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*Supplement of*

## **River water quality changes in New Zealand over 26 years: response to land use intensity**

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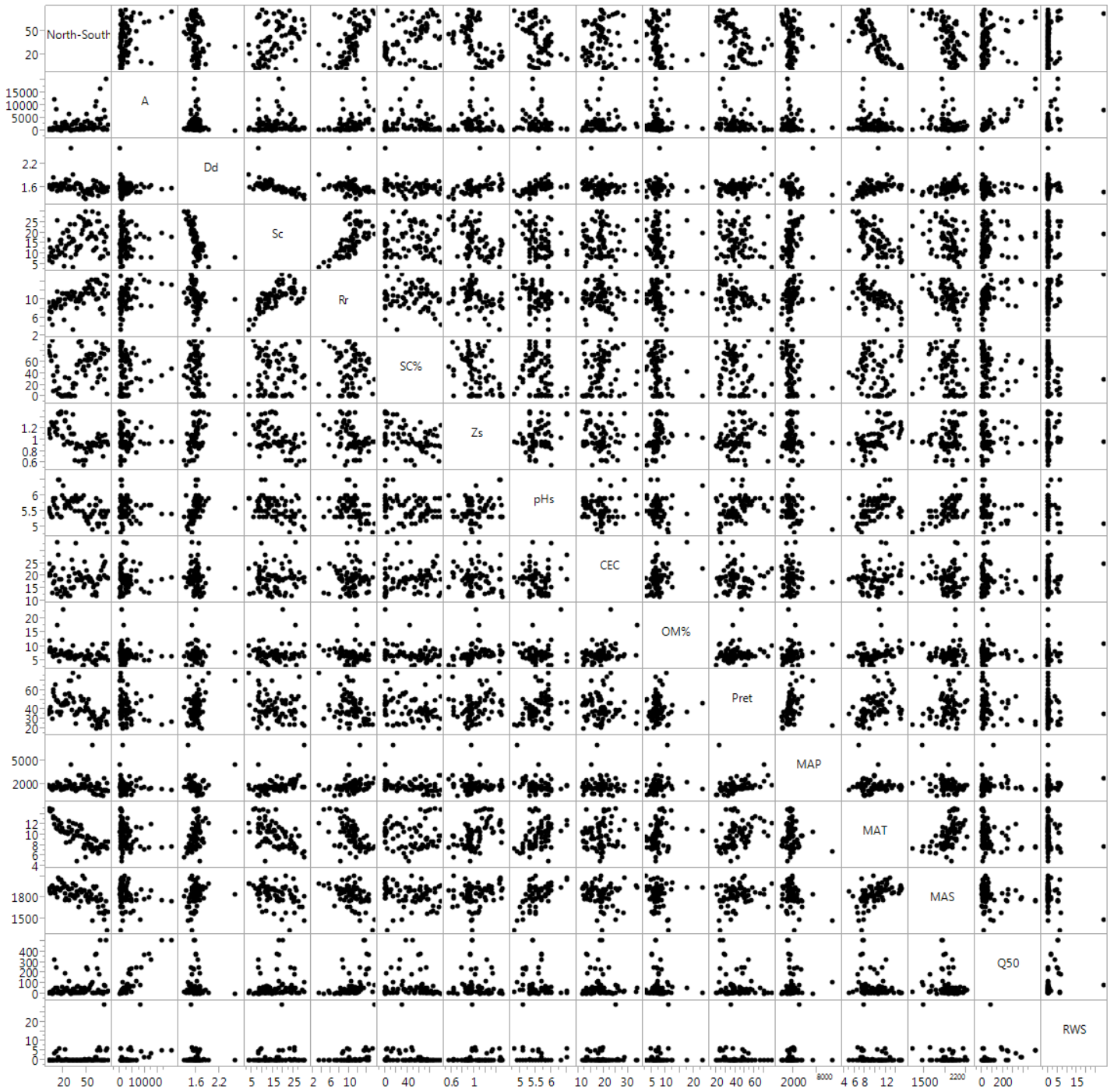


Figure S1. Scatterplots of relationships among physiographic variables for the 77 NRWQN catchments. Refer to Table 2 for variable names, units, and descriptions.

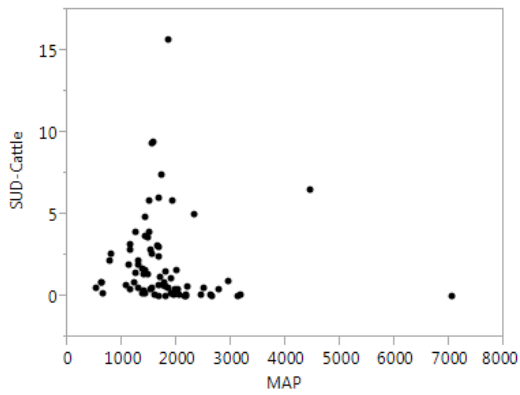
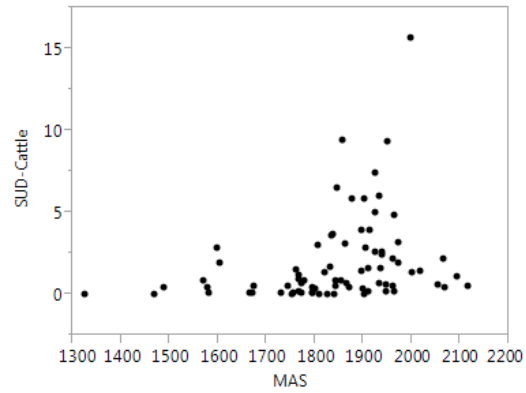
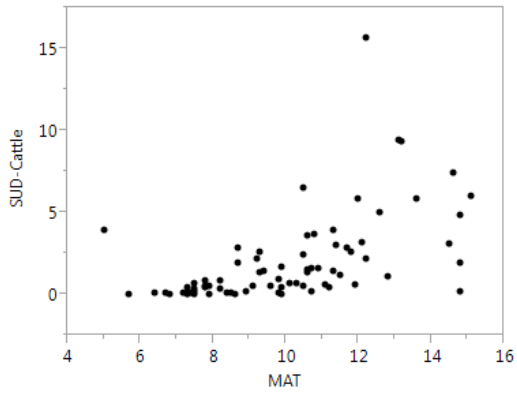
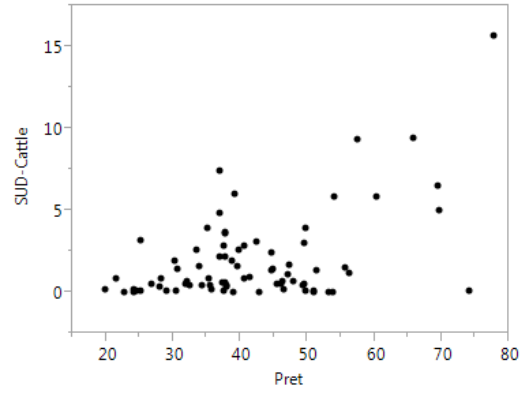
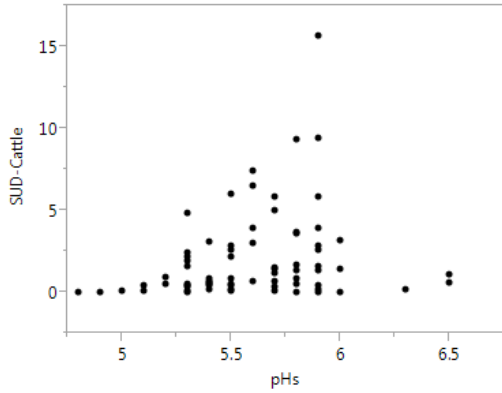
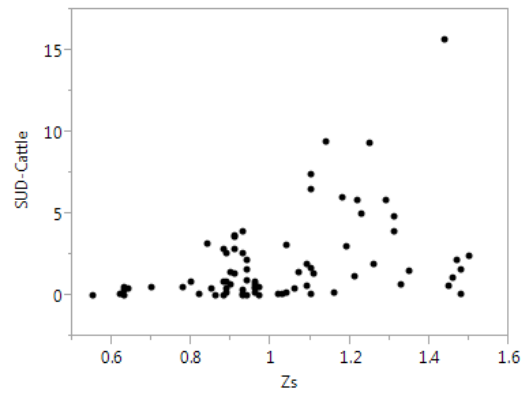
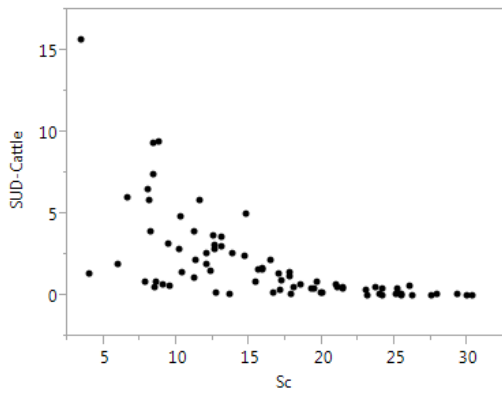


Figure S2. Scatterplots of significant relationships ( $p < 0.05$ ) between the stock unit density of all cattle ( $SUD_{cattle}$ ) and physiographic variables for the 77 NRWQN catchments. Refer to Table 2 for variable names, units, and description.



Figure S3. Scatterplots of relationships among water quality variables for the 77 NRWQN catchments. Each data point is the median value for the 26-y record. Refer to Table 1 for variable names, units, and descriptions. Median discharge ( $Q_{50}$ ) was included to show that at the national-scale, water quality is not correlated to flow.

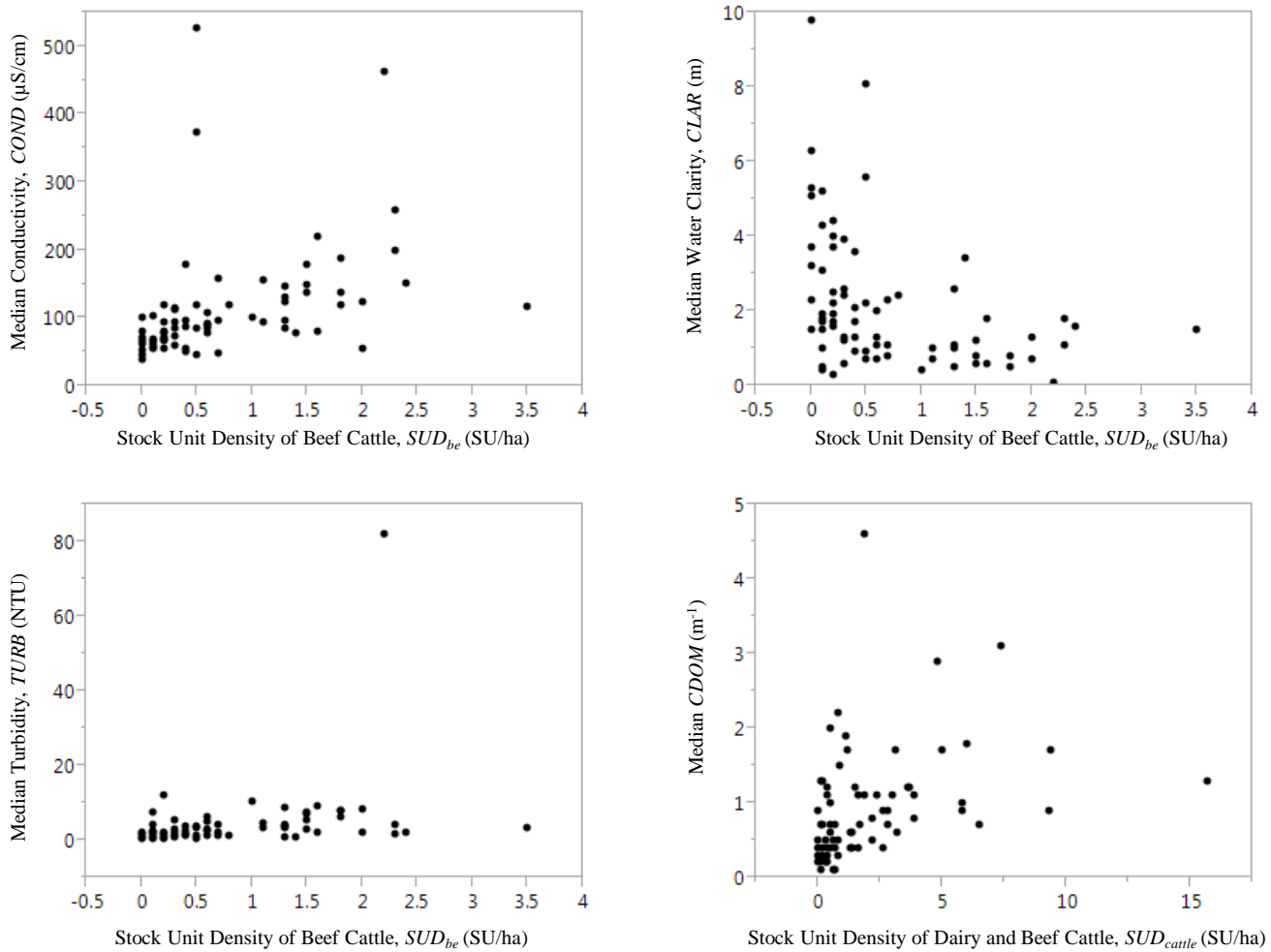


Figure S4. Scatterplots of strongest relationships between water quality variables and stock unit density for the 77 NRWQ catchments. Each data point is the median value for the 26-y record. Correlations are reported in Table 7. Note that relationships between nutrients and stock unit density are illustrated in Figure 5.

