Mahurangi River

Map of River

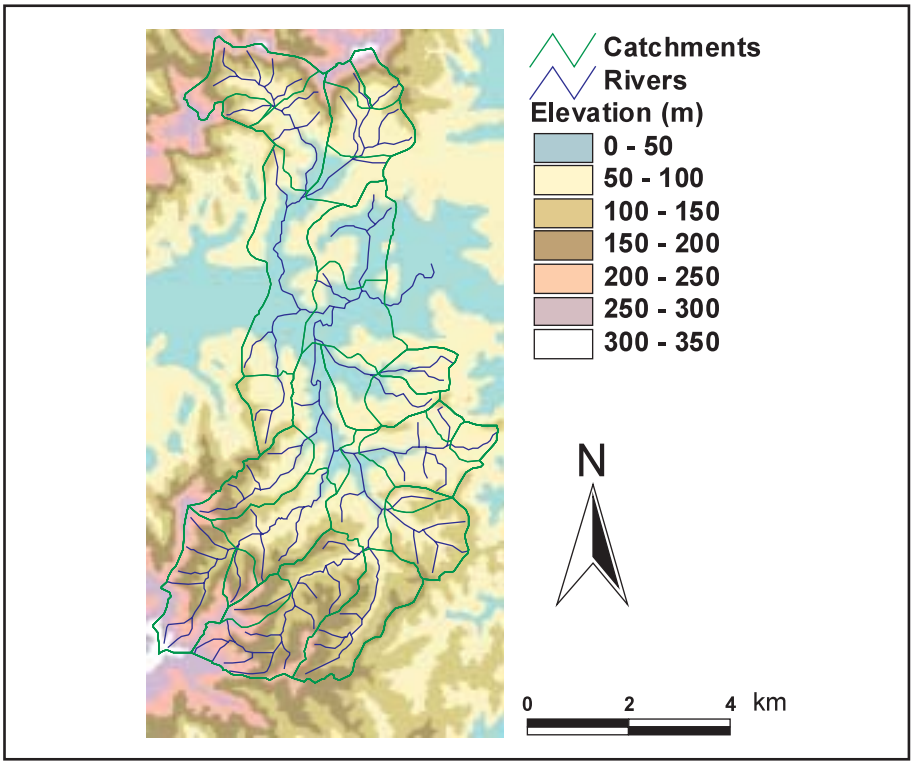


Table of Basic Data

Name: Mahurangi River		**Serial No. :** New Zealand-5
Location: Northland region, New Zealand	S 36° 19' ~ 36° 29'	E 174° 36' ~ 174° 41'
Area: 46.6 km^2	**Length of the main stream:** 10 km	
Origin: Hills	**Highest point:** The Dome, (336 m)	
Outlet: Mahurangi Harbour, Hauraki Gulf,	**Lowest point:** River mouth (0 m)	
Main geological features: Waitemata sandstones comprising alternating layers of sandstone and siltstone.		
Main tributaries: Mahurangi River (left branch), Mahurangi River (right branch)		
Main lakes: None		
Main reservoirs: None		
Mean annual precipitation: 1,600 mm		
Mean annual runoff: 860 mm		
Population: 12,000 at Warkworth, otherwise sparse.		**Main cities:** Auckland, 50 km south.
Land use: Pasture grazing in lowland area, plantation and protected (native) forest in hills.		

1. General Description

The Mahurangi River drains 50 km^2 of steep hills and gently rolling lowlands located 50 km north of Auckland, New Zealand. This part of New Zealand experiences a warm humid climate, with typical annual rainfalls of 1,600 mm. Maximum rainfall is usually in July, the middle of the austral winter.

Annual pan evaporation is 1,310 mm, with maximum monthly temperature and pan evaporation occurring during January or February. Frosts are rare and snow and ice are unknown. In late summer, the remnants of a tropical cyclone occasionally pass over northern New Zealand, producing intense bursts of rain. Convective activity is significant in summer, whereas the majority of the winter rains comes from frontal systems.

