# First National Assessment of River Health; Western Australian Program

## Milestone report 2

**W.R. Kay, M.J. Smith, M.D. Scanlon, J.S. Cocking and S.A. Halse**

**CALMScience**
**Western Australian Department of**
**Conservation and Land Management**
**PO Box 51**
**Wanneroo WA 6948**

**This milestone report covers the period 31 December 1998 to 31 December 1999**

**Due date for report: 31 December 1999**

**Project objectives:** **Conduct First National Assessment of River Health**
**Refine existing AusRivAS models**

# PART A

**Summary: A description of the milestone and the date on which it was reached**

All criteria for Milestone 2 were accomplished by 31 December 1999.

The major achievements were:

- autumn 1999 sampling of reference and test sites in south-western Australia
- spring 1999 sampling of reference and test sites in south-western Australia
- processing of all samples collected during 1998 and autumn 1999
- associated data entry and quality control checks
- refinement of models for north-western Australia
- bioassessment of all sites sampled in 1998

**A report on the work conducted by the State to achieve the Milestone including**
**The site selection process and sites selected**

Since the completion of sampling in north-western Australia we have been focusing on the forested area of the south-west of the State. Between January and April 1999 we sampled 100 sites in this region (Table 1). Sites were selected using two criteria. First, we chose sites in areas where we needed better coverage of reference sites to improve the scope and accuracy of our models. Second, we selected sites in a number of southern and karri forest catchments to give us an optimal spread of sites for our bioassessment. As part of this sampling we selected 15 sites in the Collie Basin (Table 1) to provide information to the Collie Water Advisory Group, who are currently reviewing water resource management in the basin.

Between August and October 1999 a further 201 sites were sampled in the forested and coastal regions of south-western Australia (Table 2). These comprised sites sampled in autumn 1999 plus an additional 101 sites. The number of sites chosen in each catchment was proportional to the size of that catchment. Suggestions for high quality sites and heavily impacted sites were solicited from regional based employees of government agencies such as the Department of Conservation and Land Management and the Water and Rivers Commission as well as local landowners. The remaining sites were randomly chosen from topographic maps so that unbiased assessments of regional conditions could be made.

**Progress with sampling, sample processing and data entry**

During 1998 we sampled 180 sites throughout the Gascoyne, Pilbara and Kimberley regions of north-western Australia (latitude < 28°S). The vast majority of sites were sampled both at the end of the Wet season (April/May) and the end of the Dry season (September/October). A few sites could only be sampled once because they were dry during the second visit. All samples collected during these trips have been processed and data entered onto our database.

We finished processing the 1998 Wet season samples in December 1998 and subsequently re-built the Wet season channel model for north-western Australia. Details of this model and the O/E scores derived from it were given in Milestone report 1 (December 1998). More recently we have finished processing the samples collected during the 1998 Dry season and we have now completed re-building the Dry season channel model for north-western Australia. Details of this model are given in PART C while results (ie. O/E scores and bands) are given later in PART A.

Laboratory processing of the autumn 1999 samples including the associated data entry and quality control checks was completed in January 2000. No laboratory sample residues were preserved as samples were live-picked. Processing of spring 1999 samples is underway and it is anticipated that this will be completed by the end of June 2000. Forty-seven diatom samples were collected during spring 1999 for Dr Peter Gell of the University of Adelaide.

**Table 1.** Sites sampled between January and April 1999 as part of the Western Australian First National Assessment of River Health.

| Count | Site number | River system | Site name | Date visited |
|---|---|---|---|---|
| 1 | BLA05 | Blackwood | Ellis Creek. | 28/01/1999 |
| 2 | BLA06 | Blackwood | St. Johns | 28/01/1999 |
| 3 | BLA07 | Blackwood | St. Paul | 28/01/1999 |
| 4 | BLA08 | Blackwood | Blackwood Road. | 25/01/1999 |
| 5 | BLA09 | Blackwood | Judy Road. | 25/01/1999 |
| 6 | BLA11 | Blackwood | Spearwood | 24/01/1999 |
| 7 | BLA12 | Blackwood | Rosa Brook | 25/01/1999 |
| 8 | BLA13 | Scott | Milyeannup Road. | 27/01/1999 |
| 9 | BLA14 | Scott | Brennan Bridge | 26/01/1999 |
| 10 | BLA17 | Blackwood | Macleod Creek | 26/01/1999 |
| 11 | BLA34 | Scott | BHP pump | 26/01/1999 |
| 12 | BLA35 | Scott | Flying fox | 27/01/1999 |
| 13 | BLA36 | Scott | Roberts' | 27/01/1999 |
| 14 | BLA37 | Scott | L bend | 27/01/1999 |
| 15 | BLA38 | Scott | Governor Broome Creek | 26/01/1999 |
| 16 | BLA39 | Scott | Wilmont's Drain | 26/01/1999 |
| 17 | BLA40 | Blackwood | Middle block on dairy farm | 24/01/1999 |
| 18 | BLA41 | Blackwood | Rocky Island | 24/01/1999 |
| 19 | BUS01 | Margaret | Molloy Road. | 22/01/1999 |
| 20 | BUS03 | Margaret | Challis above Mowen | 22/01/1999 |
| 21 | BUS05 | Margaret | Bramely Brook | 23/01/1999 |
| 22 | BUS06 | Ellen brook | Caves Road. | 23/01/1999 |
| 23 | BUS07 | Ellen brook | Homestead | 23/01/1999 |
| 24 | BUS08 | Carbunup | Gibb Road. | 21/01/1999 |
| 25 | BUS09 | Carbunup | Ray Harvie | 21/01/1999 |
| 26 | BUS10 | Carbunup | Unnamed tributary. | 21/01/1999 |
| 27 | BUS11 | Carbunup | Yallingup Siding | 21/01/1999 |
| 28 | BUS12 | Sabina | Sabina | 20/01/1999 |
| 29 | BUS13 | Ludlow | Headwater | 20/01/1999 |
| 30 | BUS14 | Ludlow | Reserve 18047-113 | 19/01/1999 |
| 31 | BUS15 | Ludlow | Colyoolup | 19/01/1999 |
| 32 | BUS16 | Margaret | Below pipe dam | 22/01/1999 |
| 33 | BUS17 | Wilyabrup | Wilyabrup | 21/01/1999 |
| 34 | BUS18 | Gunyulup | Gunyulup | 20/01/1999 |
| 35 | BUS19 | Margaret | Campground pools on Cane Break Rd. | 22/01/1999 |
| 36 | BUS20 | Margaret | Mint Glen | 23/01/1999 |
| 37 | DEN01 | Denmark | Cleerillup Creek Bevan Road | 16/01/1999 |
| 38 | DEN02 | Denmark | Denmark River Granite Road | 16/01/1999 |
| 39 | DEN03 | Denmark | Quickup river Hay block | 14/01/1999 |
| 40 | DEN04 | Denmark | Howe road bridge | 15/01/1999 |
| 41 | DEN05 | Mitchell/Hay | Mitchell tributary Stan Road | 15/01/1999 |
| 42 | DEN06 | Mitchell/Hay | Mitchell River upstream of sgs 603005 | 16/01/1999 |
| 43 | DEN18 | Mitchell/Hay | Torbay drain | 17/01/1999 |
| 44 | DEN19 | Marbellup | Marbellup Brook | 17/01/1999 |
| 45 | DEN20 | Mitchell/Hay | Sheepwash Creek | 18/01/1999 |
| 46 | DEN21 | Mitchell/Hay | Hay River estate | 18/01/1999 |
| 47 | DON01 | Donnelly | Beedelup Brook Steep Road | 08/02/1999 |

