Q. Hydro uses a Study Discount Rate of 9.60% in its economic evaluations of alternatives for the VHF Mobile Radio Replacement. By comparison, the evaluation of options to refurbish stack steel liner #2 at Holyrood used a 9% discount rate and the evaluation of the Holyrood distributed control system appeared to use an 8.5% discount rate.

Please justify the appropriateness of the 9.60% Study Discount Rate for the VHF Mobile Radio Replacement.

A. The 9.6% discount rate was used in original estimates and maintained for consistency. This rate of 9.6% was established when the original business case was completed in 2001. As a sensitivity the NPV calculations were recalculated at 8.5%, the current discount rate, and are attached (Appendix A.1, A.2, A.3, A.4, A.5, A.6 and A.7). Below are two tables summarizing the NPV analysis using the revised interest rates as well as the correction of the direct cash flows during construction. As is evident, the change in the rate does not significantly change the calculations or the outcome.

Table 1 - Switch Only Replacement

Option	**NPV Original Submission (9.6%)**	**NPV with corrections as per question NP-5 (9.6%)**	**NPV Calculated with 8.5% discount rate**
Mobile Trunked Radio System (MRS)	$10,827,896	$10,801,619	$11,188,642
Switch Replacement in 2004 with MRS in 2008	$12,008,866	$11,987,572	$12,513,531
Switch Replacement in 2004 with MRS in 2011	$12,229,819	$12,212,564	$12,888,784

Table 2 - Conventional Vs. Trunked Mobile Radio System			
	Option	**NPV Hydro Sole User**	**NPV Hydro & WS&T**
NPV Original Submission (9.6%)	Trunked	$10,827,896	$5,413,948
	Conventional	$10,597,828	$5,298,914
	Difference	$230,068	$115,034
NPV with corrections as per question NP-5 (9.6%)	Trunked	$10,801,619	$5,400,809
	Conventional	$10,597,828	$5,298,914
	Difference	$203,790	$101,895
NPV Calculated with 8.5% discount rate	Trunked	$11,188,672	$5,594,336
	Conventional	$10,918,724	$5,459,362
	Difference	$269,948	$134,974

VHF Mobile Radio Replacement

Switch Replacement in 2004 (Option 1)

Study Discount Rate: 8.50%

Year	Switch Replacement Capital Costs	Switch Replacement O&M Costs	Switch Replacement Total	Switch Replacement CPW to 2004	Trunked Radio System Capital Costs	Trunked Radio System O&M Costs	Trunked Radio System Total	Trunked Radio System CPW to 2004	NPV Comparison (Alt. 2 - Alt. 1) CPW to 2004
2004	1,444,842	551,250	1,996,092	1,996,092	2,700,000		2,700,000	2,700,000	$ 703,908
2005		633,938	633,938	2,580,366	3,000,000	689,250	3,689,250	6,100,230	$ 3,519,865
2006		729,028	729,028	3,199,642		689,250	689,250	6,685,717	$ 3,486,075
2007	2,880,457	838,382	3,718,840	6,111,152		689,250	689,250	7,225,337	$ 1,114,185
2008	3,200,508	964,140	4,164,648	9,116,255		689,250	689,250	7,722,682	$ (1,393,573)
2009	(103,322)	689,250	585,928	9,505,924		689,250	689,250	8,181,065	$ (1,324,859)
2010		689,250	689,250	9,928,396		689,250	689,250	8,603,537	$ (1,324,859)
2011		689,250	689,250	10,317,772		689,250	689,250	8,992,912	$ (1,324,859)
2012		689,250	689,250	10,676,643		689,250	689,250	9,351,784	$ (1,324,859)
2013		689,250	689,250	11,007,400		689,250	689,250	9,682,541	$ (1,324,859)
2014		689,250	689,250	11,312,245		689,250	689,250	9,987,386	$ (1,324,859)
2015		689,250	689,250	11,593,209		689,250	689,250	10,268,349	$ (1,324,859)
2016		689,250	689,250	11,852,161		689,250	689,250	10,527,302	$ (1,324,859)
2017		689,250	689,250	12,090,827		689,250	689,250	10,765,968	$ (1,324,859)
2018		689,250	689,250	12,310,795		689,250	689,250	10,985,936	$ (1,324,859)
2019		689,250	689,250	12,513,531		689,250	689,250	11,188,672	$ (1,324,859)