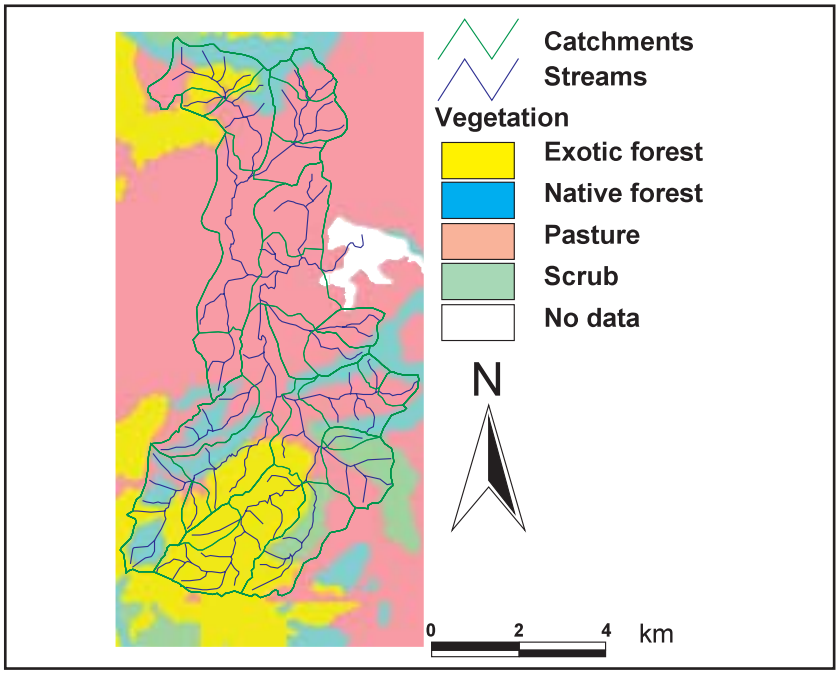
The drainage network of the Mahurangi River divides the catchment into northern and southern subcatchments, whose junction is 2 km west of Warkworth, a town of 12,000 inhabitants at the mouth of the Mahurangi River where it enters an estuary. Catchment elevation ranges from more the 250 m on the northern and southern boundaries, to near sea level at Warkworth on the east coast.

The soils of the catchment have developed over Waitemata sandstones, which typically display alternating layers of sandstone and siltstone. Most of the soils in the catchment are clay loams, no more than a metre deep. In the 19th century the dominant vegetation was native forest, but now much of the lowland area is used for grazing. Plantation forestry, dominantly *Pinus radiata*, occupies most of the hills in the south, and a mixture of native forest, scrub and grazing occurs on the hills in the north.

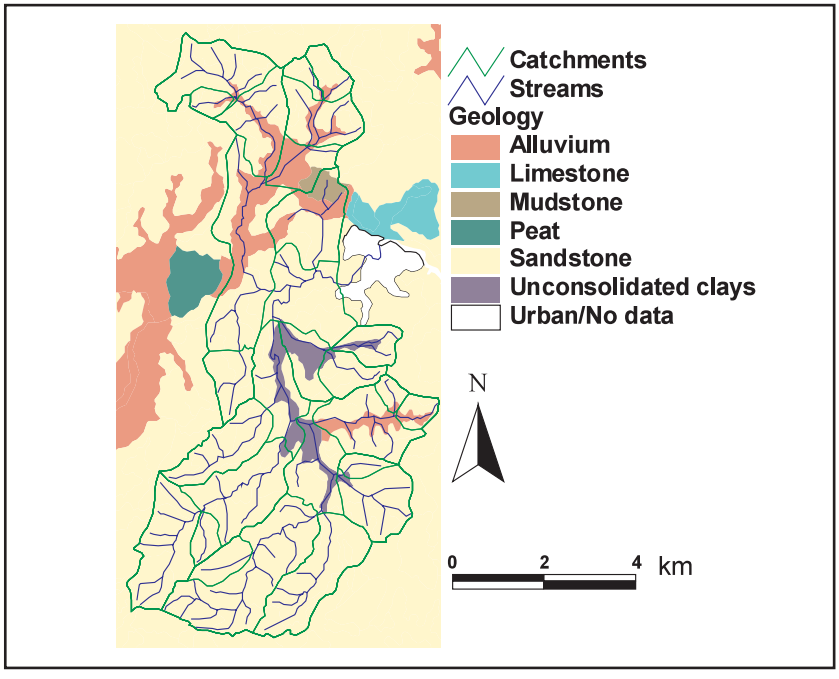
The Mahurangi catchment has been the focus of an intensive data collection experiment. The aim of the experiment is to provide data for improved modelling of spatial variability in hydrological response. The MAhurangi River Variability EXperiment (MARVEX) is specifically designed to answer the question: “what are the most important sources of variability in streamflow and hydrological response” for a temperate area of New Zealand and to provide data for testing and developing spatial modelling methods. A network of 28 streamgauges and 13 raingauges has been the key element of the MARVEX study. Rainfall has also been observed with C-band and X-band radars. The soil moisture measurement component has used two sampling strategies: a network of continuously recording sensors, and seasonal mapping campaigns in selected subcatchments. Some further details are given in Woods et al (2001), but at the time of writing the participants in this experiment are still working up other data.