**Table 1** ***cont'd.*** Sites sampled between January and April 1999 as part of the Western Australian First National Assessment of River Health.

| Count | Site number | River system | Site name | Date visited |
|---|---|---|---|---|
| 48 | DON02 | Donnelly | Off Staircase Road above v-notch | 12/02/1999 |
| 49 | DON03 | Donnelly | Dickson Road | 09/02/1999 |
| 50 | DON04 | Donnelly | Alamein Track | 08/02/1999 |
| 51 | DON05 | Donnelly | Pneumonia Road | 08/02/1999 |
| 52 | DON06 | Donnelly | Lease Road | 09/02/1999 |
| 53 | DON07 | Donnelly | Sandy Hill Road | 09/02/1999 |
| 54 | DON08 | Donnelly | Rapoff Road block 9216 | 11/02/1999 |
| 55 | DON09 | Donnelly | Willow Spring Road | 10/02/1999 |
| 56 | DON10 | Donnelly | Glenoran Pool | 10/02/1999 |
| 57 | KEN01 | Kent | Nile Creek Break Road | 19/01/1999 |
| 58 | KEN02 | Kent | Kent River Break Road | 19/01/1999 |
| 59 | KEN03 | Kent | Upstream from Styx Road crossing | 19/01/1999 |
| 60 | SHA01 | Shannon | Curtin 4 Road | 10/02/1999 |
| 61 | SHA02 | Shannon | O'Sullivan 12 Road | 11/02/1999 |
| 62 | SHA04 | Shannon | Nelson Road | 11/02/1999 |
| 63 | SHA05 | Shannon | Chesapeake Road (old bridge) | 11/02/1999 |
| 64 | SHA07 | Weld | Weld tributary downstream of sgs 606002 | 20/01/1999 |
| 65 | SHA09 | Deep | Deep River Weld Road | 20/01/1999 |
| 66 | SHA10 | Deep | Deep River Bevan Road | 20/01/1999 |
| 67 | SHA11 | Deep | Our Brook Centre Road | 21/01/1999 |
| 68 | SHA12 | Deep | Bell Brook off South-western Highway | 22/01/1999 |
| 69 | SHA13 | Walpole | Samuels Brook Quinn Road | 21/01/1999 |
| 70 | SHA14 | Walpole | Walpole River off Plain Road | 21/01/1999 |
| 71 | WAR01 | Warren | Track off Eastern Break Road | 06/02/1999 |
| 72 | WAR02 | Warren | Whim Landing Road | 02/02/1999 |
| 73 | WAR03 | Warren | Lewis Road | 07/02/1999 |
| 74 | WAR04 | Warren | Corbalup Road | 03/02/1999 |
| 75 | WAR05 | Warren | East boundary of block 1661 | 03/02/1999 |
| 76 | WAR06 | Warren | Raspy Road | 05/02/1999 |
| 77 | WAR07 | Warren | Sutton Road | 05/02/1999 |
| 78 | WAR08 | Warren | Junction Road | 03/02/1999 |
| 79 | WAR09 | Warren | Cosy Creek Road | 02/02/1999 |
| 80 | WAR10 | Warren | At Warren River | 06/02/1999 |
| 81 | WAR11 | Warren | Tone Road bridge | 04/02/1999 |
| 82 | WAR12 | Warren | Tone River off Delandgraff road | 04/02/1999 |
| 83 | WAR13 | Warren | Muirs Highway | 04/02/1999 |
| 84 | WAR14 | Warren | Wilgarup Bridge | 05/02/1999 |
| 85 | WAR15 | Warren | Lefroy Brook Channybearup Road | 06/02/1999 |
| 86 | COL06 | Collie | Duderling Pool | 13/04/1999 |
| 87 | COL08 | Collie | Sanctuary Pool | 15/04/1999 |
| 88 | COL10 | Collie | Broken concrete crossing | 13/04/1999 |
| 89 | COL11 | Collie | Rickety Bridge | 14/04/1999 |
| 90 | COL14 | Collie | Long Pool (#1) | 15/04/1999 |
| 91 | COL15 | Collie | Walker's Pool (#2) | 14/04/1999 |
| 92 | COL16 | Collie | B. Cox's Pool | 14/04/1999 |
| 93 | COL17 | Collie | Chinaman's Pool (#7) | 13/04/1999 |
| 94 | COL25 | Collie | Cardiff Pool (#4) | 14/04/1999 |
| 95 | COL26 | Collie | Graham's Pool (#5) | 14/04/1999 |
| 96 | COL27 | Collie | Piavanini's Pool (#6) | 13/04/1999 |
| 97 | COL28 | Collie | Buckingham Bridge | 13/04/1999 |
| 98 | COL29 | Collie | Buckingham Pumphouse | 14/04/1999 |
| 99 | COL30 | Collie | Collie-Williams Road | 14/04/1999 |
| 100 | COL31 | Collie | Pool on scenic route | 15/04/1999 |