Table S1. Physiographic information for all 77 NRWQN catchments. Catchments are listed in order from North to South. See Table 2 for variable descriptions. See Table 4 for summaries of these data.

Catch -ment (N-S)	<i>A</i> (km <sup>2</sup> )	<i>D<sub>d</sub></i> (km/km <sup>2</sup> )	<i>S<sub>c</sub></i> (degrees)	<i>R<sub>r</sub></i> (degrees)	<i>SC%</i> (%)	<i>Z<sub>s</sub></i> (m)	<i>pH</i> (-log <sub>10</sub> [H <sup>+</sup> ])	<i>CEC</i> (cmoles [+]/kg)	<i>OM%</i> (%)	<i>P<sub>ret</sub></i> (%)	<i>MAP</i> (mm/y)	<i>MAT</i> (°C)	<i>MAS</i> (hours/ y)	<i>Q<sub>50</sub></i> (m <sup>3</sup> /s)	<i>RWS</i> (m <sup>3</sup> /m <sup>3</sup> )
WH1	122	1.60	16.7	9.4	78.8	1.16	5.5	20.0	8.1	35.8	1900	14.8	1911	2.4	0.00
WH2	300	1.66	6.6	5.8	88.6	1.18	5.5	24.9	8.8	39.1	1664	15.1	1933	3.9	0.14
WH4	547	1.65	8.4	7.4	75.3	1.10	5.6	20.8	11.9	36.9	1734	14.6	1923	7.1	0.01
WH3	809	1.61	12.6	8.3	70.2	1.04	5.4	20.1	9.4	42.4	1652	14.5	1863	11.4	0.00
AK1	267	1.56	10.3	7.2	61.5	1.31	5.3	22.1	7.6	36.9	1417	14.8	1964	2.1	0.02
AK2	81	1.55	6.0	4.5	98.7	1.26	5.3	13.2	8.4	30.2	1305	14.8	1973	0.4	0.00
HM6	286	1.67	11.6	8.9	8.3	1.29	5.9	23.4	6.3	60.3	1927	13.6	1877	5.7	0.00
HM5	1088	1.86	8.4	9.7	36.0	1.25	5.8	17.2	6.5	57.5	1542	13.2	1949	32.4	0.00
HM4	12365	1.65	8.1	8.6	26.9	1.22	5.7	17.9	8.2	54.0	1493	12.0	1901	324.6	3.44
HM2	2849	1.63	8.8	8.2	70.0	1.14	5.9	20.0	8.7	65.8	1580	13.1	1856	57.6	0.00
HM3	8349	1.67	8.2	8.8	10.5	1.31	5.6	14.8	6.7	49.8	1500	11.3	1913	247.1	4.52
HM1	320	1.62	13.1	9.5	52.7	1.19	5.6	12.8	6.6	49.6	1686	11.4	1806	7.9	0.00
GS4	1379	1.49	26.0	11.8	43.0	1.09	5.4	33.5	17.7	37.4	2194	11.1	1946	50.4	0.00
R02	720	1.66	11.2	10.0	4.5	1.46	6.5	28.2	6.9	47.0	1906	12.8	2092	26.8	1.52
R01	192	1.61	9.5	9.6	14.1	1.45	6.5	18.5	4.7	37.7	1793	11.9	2054	6.6	6.17
GS3	294	1.55	15.9	10.2	1.9	1.48	5.3	13.9	7.1	33.9	1998	10.7	1911	6.5	0.00
GS1	1569	1.52	16.5	8.6	0.0	1.47	5.3	18.7	8.4	37.7	1309	12.2	2065	13.8	0.00
GS2	26	1.71	14.7	8.1	0.0	1.50	5.3	11.6	7.7	44.6	1687	10.5	1938	0.4	0.00
R05	2895	1.60	10.4	11.5	0.3	1.07	6.0	15.6	12.5	44.8	1426	11.3	2016	58.2	0.05
R04	508	1.60	19.9	11.3	0.0	1.04	6.3	23.0	23.2	46.5	1376	10.7	1947	10.9	0.00
R03	1161	1.59	4.0	5.4	0.0	0.91	5.9	12.7	6.8	44.7	1401	10.6	2001	20.8	0.01
R06	3450	1.69	9.1	10.1	1.8	1.33	5.6	13.4	7.3	48.0	1675	10.3	1865	196.9	5.41
TU1	2188	1.71	12.3	9.1	32.6	1.35	5.7	14.8	6.8	55.7	1802	10.6	1762	45.1	0.01
TU2	785	1.79	13.7	11.5	0.0	1.48	5.7	13.2	7.4	49.7	2448	8.5	1795	27.6	0.40
HV5	2371	1.56	21.4	11.2	1.9	0.96	5.8	13.3	7.6	45.4	1555	10.5	1960	53.7	0.00
HV6	1036	1.55	21.0	11.3	0.6	0.96	5.7	12.0	5.8	46.3	1757	10.1	1933	25.3	0.00

WA1	1114	1.78	14.8	11.0	4.2	1.23	5.7	19.7	8.2	69.6	2320	12.6	1923	29.0	0.00
WA4	6618	1.62	17.8	10.5	30.9	1.21	5.7	17.9	7.1	56.2	1707	11.5	1766	120.9	0.01
HV4	385	1.54	24.2	10.4	0.1	0.93	5.8	11.9	5.5	53.1	2138	8.6	1840	10.8	0.00
WA2	30	2.61	8.0	10.1	0.0	1.10	5.6	14.9	7.6	69.4	4454	10.5	1845	0.9	0.00
HV3	2005	1.61	15.6	11.8	0.3	0.94	5.9	26.6	6.3	39.6	1422	10.9	1935	25.4	0.02
WA3	227	1.92	3.4	3.4	20.4	1.44	5.9	22.9	10.4	77.8	1851	12.2	1998	4.9	0.00
WA5	2683	1.59	17.0	10.9	14.5	1.11	5.8	14.9	6.5	51.3	1487	9.3	1819	44.6	0.06
WA6	3443	1.61	15.9	10.8	23.2	1.10	5.8	15.5	6.3	47.3	1377	9.9	1832	48.4	0.05
HV1	121	1.56	24.2	11.6	0.2	0.64	5.5	21.1	5.4	34.2	1963	9.9	1795	4.1	0.00
HV2	2457	1.68	9.4	9.6	21.0	0.84	6.0	32.9	6.6	25.2	1146	12.1	1973	20.0	0.04
WA7	713	1.69	11.2	8.1	41.7	0.93	5.9	18.5	6.2	35.2	1256	5.0	1897	7.2	0.00
WA8	3914	1.69	13.1	10.0	55.2	0.91	5.8	18.3	6.5	37.8	1471	10.6	1835	65.7	0.00
WA9	4241	1.70	12.5	10.0	54.8	0.91	5.8	18.1	6.5	37.7	1434	10.8	1837	69.5	0.00
WN5	79	1.42	27.9	9.6	94.9	0.62	5.5	21.4	6.3	74.2	3171	9.8	1672	4.6	0.00
WN4	643	1.67	12.6	10.8	62.1	0.88	5.9	20.4	6.7	40.5	1525	11.7	1905	12.3	0.00
WN3	2361	1.64	13.8	11.4	60.2	0.89	5.9	20.3	6.8	39.8	1540	11.8	1924	52.7	0.00
WN2	87	1.57	27.5	10.1	98.5	0.88	5.9	18.7	6.9	53.8	3135	9.9	1753	4.3	0.00
WN1	606	1.57	19.5	11.0	87.9	0.89	5.9	18.2	6.9	49.4	2021	11.2	1872	14.0	0.00
NN1	1761	1.49	21.1	11.2	47.3	0.63	5.5	19.1	2.8	49.6	1852	9.6	2116	32.2	0.00
NN2	166	1.34	26.2	9.3	51.1	0.55	6.0	15.6	3.3	51.0	2638	7.5	1903	3.9	0.00
NN4	3521	1.45	25.2	12.6	64.2	0.85	5.4	16.7	5.5	37.9	1537	7.3	2069	50.5	0.01
NN5	1403	1.49	23.0	12.6	45.4	0.63	5.3	25.5	5.2	38.0	1981	8.2	1900	55.7	0.69
NN3	518	1.30	30.0	11.6	37.1	0.63	5.3	19.2	6.3	42.9	1663	5.7	1826	20.2	0.00
GY1	6305	1.48	23.7	12.4	71.7	0.78	5.2	22.3	5.7	46.1	2507	9.1	1843	253.8	0.15
GY2	3821	1.55	17.2	14.0	62.4	0.94	5.2	19.0	8.4	41.5	2961	9.8	1768	231.0	0.22
GY3	641	1.42	25.1	12.8	54.4	0.93	5.1	18.8	6.0	50.9	2634	8.4	1731	34.0	0.04
CH1	1060	1.46	25.5	11.5	67.1	0.86	5.3	19.6	7.1	39.0	1809	7.9	1808	40.8	0.52
CH2	2520	1.54	17.8	13.3	74.2	0.90	5.7	17.9	5.4	30.7	1247	9.4	1896	51.5	0.41
CH3	2384	1.43	24.0	12.8	64.7	0.82	5.3	19.1	6.9	37.5	2049	7.4	1796	79.0	0.01
CH4	3014	1.47	19.7	14.5	65.6	0.80	5.4	18.1	6.6	35.4	1771	8.2	1843	91.0	0.01
GY4	1026	1.40	30.3	12.4	14.5	0.94	4.9	17.6	10.7	22.8	7044	6.8	1468	113.0	0.00
TK3	456	1.57	18.5	11.8	74.6	0.90	5.4	12.5	4.3	32.1	1071	7.5	1773	6.5	0.00

TK2	412	1.77	11.3	11.2	72.9	0.94	5.5	15.6	4.2	36.9	774	9.2	1962	3.2	0.00
TK1	2364	1.66	12.1	11.2	73.0	0.93	5.5	16.2	4.0	33.4	788	9.3	1939	9.9	0.00
TK4	9738	1.59	17.9	14.4	58.1	0.93	5.7	13.5	5.0	29.0	1592	7.2	1772	375.0	1.36
TK6	11737	1.60	17.1	14.0	62.1	0.93	5.7	13.3	4.8	28.0	1399	7.5	1800	384.5	1.32
TK5	897	1.76	12.7	10.1	94.9	0.89	5.9	11.9	3.2	19.9	655	8.9	1965	2.9	0.00
AX1	4454	1.52	25.4	14.5	23.9	1.03	5.1	16.8	7.0	24.6	2171	7.3	1756	244.0	5.27
AX3	1064	1.37	29.3	10.4	33.2	1.10	5.0	18.9	7.9	25.2	1599	6.4	1667	32.4	0.05
AX2	4282	1.50	25.5	13.8	46.6	1.02	5.1	19.7	7.3	30.5	1953	6.7	1582	184.5	6.52
AX4	16559	1.56	20.0	13.7	37.1	0.96	5.4	18.7	6.3	24.1	1415	7.5	1766	510.0	4.94
DN1	2428	1.71	7.8	8.0	68.2	0.88	5.8	18.8	5.6	21.4	615	7.8	1855	8.7	0.28
DN3	4721	1.66	8.6	8.1	76.7	0.89	5.5	22.2	6.8	28.2	632	8.2	1778	18.0	0.14
DN6	781	1.47	21.4	11.4	91.7	1.06	5.3	27.9	6.5	32.4	1159	7.8	1578	12.7	0.00
DN2	151	1.62	8.5	6.8	84.1	0.70	5.3	23.5	9.2	31.9	533	7.9	1673	0.7	0.00
DN7	1126	1.55	15.4	12.2	73.8	0.96	5.5	20.1	5.6	40.6	1221	7.8	1571	20.1	0.00
DN9	8102	1.48	19.3	15.8	30.1	0.96	5.1	24.9	10.9	35.5	2771	7.8	1489	78.1	29.18
DN5	5144	1.57	12.1	10.7	85.1	1.09	5.3	25.5	5.9	38.8	1120	8.7	1603	68.8	0.01
DN4	20539	1.57	18.1	13.4	47.7	0.97	5.4	19.3	6.3	26.7	1311	7.8	1743	515.0	4.90
DN10	247	1.49	23.1	15.4	3.2	0.97	4.8	19.4	10.9	24.2	2174	7.3	1325	13.0	6.31
DN8	2143	1.61	10.2	11.3	81.9	0.91	5.5	19.1	4.9	37.6	1154	8.7	1599	26.0	0.00



Table S2. Land use information for all 77 NRWQN catchments. All units are percent of catchment. Land use change (2012 – 1990) is included for non-plantation forests (*NF*), plantation forests (*PF*), shrub/grassland (*SG*), and high-producing grassland (*HG*). Catchments are listed in order from North to South. See Table 3 for variable descriptions. See Table 4 for summaries of these data.