2. Geographical Information

2.1 Geological Map



2.2 Land Use Map

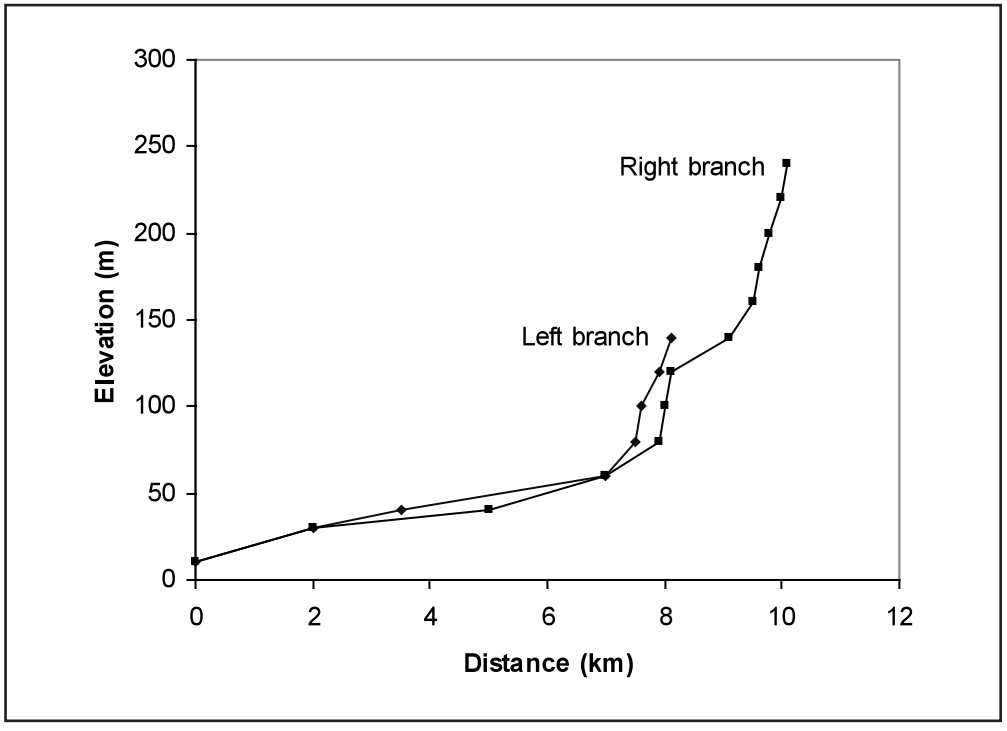


2.3 Characteristics of River and Main Tributaries

No.	Name of river	Length [km] Catchment area [km^2]	Highest peak [m] Lowest point [m]	Cities population (1985)	Land use [%] (1991)
1	**Mahurangi** (Main river)	2 km 4.6 km^2	87 m 10 m	Warkworth 12,000	A 58 F 42
2	**Mahurangi left branch** (Tributary)	10 km 14.0 km^2	336 m 30 m	None	A 82 F 18
3	**Mahurangi right branch** (Tributary)	8 km 25.0 km^2	330 m 30 m	None	A 43 F 57

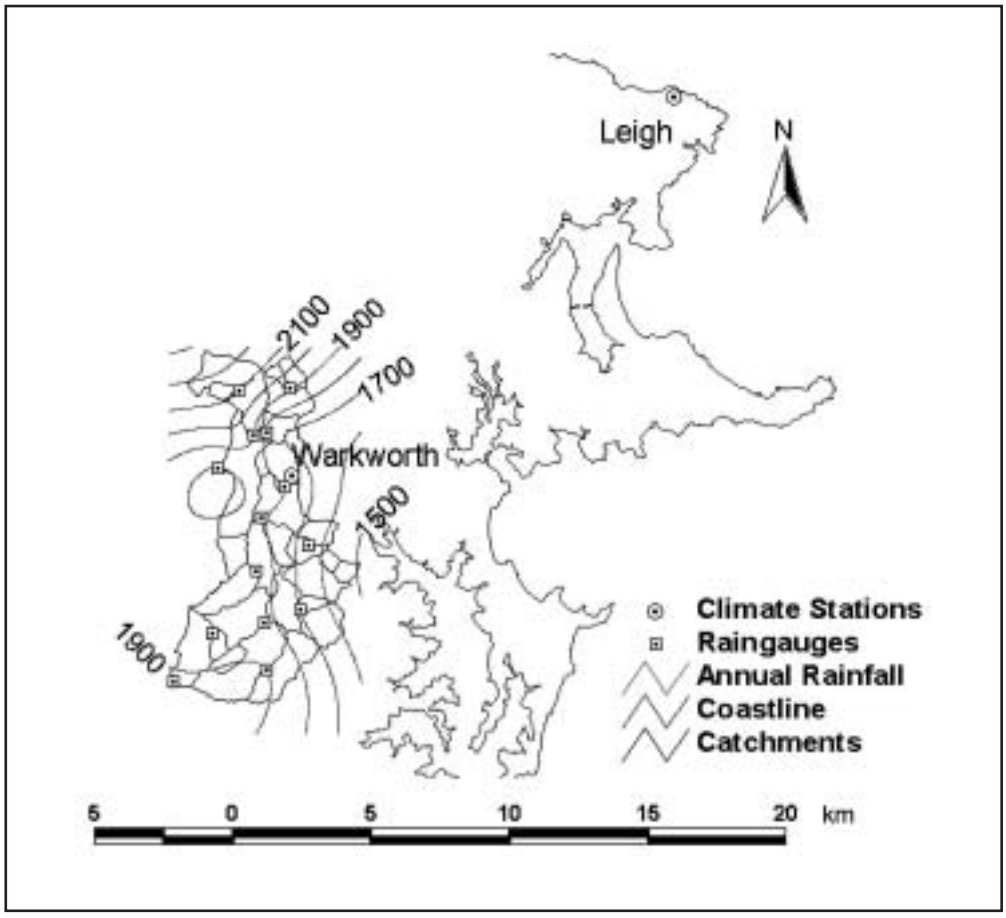
A: Other agricultural field (vegetable, grass) F: Forest

