

Appendix 1. Changes in the monitoring programme of hydrology and hydrogeology (added parameters in bold)

Year	Monitored parameters	Changes in the monitoring programme	Reports
1989-2002	Groundwater table level, sea water table level*, hydraulic head, precipitation*, snow depth and water content*, soil frost*	Baseline measurements and observations	
2003	Groundwater table level, sea water table level*, hydraulic head, precipitation*, snow depth and water content*, soil frost*	Monitoring programme was set for years 2004-2011 (during construction of ONKALO).	WR 2003-02, <i>Baseline Conditions at Olkiluoto</i> ; WR 2003-05, <i>Programme of Monitoring at Olkiluoto during construction and operation of the ONKALO</i>
2004	Groundwater table level, sea water table level*, hydraulic head, <b>flow conditions in open drillholes, leakage of groundwater into tunnels, water balance in the tunnels, runoff*</b> , precipitation*, snow depth and water content*, <b>infiltration*</b> , soil frost*	ONKALO construction began. Posiva flow log (PFL DIFF) measurements, inflow measurements in ONKALO, runoff and infiltration measurements were added to the programme as planned in report WR 2003-05.	
2005	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, <b>hydraulic conductivity, salinity (in situ EC)</b> , leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*	HTU-measurements (hydraulic conductivity) were added to the monitoring programme. Also, measurements of salinity (in situ EC) with PFL were added to the monitoring programme (planned in WR 2003-05).	WR 2005-28, <i>Results of Monitoring at Olkiluoto in 2003-2004 - Hydrology</i>

2006	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, hydraulic conductivity, salinity (in situ EC), leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*	Extensive multi-packer installation campaign was planned for years 2006-2007 because several experts were worried about hydrogeological disturbances caused by open drillholes.	WR 2006-54, Results of Monitoring at Olkiluoto in 2005 - Hydrology
2007	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, hydraulic conductivity, salinity (in situ EC), leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*	Multi-packer installation campaign was continued for years 2007-2008.	WR 2007-50, Results of Monitoring at Olkiluoto in 2006 - Hydrology
2008	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, hydraulic conductivity, salinity (in situ EC), leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*	Extensive multi-packer installation campaign was performed in 2006-2008. Emphasis changed during these years from monitoring of the flow conditions in open drillholes to the pressure monitoring (hydraulic head) (discussed in WR 2009-43, p. 4). The extension of the pressure monitoring (GWMS) network enabled more effective monitoring of the immediate disturbances caused by ONKALO construction work, especially concerning highly conductive hydrogeological structures e.g. HZ20 (online monitoring).	WR 2008-23, Results of Monitoring at Olkiluoto in 2007 - Hydrology

2009	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, hydraulic conductivity, salinity (in situ EC), leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*		WR 2009-43, Results of Monitoring at Olkiluoto in 2008 - Hydrology
2010	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, hydraulic conductivity, salinity (in situ EC), leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*		WR 2010-43, Results of Monitoring at Olkiluoto in 2009 - Hydrology
2011	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, hydraulic conductivity, salinity (in situ EC), leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*	ONKALO inflow measurement interval was changed to once a month (before twice a month). Additional fracture EC measurements from the deeper parts of the bedrock were added to the PFL measurement programme. Flow conditions measurement in open drillholes in ONKALO were started. Monitoring programme was set for years 2012-2018.	WR 2011-43, Results of Monitoring at Olkiluoto in 2010 - Hydrology

2012	<p>Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, <b>transverse flow</b>, hydraulic conductivity, salinity (in situ EC), leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*</p>	<p>Updated monitoring programme was introduced. HTU tests in deep drillholes and hydraulic conductivity in seepage tubes of the dam were changed to every other year and number of slug tests in observation tubes was halved. Multi-packer installation campaign within the eastern area was started.</p>	<p>POSIVA 2012-01, <i>Monitoring at Olkiluoto - a Program for the Period Before Repository Operation</i> ; WR 2012-43, <i>Results of Monitoring at Olkiluoto in 2011 - Hydrology</i></p>
2013	<p>Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, transverse flow, hydraulic conductivity, salinity (in situ EC), leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*</p>	<p>Multi-packer installation campaign within the eastern area started in 2012 was completed. Process 'Evolution of groundwater salinity distribution' was removed from monitored processes in hydrology and hydrogeology.</p>	<p>WR 2013-43, <i>Results of Monitoring at Olkiluoto in 2012 - Hydrology and Hydrogeology</i></p>
2014	<p>Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, transverse flow, hydraulic conductivity, leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*</p>	<p>Multi-packers installed during 2012-2013 were removed due to technical problems. Parameter "salinity (in situ EC)" was removed from monitored parameters in hydrology and hydrogeology.</p>	<p>WR 2014-43, <i>Results of Monitoring at Olkiluoto in 2013 - Hydrology and Hydrogeology</i></p>

2015	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, transverse flow, hydraulic conductivity, leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*	Reinstallation of multi-packers removed in 2014 started.	WR 2015-43, Results of Monitoring at Olkiluoto in 2014 - Hydrology and Hydrogeology
2016	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, transverse flow, hydraulic conductivity, leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*	Monitoring measurements with HTU-tool were ended. Number of slug-tests was decreased.	WR 2016-43, Results of Monitoring at Olkiluoto in 2015 - Hydrology and Hydrogeology
2017	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, transverse flow, hydraulic conductivity, leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*		WR 2017-43, Results of Monitoring at Olkiluoto in 2016 - Hydrology and Hydrogeology
2018	Groundwater table level, sea water table level*, hydraulic head, flow conditions in open drillholes, transverse flow, hydraulic conductivity, leakage of groundwater into tunnels, water balance in the tunnels, runoff*, precipitation*, snow depth and water content*, infiltration*, soil frost*		WR 2018-43, Results of Monitoring at Olkiluoto in 2017 - Hydrology and Hydrogeology

\* Parameters reported in the Monitoring Programme of Environment