Notes:

1. Summary of Capital Costs for Switch Replacement:

2004	The cost of switch replacement was calculated based on the 1997 estimate of $1,269,200. Using an average inflation rate of 2.16% per year, the cost of switch replacement was estimated at $1,444,842 in 2004.
2007-2008	The useful life of the existing system would be extended by 5 years with the replacement of the central switch. A new system would still need to be installed and operational in 2008. The cost of completely replacing the existing system was estimated using the Trunked Radio System estimate, assuming an average inflation rate of 2.18%.
2009	It is estimated that the central switch would have a salvageable value of $103,322 (using a declining balance depreciation calculation at 30% per year).

2. Summary of O&M Costs for Switch Replacement

2004-2008	Due to the increasing age of the current system, the O&M costs were assumed to be the same as the Conventional Radio System in the first year and then increasing 15% per year for each subsequent year that the system is in service.

VHF Mobile Radio Replacement
Switch Replacement in 2004 (Option 2)

Study Discount Rate: 8.50%

	Switch Replacement				Trunked Radio System				NPV Comparison (Alt. 2 - Alt. 1)
Year	Capital Costs	O&M Costs	Total	CPW to 2004	Capital Costs	O&M Costs	Total	CPW to 2004	CPW to 2004
2004	1,444,842	551,250	1,996,092	1,996,092	2,700,000		2,700,000	2,700,000	$ 703,908
2005		633,938	633,938	2,580,366	3,000,000	689,250	3,689,250	6,100,230	$ 3,519,865
2006		729,028	729,028	3,199,642		689,250	689,250	6,685,717	$ 3,486,075
2007		838,382	838,382	3,856,019		689,250	689,250	7,225,337	$ 3,369,318
2008		964,140	964,140	4,551,717		689,250	689,250	7,722,682	$ 3,170,965
2009		1,108,761	1,108,761	5,289,093		689,250	689,250	8,181,065	$ 2,891,971
2010	3,072,976	1,275,075	4,348,051	7,954,210		689,250	689,250	8,603,537	$ 649,327
2011	3,414,418	1,466,336	4,880,754	10,711,476		689,250	689,250	8,992,912	$ (1,718,564)
2012	(35,439)	689,250	653,811	11,051,895		689,250	689,250	9,351,784	$ (1,700,112)
2013		689,250	689,250	11,382,653		689,250	689,250	9,682,541	$ (1,700,112)
2014		689,250	689,250	11,687,498		689,250	689,250	9,987,386	$ (1,700,112)
2015		689,250	689,250	11,968,461		689,250	689,250	10,268,349	$ (1,700,112)
2016		689,250	689,250	12,227,413		689,250	689,250	10,527,302	$ (1,700,112)
2017		689,250	689,250	12,466,079		689,250	689,250	10,765,968	$ (1,700,112)
2018		689,250	689,250	12,686,048		689,250	689,250	10,985,936	$ (1,700,112)
2019		689,250	689,250	12,888,784		689,250	689,250	11,188,672	$ (1,700,112)

Notes:

1. Summary of Capital Costs for Switch Replacement:

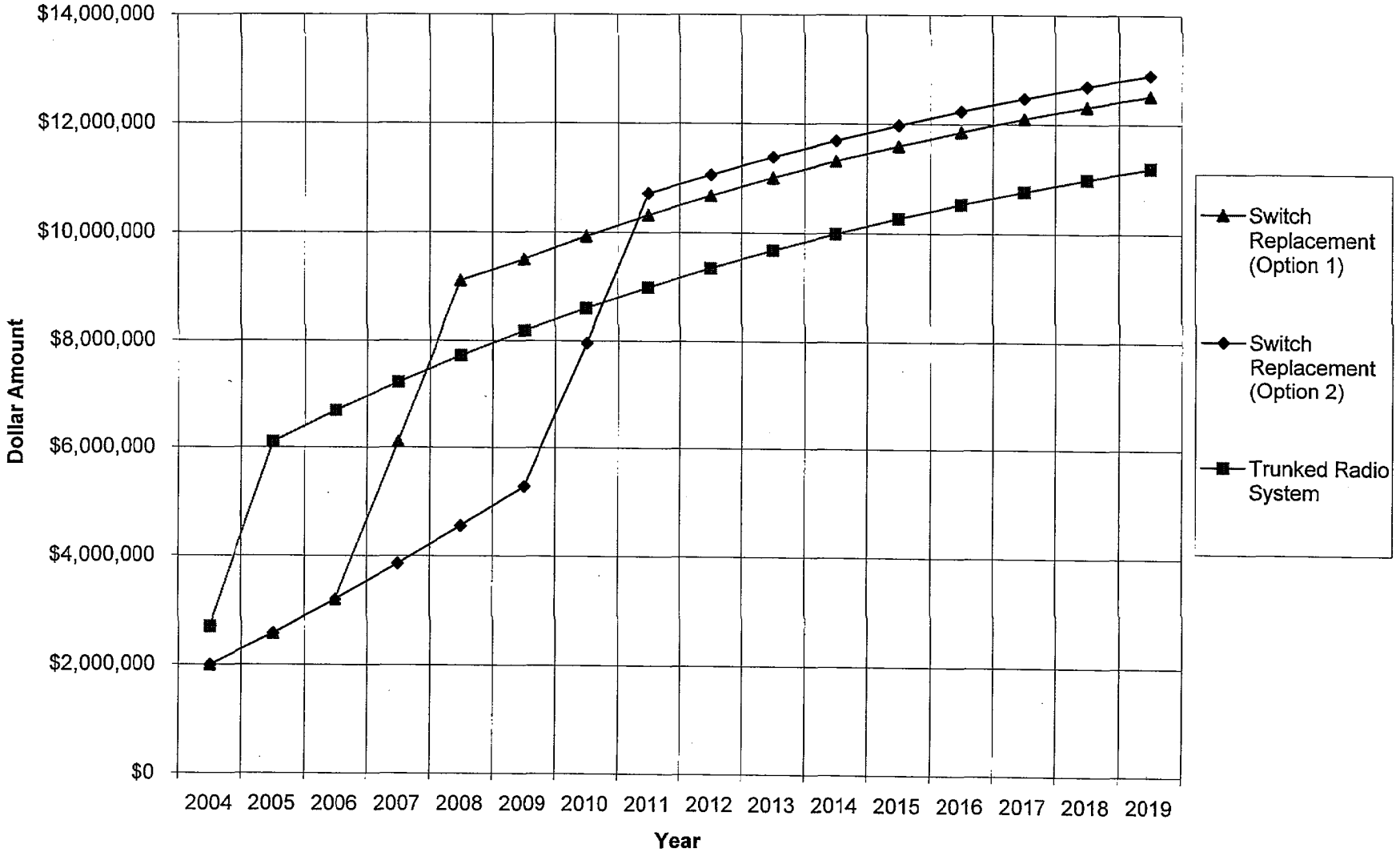
2004	The cost of switch replacement was calculated based on the 1997 estimate of $1,269,200. Using an average inflation rate of 2.16% per year, the cost of switch replacement was estimated at $1,444,842 in 2004.
2010-2011	The useful life of the existing system would be extended by 8 years with the replacement of the central switch. A new system would still need to be installed and operational in 2011. The cost of completely replacing the existing system was estimated using the Trunked Radio System estimate, assuming an average inflation rate of 2.18%.
2012	It is estimated that the central switch would have a salvageable value of $35,439 (using a declining balance depreciation calculation at 30% per year).

2. Summary of O&M Costs for Switch Replacement

2004-2011	Due to the increasing age of the current system, the O&M costs were assumed to be the same as the Conventional Radio System in the first year and then increasing 15% per year for each subsequent year that the system is in service.