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



3.2 List of Meteorological Observation Stations

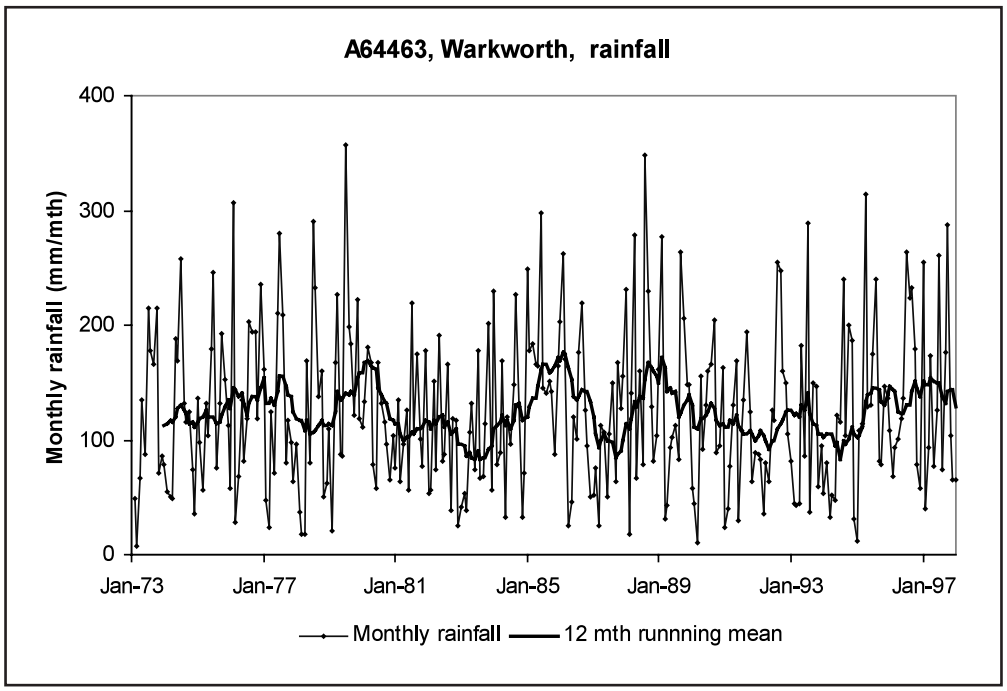
No.*	Station	Elevation [m]	Location	Observation period	Mean annual precipitation [mm]	Mean annual evaporation [mm]	Observation items[1)]
A64463	**Warkworth**	72	S 36° 26' E 174° 40'	1973 - 1997	1,491	No data	P, TB, T
A64282	**Leigh**	72	S 36° 16' E 174° 48'	1973 - 1997	1,122	1,308	BP, DS, P, RPE, SR, T, W

* Code used by National Institute for Water and Atmospheric Research.
1) BP, barometric pressure DS: Duration of sunshine P: Precipitation with recording chart RPE: Raised pan evaporation
SR: Solar radiation T: temperature (air and soil) W: wind speed and direction.