Catchment (N-S)	<i>NF</i> 2001	<i>PF</i> 2001	<i>SG</i> 2001	<i>HG</i> 2001	<i>PC</i> 2001	<i>AC</i> 2001	<i>OW</i> 2001	<i>VW</i> 2001	<i>UR</i> 2001	<i>BO</i> 2001	<i>NF</i> 2012-1990	<i>PF</i> 2012-1990	<i>SG</i> 2012-1990	<i>HG</i> 2012-1990
WH1	85.4	9	2.4	3.2	0	0	0	0	0	0	0.0	0.1	-0.1	0.0
WH2	12.9	7.5	10	67.5	0.4	0.1	0.6	0.5	0.4	0.1	-0.6	1.5	-0.7	0.0
WH4	19.9	10.3	4.2	62.9	0.4	0.1	0.3	1.3	0.5	0.1	-0.6	1.2	-0.9	0.1
WH3	28	30.1	8.8	32.9	0	0	0.1	0.1	0	0	-0.1	6.6	-1.6	-4.8
AK1	13.5	22.8	7.7	55.4	0.1	0	0.1	0	0.3	0.1	-0.3	3.5	-1.7	-1.5
AK2	5.9	16.6	7.5	67.5	0.5	0.5	0.1	0	0.7	0.7	-0.1	0.4	-0.5	0.4
HM6	40.7	3.3	5.9	46.1	0.7	0	0.3	0	1.7	1.3	-0.1	2.5	-2.3	-0.5
HM5	23	16.4	2.2	56.8	0	0.9	0.1	0	0.6	0	-0.2	-0.1	-0.1	0.2
HM4	14.1	21.3	8.7	47	0.1	0.4	5.8	0.3	1.4	0.9	-0.2	-1.8	-0.4	2.0
HM2	17	3.7	3.5	74.2	0.1	0.4	0.2	0.1	0.7	0.1	-0.2	1.5	-1.0	-0.5
HM3	13.9	30	10.9	33.8	0.1	0.4	8.2	0.4	1.1	1.2	-0.1	-3.3	-0.1	3.4
HM1	45.1	8.7	4.7	41.1	0	0	0	0.1	0	0.3	-0.1	0.9	-0.8	-0.1
GS4	70.8	3.2	8.9	16.5	0	0	0.3	0.1	0	0.2	0.0	3.5	-3.4	-0.1
R02	19.9	42.5	12.4	15.7	0.1	0.5	7	0.5	1.1	0.3	0.0	1.0	-1.4	0.3
R01	22.9	12.9	22.1	15.1	0	0	25.6	0.3	0.7	0.4	0.1	1.8	-0.7	-1.1
GS3	23.7	2.1	11.9	62	0	0	0	0.2	0.1	0	0.0	2.0	-2.0	0.0
GS1	4.7	24.5	11.4	57.5	0	0.6	0.2	0	0	1.1	-0.2	13.4	-13.0	-0.2
GS2	1.8	1.4	18.6	78.2	0	0	0	0	0	0	0.0	-0.1	-0.1	0.2
R05	25.4	53.3	5	14.3	0	0.9	0.4	0.3	0.3	0.1	0.0	0.4	-0.4	0.0
R04	79.1	11.2	6.6	2.9	0	0	0	0.1	0.1	0	0.0	0.1	-0.1	0.0
R03	3.8	69.8	6.8	17.7	0	1.2	0.1	0.4	0.2	0	0.0	0.7	-0.8	0.1
R06	22	19.5	20.2	15	0	0.1	18.5	0.8	1	2.9	-0.1	1.7	-1.4	-0.3
TU1	21.2	11.9	29.3	34.2	0	0.1	0.3	0.7	0.4	1.9	-0.5	3.4	-2.2	-0.7
TU2	34.7	10.4	36.2	2.3	0	0.2	2.7	0.9	0.1	12.5	0.0	0.6	-0.3	-0.1
HV5	49.6	17.3	20.8	11.7	0	0.1	0.3	0	0	0.2	-0.3	3.1	-1.6	-1.2
HV6	50.5	13.1	22.5	13.2	0	0.1	0.2	0	0	0.4	-0.7	3.2	-2.1	-0.4

WA1	30.9	3.7	11.9	52.6	0	0	0.4	0.1	0.1	0.3	-0.9	2.6	-1.5	-0.2
WA4	38.9	6.8	23.1	29.2	0	0.1	0.3	0.5	0.2	0.9	-0.7	3.3	-2.2	-0.3
HV4	52.8	0	46.1	0	0	0	0	0	0	1.1	0.0	0.2	-0.2	0.0
WA2	45.5	0.2	9.5	39.2	0	0	0	0	0	5.6	-0.1	0.0	0.1	0.0
HV3	20.5	5.3	34.1	35.6	1.3	0.8	0.4	0.4	0.1	1.5	-0.1	3.2	-2.8	-0.9
WA3	6.6	0.6	0.4	91.2	0	0	0.1	0	1.1	0	-0.1	-0.1	0.0	0.2
WA5	19.2	1.1	36.1	41.5	0	0	0.4	0.6	0.2	0.9	-0.1	0.6	-0.6	0.1
WA6	15.8	2	29.1	50.7	0	0.3	0.5	0.6	0.2	0.8	-0.1	1.7	-1.5	0.0
HV1	64.9	5.9	15.5	10.6	0	0	0	0.1	0	3	0.0	0.5	-0.5	0.0
HV2	10.3	4.8	4.2	76.8	0.3	1.7	0.5	0.1	0.3	1	0.0	1.5	-1.0	-1.1
WA7	3.6	3	4.8	88.3	0	0	0.1	0	0.2	0	0.0	1.9	-1.5	-0.3
WA8	8	2.4	14.2	74	0	0.3	0.3	0	0.5	0.3	-0.3	1.5	-1.1	-0.2
WA9	7.7	2.6	14.2	73.3	0	0.3	0.4	0	1.2	0.3	-0.2	1.6	-1.1	-0.3
WN5	52	0	43.4	3	0	0	0	0	0	1.6	-0.3	0.5	-0.3	0.0
WN4	12.4	2.7	10	68.7	0.3	3.2	0.2	0.1	1.6	0.8	-0.3	1.4	-1.4	-0.2
WN3	15.1	4.9	12.7	63.5	0.3	1.8	0.2	0.1	0.8	0.6	-0.2	3.2	-3.0	-0.4
WN2	94.1	0	5.6	0	0	0	0	0.3	0	0	0.0	0.0	0.0	0.0
WN1	48.5	12.1	23	9.9	0	0	0.4	0.1	5.8	0.2	-1.0	3.2	-2.1	-0.3
NN1	40.4	27	16	14.6	0.2	0	0	0	0.1	1.7	-0.3	3.0	-2.6	-0.1
NN2	46.6	0.5	47.4	0	0	0	0	0	0	5.5	0.0	0.5	-0.5	0.0
NN4	25.2	11.8	36	12.2	0.5	0.1	0.4	0	0.1	13.7	-0.1	6.6	-6.5	-1.3
NN5	60.2	3.3	16.3	7.2	0	0	2.7	0.1	0.1	10.1	-0.1	2.0	-1.8	-0.1
NN3	21.5	0	47.1	1.1	0	0	0.2	0.1	0	30	0.0	0.0	0.0	0.0
GY1	72.3	1.7	14.4	5.7	0	0	1	0.1	0.1	4.7	-0.2	0.9	-0.8	0.0
GY2	63.3	4.2	16.4	11.2	0	0	2	0.5	0.1	2.3	-0.6	0.3	-0.1	0.4
GY3	76.6	0	17.9	1.5	0	0	0.9	0.1	0	3	0.0	0.0	0.0	0.0
CH1	38.4	0.1	50.3	2.9	0	0	2.1	0.2	0	6	-0.3	0.1	0.1	0.0
CH2	18.6	4.5	42.6	23.1	0	5.8	0.9	0.1	0.2	4.2	-0.3	-1.0	0.9	0.3
CH3	26.8	2.1	51	3.2	0	0.1	0.5	0.1	0	16.2	-0.1	0.1	0.0	0.0
CH4	21.7	6.3	41.9	13.8	0	1.2	0.8	0	0.1	14.2	-0.1	-0.3	0.4	0.0
GY4	43	0	30.9	1.1	0	0	0.8	0	0	24.2	0.0	0.0	0.0	0.0
TK3	1.1	0.6	55.4	21.6	0	1.5	1.3	0	0	18.5	0.0	1.0	-1.0	-0.1

TK2	1.7	3.5	24.1	60	0	7.9	0	0	0.4	2.4	0.0	1.3	-1.0	-1.1
TK1	2	5.4	27	54.4	0	5.9	0.4	0	0.4	4.5	0.0	2.2	-1.8	-0.6
TK4	1.8	0.7	64.2	4.5	0	0.2	5.3	0.4	0	22.9	0.0	0.4	-0.5	0.0
TK6	1.9	0.8	62.4	10.2	0	0.5	4.5	0.3	0.1	19.3	0.0	0.4	-0.4	0.0
TK5	0.6	0.6	56.3	38.2	0	3.1	0.2	0	0	1	0.0	0.1	0.0	0.0
AX1	14.8	0.2	59	5.9	0	0.2	8.2	0.1	0.3	11.3	0.0	0.1	-0.1	0.0
AX3	5.4	0.2	82.3	1.2	0	0	0.7	0	0	10.2	0.0	0.2	-0.2	0.0
AX2	11.5	0.5	60.5	3.6	0	0.1	7.7	0.2	0.3	15.6	0.0	0.2	-0.2	-0.1
AX4	7.2	0.4	68.1	10	0.3	0.3	4.6	0.4	0.3	8.4	0.0	0.3	-0.4	0.0
DN1	0.4	1.3	56.1	35.7	0	0.5	0.7	2.2	0.1	3	0.0	0.0	0.0	0.0
DN3	0.4	2.2	43.2	50	0	0.4	0.5	1.6	0	1.7	0.0	0.2	-0.1	-0.1
DN6	5.9	1.6	69.6	12.1	0	1.5	0.3	0.1	0	8.9	-0.1	4.8	-4.7	0.0
DN2	0.1	0.5	39.1	58.3	0	0	0	2	0	0	0.0	-0.2	0.2	0.0
DN7	24.6	3.4	36.5	26.5	0	0.5	0.2	0.4	0	7.9	-0.2	1.2	-1.1	0.1
DN9	39	2.5	27.5	15.6	0	0	7.3	0.9	0.1	7.1	-0.2	1.3	-0.9	-0.2
DN5	7.7	2.7	35.6	50.3	0	0.7	0.3	0.5	0.3	1.9	-0.1	1.9	-1.4	-0.5
DN4	6.6	2.1	59.2	20.5	0.2	0.3	3.8	0.4	0.2	6.7	-0.1	0.9	-0.8	-0.2
DN10	56.4	0	25.5	0	0	0	15.3	0.2	0	2.6	0.0	0.0	0.0	0.0
DN8	14	7	21.7	51.3	0	0.6	0.4	0.3	0.2	4.5	-0.2	2.9	-2.6	-0.1

Table S3. Stock unit density (SUD; in SU/ha) in 2011 and changes (2012 – 1990) for all 77 NRWQN catchments. Catchments are listed in order from North to South. See Table 2 for variable descriptions. See Table 4 for summaries of these data.