**Table 2.** Sites sampled between August and October 1999 as part of the Western Australian First National Assessment of River Health

| Count | Site no | Site name | Latitude S | Longitude E | Sample date |
|---|---|---|---|---|---|
| 1 | BLA05 | ELLIS CREEK | 33.9419 | 115.8881 | 20-Sep-99 |
| 2 | BLA06 | ST JOHN BROOK | 33.9400 | 115.6925 | 20-Sep-99 |
| 3 | BLA07 | ST PAUL | 33.9006 | 115.6756 | 20-Sep-99 |
| 4 | BLA08 | BLACKWOOD ROAD | 34.1156 | 115.5331 | 21-Sep-99 |
| 5 | BLA09 | JUDY ROAD | 34.0797 | 115.4678 | 22-Sep-99 |
| 6 | BLA11 | SPEARWOOD CREEK | 34.0847 | 115.3144 | 22-Sep-99 |
| 7 | BLA12 | ROSA BROOK | 34.0608 | 115.4261 | 22-Sep-99 |
| 8 | BLA13 | MILYEANNUP ROAD | 34.2911 | 115.3986 | 19-Sep-99 |
| 9 | BLA14 | BRENNAN BRIDGE | 34.2614 | 115.2692 | 19-Sep-99 |
| 10 | BLA40 | MIDDLE BLOCK | 33.9725 | 115.2119 | 18-Sep-99 |
| 11 | BLA42 | CHAPMAN POOL CAMPSITE | 34.0939 | 115.2044 | 19-Sep-99 |
| 12 | BLA43 | BLACKWOOD ROAD MILYEANNUP | 34.1250 | 115.5681 | 21-Sep-99 |
| 13 | BLA44 | RED GULLY | 34.0733 | 115.6183 | 21-Sep-99 |
| 14 | BLA45 | CALGARDUP ROAD | 34.0497 | 115.1278 | 23-Sep-99 |
| 15 | BLA46 | CROUCH ROAD | 34.0261 | 115.5817 | 23-Sep-99 |
| 16 | BLA47 | GLENARTY ROAD | 34.2189 | 115.1617 | 23-Sep-99 |
| 17 | BLA48 | WINNEJUP RESERVE | 33.9683 | 116.3239 | 04-Oct-99 |
| 18 | BLA49 | DWALGANUP ROAD | 33.9772 | 116.4294 | 04-Oct-99 |
| 19 | BLA50 | OLD BRIDGETOWN ROAD | 34.0011 | 116.0547 | 05-Oct-99 |
| 20 | BUS01 | MOLLOY ROAD | 33.8533 | 115.3519 | 16-Sep-99 |
| 21 | BUS03 | CHALLIS ABOVE MOWEN | 33.9303 | 115.2667 | 16-Sep-99 |
| 22 | BUS05 | BRAMLEY BROOK | 33.8997 | 115.0678 | 13-Sep-99 |
| 23 | BUS06 | CAVES ROAD | 33.9058 | 115.0317 | 19-Sep-99 |
| 24 | BUS07 | ELLESBROOK HOMESTEAD | 33.9108 | 114.9947 | 17-Sep-99 |
| 25 | BUS08 | GIBB ROAD | 33.7847 | 115.1694 | 15-Sep-99 |
| 26 | BUS09 | RAY HARVIE | 33.8144 | 115.1628 | 15-Sep-99 |
| 27 | BUS10 | UN-NAMED TRIBUTARY | 33.8039 | 115.2794 | 15-Sep-99 |
| 28 | BUS12 | SABINA ROAD | 33.7681 | 115.4519 | 14-Sep-99 |
| 29 | BUS13 | LUDLOW HEADWATER | 33.7308 | 115.6797 | 14-Sep-99 |
| 30 | BUS14 | RESERVE 18047-113 | 33.6650 | 115.5989 | 14-Sep-99 |
| 31 | BUS16 | BELOW PIPE HEAD DAM | 33.9456 | 115.1056 | 17-Sep-99 |
| 32 | BUS18 | GUNYULGUP CREEK | 33.6681 | 115.0311 | 15-Sep-99 |
| 33 | BUS19 | CAMPGROUND POOLS | 33.8811 | 115.2814 | 16-Sep-99 |
| 34 | BUS20 | RIVERBEND | 33.9464 | 115.1431 | 17-Sep-99 |
| 35 | BUS21 | DONS ROAD | 33.7628 | 115.3197 | 16-Sep-99 |
| 36 | BUS22 | KALGUP ROAD | 33.7269 | 115.3572 | 18-Sep-99 |
| 37 | BUS23 | PRINCEFIELD ROAD | 33.6814 | 115.4900 | 18-Sep-99 |
| 38 | BUS24 | STIRLING STREET | 33.5517 | 115.5350 | 24-Sep-99 |
| 39 | BUS25 | CAPEL | 33.5519 | 115.5625 | 24-Sep-99 |
| 40 | COL01 | BINGHAM RIVER | 33.2411 | 116.4053 | 16-Sep-99 |

**Table 2** ***cont'd.*** Sites sampled between August and October 1999 as part of the Western Australian First National Assessment of River Health.