3.3 Monthly Climate Data

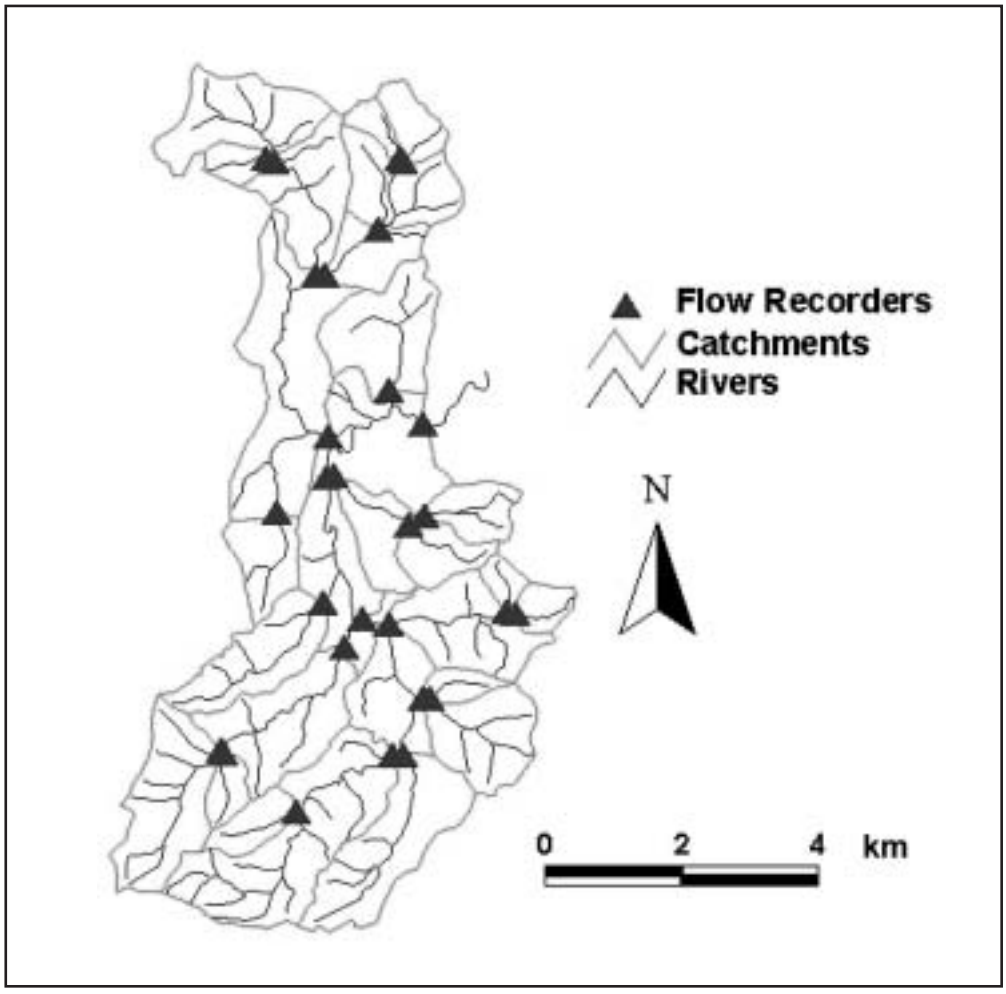
Observation item	Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	**Warkworth**	18.5	19.0	17.9	15.5	13.1	11.1	10.3	10.8	12.0	13.6	15.2	16.9	14.5	1973-1999
Precipitation [mm]	**Warkworth**	97	76	119	111	118	176	165	160	146	110	100	110	1,493	1973-1997
Evaporation (raised pan) [mm]	**Leigh**	181	155	136	97	70	48	50	62	84	117	141	168	1,308	1973-1997
Solar radiation [MJ/m^2/day]	**Leigh**	23.1	19.6	16.9	11.4	8.4	6.9	7.1	10.4	13.7	16.8	20.5	23.0	14.8	1993-2001
Duration of sunshine [hr]	**Leigh**	244	195	170	164	167	118	144	153	156	186	197	234	2,111	1972-1988

3.4 Long-term Variation of Monthly Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



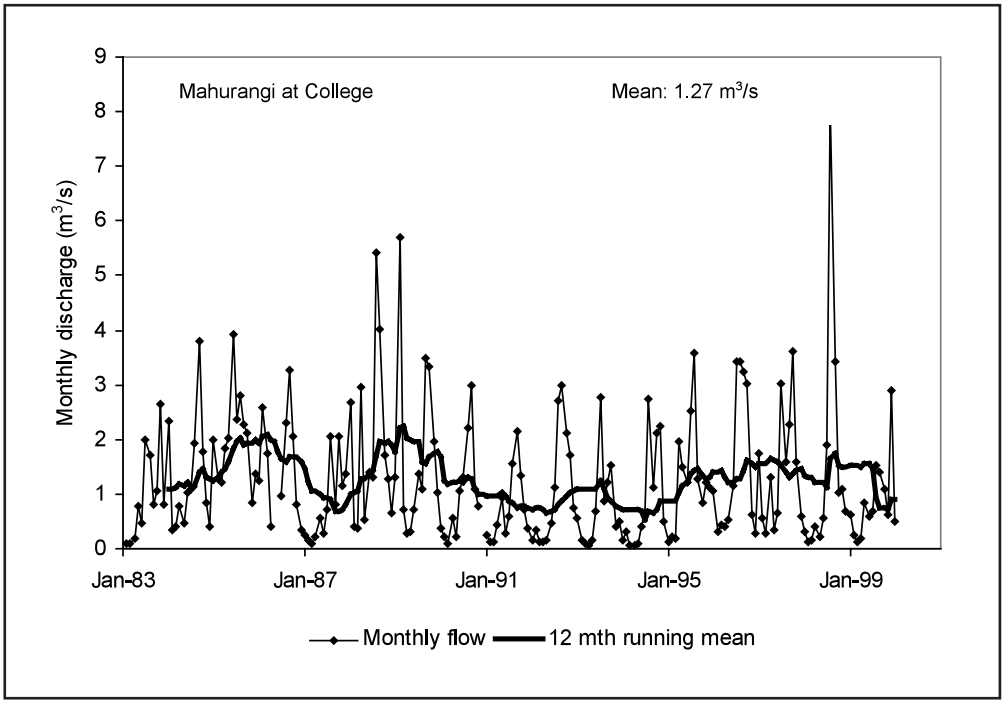
4.2 List of Hydrological Observation Stations