APPENDIX A.3

Comparison of VHF Mobile Radio Replacement Options



VHF Mobile Radio Replacement (Hydro Sole User)

Study Discount Rate: 8.50%

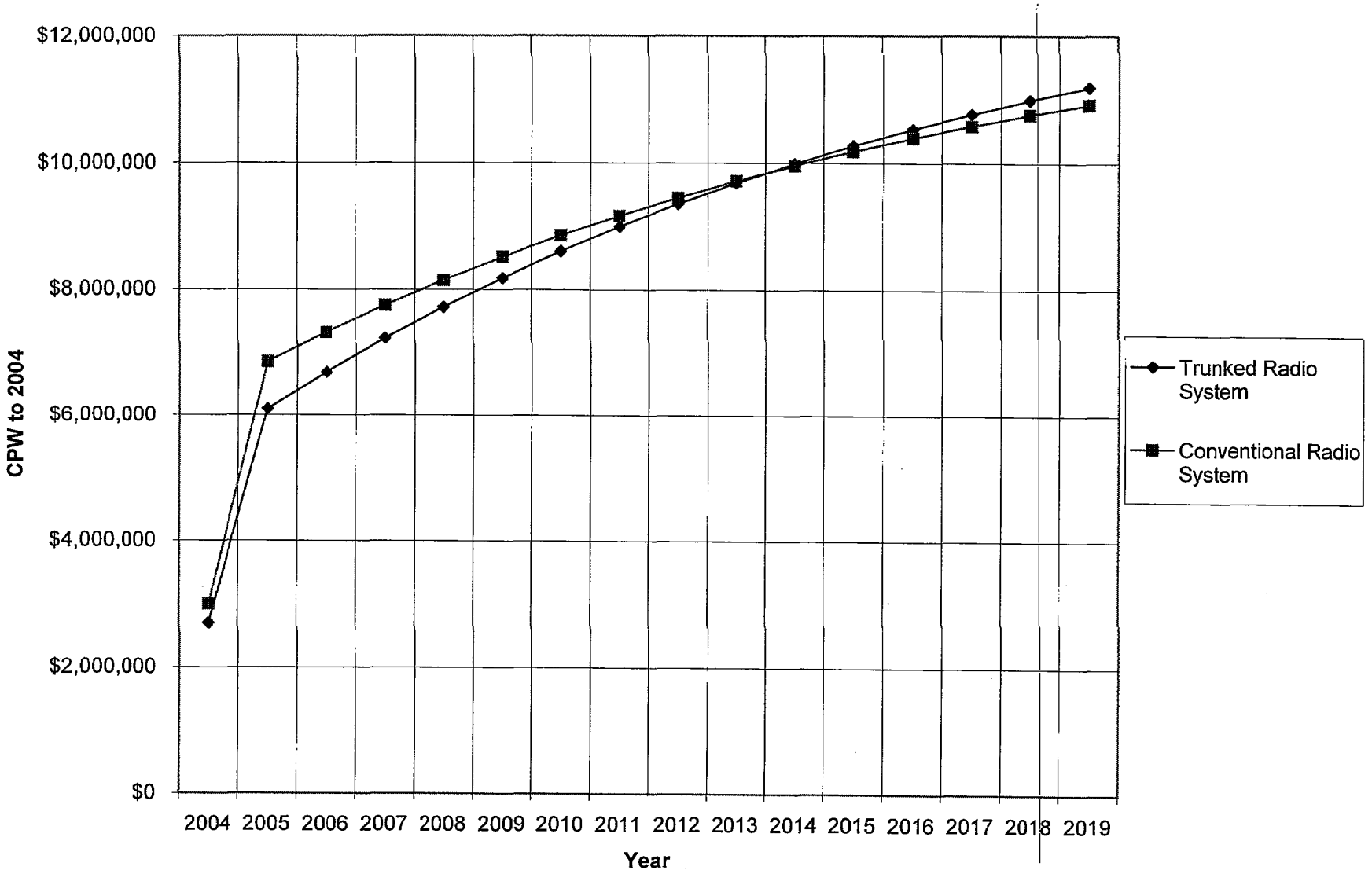
	Trunked Radio System				Conventional Radio System				NPV Comparison (Alt. 2 - Alt. 1)	
Year	Capital Costs	O&M Costs	Total	CPW to 2004	Capital Costs	O&M Costs	Total	CPW to 2004		CPW to 2004
2004	2,700,000		2,700,000	2,700,000	3,000,000		3,000,000	3,000,000	$	300,000
2005	3,000,000	689,250	3,689,250	6,100,230	3,625,000	551,250	4,176,250	6,849,078	$	748,848
2006		689,250	689,250	6,685,717		551,250	551,250	7,317,341	$	631,623
2007		689,250	689,250	7,225,337		551,250	551,250	7,748,919	$	523,582
2008		689,250	689,250	7,722,682		551,250	551,250	8,146,686	$	424,005
2009		689,250	689,250	8,181,065		551,250	551,250	8,513,293	$	332,228
2010		689,250	689,250	8,603,537		551,250	551,250	8,851,179	$	247,642
2011		689,250	689,250	8,992,912		551,250	551,250	9,162,594	$	169,682
2012		689,250	689,250	9,351,784		551,250	551,250	9,449,613	$	97,830
2013		689,250	689,250	9,682,541		551,250	551,250	9,714,147	$	31,606
2014		689,250	689,250	9,987,386		551,250	551,250	9,957,957	$	(29,429)
2015		689,250	689,250	10,268,349		551,250	551,250	10,182,666	$	(85,683)
2016		689,250	689,250	10,527,302		551,250	551,250	10,389,772	$	(137,530)
2017		689,250	689,250	10,765,968		551,250	551,250	10,580,653	$	(185,315)
2018		689,250	689,250	10,985,936		551,250	551,250	10,756,580	$	(229,356)
2019		689,250	689,250	11,188,672		551,250	551,250	10,918,724	$	(269,948)