| Count | Site no | Site name | Latitude S | Longitude E | Sample date |
|---|---|---|---|---|---|
| 41 | COL02 | HARRIS RIVER | 33.1739 | 116.2650 | 15-Sep-99 |
| 42 | COL03 | STONES BROOK | 33.2053 | 115.9394 | 14-Sep-99 |
| 43 | COL04 | POWERLINE | 33.1911 | 116.0311 | 02-Sep-99 |
| 44 | COL05 | FREDERIC RIVER | 33.2144 | 115.9939 | 19-Sep-99 |
| 45 | COL06 | DUDELING POOL | 33.3936 | 116.3200 | 14-Sep-99 |
| 46 | COL25 | POLLARD BROOK | 33.3022 | 116.2936 | 15-Sep-99 |
| 47 | COL26 | MARRIOT ROAD | 33.2108 | 115.7842 | 16-Sep-99 |
| 48 | COL27 | HENTY BROOK | 33.3422 | 115.8331 | 16-Sep-99 |
| 49 | COL28 | MC ALINDEN ROAD | 33.5900 | 116.3269 | 17-Sep-99 |
| 50 | DEN01 | CLEARILLUP CREEK BEVAN ROAD | 34.6867 | 117.2261 | 08-Oct-99 |
| 51 | DEN02 | DENMARK RIVER GRANITE ROAD | 34.8286 | 117.2522 | 05-Oct-99 |
| 52 | DEN03 | QUICKUP RIVER HAY BLOCK | 34.8806 | 117.3850 | 06-Oct-99 |
| 53 | DEN04 | HOWE ROAD BRIDGE | 34.9328 | 117.3411 | 04-Oct-99 |
| 54 | DEN05 | MITCHELL TRIBUTARY STAN ROAD | 34.8256 | 117.3483 | 06-Oct-99 |
| 55 | DEN06 | UPSTREAM OF GAUGING STATION S603005 | 34.8267 | 117.3925 | 06-Oct-99 |
| 56 | DEN18 | TORBAY DRAIN UPSTREAM OF SGS603012 | 35.0244 | 117.6414 | 07-Oct-99 |
| 57 | DEN19 | MARBELUP BROOK | 34.9983 | 117.7217 | 07-Oct-99 |
| 58 | DEN20 | SHEEPWASH CREEK THE SPRINGS | 34.7600 | 117.4878 | 06-Oct-99 |
| 59 | DEN21 | HAYRIVER ESTATE | 34.7369 | 117.5689 | 08-Oct-99 |
| 60 | DEN22 | HENNING ROAD | 34.9514 | 117.6019 | 07-Oct-99 |
| 61 | DEN23 | THE PASS ROAD | 34.8344 | 117.5625 | 07-Oct-99 |
| 62 | DEN24 | SLEEMAN CREEK SPENCER ROAD | 34.7700 | 117.6881 | 08-Oct-99 |
| 63 | DEN25 | QUICKUP RIVER POWLEY ROAD | 34.9178 | 117.3742 | 09-Oct-99 |
| 64 | DEN26 | DENMARK TOWN CREEK | 34.9594 | 117.3506 | 09-Oct-99 |
| 65 | DON01 | BEEDELUP BROOK STEEP ROAD | 34.4117 | 115.8767 | 21-Sep-99 |
| 66 | DON02 | CAREY BROOK UPSTREAM OF SGS 608006 | 34.3922 | 115.8436 | 20-Sep-99 |
| 67 | DON03 | BARLEE BROOK DICKSON ROAD | 34.2058 | 115.7706 | 22-Sep-99 |
| 68 | DON05 | JASPER BROOK PNEUMONIA ROAD | 34.3967 | 115.7553 | 21-Sep-99 |
| 69 | DON06 | LEASE ROAD DONNELY RIVER | 34.2847 | 115.8847 | 20-Sep-99 |
| 70 | DON09 | WILLOW SPRING ROAD | 34.0603 | 115.9325 | 19-Sep-99 |
| 71 | DON10 | GLENORAN POOL DONNELY RIVER | 34.2161 | 115.9411 | 22-Sep-99 |
| 72 | DON11 | OFF GOLD GULLY ROAD | 34.0500 | 115.9475 | 19-Sep-99 |
| 73 | DON12 | FLY BROOK TRIBUTARY | 34.4144 | 115.9358 | 22-Sep-99 |
| 74 | DON13 | MC KAY ROAD BARLEE BROOK | 34.1072 | 115.8592 | 23-Sep-99 |
| 75 | FRA01 | ROCKY ROAD | 34.6617 | 116.7783 | 12-Oct-99 |
| 76 | FRA02 | ROE ROAD | 34.6831 | 116.8547 | 13-Oct-99 |
| 77 | FRA03 | SHEDICK | 34.5939 | 116.7928 | 13-Oct-99 |
| 78 | FRA04 | MYALGELUP ROAD | 34.5306 | 116.8472 | 13-Oct-99 |
| 79 | FRA05 | WEDDING BROOK | 34.8475 | 116.7367 | 14-Oct-99 |
| 80 | FRA06 | ROCKY GULLY TRIBUTARY FRANKLAND ROAD | 34.4969 | 117.0103 | 12-Oct-99 |

**Table 2** ***cont'd.*** Sites sampled between August and October 1999 as part of the Western Australian First National Assessment of River Health.