No.*	Station	Location	Catchment area (A) [km^2]	Observation period	Observation items[1)] (frequency)
6806	**Mahurangi at College**	R9:586319	46.6	1982 ~ present	Q (15 min), S (periodic)
6809	**Wyllie Stm at Whitemans Br.**	R9:566302	1.145	1997 ~ present	Q (2 min)
6810	**Redwood Forest at Airstrip Ridge**	R9:568259	0.6	1994 ~ 1998	Q (15 min)
6812	**Mahurangi at Dome Valley**	R9:564533	0.429	1998 ~ present	Q (2 min)
6813	**Mahurangi at Sheepworld**	R9:565354	2.627	1997 ~ present	Q (2 min)
6814	**Mahurangi at Taylors**	R9:571338	4.606	1997 ~ present	Q (2 min)
6815	**Mahurangi at Taylors Reserve**	R9:571338	3.917	1997 ~ present	Q (2 min)
6816	**Mahurangi at Upper Goatley (right)**	R9:584355	0.364	1997 ~ present	Q (2 min)
6817	**Mahurangi at Upper Goatley (left)**	R9:584355	0.710	1997 ~ present	Q (2 min)
6819	**Mahurangi at Mid Goatley**	R9:580344	2.811	1998 ~ present	Q (2 min)
6820	**Falls Rd at Br.**	R9:582319	2.341	1997 ~ present	Q (2 min)
6821	**Mahurangi at Wynyards**	R9:573314	13.997	1997 ~ present	Q (2 min)
6823	**Mahurangi at Cashmores (right)**	R9:574308	2.963	1997 ~ present	Q (2 min)
6824	**Mahurangi at Cashmores (left)**	R9:573308	24.803	1997 ~ present	Q (2 min)
6825	**Mahurangi at Morrison's Fence**	R9:587302	0.928	1998 ~ present	Q (2 min)
6826	**Mahurangi at Morrison's Br**.	R9:586301	0.930	1998 ~ present	Q (2 min)
6827	**Mahurangi at Fish Farm**	R9:572289	1.997	1998 ~ present	Q (2 min)
6828	**Mahurangi at Harnish's**	R9:578287	15.054	1997 ~ present	Q (2 min)
6829	**Mahurangi at Perry Rd**	R9:575283	5.769	1997 ~ present	Q (2 min)
6830	**Mahurangi at Waterfall (left)**	R9:557268	2.650	1998 ~ present	Q (2 min)
6831	**Mahurangi at Waterfall (right)**	R9:558267	0.509	1998 ~ present	Q (2 min)
6832	**Mahurangi at Satellite Stn (right)**	R9:599289	0.343	1998 ~ present	Q (2 min)
6833	**Mahurangi at Satellite Stn (left)**	R9:602287	0.514	1998 ~ present	Q (2 min)
6834	**Meikles Stm at Old Army Br.**	R9:582286	3.006	1998 ~ present	Q (2 min)
6835	**Mahurangi at Scenic Reserve**	R9:587275	2.301	1998 ~ present	Q (2 min)
6836	**Mahurangi at Grimmer's**	R9:588275	0.424	1998 ~ present	Q (2 min)
6837	**Pohuehue Stm at Redwoods**	R9:584267	2.867	1997 ~ present	Q (2 min)
6838	**Redwoods Stm at Redwoods Ford**	R9:582267	5.025	1997 ~ present	Q (2 min)