Catch -ment (N-S)	Total SUD 2011	Dairy SUD 2011	Beef SUD 2011	Sheep SUD 2011	Deer SUD 2011	Total SUD 2012- 1990	Dairy SUD 2012- 1990	Beef SUD 2012- 1990	Sheep SUD 2012- 1990	Deer SUD 2012- 1990
WH1	0.3	0.0	0.2	0.0	0.0	-1.0	0.1	-0.7	-0.4	0.0
WH2	6.5	2.5	3.5	0.5	0.0	-1.0	0.1	-0.7	-0.4	0.0
WH4	7.6	5.4	2.0	0.3	0.0	-1.4	0.2	-1.0	-0.6	0.0
WH3	3.7	1.4	1.8	0.6	0.0	-1.4	0.2	-1.0	-0.7	0.0
AK1	5.6	3.0	1.8	0.8	0.0	-5.1	-1.5	-1.8	-1.6	-0.2
AK2	3.0	0.3	1.6	1.0	0.0	-5.1	-1.5	-1.8	-1.6	-0.2
HM6	6.0	5.0	0.8	0.2	0.0	-0.6	0.8	-0.7	-0.7	0.0
HM5	9.6	8.7	0.6	0.3	0.0	-0.4	0.9	-0.7	-0.5	-0.2
HM4	6.7	4.8	1.1	0.8	0.0	-0.1	1.5	-0.6	-1.0	0.0
HM2	10.7	7.6	1.8	1.3	0.0	-0.9	2.0	-1.1	-1.6	-0.1
HM3	4.6	3.2	0.7	0.7	0.0	0.1	1.4	-0.4	-0.9	0.0
HM1	5.2	1.0	2.0	2.2	0.0	-1.2	1.9	-1.1	-1.9	-0.1
GS4	1.2	0.0	0.6	0.6	0.0	-0.7	0.1	-0.3	-0.5	0.0
R02	1.3	0.5	0.5	0.2	0.0	-0.6	0.9	-0.4	-0.9	-0.1
R01	1.0	0.0	0.5	0.4	0.0	-0.7	1.7	-0.6	-1.6	-0.1
GS3	3.9	0.0	1.6	2.1	0.1	-1.1	0.1	-0.4	-0.8	0.0
GS1	5.0	0.0	2.2	2.8	0.0	-1.1	0.1	-0.4	-0.8	0.0
GS2	6.1	0.0	2.4	3.6	0.0	-1.1	0.1	-0.4	-0.8	0.0
R05	1.8	1.1	0.3	0.4	0.0	-0.2	0.5	-0.2	-0.5	0.0
R04	0.3	0.0	0.2	0.1	0.0	-0.3	0.2	-0.2	-0.2	-0.1
R03	2.2	0.7	0.6	0.9	0.0	0.0	0.9	-0.2	-0.7	0.0
R06	1.3	0.2	0.5	0.6	0.0	0.0	1.0	-0.3	-0.8	0.1
TU1	3.3	0.4	1.1	1.8	0.0	-0.9	0.3	-0.3	-1.0	0.0
TU2	0.2	0.0	0.1	0.1	0.0	0.0	1.0	-0.3	-0.8	0.0
HV5	0.9	0.2	0.3	0.4	0.0	0.1	0.6	0.2	-0.7	0.0
HV6	1.1	0.4	0.3	0.4	0.0	0.4	0.7	0.3	-0.6	0.0

WA1	6.2	3.6	1.3	1.2	0.0	-1.1	0.2	-0.4	-0.9	0.0
WA4	2.8	0.2	1.0	1.6	0.0	-0.7	0.3	-0.2	-0.8	0.0
HV4	0.0	0.0	0.0	0.0	0.0	-0.5	0.6	0.0	-1.1	0.0
WA2	6.5	6.4	0.2	0.0	0.0	-1.3	0.0	-0.3	-1.0	0.0
HV3	3.6	0.4	1.3	2.0	0.0	-0.1	0.5	0.3	-0.9	0.0
WA3	16.1	15.4	0.4	0.4	0.0	-1.2	0.4	-0.4	-1.2	0.0
WA5	4.0	0.0	1.3	2.7	0.0	-1.5	0.5	-0.5	-1.6	0.0
WA6	5.1	0.2	1.5	3.3	0.0	-1.6	0.7	-0.5	-1.7	0.0
HV1	1.0	0.0	0.4	0.7	0.0	-0.2	0.6	0.4	-1.3	0.0
HV2	7.2	0.9	2.3	4.0	0.1	-1.0	0.7	0.3	-1.9	0.0
WA7	8.4	1.5	2.3	4.5	0.0	-1.2	0.8	-0.2	-1.8	0.0
WA8	7.0	2.1	1.5	3.4	0.0	-1.3	0.9	-0.4	-1.9	0.0
WA9	7.1	2.2	1.5	3.3	0.0	-1.4	1.0	-0.5	-1.9	0.0
WN5	0.2	0.0	0.1	0.1	0.0	-1.4	0.5	-0.1	-1.7	0.0
WN4	6.6	1.3	1.5	3.8	0.0	-1.4	0.5	-0.1	-1.7	0.0
WN3	5.8	1.3	1.3	3.2	0.0	-0.9	0.5	-0.2	-1.2	0.0
WN2	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	-0.2	0.0
WN1	0.6	0.2	0.2	0.2	0.0	-0.3	0.0	0.0	-0.3	0.0
NN1	1.0	0.2	0.3	0.5	0.0	-0.2	0.2	-0.1	-0.3	0.0
NN2	0.0	0.0	0.0	0.0	0.0	-0.2	0.2	-0.1	-0.3	0.0
NN4	0.8	0.1	0.3	0.4	0.0	-0.5	0.1	0.0	-0.5	0.0
NN5	0.5	0.1	0.2	0.3	0.0	-0.2	0.2	-0.1	-0.3	0.0
NN3	0.1	0.0	0.0	0.1	0.0	-0.5	0.1	0.0	-0.5	0.0
GY1	0.6	0.4	0.1	0.1	0.0	-0.1	0.2	-0.1	-0.3	0.0
GY2	1.0	0.8	0.1	0.0	0.1	0.2	0.5	-0.2	-0.2	0.0
GY3	0.1	0.0	0.0	0.0	0.0	0.1	0.4	-0.1	-0.2	0.0
CH1	0.2	0.0	0.0	0.1	0.0	-0.2	0.7	0.1	-1.0	0.0
CH2	3.0	1.0	0.4	1.6	0.0	-0.2	0.7	0.1	-1.0	0.0
CH3	0.4	0.0	0.1	0.3	0.0	1.0	1.8	0.2	-1.0	0.0
CH4	1.4	0.6	0.2	0.6	0.0	1.2	2.0	0.2	-1.0	0.0
GY4	0.0	0.0	0.0	0.0	0.0	0.1	0.2	-0.1	-0.1	0.0
TK3	2.1	0.0	0.7	1.4	0.0	0.0	0.3	0.1	-0.5	0.1

TK2	6.1	0.9	1.3	3.8	0.1	0.0	0.4	0.1	-0.5	0.1
TK1	5.9	1.2	1.4	3.1	0.1	0.7	1.4	0.2	-1.1	0.2
TK4	0.4	0.0	0.1	0.3	0.0	0.1	0.6	0.1	-0.7	0.1
TK6	0.8	0.2	0.1	0.5	0.0	0.1	0.8	0.1	-0.9	0.1
TK5	1.6	0.0	0.2	1.2	0.2	0.1	2.1	0.2	-2.2	0.1
AX1	0.6	0.0	0.1	0.4	0.0	-0.2	0.0	-0.1	-0.3	0.1
AX3	0.3	0.0	0.1	0.3	0.0	-0.2	0.0	-0.1	-0.3	0.1
AX2	0.4	0.0	0.1	0.3	0.0	-0.2	0.0	-0.1	-0.3	0.1
AX4	1.0	0.0	0.2	0.8	0.0	-0.1	0.2	0.0	-0.4	0.1
DN1	3.3	0.3	0.5	2.5	0.0	0.0	0.3	0.2	-0.5	0.1
DN3	3.4	0.2	0.6	2.6	0.0	0.3	0.4	0.3	-0.4	0.1
DN6	2.2	0.0	0.4	1.7	0.1	0.1	1.2	0.0	-1.1	0.1
DN2	2.2	0.0	0.5	1.7	0.0	0.7	0.4	0.4	-0.2	0.1
DN7	2.5	0.4	0.4	1.6	0.1	0.1	1.2	0.0	-1.2	0.1
DN9	1.4	0.1	0.2	1.0	0.1	0.1	1.2	0.0	-1.2	0.1
DN5	5.8	1.2	0.7	3.8	0.1	0.0	1.7	-0.1	-1.7	0.1
DN4	2.0	0.2	0.3	1.5	0.0	-0.1	0.4	0.0	-0.6	0.1
DN10	0.0	0.0	0.0	0.0	0.0	0.1	1.2	0.0	-1.2	0.1
DN8	5.8	2.3	0.6	2.8	0.1	0.1	1.2	0.0	-1.2	0.1

Table S4. Land disturbance (in % of catchment) for high-producing grassland ( $D_{HG}$ ), plantation forests ( $D_{PF}$ ), and entire catchment ( $D_C$ ) for all 77 NRWQN catchments. Changes in land disturbance were assessed with Seasonal Kendall slope estimators (SKSE) for the period 2000 – 2013. Catchments are listed in order from North to South. See Table 2 for variable descriptions. See Table 4 for summaries of these data. Blank values for disturbance means that at least 100 pixels of that land use was not present and thus statistics were not calculated. Light blue cells represent significant decrease ( $p < 0.05$ ). Dark blue cells represent ‘meaningful’ decrease ( $p < 0.05$ , and  $RSKSE > \pm 1$ ). Pink cells represent significant increase ( $p < 0.05$ ). Red cells represent ‘meaningful’ increase ( $p < 0.05$ , and  $RSKSE > \pm 1$ ).

Catch-ment (N-S)	$D_{HG}$				$D_{PF}$				$D_C$			
	Median	SKSE	SKSE p-value	RSKSE	Median	SKSE	SKSE p-value	RSKSE	Median	SKSE	SKSE p-value	RSKSE
WH1	4.8	0.0000	0.219	0.0	0.0	0.0000	0.027	0.0	0.8	0.0009	0.037	10.5
WH2	3.4	-0.0002	0.814	-0.5	12.9	-0.0059	0.193	-4.5	4.2	-0.0001	0.824	-0.3
WH4	3.2	-0.0003	0.447	-1.1	3.2	-0.0100	0.000	-31.2	3.8	-0.0015	0.046	-3.9
WH3	5.8	0.0018	0.098	3.0	3.1	0.0078	0.001	25.3	4.0	0.0040	0.000	9.9
AK1	2.3	-0.0004	0.074	-1.5	13.9	-0.0146	0.020	-10.5	5.1	-0.0036	0.013	-7.1
AK2	3.1	0.0000	0.278	0.0	6.5	0.0029	0.559	4.5	4.9	0.0003	0.804	0.6
HM6	4.8	-0.0013	0.134	-2.8	0.0	0.0000	0.007	0.0	3.0	-0.0007	0.231	-2.2
HM5	4.1	-0.0015	0.006	-3.6	18.2	-0.0160	0.008	-8.8	6.4	-0.0041	0.009	-6.4
HM4	5.7	0.0002	0.475	0.4	12.9	0.0079	0.000	6.1	7.4	0.0021	0.000	2.8
HM2	5.3	-0.0003	0.481	-0.6	12.6	0.0156	0.001	12.4	5.1	0.0000	0.965	0.0
HM3	4.7	0.0007	0.098	1.5	12.9	0.0075	0.000	5.8	8.1	0.0033	0.000	4.0
HM1	1.0	0.0000	0.769	0.0	15.7	0.0200	0.007	12.7	3.4	0.0014	0.030	4.1
GS4	3.0	-0.0011	0.043	-3.6	3.3	-0.0098	0.000	-30.0	1.8	-0.0014	0.001	-7.8
R02	2.1	0.0002	0.478	0.7	14.9	-0.0041	0.034	-2.8	9.9	-0.0010	0.422	-1.0
R01	2.2	0.0000	0.297	0.0	4.0	-0.0079	0.002	-20.0	3.8	-0.0020	0.043	-5.3
GS3	1.3	-0.0003	0.118	-2.5	3.3	0.0000	0.181	0.0	2.0	-0.0006	0.112	-2.9
GS1	4.0	0.0000	0.946	0.1	3.4	-0.0018	0.002	-5.3	3.9	-0.0005	0.417	-1.3
GS2	0.0	0.0000	0.312	0.0	0.0				0.0	0.0000	0.940	0.0
R05	5.4	-0.0018	0.041	-3.4	9.8	0.0010	0.094	1.0	6.8	0.0001	0.668	0.2
R04	6.0	-0.0040	0.003	-6.7	6.1	0.0057	0.020	9.4	2.1	0.0007	0.211	3.3
R03	7.9	-0.0032	0.041	-4.0	11.6	-0.0013	0.156	-1.1	10.5	-0.0020	0.020	-1.9
R06	6.6	0.0038	0.015	5.7	13.3	-0.0003	0.558	-0.2	6.9	0.0014	0.025	2.0