| Count | Site no | Site name | Latitude S | Longitude E | Sample date |
|---|---|---|---|---|---|
| 81 | FRA07 | FRANKLAND RIVER TRIBUTARY COSBY ROAD | 34.4656 | 116.8917 | 12-Oct-99 |
| 82 | FRA08 | FRANKLAND RIVER WINGEBELLUP BRIDGE | 34.3589 | 117.0131 | 12-Oct-99 |
| 83 | FRA09 | BOLBELUP CREEK | 34.2894 | 116.9511 | 13-Oct-99 |
| 84 | FRA10 | TOWERLUP BROOK | 34.1183 | 117.0250 | 13-Oct-99 |
| 85 | FRA11 | GORDON RIVER BOYACUP ROAD | 34.2656 | 117.2514 | 13-Oct-99 |
| 86 | FRA12 | GORDON RIVER JOHNSTON ROAD | 34.1569 | 117.5564 | 13-Oct-99 |
| 87 | FRA13 | SLAB HUT GULLY | 34.1519 | 117.3717 | 14-Oct-99 |
| 88 | FRA14 | GORDON RIVER POONAWARIUP ROAD | 33.9611 | 117.6017 | 14-Oct-99 |
| 89 | FRA15 | WADJEKANUP RIVER | 34.0072 | 117.5583 | 14-Oct-99 |
| 90 | FRA16 | EL QUESTRO | 34.9328 | 116.7639 | 15-Oct-99 |
| 91 | HAR01 | NEAR HOFFMANS MILL | 33.0181 | 116.0964 | 01-Sep-99 |
| 92 | HAR02 | CORNWALL FORM | 33.0800 | 116.1125 | 01-Sep-99 |
| 93 | HAR03 | OLD BUNBURY ROAD | 32.8181 | 115.7350 | 31-Aug-99 |
| 94 | HAR04 | MAYFIELD DRAIN | 32.7847 | 115.8139 | 31-Aug-99 |
| 95 | HAR05 | DRAKESBROOK DRAIN | 32.8600 | 115.9211 | 31-Aug-99 |
| 96 | HAR06 | CORONATION ROAD | 32.8694 | 115.7650 | 31-Aug-99 |
| 97 | HAR07 | BRISTOL ROAD | 32.9097 | 115.8178 | 01-Sep-99 |
| 98 | HAR09 | NEAR WAROONA DAM | 32.8475 | 115.9669 | 02-Sep-99 |
| 99 | HAR10 | SCARP ROAD CROSSING | 32.8761 | 115.9922 | 02-Sep-99 |
| 100 | HAR11 | MCKNOE ROAD CROSSING | 32.8931 | 115.9578 | 02-Sep-99 |
| 101 | HAR12 | SOUTH WESTERN HWY | 32.9844 | 115.9164 | 01-Sep-99 |
| 102 | HAR16 | BARCELL BROOK | 32.9519 | 115.9525 | 01-Sep-99 |
| 103 | HAR17 | LINK ROAD | 33.1158 | 116.0672 | 01-Sep-99 |
| 104 | HAR18 | HONEYMOON ROAD | 33.0503 | 116.0092 | 02-Sep-99 |
| 105 | HAR19 | MAVERICK ROAD | 33.0594 | 116.0731 | 02-Sep-99 |
| 106 | KEN01 | NILE CREEK BREAK ROAD | 34.8436 | 117.0458 | 05-Oct-99 |
| 107 | KEN02 | KENT RIVER BREAK ROAD | 34.8347 | 117.0631 | 05-Oct-99 |
| 108 | KEN03 | NEAR STYX ROAD CROSSING | 34.8819 | 117.1378 | 05-Oct-99 |
| 109 | KEN04 | KORDABUP RIVER SKIPPINGS ROAD | 34.9558 | 117.1431 | 09-Oct-99 |
| 110 | KEN05 | KARRI CREEK SOUTH COAST HIGHWAY | 34.9678 | 116.9903 | 10-Oct-99 |
| 111 | KEN06 | BOW RIVER GUM LINK ROAD | 34.9161 | 116.9431 | 10-Oct-99 |
| 112 | KEN07 | BOW RIVER TRIUTARY TRENT ROAD | 34.9103 | 116.8831 | 10-Oct-99 |
| 113 | KEN08 | KENT RIVER PERILLUP ROAD SOUTH | 34.5969 | 117.0622 | 11-Oct-99 |
| 114 | KEN09 | KENT RIVER MUIR HIGHWAY | 34.5575 | 117.1717 | 11-Oct-99 |
| 115 | KEN10 | KENT RIVER BEVAN ROAD | 34.6867 | 117.1006 | 11-Oct-99 |
| 116 | MRY02 | SERPENTINE RIVER | 32.4967 | 116.3061 | 30-Aug-99 |
| 117 | MRY03 | LOWLANDS FARM | 32.3367 | 115.9128 | 23-Aug-99 |
| 118 | MRY05 | CAMERON BLOCK | 32.6306 | 116.2661 | 30-Aug-99 |
| 119 | MRY06 | YARRAGIL FORM | 32.8314 | 116.2047 | 26-Aug-99 |
| 120 | MRY07 | NANGA ROAD | 32.8147 | 116.0794 | 26-Aug-99 |

**Table 2** ***cont'd.*** Sites sampled between August and October 1999 as part of the Western Australian First National Assessment of River Health.

| Count | Site no | Site name | Latitude S | Longitude E | Sample date |
|---|---|---|---|---|---|
| 121 | MRY08 | TORRENS ROAD | 32.5900 | 116.0278 | 29-Aug-99 |
| 122 | MRY09 | BIG BROOK | 32.8814 | 116.1056 | 27-Aug-99 |
| 123 | MRY10 | BLOCK 10 | 32.7325 | 115.9481 | 25-Aug-99 |
| 124 | MRY11 | SOUTH WESTERN HWY | 32.5928 | 115.9161 | 24-Aug-99 |
| 125 | MRY23 | OAKLEY BROOK | 32.6464 | 115.8822 | 24-Aug-99 |
| 126 | MRY24 | LAKES ROAD | 32.5169 | 115.9333 | 25-Aug-99 |
| 127 | MRY25 | COOLUP ROAD | 32.7353 | 115.8994 | 25-Aug-99 |
| 128 | MRY26 | TWENTY SIX MILE GULLY | 32.7936 | 116.1953 | 26-Aug-99 |
| 129 | MRY27 | COFFS FORM | 32.8353 | 116.1292 | 27-Aug-99 |
| 130 | MRY28 | OFF CALONA FORM | 32.9717 | 116.1925 | 27-Aug-99 |
| 131 | MRY29 | LONG GULLY | 32.9231 | 116.2931 | 28-Aug-99 |
| 132 | MRY30 | LOWER HOTHAM ROAD | 32.8811 | 116.4214 | 28-Aug-99 |
| 133 | MRY31 | FLETCHER ROAD | 33.0186 | 116.4736 | 28-Aug-99 |
| 134 | MRY32 | REYNOLDS BRIDGE | 32.5375 | 116.0542 | 29-Aug-99 |
| 135 | MRY33 | NORTH ROAD | 32.5794 | 116.0647 | 29-Aug-99 |
| 136 | MRY34 | NORTH EAST ROAD | 32.5497 | 116.2492 | 30-Aug-99 |
| 137 | MRY35 | BGM | 32.8111 | 116.3850 | 30-Aug-99 |
| 138 | MRY36 | LONG GULLY BRIDGE | 33.0100 | 116.2736 | 31-Aug-99 |
| 139 | MRY37 | BELL BROOK ROAD | 33.0392 | 116.3481 | 31-Aug-99 |
| 140 | MRY38 | OFF CHALK ROAD | 33.0342 | 116.2383 | 31-Aug-99 |
| 141 | MRY39 | SCARP POOL | 32.7664 | 115.9969 | 01-Sep-99 |
| 142 | PRE01 | GLEN MERVYN TRIBUTARY | 33.5067 | 116.1061 | 17-Sep-99 |
| 143 | PRE02 | FERGUSON RIVER TRIBUTARY | 33.4494 | 115.9400 | 17-Sep-99 |
| 144 | PRE03 | GAVIN GULLY | 33.5717 | 115.7572 | 18-Sep-99 |
| 145 | PRE05 | BURNSIDE | 33.6500 | 115.9178 | 18-Sep-99 |
| 146 | PRE06 | BEELERUP ROAD | 33.5564 | 115.8544 | 18-Sep-99 |
| 147 | PRE07 | PILE ROAD | 33.4056 | 115.8111 | 19-Sep-99 |
| 148 | SHA01 | CUTIN 4 ROAD | 34.5678 | 116.4311 | 11-Oct-99 |
| 149 | SHA02 | O SULLIVAN 12 ROAD | 34.6725 | 116.3769 | 11-Oct-99 |
| 150 | SHA07 | BELOW SGS 606002 | 34.6894 | 116.5233 | 12-Oct-99 |
| 151 | SHA09 | WELD ROAD | 34.7017 | 116.6192 | 12-Oct-99 |
| 152 | SHA10 | BEVAN ROAD | 34.5906 | 116.5536 | 11-Oct-99 |
| 153 | SHA11 | CENTRE ROAD | 34.9111 | 116.6256 | 14-Oct-99 |
| 154 | SHA13 | QUINN ROAD | 34.9350 | 116.6756 | 14-Oct-99 |
| 155 | SHA14 | OFF PLAIN ROAD | 34.9597 | 116.7058 | 14-Oct-99 |
| 156 | SHA15 | MIDDLETON ROAD | 34.6122 | 116.1614 | 08-Oct-99 |
| 157 | SHA16 | MEERUP RIVER | 34.6767 | 116.0169 | 09-Oct-99 |
| 158 | SHA17 | DOGGERUP CREEK | 34.7350 | 116.0547 | 09-Oct-99 |
| 159 | SHA18 | CHUDALUP | 34.8106 | 116.0889 | 10-Oct-99 |
| 160 | SHA19 | MIDDLETON ROAD BOORARA | 34.6125 | 116.2211 | 10-Oct-99 |