Notes:

1. Trunked Radio System estimate based on figures used in Capital Job cost. Conventional Radio System estimate based on typical costs for a system of this nature.
2. Operations and Maintenance costs are assumed to be fixed for a 15 year contract with a third party supplier.
3. Maintenance costs for both systems are assumed to be identical.
4. 15 year life span of system assumed.
5. It is assumed that Hydro will be the sole user.

APPENDIX A.5

VHF Mobile Radio Replacemnt (Hydro Sole User)



VHF Mobile Radio Replacement (With WST Involvement)

Study Discount Rate: 8.50%

	Trunked Radio System				Conventional Radio System				NPV Comparison (Alt. 2 - Alt. 1)	
Year	Capital Costs	O&M Costs	Total	CPW to 2004	Capital Costs	O&M Costs	Total	CPW to 2004		CPW to 2004
2004	1,350,000		1,350,000	1,350,000	1,500,000		1,500,000	1,500,000	$	150,000
2005	1,500,000	344,625	1,844,625	3,050,115	1,812,500	275,625	2,088,125	3,424,539	$	374,424
2006		344,625	344,625	3,342,859		275,625	275,625	3,658,670	$	315,812
2007		344,625	344,625	3,612,668		275,625	275,625	3,874,459	$	261,791
2008		344,625	344,625	3,861,341		275,625	275,625	4,073,343	$	212,002
2009		344,625	344,625	4,090,532		275,625	275,625	4,256,646	$	166,114
2010		344,625	344,625	4,301,768		275,625	275,625	4,425,589	$	123,821
2011		344,625	344,625	4,496,456		275,625	275,625	4,581,297	$	84,841
2012		344,625	344,625	4,675,892		275,625	275,625	4,724,807	$	48,915
2013		344,625	344,625	4,841,270		275,625	275,625	4,857,074	$	15,803
2014		344,625	344,625	4,993,693		275,625	275,625	4,978,978	$	(14,715)
2015		344,625	344,625	5,134,175		275,625	275,625	5,091,333	$	(42,841)
2016		344,625	344,625	5,263,651		275,625	275,625	5,194,886	$	(68,765)
2017		344,625	344,625	5,382,984		275,625	275,625	5,290,326	$	(92,657)
2018		344,625	344,625	5,492,968		275,625	275,625	5,378,290	$	(114,678)
2019		344,625	344,625	5,594,336		275,625	275,625	5,459,362	$	(134,974)

Notes:

1. Trunked Radio System estimate based on figures used in Capital Job cost. Conventional Radio System estimate based on typical costs for a system of this nature.
2. Operations and Maintenance costs are assumed to be fixed for a 15 year contract with a third party supplier.
3. Maintenance costs for both systems are assumed to be identical.
4. 15 year life span of system assumed.
5. It is assumed that the Provincial Department of Works, Services, and Transportation (WST) contributes 50% of the costs of the system.

APPENDIX A.7

VHF Mobile Radio Replacemnt (With WST Involvement)