TU1	2.5	0.0002	0.612	0.7	9.9	0.0101	0.001	10.2	3.4	0.0016	0.001	4.7
TU2	7.5	-0.0014	0.202	-1.9	7.4	-0.0093	0.000	-12.5	4.5	-0.0020	0.000	-4.4
HV5	9.2	-0.0029	0.068	-3.1	15.9	0.0096	0.003	6.1	5.6	0.0028	0.002	5.0
HV6	8.0	-0.0022	0.157	-2.7	16.9	0.0020	0.662	1.2	5.2	0.0008	0.199	1.6
WA1	3.8	-0.0012	0.008	-3.3	2.4	0.0040	0.003	16.7	2.9	-0.0009	0.014	-2.9
WA4	4.6	-0.0004	0.427	-0.8	8.8	0.0069	0.001	7.9	3.3	0.0002	0.391	0.5
HV4									2.3	0.0000	0.581	0.0
WA2	0.0	0.0000	0.045	0.0					1.4	0.0000	0.067	0.0
HV3	4.6	0.0000	0.964	0.0	9.7	0.0090	0.009	9.2	4.2	0.0002	0.631	0.4
WA3	0.3	0.0003	0.001	9.5					0.4	0.0003	0.001	7.1
WA5	5.9	0.0015	0.054	2.6	21.3	0.0000	0.871	0.0	5.0	0.0008	0.070	1.6
WA6	6.8	0.0012	0.084	1.8	11.2	-0.0006	0.361	-0.5	5.9	0.0010	0.090	1.7
HV1	4.2	0.0000	0.131	0.0	0.0	0.0000	0.018	0.0	1.5	-0.0010	0.006	-6.8
HV2	3.9	0.0019	0.001	4.7	11.4	0.0007	0.562	0.6	3.9	0.0017	0.002	4.3
WA7	0.9	0.0001	0.282	1.4	25.0	0.0000	0.801	0.0	1.1	0.0001	0.437	0.9
WA8	1.9	-0.0004	0.273	-2.0	18.4	0.0089	0.050	4.8	2.1	-0.0003	0.331	-1.6
WA9	2.0	-0.0003	0.332	-1.4	15.5	0.0074	0.027	4.8	2.2	-0.0002	0.442	-1.0
WN5	0.0	0.0000	0.127	0.0					1.0	0.0000	0.881	0.0
WN4	1.9	0.0001	0.608	0.7	11.4	0.0000	1.000	0.0	2.0	0.0000	0.897	0.0
WN3	3.9	-0.0008	0.158	-2.2	7.7	0.0004	0.633	0.5	3.4	-0.0006	0.168	-1.8
WN2									0.2	0.0000	0.077	0.0
WN1	12.8	-0.0074	0.005	-5.8	1.5	0.0011	0.118	7.5	2.1	-0.0010	0.015	-4.9
NN1	3.1	-0.0003	0.693	-1.0	8.0	-0.0024	0.210	-3.0	5.0	0.0000	0.861	0.0
NN2					0.0	0.0000	0.733	0.0	2.7	0.0000	0.055	0.0
NN4	9.1	0.0018	0.310	2.0	5.2	-0.0032	0.007	-6.1	5.3	-0.0005	0.078	-0.9
NN5	4.4	0.0000	0.891	0.0	3.8	0.0040	0.003	10.7	4.4	0.0005	0.066	1.1
NN3	0.0	0.0000	0.535	0.0					4.4	0.0004	0.031	0.9
GY1	3.9	-0.0008	0.482	-2.1	2.7	0.0046	0.000	16.7	2.2	0.0000	0.820	0.0
GY2	7.3	-0.0002	0.731	-0.2	5.8	-0.0006	0.461	-1.1	2.6	0.0000	0.783	0.0
GY3	4.2	0.0000	0.006	0.0					1.7	0.0001	0.554	0.5
CH1	4.0	0.0000	0.562	0.0					2.9	0.0003	0.092	0.9
CH2	3.0	0.0003	0.701	1.0	20.4	0.0114	0.039	5.6	4.0	0.0008	0.077	2.0



CH3	4.4	0.0035	0.016	7.9	16.6	-0.0167	0.009	-10.1	3.3	0.0002	0.187	0.5
CH4	5.4	0.0009	0.283	1.7	16.1	0.0031	0.432	1.9	4.2	0.0003	0.206	0.8
GY4	21.4	0.0000	0.321	0.0					4.1	0.0006	0.144	1.5
TK3	1.8	0.0000	0.606	0.0					1.4	-0.0002	0.427	-1.2
TK2	1.8	0.0008	0.039	4.5	16.7	-0.0238	0.000	-14.3	1.9	0.0002	0.421	1.1
TK1	1.7	0.0006	0.028	3.7	6.4	-0.0056	0.003	-8.8	1.7	0.0003	0.300	1.5
TK4	33.2	-0.0063	0.142	-1.9	15.8	0.0027	0.400	1.7	3.9	-0.0004	0.382	-1.1
TK6	19.3	-0.0043	0.082	-2.2	20.1	0.0098	0.022	4.9	4.9	-0.0006	0.275	-1.1
TK5	20.6	-0.0049	0.196	-2.4					8.2	-0.0020	0.188	-2.4
AX1	7.9	0.0008	0.715	1.0	20.0	0.0500	0.000	24.9	2.7	0.0001	0.537	0.4
AX3	16.3	0.0000	0.633	0.0	14.3	0.0287	0.000	20.1	1.1	0.0002	0.051	2.1
AX2	8.8	0.0030	0.119	3.4	1.3	0.0049	0.000	37.8	2.8	0.0002	0.175	0.8
AX4	7.4	0.0002	0.883	0.3	14.8	0.0019	0.096	1.3	2.2	0.0001	0.543	0.5
DN1	3.0	0.0002	0.667	0.6	20.4	0.0358	0.000	17.6	1.5	0.0005	0.015	3.4
DN3	10.0	0.0005	0.809	0.5	8.1	0.0288	0.000	35.5	4.8	0.0010	0.313	2.1
DN6	7.7	0.0033	0.142	4.3	27.8	-0.0556	0.000	-20.0	3.1	-0.0003	0.330	-1.1
DN2	34.9	0.0058	0.646	1.7					7.3	0.0013	0.641	1.7
DN7	6.4	-0.0008	0.655	-1.2	5.7	0.0080	0.003	14.1	4.1	0.0001	0.803	0.3
DN9	4.8	-0.0008	0.490	-1.6	5.9	0.0011	0.340	1.9	3.2	-0.0001	0.599	-0.4
DN5	2.4	0.0003	0.554	1.1	10.6	0.0000	0.949	0.0	2.1	0.0000	0.748	0.0
DN4	4.6	0.0004	0.548	0.9	9.2	0.0043	0.001	4.7	2.6	0.0003	0.171	1.0
DN10									1.7	-0.0003	0.014	-2.0
DN8	3.4	-0.0004	0.624	-1.1	5.7	0.0038	0.042	6.7	3.4	0.0000	0.914	0.0

Table S5a. Median water quality data and changes in water quality (1989 – 2014) via Seasonal Kendal slope estimators (SKSE) for all 77 NRWQN catchments. Catchments are listed in order from North to South. See Table 1 for variable descriptions. See Tables 5 and 6 for summaries of these data. Light blue cells represent significant decrease ( $p < 0.05$ ). Dark blue cells represent ‘meaningful’ decrease ( $p < 0.05$ , and  $RSKSE > \pm 1$ ). Pink cells represent significant increase ( $p < 0.05$ ). Red cells represent ‘meaningful’ increase ( $p < 0.05$ , and  $RSKSE > \pm 1$ ).

Catchment (N-S)	Median $Q$ ( $m^3/s$ )	SKSE $Q$	SKSE p-value $Q$	RSKSE $Q$	Median $T_w$ ( $^{\circ}C$ )	SKSE $T_w$	SKSE p-value $T_w$	Median $DO$ (%)	SKSE $DO$	SKSE p-value $DO$	RSKSE $DO$
WH1	2.4	0.038	0.061	1.6	14.6	0.033	0.083	97.0	-0.053	0.002	-0.1
WH2	3.9	0.010	0.616	0.3	16.7	0.029	0.088	100.9	0.033	0.186	0.0
WH4	7.1	0.097	0.049	1.4	16.9	0.023	0.067	91.0	0.231	0.007	0.3
WH3	11.4	-0.095	0.103	-0.8	16.8	0.000	0.656	96.6	-0.202	0.000	-0.2
AK1	2.1	0.007	0.457	0.3	15.2	0.021	0.163	90.8	0.017	0.666	0.0
AK2	0.4	0.000	0.622	0.0	14.8	0.000	0.877	85.5	-0.222	0.000	-0.3
HM6	5.7	-0.023	0.366	-0.4	15.4	0.039	0.028	105.5	-0.098	0.005	-0.1
HM5	32.4	-0.142	0.047	-0.4	15.2	0.000	0.699	93.3	-0.088	0.019	-0.1
HM4	324.6	-3.714	0.002	-1.1	16.4	0.011	0.348	95.9	-0.083	0.090	-0.1
HM2	57.6	-0.545	0.074	-0.9	14.9	0.022	0.152	91.6	-0.032	0.224	0.0
HM3	247.1	-1.772	0.012	-0.7	16.4	0.033	0.027	103.7	-0.122	0.032	-0.1
HM1	7.9	-0.046	0.171	-0.6	12.4	0.025	0.161	98.5	-0.048	0.001	0.0
GS4	50.4	-0.343	0.056	-0.7	13.4	0.042	0.010	99.7	-0.058	0.003	-0.1
R02	26.8	0.008	0.930	0.0	16.6	-0.031	0.001	75.5	0.550	0.000	0.7
R01	6.6	0.010	0.590	0.1	15.6	0.017	0.083	106.8	-0.028	0.181	0.0
GS3	6.5	-0.037	0.077	-0.6	12.6	0.050	0.011	101.3	-0.006	0.817	0.0
GS1	13.8	0.041	0.466	0.3	16.6	0.050	0.037	99.5	-0.051	0.068	-0.1
GS2	0.4	-0.001	0.462	-0.3	12.8	0.000	0.811	102.3	-0.033	0.129	0.0
R05	58.2	-0.003	1.000	0.0	14.7	0.014	0.086	105.5	0.202	0.001	0.2
R04	10.9	-0.129	0.031	-1.2	12.3	0.000	0.909	102.6	-0.032	0.097	0.0
R03	20.8	-0.261	0.013	-1.3	13.2	0.000	0.938	104.0	-0.055	0.014	-0.1
R06	196.9	-0.539	0.458	-0.3	14.8	0.023	0.037	102.9	-0.015	0.317	0.0
TU1	45.1	0.024	0.809	0.1	12.7	-0.014	0.437	102.9	-0.035	0.279	0.0
TU2	27.6	-0.108	0.012	-0.4	9.7	0.011	0.331	101.1	-0.005	0.814	0.0