**Table 2** ***cont'd.*** Sites sampled between August and October 1999 as part of the Western Australian First National Assessment of River Health.

| Count | Site no | Site name | Latitude S | Longitude E | Sample date |
|---|---|---|---|---|---|
| 161 | SHA20 | MIDDLETON ROAD GARDNER | 34.6125 | 116.1472 | 10-Oct-99 |
| 162 | SWA01 | LOWER WUNGONG BROOK | 32.1953 | 116.0150 | 29-Aug-99 |
| 163 | SWA02 | DEATH ADDER CREEK | 32.1369 | 116.1936 | 28-Aug-99 |
| 164 | SWA03 | DARKIN RIVER | 32.0828 | 116.4367 | 29-Aug-99 |
| 165 | SWA04 | WUNGONG BROOK | 32.3139 | 116.1861 | 30-Aug-99 |
| 166 | SWA05 | WOOROLOO BROOK | 31.7372 | 116.1594 | 25-Aug-99 |
| 167 | SWA06 | JULIMAR BROOK | 31.4453 | 116.2736 | 24-Aug-99 |
| 168 | SWA07 | SPICE BROOK | 31.3711 | 116.1939 | 24-Aug-99 |
| 169 | SWA08 | JANE BROOK | 31.8808 | 116.0644 | 26-Aug-99 |
| 170 | SWA09 | SUSSANNAH BROOK | 31.8139 | 116.0572 | 26-Aug-99 |
| 171 | SWA10 | ELLEN BROOK | 31.7142 | 116.0303 | 26-Aug-99 |
| 172 | SWA16 | CNR JULIMAR AND CHITTERING | 31.4956 | 116.1144 | 24-Aug-99 |
| 173 | SWA17 | WOOTRA BROOK | 31.3122 | 116.1339 | 25-Aug-99 |
| 174 | SWA18 | PHILLIPS BROOK | 31.4525 | 116.4092 | 25-Aug-99 |
| 175 | SWA19 | BLACKADDER CREEK | 31.8775 | 116.0153 | 26-Aug-99 |
| 176 | SWA20 | OLD RIDLEY BRIDGE | 31.9442 | 116.4375 | 27-Aug-99 |
| 177 | SWA21 | GORRIE PLANTATION | 31.9689 | 116.2914 | 27-Aug-99 |
| 178 | SWA22 | MAHOGANY CREEK | 31.8889 | 116.1017 | 27-Aug-99 |
| 179 | SWA23 | PICKERING BROOK | 31.9919 | 116.1758 | 28-Aug-99 |
| 180 | SWA24 | LITTLE DARKIN RIVER | 32.0472 | 116.2347 | 28-Aug-99 |
| 181 | SWA25 | LOWER CANNING RIVER | 32.1189 | 116.0186 | 28-Aug-99 |
| 182 | SWA26 | CANNING RIVER | 32.3797 | 116.3542 | 30-Aug-99 |
| 183 | SWA27 | COOKE PLANTATION | 32.4250 | 116.2933 | 30-Aug-99 |
| 184 | SWA28 | JENKINSON STREET | 32.0761 | 115.9792 | 03-Sep-99 |
| 185 | SWA29 | BICKLEY ROAD | 32.0211 | 115.9717 | 03-Sep-99 |
| 186 | SWA30 | BICKLEY BROOK | 32.0417 | 115.9828 | 03-Sep-99 |
| 187 | WAR01 | TREEN BROOK OFF EASTERN BREAK ROAD | 34.4486 | 115.9583 | 24-Sep-99 |
| 188 | WAR02 | DUDIJUP CREEK WANDING ROAD | 34.1308 | 116.2458 | 23-Sep-99 |
| 189 | WAR03 | LEWIS ROAD | 34.5917 | 115.9147 | 08-Oct-99 |
| 190 | WAR04 | CORBALUP ROAD | 34.1944 | 116.3925 | 05-Oct-99 |
| 191 | WAR05 | EASTERN BOUNDARY OF 1661 | 34.1150 | 116.5772 | 05-Oct-99 |
| 192 | WAR06 | RASPY ROAD | 34.4633 | 116.0358 | 08-Oct-99 |
| 193 | WAR07 | SUTTON ROAD | 34.4561 | 116.2564 | 07-Oct-99 |
| 194 | WAR08 | JUNCTION ROAD | 34.2575 | 116.4531 | 07-Oct-99 |
| 195 | WAR09 | WILGARUP RIVER COSY CREEK ROAD | 34.1886 | 116.1906 | 23-Sep-99 |
| 196 | WAR11 | TONE ROAD BRIDGE | 34.0633 | 116.8656 | 06-Oct-99 |
| 197 | WAR12 | OFF DELANDGRAAFT ROAD | 34.2489 | 116.6792 | 06-Oct-99 |
| 198 | WAR13 | MUIRS HIGHWAY | 34.4089 | 116.5544 | 06-Oct-99 |
| 199 | WAR14 | WILGARUP BRIDGE | 34.3497 | 116.3464 | 07-Oct-99 |
| 200 | WAR15 | LEFROY BROOK CHANNYBEARUP ROAD | 34.3419 | 116.0600 | 24-Sep-99 |
| 201 | WAR16 | BANNISTER ROAD | 34.4461 | 116.1344 | 21-Sep-99 |

**Progress with habitat assessment conducted and data analysis of same**

Habitat assessment data were collected for all sites visited during 1998 and we have performed preliminary analyses of these data. We found no significant correlation in a regression of O/E scores against habitat assessment scores. We are presently endeavouring to improve our habitat assessment method and look forward to input from other agencies at the next National workshop.