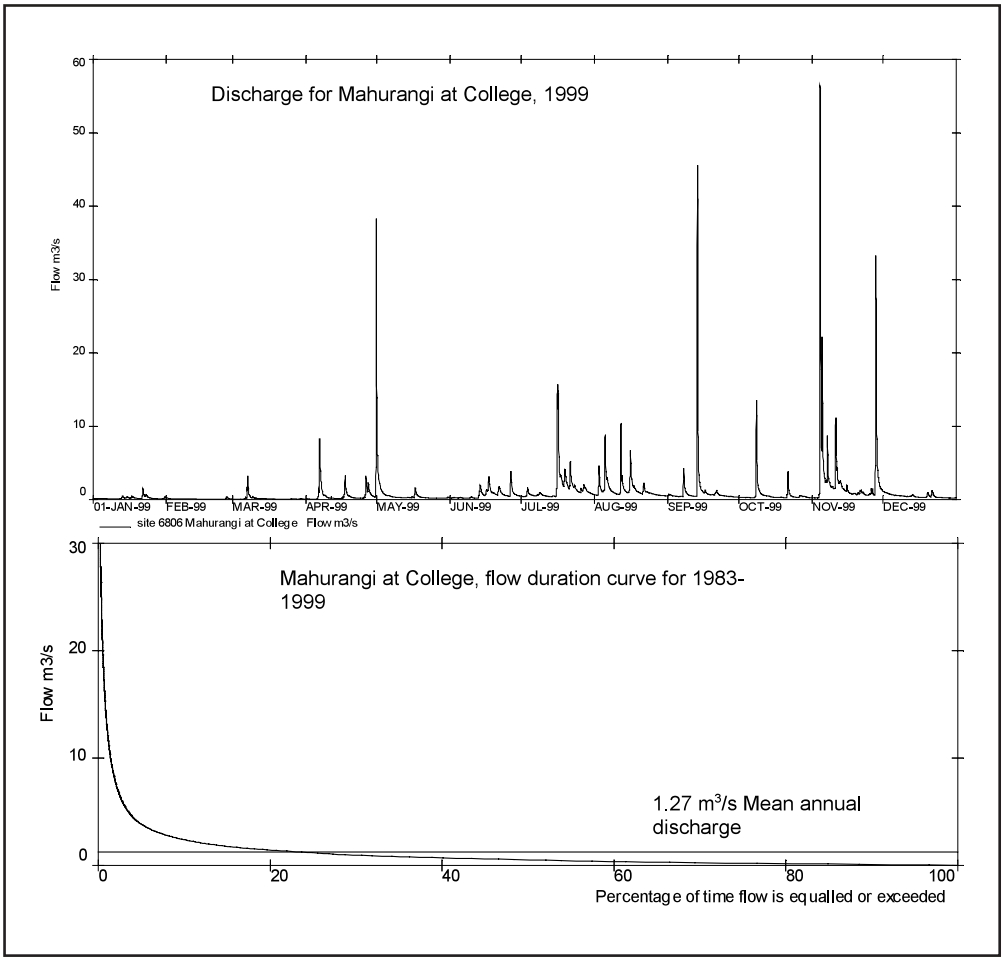
No.*	$\overline{Q}$[1)] [m^3/s]	Qmax[2)] [m^3/s]	$\overline{Q}$max[3)] [m^3/s]	$\overline{Q}$min[4)] [m^3/s]	$\overline{Q}$/A [$m^3/s/100km^2$]	Qmax/A [$m^3/s/100km^2$]	Period of statistics
6806	1.27	205	90.9	0.105	2.70	438	1983 - 1999
6809	0.0255	10.4	6.24	0.002	2.23	908	1998 - 2000

* Streamgauge number used in New Zealand
1) Mean annual discharge
2) Maximum discharge
3) Mean of annual maximum discharge
4) Mean of annual minimum discharge

4.3 Long-term Variation of Monthly Discharge



4.4 Annual Pattern of Discharge



4.5 Unique Hydrological Features

The unique hydrological feature of this area is the intensive instrumentation network to measure the spatial and temporal variability of moisture fluxes. The basin itself is characteristic of many basins in northern New Zealand.

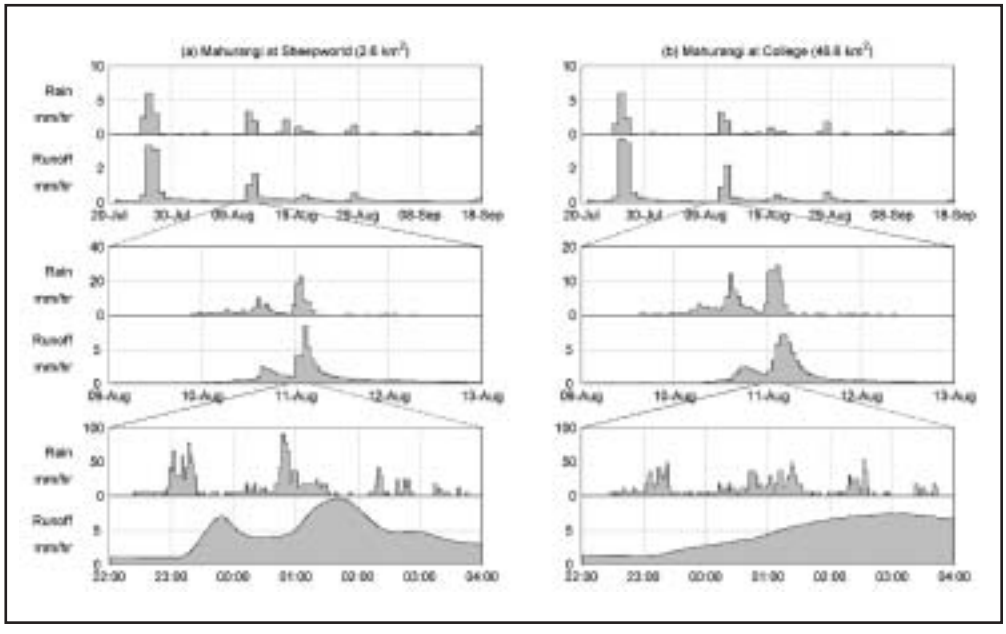
4.6 Annual Maximum and Minimum Discharges