HV5	53.7	-0.579	0.056	-1.1	13.4	0.071	0.001	103.2	0.031	0.474	0.0
HV6	25.3	-0.172	0.097	-0.7	11.2	0.025	0.165	101.2	-0.073	0.006	-0.1
WA1	29.0	-0.175	0.219	-0.6	13.7	0.033	0.041	102.1	-0.076	0.004	-0.1
WA4	120.9	-0.187	0.707	-0.2	14.3	0.050	0.023	99.7	-0.091	0.001	-0.1
HV4	10.8	-0.033	0.382	-0.3	10.9	0.018	0.265	100.1	-0.080	0.011	-0.1
WA2	0.9	0.000	0.923	0.0	10.5	0.030	0.061	101.0	-0.112	0.000	-0.1
HV3	25.4	0.046	0.688	0.2	15.9	0.040	0.045	102.8	-0.007	0.829	0.0
WA3	4.9	-0.007	0.677	-0.2	13.9	0.014	0.300	103.8	-0.177	0.000	-0.2
WA5	44.6	-0.037	0.803	-0.1	10.4	0.022	0.163	100.9	-0.062	0.003	-0.1
WA6	48.4	-0.233	0.321	-0.5	12.8	0.017	0.283	100.8	-0.101	0.000	-0.1
HV1	4.1	0.000	0.965	0.0	11.1	0.000	0.764	98.9	-0.117	0.000	-0.1
HV2	20.0	-0.120	0.233	-0.6	16.2	0.033	0.116	113.1	-0.319	0.002	-0.3
WA7	7.2	0.028	0.432	0.4	13.0	0.010	0.624	100.2	-0.155	0.002	-0.2
WA8	65.7	-0.174	0.602	-0.3	13.9	0.020	0.261	100.7	-0.107	0.012	-0.1
WA9	69.5	-0.046	0.863	-0.1	14.4	0.017	0.352	99.0	0.040	0.419	0.0
WN5	4.6	-0.016	0.514	-0.3	10.4	0.015	0.342	101.0	0.013	0.717	0.0
WN4	12.3	-0.022	0.721	-0.2	13.3	0.033	0.102	99.8	0.079	0.076	0.1
WN3	52.7	-0.373	0.092	-0.7	12.8	0.023	0.155	98.8	0.039	0.275	0.0
WN2	4.3	-0.014	0.407	-0.3	9.4	0.030	0.046	100.8	0.047	0.056	0.0
WN1	14.0	-0.009	0.892	-0.1	11.3	0.033	0.081	98.0	0.004	0.954	0.0
NN1	32.2	-0.270	0.078	-0.8	11.3	0.011	0.439	103.4	-0.012	0.591	0.0
NN2	3.9	-0.015	0.513	-0.4	8.1	0.032	0.074	100.4	0.001	0.845	0.0
NN4	50.5	-0.004	0.993	0.0	14.2	0.010	0.523	103.4	0.029	0.356	0.0
NN5	55.7	0.080	0.770	0.1	10.8	0.005	0.673	100.2	-0.021	0.012	0.0
NN3	20.2	0.068	0.348	0.3	7.2	0.018	0.129	100.8	0.000	1.000	0.0
GY1	253.8	-1.011	0.406	-0.4	11.5	0.025	0.113	99.3	0.028	0.187	0.0
GY2	231.0	-1.283	0.258	-0.6	12.0	0.025	0.092	99.8	0.079	0.003	0.1
GY3	34.0	-0.218	0.267	-0.6	11.0	0.055	0.004	100.4	0.081	0.043	0.1
CH1	40.8	-0.226	0.206	-0.6	9.5	0.000	0.698	102.1	0.032	0.112	0.0
CH2	51.5	-0.552	0.017	-1.1	11.6	-0.025	0.047	102.0	-0.021	0.416	0.0
CH3	79.0	-0.326	0.462	-0.4	9.5	0.017	0.198	99.8	-0.005	0.878	0.0
CH4	91.0	0.000	0.965	0.0	13.5	-0.027	0.120	101.3	0.022	0.387	0.0

GY4	113.0	-1.280	0.032	-1.1	8.5	-0.020	0.133	98.8	0.002	0.806	0.0
TK3	6.5	0.002	0.956	0.0	9.1	0.081	0.001	99.8	-0.042	0.212	0.0
TK2	3.2	0.000	1.000	0.0	9.4	0.031	0.058	100.4	-0.107	0.006	-0.1
TK1	9.9	0.033	0.664	0.3	11.7	0.023	0.081	98.9	-0.078	0.169	-0.1
TK4	375.0	-1.087	0.391	-0.3	11.7	0.056	0.001	101.8	-0.053	0.167	-0.1
TK6	384.5	-0.900	0.464	-0.2	11.8	0.063	0.001	100.3	-0.007	0.804	0.0
TK5	2.9	-0.005	0.770	-0.2	12.5	0.000	0.891	102.8	-0.178	0.011	-0.2
AX1	244.0	-0.370	0.761	-0.2	12.2	0.027	0.003	104.7	0.128	0.003	0.1
AX3	32.4	0.038	0.791	0.1	8.3	0.043	0.008	102.8	-0.001	0.970	0.0
AX2	184.5	-0.198	0.779	-0.1	11.4	0.030	0.019	102.1	0.006	0.778	0.0
AX4	510.0	3.694	0.033	0.7	11.2	0.025	0.029	100.9	0.011	0.628	0.0
DN1	8.7	-0.015	0.780	-0.2	9.1	0.025	0.094	97.4	-0.001	0.931	0.0
DN3	18.0	-0.051	0.737	-0.3	10.3	0.025	0.147	102.4	-0.069	0.017	-0.1
DN6	12.7	-0.025	0.744	-0.2	9.3	0.007	0.596	98.4	-0.031	0.231	0.0
DN2	0.7	-0.003	0.611	-0.4	8.5	0.037	0.075	97.9	-0.067	0.022	-0.1
DN7	20.1	-0.077	0.455	-0.4	9.8	0.017	0.309	97.8	-0.081	0.003	-0.1
DN9	78.1	0.464	0.270	0.6	11.2	0.025	0.147	103.1	0.056	0.103	0.1
DN5	68.8	-0.088	0.809	-0.1	10.2	0.030	0.065	95.7	0.005	0.861	0.0
DN4	515.0	-1.507	0.395	-0.3	11.7	0.036	0.006	100.9	0.053	0.090	0.1
DN10	13.0	-0.071	0.122	-0.5	11.9	0.033	0.002	100.1	-0.056	0.046	-0.1
DN8	26.0	-0.144	0.297	-0.6	12.1	0.017	0.206	102.0	-0.103	0.001	-0.1

Table S5b. Median water quality data and changes in water quality (1989 – 2014) via Seasonal Kendal slope estimators (SKSE) for all 77 NRWQN catchments. Catchments are listed in order from North to South. See Table 1 for variable descriptions. See Tables 5 and 6 for summaries of these data. Light blue cells represent significant decrease ( $p < 0.05$ ). Dark blue cells represent ‘meaningful’ decrease ( $p < 0.05$ , and  $RSKSE > \pm 1$ ). Pink cells represent significant increase ( $p < 0.05$ ). Red cells represent ‘meaningful’ increase ( $p < 0.05$ , and  $RSKSE > \pm 1$ ).

Catchment (N-S)	Median <i>COND</i> ( $\mu\text{S/cm}$ )	SKSE <i>COND</i>	SKSE p-value <i>COND</i>	RSKSE <i>COND</i>	Median <i>pH<sub>w</sub></i>	SKSE <i>pH<sub>w</sub></i>	SKSE p-value <i>pH<sub>w</sub></i>	RSKSE <i>pH<sub>w</sub></i>	Median <i>CLAR</i> (m)	SKSE <i>CLAR</i>	SKSE p-value <i>CLAR</i>	RSKSE <i>CLAR</i>
WH1	119	0.211	0.025	0.2	7.6	0.002	0.077	0.0	2.2	0.042	0.002	1.9
WH2	116	0.045	0.661	0.0	7.5	0.003	0.006	0.0	1.5	-0.015	0.003	-1.0
WH4	123	0.333	0.037	0.3	6.9	0.010	0.001	0.1	0.7	0.003	0.397	0.5
WH3	138	0.423	0.001	0.3	7.4	-0.006	0.000	-0.1	0.8	-0.010	0.002	-1.3
AK1	187	0.872	0.000	0.5	7.4	0.006	0.000	0.1	0.8	0.002	0.712	0.2
AK2	219	0.942	0.000	0.4	7.2	-0.001	0.567	0.0	0.6	0.014	0.000	2.4
HM6	120	1.771	0.000	1.5	7.8	-0.008	0.007	-0.1	2.4	0.015	0.086	0.6
HM5	108	0.455	0.000	0.4	7.3	0.000	0.637	0.0	0.7	0.004	0.146	0.6
HM4	155	-0.083	0.379	-0.1	7.5	-0.004	0.023	-0.1	0.7	0.002	0.422	0.3
HM2	119	0.452	0.000	0.4	7.2	-0.002	0.150	0.0	0.5	-0.004	0.068	-0.8
HM3	158	-0.246	0.047	-0.2	7.7	-0.004	0.122	0.0	1.1	0.007	0.079	0.6
HM1	56	0.094	0.008	0.2	7.2	0.002	0.076	0.0	1.3	0.017	0.005	1.3
GS4	92	-0.235	0.001	-0.3	7.7	0.002	0.100	0.0	0.7	0.019	0.000	2.6
R02	373	-2.975	0.000	-0.8	7.3	0.004	0.000	0.1	0.7	0.023	0.000	3.2
R01	528	-1.890	0.000	-0.4	8.1	-0.003	0.008	0.0	5.6	-0.007	0.678	-0.1
GS3	80	0.073	0.235	0.1	7.7	0.002	0.221	0.0	1.8	-0.010	0.047	-0.6
GS1	464	-1.055	0.016	-0.2	8.2	-0.003	0.001	0.0	0.1	0.001	0.002	1.8
GS2	152	0.335	0.010	0.2	8.2	-0.004	0.019	0.0	1.6	0.003	0.535	0.2
R05	93	0.320	0.000	0.3	7.1	0.005	0.005	0.1	1.3	0.015	0.021	1.1
R04	81	0.036	0.218	0.0	7.9	0.000	0.677	0.0	1.9	0.000	0.916	0.0
R03	85	0.344	0.000	0.4	7.7	0.000	0.721	0.0	2.0	-0.017	0.042	-0.9
R06	120	-0.010	0.659	0.0	8.0	-0.001	0.305	0.0	8.1	-0.029	0.163	-0.4
TU1	94	0.388	0.000	0.4	7.7	0.004	0.039	0.0	1.0	0.004	0.292	0.4
TU2	102	-0.318	0.002	-0.3	7.5	0.002	0.024	0.0	3.1	0.030	0.019	1.0

HV5	112	0.470	0.023	0.4	8.3	0.003	0.258	0.0	0.6	0.010	0.001	1.8
HV6	84	0.277	0.005	0.3	7.9	0.001	0.594	0.0	2.4	0.007	0.471	0.3
WA1	96	0.015	0.862	0.0	7.7	0.000	0.848	0.0	0.5	-0.002	0.533	-0.4
WA4	101	0.208	0.033	0.2	7.6	-0.002	0.050	0.0	0.4	0.003	0.015	0.8
HV4	72	0.244	0.011	0.3	7.8	0.002	0.019	0.0	5.1	-0.003	0.877	-0.1
WA2	69	0.170	0.002	0.2	7.5	0.002	0.068	0.0	4.0	0.023	0.141	0.6
HV3	147	0.486	0.042	0.3	8.1	0.000	0.933	0.0	1.1	0.009	0.063	0.9
WA3	179	0.305	0.155	0.2	7.9	-0.006	0.000	-0.1	1.3	0.001	0.741	0.1
WA5	123	-0.026	0.817	0.0	8.0	-0.001	0.480	0.0	1.0	0.004	0.336	0.4
WA6	150	0.086	0.631	0.1	8.0	-0.003	0.014	0.0	0.8	-0.003	0.249	-0.4
HV1	96	-0.091	0.259	-0.1	7.8	-0.003	0.026	0.0	1.7	0.054	0.002	3.1
HV2	199	0.436	0.095	0.2	8.5	-0.012	0.000	-0.1	1.8	0.006	0.318	0.3
WA7	259	0.629	0.029	0.2	8.1	-0.005	0.009	-0.1	1.1	0.010	0.014	1.0
WA8	177	0.280	0.188	0.2	7.7	-0.003	0.032	0.0	0.6	0.008	0.005	1.3
WA9	178	0.034	0.912	0.0	7.7	0.003	0.136	0.0	0.6	0.005	0.038	0.8
WN5	54	0.118	0.013	0.2	7.5	0.000	0.928	0.0	4.3	0.068	0.003	1.6
WN4	138	0.632	0.017	0.5	7.6	0.002	0.117	0.0	1.2	0.033	0.000	2.8
WN3	131	0.380	0.192	0.3	7.6	0.001	0.758	0.0	1.1	0.006	0.138	0.6
WN2	63	0.112	0.001	0.2	7.5	0.000	0.446	0.0	5.3	0.031	0.283	0.6
WN1	94	0.145	0.029	0.2	7.2	-0.001	0.550	0.0	2.5	0.005	0.632	0.2
NN1	114	0.337	0.000	0.3	8.0	-0.001	0.389	0.0	3.9	0.023	0.090	0.6
NN2	100	0.321	0.005	0.3	8.0	0.003	0.028	0.0	9.8	0.080	0.016	0.8
NN4	60	0.239	0.000	0.4	7.7	-0.001	0.749	0.0	2.6	0.009	0.294	0.3
NN5	56	0.146	0.008	0.3	7.7	0.000	0.709	0.0	3.7	0.069	0.000	1.9
NN3	45	0.126	0.000	0.3	7.6	0.004	0.007	0.0	3.7	0.018	0.345	0.5
GY1	67	0.148	0.013	0.2	7.6	0.002	0.034	0.0	1.8	-0.002	0.748	-0.1
GY2	57	0.220	0.000	0.4	7.4	0.002	0.045	0.0	1.7	0.018	0.035	1.1
GY3	53	0.179	0.007	0.3	7.5	-0.001	0.454	0.0	3.2	0.031	0.022	1.0
CH1	67	0.199	0.000	0.3	7.8	-0.001	0.300	0.0	1.5	-0.001	0.920	0.0
CH2	86	0.362	0.000	0.4	7.9	-0.007	0.001	-0.1	0.9	0.002	0.673	0.2
CH3	67	0.214	0.001	0.3	7.7	-0.001	0.235	0.0	0.5	-0.001	0.658	-0.3
CH4	67	0.341	0.000	0.5	7.7	-0.004	0.001	-0.1	0.3	-0.001	0.725	-0.2