**Results of any habitat or bio-assessments completed**

All sites sampled in 1998 have been assessed using the refined AusRivAS models for the north-west of the State. There are two new channel habitat models for the north-west: one for each season. The new models have not yet been put onto the AusRivAS web site.

Outputs from the new Dry season channel model are given as both tables and maps. Table 4 shows Observed/Expected (O/E) scores and associated bands for reference site data while Table 5 gives the same for test site data. Figure 1 shows the both reference and test site O/E scores plotted according to band for the Timor Sea drainage division (Kimberley region). Figure 2 shows the same for the Indian Ocean drainage division (Pilbara and Gascoyne regions). Results of the Wet season sampling were given in Milestone 1.

**A report on the number of sites visited but not assessed, and the reason for not assessing**

During our field season in the south-west earlier this year we encountered a number of sites that could not be sampled. These sites, and the reason for not sampling, are listed in Table 3.

**Table 3.** Sites visited but not sampled during the 1998 Western Australian First National Assessment of River Health

| Site code | River system | Site name | Date Visited | Reason |
|---|---|---|---|---|
| BLA05 | Blackwood | Ellis Creek. | 28/01/1999 | Site dry |
| BLA07 | Blackwood | St. Paul | 28/01/1999 | Site dry |
| BLA35 | Scott | Flying fox | 27/01/1999 | Site dry |
| BLA37 | Scott | L bend | 27/01/1999 | Site inaccessible |
| BLA39 | Scott | Wilmont's Drain | 26/01/1999 | Site dry |
| BUS01 | Margaret | Molloy Road. | 22/01/1999 | Site dry |
| BUS10 | Carbunup | Unnamed tributary | 21/01/1999 | Site dry |
| BUS13 | Ludlow | Headwater | 20/01/1999 | Site dry |
| DEN01 | Denmark | Cleerillup Creek Bevan Road | 16/01/1999 | Site dry |
| DON09 | Donnelly | Willow Spring Road | 10/02/1999 | Site dry |
| SHA01 | Shannon | Curtin 4 Road | 10/02/1999 | Site dry |
| SHA07 | Weld | Weld tributary downstream of sgs 606002 | 20/01/1999 | Site dry |
| WAR02 | Warren | Whim Landing Road | 02/02/1999 | Site dry |
| WAR04 | Warren | Corbalup Road | 03/02/1999 | Site dry |
| WAR05 | Warren | East boundary of block 1661 | 03/02/1999 | Site dry |
| WAR07 | Warren | Sutton Road | 05/02/1999 | Site dry |
| COL19 | Collie | Westerdale | 14/04/1999 | Site dry |

**Table 4.** AusRivAS observed/expected scores and associated bands for all north-western (<28°S) reference sites used to build new Dry season channel habitat model. 10th percentile O/E = 0.81 therefore bands: 0.62< B <0.80; 0.81< A <1.18; X >1.19.