Station: Mahurangi at College [46.6 km^2]

Year	Maximum[1)]		Minimum[2)]		Year	Maximum[1)]		Minimum[2)]	
	Date [m/d]	[m^3/s]	Date [m/d]	[m^3/s]		Date [m/d]	[m^3/s]	Date [m/d]	[m^3/s]
1983	12/6	47.0	3/4	0.043	**1992**	7/22	49.2	3/2	0.045
1984	12/11	70.9	3/3	0.160	**1993**	6/29	57.1	3/28	0.038
1985	5/22	205	2/7	0.194	**1994**	7/25	63.6	3/12	0.031
1986	1/4	60.0	12/20	0.122	**1995**	3/29	139	1/8	0.054
1987	12/16	60.7	3/8	0.048	**1996**	6/23	88.1	2/7	0.118
1988	7/18	121	3/5	0.142	**1997**	6/30	63.0	2/18	0.133
1989	9/8	64.2	4/27	0.112	**1998**	7/14	147	2/18	0.060
1990	8/23	84.6	3/3	0.053	**1999**	11/4	56.5	3/4	0.069
1991	8/25	51.3	3/14	0.040					

1), 2) Observations at 15 min. intervals by recording gauge.

4.7 Hyetographs and Hydrographs of Major Floods



5. Water Resources

5.1 General Description

No significant water resource developments (dam, transfers, etc.) exist in this river basin.

5.2 Map of Water Resource Systems

Not applicable.

5.3 List of Major Water Resources Facilities

Major Reservoirs
No reservoirs in this basin

Major Interbasin Transfer
No water transfers to or from this basin.

5.4 Major Floods and Droughts

Major Floods at College streamgauge

Date	Peak discharge [m^3/s]	Rainfall [mm] Duration	Meteorological cause	Dead and missing	Major damages (Districts affected)
22 May 1985	205	200 24 h	No details	0	Northland region
29 March 1995	139	157 24 h	No details	0	Northland region
14 July 1998	147	86 24 h	No details	0	Northland region

Major Droughts

Period	Affected area	Major damages and counteractions
January 1993 to June 1994	Auckland metropolitan region	Urban water shortages for December 1993 to June 1994.

5.5 Groundwater and River Water Quality

No groundwater or water quality data was collected as part of the MARVEX experiment.

6. Socio-cultural Characteristics

The Mahurangi River basin is lightly populated. The only town in the basin (Warkworth) is beside the tidal estuary of the river. The principal land uses are grazing and plantation forestry, which is typical of large areas of northern New Zealand. Exploitation of slower growing native hardwood species since the time of European settlement in the 19th century has been completely replaced by plantation forestry, which uses mainly the exotic *Pinus radiata*.

The region regularly suffers soil moisture deficits in the later part of summer.

The environment and natural resources of the Mahurangi River basin are managed by the Auckland Regional Council, within the provisions of the New Zealand Resource Management Act 1991 (see: www.arc.govt.nz). In practice of course, the ultimate managers of the water resources are the landowners and users of the river system, with the Auckland Regional council exercising an oversight role. Management is carried out within the framework of a Regional Policy Statement and a system of issuing "resource consents" to abstract or divert water, discharge effluents and so on.

7. References, Databooks and Bibliography

Auckland Regional Water Board (1990): Mahurangi River Catchment: 1990 Allocation and Management Plan, Technical Publication No. 90 of the Auckland Regional Water Board, Auckland, New Zealand.

DSIR Land Resources (1992): New Zealand Land Resource Inventory Survey, 1:50000. Department of Scientific and Industrial Research, Wellington, New Zealand.

Woods, R.A., Grayson, R.B., Western, A.W., Duncan, M.J., Wilson, D.J., Young, R.I., Ibbitt, R.P., Henderson, R.D. and T.A. McMahon (2001): Experimental Design and Initial Results from the Mahurangi River Variability Experiment: MARVEX. In: Observations And Modeling Of Land Surface Hydrological Processes, Eds: Lakshmi, V., Albertson, J.D. and J. Schaake., Water Resources Monograph, American Geophysical Union, 3, 201-213.