GY4	81	0.015	0.802	0.0	7.7	0.000	0.819	0.0	2.3	0.006	0.662	0.2
TK3	47	0.178	0.015	0.4	7.5	0.001	0.312	0.0	2.3	-0.019	0.202	-0.8
TK2	84	1.047	0.000	1.2	7.7	-0.003	0.122	0.0	2.6	0.027	0.148	1.1
TK1	79	0.541	0.000	0.7	7.6	0.003	0.148	0.0	3.4	0.036	0.021	1.1
TK4	57	0.125	0.000	0.2	7.8	-0.001	0.341	0.0	1.9	0.107	0.000	5.8
TK6	62	0.110	0.011	0.2	7.6	0.002	0.317	0.0	1.0	0.044	0.000	4.4
TK5	79	0.625	0.000	0.8	7.7	-0.007	0.023	-0.1	4.4	0.046	0.141	1.0
AX1	68	0.184	0.000	0.3	8.0	0.005	0.091	0.1	5.2	0.010	0.559	0.2
AX3	101	0.166	0.172	0.2	7.9	-0.001	0.365	0.0	0.4	0.008	0.019	1.9
AX2	66	0.050	0.037	0.1	7.9	-0.001	0.612	0.0	1.5	0.015	0.149	1.1
AX4	71	0.083	0.018	0.1	7.8	0.000	0.811	0.0	1.7	0.042	0.000	2.5
DN1	85	0.422	0.039	0.5	7.5	0.001	0.361	0.0	0.9	0.009	0.002	1.1
DN3	77	0.492	0.013	0.6	7.6	-0.001	0.382	0.0	1.1	0.007	0.129	0.6
DN6	51	0.233	0.000	0.5	7.2	0.003	0.051	0.0	2.1	0.034	0.000	1.6
DN2	46	0.203	0.047	0.4	7.2	0.000	0.928	0.0	2.2	0.017	0.047	0.8
DN7	54	0.432	0.000	0.8	7.2	-0.004	0.012	0.0	3.6	0.043	0.001	1.2
DN9	80	-0.020	0.796	0.0	7.7	0.004	0.071	0.0	1.6	0.028	0.001	1.7
DN5	96	0.921	0.000	1.0	7.2	0.001	0.628	0.0	0.8	0.014	0.000	1.7
DN4	73	0.062	0.075	0.1	7.8	0.001	0.396	0.0	1.2	0.017	0.004	1.4
DN10	39	0.000	0.984	0.0	7.4	0.000	0.882	0.0	6.3	0.037	0.048	0.6
DN8	89	0.947	0.000	1.1	7.5	-0.007	0.002	-0.1	1.3	0.022	0.000	1.7

Table S5c. Median water quality data and changes in water quality (1989 – 2014) via Seasonal Kendal slope estimators (SKSE) for all 77 NRWQN catchments. Catchments are listed in order from North to South. See Table 1 for variable descriptions. See Tables 5 and 6 for summaries of these data. Light blue cells represent significant decrease ( $p < 0.05$ ). Dark blue cells represent ‘meaningful’ decrease ( $p < 0.05$ , and  $RSKSE > \pm 1$ ). Pink cells represent significant increase ( $p < 0.05$ ). Red cells represent ‘meaningful’ increase ( $p < 0.05$ , and  $RSKSE > \pm 1$ ).

Catchment (N-S)	Median <i>TURB</i> (NTU)	SKSE <i>TURB</i>	SKSE p-value <i>TURB</i>	RSKSE <i>TURB</i>	Median <i>CDOM</i> (m <sup>-1</sup> )	SKSE <i>CDOM</i>	SKSE p-value <i>CDOM</i>	RSKSE <i>CDOM</i>	Median <i>TN</i> (mg/m <sup>3</sup> )	SKSE <i>TN</i>	SKSE p-value <i>TN</i>	RSKSE <i>TN</i>
WH1	1.9	-0.030	0.005	-1.6	1.3	-0.013	0.010	-1.0	99	-0.695	0.066	-0.7
WH2	3.2	0.030	0.032	0.9	1.8	0.001	0.837	0.1	443	1.245	0.167	0.3
WH4	8.4	-0.011	0.854	-0.1	3.1	-0.023	0.018	-0.7	740	-6.515	0.016	-0.9
WH3	6.1	0.078	0.002	1.3	1.7	-0.003	0.362	-0.2	259	0.488	0.516	0.2
AK1	8.1	-0.034	0.281	-0.4	2.9	0.003	0.589	0.1	648	-9.395	0.000	-1.4
AK2	9.0	-0.189	0.000	-2.1	4.6	0.010	0.241	0.2	662	-4.549	0.019	-0.7
HM6	1.2	-0.004	0.425	-0.3	0.9	-0.006	0.014	-0.7	608	-2.740	0.187	-0.5
HM5	5.2	0.006	0.808	0.1	0.9	-0.001	0.768	-0.1	1223	4.457	0.007	0.4
HM4	4.6	0.063	0.015	1.4	1.0	0.002	0.615	0.2	571	5.678	0.002	1.0
HM2	7.8	0.119	0.003	1.5	1.7	-0.002	0.698	-0.1	926	7.403	0.007	0.8
HM3	1.9	0.015	0.068	0.8	0.8	-0.005	0.040	-0.6	385	5.765	0.000	1.5
HM1	2.1	-0.034	0.014	-1.6	1.1	-0.006	0.053	-0.6	383	1.324	0.186	0.3
GS4	6.3	-0.123	0.004	-1.9	0.5	0.000	0.950	0.0	120	-0.245	0.453	-0.2
R02	3.4	0.000	0.991	0.0	1.9	-0.105	0.000	-5.6	630	2.886	0.115	0.5
R01	0.5	0.006	0.017	1.2	0.1	0.000	0.635	0.0	89	0.665	0.016	0.7
GS3	2.1	0.026	0.025	1.3	1.1	0.003	0.226	0.3	260	3.307	0.001	1.3
GS1	82.0	-1.979	0.001	-2.4	0.8	0.000	0.748	0.1	275	2.382	0.054	0.9
GS2	2.2	0.006	0.542	0.3	1.1	0.002	0.286	0.2	348	2.949	0.046	0.8
R05	2.0	-0.005	0.633	-0.2	0.6	-0.005	0.011	-0.8	462	7.029	0.001	1.5
R04	1.6	0.022	0.001	1.4	0.7	0.001	0.355	0.2	198	-0.042	0.976	0.0
R03	1.3	0.015	0.013	1.2	0.4	0.002	0.256	0.5	734	19.177	0.000	2.6
R06	0.3	0.004	0.037	1.2	0.1	0.000	0.537	0.0	63	0.244	0.380	0.4
TU1	3.3	-0.007	0.703	-0.2	1.2	-0.008	0.017	-0.7	378	-0.868	0.527	-0.2
TU2	0.8	0.001	0.914	0.1	0.3	0.000	0.766	0.0	71	0.104	0.687	0.1



HV5	5.5	-0.098	0.013	-1.8	0.6	0.001	0.609	0.1	190	3.665	0.001	1.9
HV6	1.2	0.014	0.020	1.2	0.4	-0.001	0.210	-0.3	245	5.579	0.000	2.3
WA1	8.7	0.009	0.837	0.1	1.7	-0.004	0.454	-0.2	537	4.753	0.001	0.9
WA4	10.5	-0.056	0.280	-0.5	1.7	-0.013	0.039	-0.7	400	0.572	0.639	0.1
HV4	0.6	0.016	0.001	2.8	0.3	0.001	0.362	0.3	47	0.131	0.547	0.3
WA2	0.8	0.006	0.188	0.7	0.7	-0.007	0.003	-1.0	174	-0.433	0.516	-0.2
HV3	3.3	-0.019	0.416	-0.6	0.4	-0.003	0.024	-0.8	151	1.486	0.142	1.0
WA3	2.4	0.018	0.074	0.7	1.3	-0.007	0.017	-0.5	2162	5.287	0.366	0.2
WA5	3.7	0.006	0.779	0.2	0.6	-0.003	0.161	-0.5	167	-1.446	0.081	-0.9
WA6	5.3	0.074	0.049	1.4	0.7	-0.005	0.033	-0.7	209	0.342	0.699	0.2
HV1	2.2	-0.059	0.016	-2.7	0.3	-0.004	0.032	-1.2	97	-1.005	0.155	-1.0
HV2	1.7	0.004	0.572	0.2	0.6	-0.003	0.123	-0.5	776	2.620	0.491	0.3
WA7	4.1	-0.009	0.595	-0.2	1.1	-0.007	0.022	-0.6	678	2.212	0.220	0.3
WA8	6.9	-0.007	0.825	-0.1	1.2	-0.008	0.015	-0.6	789	-2.681	0.454	-0.3
WA9	7.3	-0.013	0.736	-0.2	1.2	-0.006	0.110	-0.5	908	-3.623	0.227	-0.4
WN5	0.9	-0.001	0.783	-0.1	0.7	-0.005	0.071	-0.7	88	-0.056	0.861	-0.1
WN4	3.1	-0.006	0.656	-0.2	0.9	-0.009	0.001	-0.9	695	2.343	0.405	0.3
WN3	4.3	0.006	0.646	0.1	0.9	-0.005	0.053	-0.6	549	0.395	0.898	0.1
WN2	0.6	0.002	0.647	0.3	0.9	-0.001	0.727	-0.1	93	0.051	0.809	0.1
WN1	1.4	0.022	0.008	1.6	1.2	-0.002	0.676	-0.1	344	-3.154	0.000	-0.9
NN1	1.0	0.009	0.083	1.0	0.7	0.004	0.036	0.6	216	4.395	0.001	2.0
NN2	0.5	0.003	0.380	0.7	0.3	0.000	0.711	0.0	52	0.187	0.544	0.4
NN4	1.4	-0.003	0.823	-0.2	0.2	0.000	0.870	0.0	125	1.448	0.072	1.2
NN5	0.9	0.008	0.076	0.9	0.5	0.000	0.854	0.0	85	1.113	0.002	1.3
NN3	1.0	0.018	0.017	1.8	0.2	0.000	0.848	0.0	40	-0.213	0.385	-0.5
GY1	1.8	0.014	0.251	0.8	1.0	0.001	0.847	0.1	143	2.428	0.000	1.7
GY2	2.1	-0.004	0.744	-0.2	1.5	-0.002	0.673	-0.2	207	5.309	0.000	2.6
GY3	0.9	0.008	0.356	0.9	1.3	0.000	0.968	0.0	105	1.656	0.009	1.6
CH1	2.0	0.006	0.348	0.3	0.4	0.000	0.811	0.0	60	0.860	0.001	1.4
CH2	3.8	0.069	0.002	1.8	0.4	0.000	0.966	0.0	372	4.831	0.001	1.3
CH3	7.4	0.079	0.123	1.1	0.3	-0.001	0.459	-0.4	99	1.345	0.002	1.4
CH4	11.9	0.073	0.321	0.6	0.3	-0.001	0.540	-0.3	125	4.918	0.000	3.9

