marine crew	$8,357	$8,682	1.039	$9,282	1.111	$7,300	0.874
Jack up consumables	$17,867	$17,829	0.998	$17,875	1.000	$17,900	1.002
Jack up helicopter services	$5,572	$5,581	1.002	$6,396	1.148	$5,500	0.987
Jack up supply boats	$16,330	$11,008	0.674	$13,939	0.854	$9,700	0.594
Jack up supply base	$7,012	$6,202	0.884	$7,051	1.006	$6,200	0.884
Rig Supported Day Rate	**$297,597**	**$184,806**	**0.621**	**$338,801**	**1.138**	**$98,500**	**0.331**

Unfortunately QUE$TOR does not differentiate Jack-up types. The Jack-ups used on the East Coast of Canada and the Norwegian North Sea are likely equipped for the harsh climate and will demand higher day rates. Coupling the rig differences and the high volume markets in the UK and the GoM, the day rates are significantly higher on the East Coast Canada and the Norwegian North Sea.

Table 8 – Support Service Rates – 5th Generation Semi

INSTALLATION	East Coast Canada	N. North Sea (U.K.)		N. North Sea (Norway)		Gulf of Mexico	
5th Generation Semi	**UNIT RATE US$**	**UNIT RATE US$**	**Ratio to Canada**	**UNIT RATE US$**	**Ratio to Canada**	**UNIT RATE US$**	**Ratio to Canada**
Floating bare rig charter	$440,922	$441,860	1.00	$487,045	1.10	$461,000	1.05
Floating drill crew	$28,722	$30,543	1.06	$32,224	1.12	$24,200	0.84
Floating marine crew	$11,912	$12,403	1.04	$13,250	1.11	$10,100	0.85
Floating consumables	$21,422	$23,876	1.11	$23,122	1.08	$21,400	1.00
Floating helicopter services	$5,572	$5,581	1.00	$6,396	1.15	$5,500	0.99
Floating supply boats	$20,653	$13,953	0.68	$17,637	0.85	$12,250	0.59
Floating supply base	$7,012	$6,202	0.88	$7,051	1.01	$6,200	0.88
Rig Supported Day Rate	**$536,215**	**$534,418**	**1.00**	**$586,725**	**1.09**	**$540,650**	**1.01**

The limited availability of 5th Generation semi`s, the rig that is preferred for work in harsh environments, is on par on the East Coast with the UK and the GoM, while the Norwegian North Sea is ~ 10% higher.

This two rig type comparison demonstrates the significance of rig availability and the market at the time the well is drilled. A larger well program and rig fleet than has been the norm in the past would certainly reduce rig rates and well costs significantly.

APPENDIX