GY4	1.5	0.022	0.044	1.4	0.2	0.000	0.582	0.0	57	-0.723	0.003	-1.3
TK3	1.4	0.034	0.022	2.5	0.7	0.015	0.002	2.3	365	4.617	0.059	1.3
TK2	1.0	-0.001	0.923	-0.1	0.5	0.000	0.995	0.0	895	31.761	0.000	3.5
TK1	0.7	0.001	0.769	0.2	0.4	0.002	0.191	0.6	510	10.483	0.000	2.1
TK4	2.5	-0.151	0.006	-6.1	0.2	-0.003	0.229	-1.4	58	0.063	0.861	0.1
TK6	4.2	-0.117	0.041	-2.8	0.2	-0.004	0.086	-1.7	118	-0.193	0.803	-0.2
TK5	0.6	0.004	0.220	0.7	0.4	-0.001	0.741	-0.2	114	1.739	0.003	1.5
AX1	0.6	0.010	0.024	1.8	0.1	-0.001	0.081	-0.9	71	-0.405	0.172	-0.6
AX3	7.5	0.025	0.726	0.3	0.2	0.000	0.978	0.0	54	-0.142	0.680	-0.3
AX2	2.2	0.026	0.186	1.2	0.1	0.000	0.477	0.4	74	1.050	0.001	1.4
AX4	2.0	-0.012	0.349	-0.6	0.3	0.000	0.794	0.0	89	0.100	0.770	0.1
DN1	3.8	0.002	0.908	0.0	2.2	-0.002	0.651	-0.1	295	2.336	0.008	0.8
DN3	3.0	0.023	0.177	0.8	2.2	0.003	0.499	0.1	304	3.063	0.001	1.0
DN6	1.7	-0.004	0.678	-0.2	0.4	-0.003	0.120	-0.8	310	4.440	0.000	1.4
DN2	1.2	0.005	0.489	0.4	2.0	-0.026	0.043	-1.3	245	0.525	0.292	0.2
DN7	1.1	0.000	0.996	0.0	0.5	-0.005	0.021	-0.9	555	18.243	0.000	3.3
DN9	2.1	-0.027	0.082	-1.3	1.1	-0.013	0.006	-1.2	300	4.630	0.000	1.5
DN5	4.2	-0.021	0.284	-0.5	1.1	-0.006	0.096	-0.5	1285	20.509	0.000	1.6
DN4	2.8	0.011	0.386	0.4	0.4	0.000	0.984	0.0	135	1.412	0.039	1.0
DN10	0.4	0.004	0.130	1.0	0.5	-0.002	0.225	-0.4	80	0.023	0.905	0.0
DN8	2.5	-0.014	0.143	-0.6	0.7	-0.002	0.388	-0.3	1009	25.160	0.000	2.5

Table S5d. Median water quality data and changes in water quality (1989 – 2014) via Seasonal Kendal slope estimators (SKSE) for all 77 NRWQN catchments. Catchments are listed in order from North to South. See Table 1 for variable descriptions. See Tables 5 and 6 for summaries of these data. Light blue cells represent significant decrease ( $p < 0.05$ ). Dark blue cells represent ‘meaningful’ decrease ( $p < 0.05$ , and  $RSKSE > \pm 1$ ). Pink cells represent significant increase ( $p < 0.05$ ). Red cells represent ‘meaningful’ increase ( $p < 0.05$ , and  $RSKSE > \pm 1$ ).

Catchment (N-S)	Median $NO_x$ (mg/m <sup>3</sup> )	SKSE $NO_x$	SKSE p-value $NO_x$	RSKSE $NO_x$	Median $TP$ (mg/m <sup>3</sup> )	SKSE $TP$	SKSE p-value $TP$	RSKSE $TP$	Median $DRP$ (mg/m <sup>3</sup> )	SKSE $DRP$	SKSE p-value $DRP$	RSKSE $DRP$
WH1	15	-0.384	0.004	-2.6	9	-0.068	0.035	-0.8	4.8	-0.002	0.883	0.0
WH2	246	-0.633	0.430	-0.3	20	0.254	0.000	1.3	5.0	-0.010	0.790	-0.2
WH4	402	-6.739	0.001	-1.7	61	0.376	0.167	0.6	18.0	0.027	0.822	0.1
WH3	70	0.257	0.412	0.4	24	0.251	0.006	1.0	6.2	0.065	0.050	1.0
AK1	347	-10.160	0.000	-2.9	54	-0.119	0.479	-0.2	18.6	-0.053	0.522	-0.3
AK2	215	-6.750	0.000	-3.1	59	0.009	0.944	0.0	16.6	0.000	1.000	0.0
HM6	445	-2.313	0.204	-0.5	15	-0.447	0.000	-3.0	4.5	-0.238	0.000	-5.3
HM5	1054	4.436	0.002	0.4	96	-0.498	0.076	-0.5	54.4	-0.318	0.016	-0.6
HM4	332	6.030	0.000	1.8	60	-0.031	0.817	-0.1	22.4	0.022	0.705	0.1
HM2	671	5.781	0.013	0.9	68	0.265	0.046	0.4	20.4	-0.170	0.008	-0.8
HM3	190	5.120	0.000	2.7	34	0.241	0.004	0.7	12.7	0.136	0.008	1.1
HM1	235	1.164	0.126	0.5	21	-0.158	0.085	-0.8	8.8	0.038	0.277	0.4
GS4	62	-0.456	0.129	-0.7	22	-0.346	0.001	-1.6	11.1	0.014	0.659	0.1
R02	358	4.433	0.000	1.2	115	-0.746	0.029	-0.6	66.2	-0.065	0.810	-0.1
R01	1	-0.003	0.377	-0.3	8	0.097	0.001	1.2	2.1	0.039	0.008	1.9
GS3	138	0.696	0.123	0.5	24	0.306	0.000	1.3	8.9	0.078	0.017	0.9
GS1	80	0.896	0.029	1.1	74	-2.910	0.000	-3.9	2.5	0.063	0.001	2.5
GS2	153	1.432	0.096	0.9	22	0.167	0.118	0.8	7.1	0.116	0.003	1.6
R05	347	5.975	0.001	1.7	37	-0.139	0.047	-0.4	19.7	-0.151	0.026	-0.8
R04	113	-0.179	0.740	-0.2	30	0.133	0.017	0.4	20.5	0.024	0.426	0.1
R03	634	18.743	0.000	3.0	30	0.000	1.000	0.0	21.3	-0.010	0.726	0.0
R06	1	-0.011	0.097	-1.1	5	0.032	0.022	0.6	1.1	0.015	0.003	1.4
TU1	223	-0.558	0.593	-0.3	21	-0.007	0.937	0.0	7.0	0.012	0.694	0.2
TU2	28	0.129	0.480	0.5	19	0.017	0.584	0.1	13.4	0.055	0.015	0.4

HV5	107	2.284	0.000	2.1	20	-0.405	0.001	-2.0	8.2	-0.057	0.015	-0.7
HV6	179	5.173	0.000	2.9	11	0.001	0.974	0.0	5.7	-0.030	0.080	-0.5
WA1	294	3.393	0.001	1.2	34	0.356	0.009	1.0	5.1	0.065	0.009	1.3
WA4	189	0.434	0.535	0.2	31	-0.164	0.092	-0.5	5.0	-0.010	0.602	-0.2
HV4	6	-0.129	0.003	-2.1	4	0.031	0.037	0.8	2.0	0.020	0.045	1.0
WA2	90	-0.027	0.947	0.0	15	-0.139	0.019	-0.9	9.4	-0.086	0.019	-0.9
HV3	78	0.564	0.214	0.7	17	-0.117	0.204	-0.7	6.8	0.033	0.419	0.5
WA3	1852	6.287	0.319	0.3	91	1.090	0.033	1.2	41.9	0.832	0.020	2.0
WA5	68	-1.165	0.008	-1.7	14	-0.004	0.929	0.0	4.0	-0.006	0.811	-0.1
WA6	83	-0.414	0.203	-0.5	20	0.172	0.107	0.9	4.1	0.019	0.597	0.5
HV1	55	-0.860	0.019	-1.6	10	-0.151	0.109	-1.6	5.0	-0.020	0.340	-0.4
HV2	549	3.470	0.324	0.6	21	0.072	0.424	0.3	7.6	0.128	0.015	1.7
WA7	397	2.280	0.092	0.6	33	0.095	0.499	0.3	9.5	0.129	0.111	1.4
WA8	495	-2.195	0.375	-0.4	35	-0.136	0.350	-0.4	10.0	0.017	0.712	0.2
WA9	506	-2.400	0.426	-0.5	80	-2.911	0.000	-3.6	24.7	-1.132	0.000	-4.6
WN5	34	-0.265	0.166	-0.8	5	-0.017	0.556	-0.3	2.9	-0.008	0.579	-0.3
WN4	523	3.412	0.173	0.7	22	-0.058	0.593	-0.3	8.4	0.021	0.612	0.3
WN3	376	0.527	0.770	0.1	30	-0.013	0.841	0.0	14.0	0.055	0.225	0.4
WN2	33	-0.071	0.502	-0.2	6	0.028	0.084	0.5	3.8	0.002	0.837	0.1
WN1	237	-2.597	0.003	-1.1	12	-0.189	0.001	-1.6	5.8	-0.179	0.000	-3.1
NN1	116	3.445	0.002	3.0	7	0.033	0.093	0.5	3.0	0.016	0.328	0.5
NN2	23	0.065	0.432	0.3	4	0.032	0.020	0.8	2.6	0.022	0.020	0.9
NN4	67	1.259	0.041	1.9	7	-0.040	0.162	-0.6	3.2	0.000	1.000	0.0
NN5	25	0.233	0.171	0.9	5	-0.002	0.873	0.0	1.0	0.017	0.044	1.7
NN3	11	-0.019	0.808	-0.2	5	0.075	0.003	1.5	3.0	0.033	0.012	1.1
GY1	49	1.781	0.000	3.6	9	0.020	0.586	0.2	2.0	-0.005	0.672	-0.2
GY2	90	3.971	0.000	4.4	9	-0.017	0.625	-0.2	2.3	0.023	0.029	1.0
GY3	28	0.916	0.000	3.3	5	0.020	0.450	0.4	2.0	0.015	0.162	0.8
CH1	11	0.125	0.056	1.1	5	0.033	0.395	0.7	1.0	0.014	0.097	1.4
CH2	289	4.195	0.001	1.5	11	0.078	0.132	0.7	2.5	0.019	0.104	0.8
CH3	65	1.027	0.004	1.6	11	0.022	0.755	0.2	2.0	0.026	0.011	1.3
CH4	81	4.313	0.000	5.3	18	-0.080	0.412	-0.4	2.0	0.016	0.217	0.8

GY4	32	-0.016	0.786	0.0	4	-0.035	0.191	-0.9	1.2	0.011	0.129	0.9
TK3	225	1.643	0.318	0.7	8	0.186	0.008	2.3	1.5	-0.007	0.736	-0.4
TK2	740	28.711	0.000	3.9	8	0.054	0.162	0.7	3.9	0.099	0.000	2.5
TK1	369	9.390	0.000	2.5	7	0.033	0.201	0.5	3.3	0.026	0.327	0.8
TK4	8	-0.373	0.001	-4.7	5	-0.063	0.101	-1.4	0.7	0.001	0.727	0.2
TK6	50	-0.211	0.667	-0.4	9	-0.157	0.033	-1.7	1.0	-0.013	0.212	-1.3
TK5	13	-0.015	0.925	-0.1	7	0.032	0.197	0.5	3.2	0.012	0.525	0.4
AX1	34	-0.290	0.016	-0.9	3	-0.014	0.339	-0.5	0.5	0.011	0.029	2.2
AX3	16	-0.113	0.171	-0.7	33	0.033	0.884	0.1	1.0	0.006	0.347	0.6
AX2	23	0.181	0.006	0.8	12	0.120	0.157	1.0	0.9	0.036	0.000	4.0
AX4	35	-0.439	0.001	-1.3	6	-0.047	0.126	-0.8	0.7	0.002	0.654	0.2
DN1	26	0.229	0.353	0.9	41	0.184	0.218	0.4	13.0	0.011	0.896	0.1
DN3	38	0.205	0.461	0.5	30	0.152	0.096	0.5	8.1	-0.013	0.806	-0.2
DN6	238	4.804	0.000	2.0	11	0.000	1.000	0.0	5.3	0.020	0.164	0.4
DN2	11	-0.248	0.020	-2.3	17	0.091	0.058	0.5	5.0	-0.008	0.770	-0.2
DN7	435	18.238	0.000	4.2	5	-0.001	0.917	0.0	2.7	0.015	0.130	0.6
DN9	171	4.920	0.000	2.9	10	-0.049	0.357	-0.5	1.7	-0.018	0.086	-1.1
DN5	991	22.154	0.000	2.2	39	-0.181	0.346	-0.5	13.7	0.063	0.468	0.5
DN4	53	0.083	0.738	0.2	9	-0.032	0.489	-0.4	1.5	0.018	0.092	1.2
DN10	6	-0.133	0.005	-2.2	3	0.009	0.105	0.3	0.6	-0.001	0.613	-0.2
DN8	840	26.146	0.000	3.1	14	0.026	0.483	0.2	6.0	0.058	0.013	1.0