| Site code | River system | Site name | Round | Latitude | Longitude | Expected | Observed | O/E | Band |
|---|---|---|---|---|---|---|---|---|---|
| ASH01 | Ashburton | Whiskey pool | 1 | 22.5469 | 115.3006 | 11.86 | 12.00 | 1.01 | A |
| ASH01 | Ashburton | Whiskey pool | 3 | 22.5469 | 115.3006 | 11.85 | 12.00 | 1.01 | A |
| ASH02 | Ashburton | Minnie springs | 1 | 23.0572 | 115.6967 | 11.85 | 11.00 | 0.93 | A |
| ASH02 | Ashburton | Minnie springs | 3 | 23.0572 | 115.6967 | 11.72 | 10.00 | 0.85 | A |
| ASH02 | Ashburton | Minnie springs | 7 | 23.0572 | 115.6967 | 11.17 | 13.00 | 1.16 | A |
| ASH03 | Ashburton | Goordeman pool | 1 | 23.1319 | 115.9972 | 11.82 | 11.00 | 0.93 | A |
| ASH04 | Ashburton | Boolaloo pool | 1 | 22.6044 | 115.8714 | 11.86 | 10.00 | 0.84 | A |
| ASH04 | Ashburton | Boolaloo pool | 3 | 22.6044 | 115.8714 | 11.84 | 11.00 | 0.93 | A |
| ASH04 | Ashburton | Boolaloo pool | 7 | 22.6044 | 115.8714 | 11.80 | 13.00 | 1.10 | A |
| ASH05 | Ashburton | Wallarook pool | 1 | 22.4817 | 116.4681 | 11.86 | 10.00 | 0.84 | A |
| ASH05 | Ashburton | Wallarook pool | 3 | 22.4817 | 116.4681 | 11.86 | 9.00 | 0.76 | B |
| ASH05 | Ashburton | Wallarook pool | 7 | 22.4817 | 116.4681 | 11.86 | 12.00 | 1.01 | A |
| DEG01 | De Grey | Marloo pool | 7 | 20.2667 | 119.2003 | 11.86 | 12.00 | 1.01 | A |
| DEG02 | De Grey | Talyirina pool | 7 | 20.5303 | 119.6619 | 11.86 | 12.00 | 1.01 | A |
| DEG08 | De Grey | Womary gap | 7 | 21.6100 | 119.7456 | 11.85 | 14.00 | 1.18 | A |
| DRY01 | Berkley | Berkley river | 7 | 14.8903 | 127.6647 | 12.38 | 13.00 | 1.05 | A |
| DRY02 | Drysdale | King George river | 7 | 14.0808 | 127.3061 | 12.38 | 14.00 | 1.13 | A |
| DRY04 | Drysdale | Johnson confluence | 7 | 14.6897 | 126.9961 | 12.38 | 14.00 | 1.13 | A |
| FIT01 | Fitzroy | Clanmyra pool | 1 | 18.2261 | 123.7433 | 12.38 | 10.00 | 0.81 | A |
| FIT01 | Fitzroy | Clanmyra pool | 3 | 18.2261 | 123.7433 | 12.38 | 13.00 | 1.05 | A |
| FIT01 | Fitzroy | Clanmyra pool | 7 | 18.2261 | 123.7433 | 12.38 | 10.00 | 0.81 | A |
| FIT02 | Fitzroy | Wilson spring | 1 | 17.9081 | 125.5619 | 12.38 | 10.00 | 0.81 | A |
| FIT02 | Fitzroy | Wilson spring | 3 | 17.9081 | 125.5619 | 12.38 | 10.00 | 0.81 | A |
| FIT03 | Fitzroy | Geike gorge | 1 | 18.1164 | 125.6831 | 12.38 | 10.00 | 0.81 | A |
| FIT03 | Fitzroy | Geike gorge | 3 | 18.1164 | 125.6831 | 12.38 | 14.00 | 1.13 | A |
| FIT03 | Fitzroy | Geike gorge | 7 | 18.1164 | 125.6831 | 12.38 | 16.00 | 1.29 | X |
| FIT04 | Fitzroy | Palm springs | 3 | 18.5031 | 126.4289 | 12.38 | 13.00 | 1.05 | A |
| FIT05 | Fitzroy | Ord gap | 1 | 17.5894 | 125.8697 | 12.38 | 14.00 | 1.13 | A |
| FIT05 | Fitzroy | Ord gap | 3 | 17.5894 | 125.8697 | 12.38 | 13.00 | 1.05 | A |
| FIT05 | Fitzroy | Ord gap | 7 | 17.5894 | 125.8697 | 12.38 | 14.00 | 1.13 | A |
| FIT08 | Fitzroy | Sir John gorge | 7 | 17.5050 | 126.2228 | 12.38 | 13.00 | 1.05 | A |
| FIT13 | Fitzroy | Hann river | 7 | 16.5981 | 126.3128 | 12.38 | 14.00 | 1.13 | A |
| FOR01 | Fortescue | Tarda pool | 1 | 21.3094 | 116.1531 | 11.86 | 11.00 | 0.93 | A |
| FOR01 | Fortescue | Tarda pool | 3 | 21.3094 | 116.1531 | 11.86 | 9.00 | 0.76 | B |
| FOR02 | Fortescue | Crossing pool | 1 | 21.5794 | 117.0856 | 11.86 | 11.00 | 0.93 | A |
| FOR02 | Fortescue | Crossing pool | 3 | 21.5794 | 117.0856 | 11.86 | 12.00 | 1.01 | A |
| FOR02 | Fortescue | Crossing pool | 7 | 21.5794 | 117.0856 | 11.86 | 15.00 | 1.27 | X |
| FOR05 | Fortescue | Fortescue falls | 3 | 22.4833 | 118.5517 | 11.75 | 9.00 | 0.77 | B |
| FOR05 | Fortescue | Fortescue falls | 7 | 22.4833 | 118.5517 | 11.85 | 11.00 | 0.93 | A |
| FOR06 | Fortescue | Weeli wolli springs | 1 | 22.9167 | 119.2008 | 11.81 | 10.00 | 0.85 | A |
| FOR06 | Fortescue | Weeli wolli springs | 3 | 22.9167 | 119.2008 | 11.86 | 11.00 | 0.93 | A |
| FOR06 | Fortescue | Weeli wolli springs | 7 | 22.9167 | 119.2008 | 11.85 | 12.00 | 1.01 | A |
| FOR09 | Fortescue | Cooribin pool | 7 | 21.4839 | 116.8272 | 11.86 | 14.00 | 1.18 | A |
| FOR10 | Fortescue | Pipeline crossing | 7 | 21.5711 | 117.0536 | 11.86 | 13.00 | 1.10 | A |
| GAS02 | Gascoyne | Winnemia pool | 1 | 25.0094 | 114.9483 | 10.15 | 10.00 | 0.98 | A |
| GAS02 | Gascoyne | Winnemia pool | 3 | 25.0094 | 114.9483 | 10.16 | 10.00 | 0.98 | A |
| GAS02 | Gascoyne | Winnemia pool | 7 | 25.0094 | 114.9483 | 10.16 | 10.00 | 0.98 | A |
| GAS03 | Gascoyne | Mooka ruins | 1 | 24.8922 | 114.9583 | 10.14 | 9.00 | 0.89 | A |
| GAS03 | Gascoyne | Mooka ruins | 3 | 24.8922 | 114.9583 | 10.16 | 11.00 | 1.08 | A |
| GAS03 | Gascoyne | Mooka ruins | 7 | 24.8922 | 114.9583 | 10.16 | 9.00 | 0.89 | A |
| GAS04 | Gascoyne | Edithana pool | 1 | 24.1236 | 116.4922 | 10.15 | 9.00 | 0.89 | A |
| GAS04 | Gascoyne | Edithana pool | 3 | 24.1236 | 116.4922 | 10.12 | 9.00 | 0.89 | A |
| GAS04 | Gascoyne | Edithana pool | 7 | 24.1236 | 116.4922 | 10.12 | 12.00 | 1.19 | A |
| GAS05 | Gascoyne | Deep pool | 1 | 25.2408 | 118.8967 | 10.16 | 8.00 | 0.79 | B |
| GAS05 | Gascoyne | Deep pool | 3 | 25.2408 | 118.8967 | 10.16 | 12.00 | 1.18 | A |
| GAS05 | Gascoyne | Deep pool | 7 | 25.2408 | 118.8967 | 10.16 | 12.00 | 1.18 | A |
| GAS06 | Gascoyne | Jibboongunna pool | 3 | 24.9450 | 119.3467 | 10.16 | 10.00 | 0.98 | A |
| GAS07 | Gascoyne | Rocky pool | 7 | 24.7575 | 114.1361 | 10.16 | 9.00 | 0.89 | A |
| GAS10 | Gascoyne | Eudamulla pool | 7 | 24.3939 | 115.5164 | 10.07 | 11.00 | 1.09 | A |
| GAS12 | Gascoyne | Cattle pool | 7 | 24.2836 | 116.8258 | 10.16 | 10.00 | 0.98 | A |
| GAS16 | Gascoyne | Mibbley pool | 7 | 24.9772 | 118.2286 | 10.15 | 11.00 | 1.08 | A |
| GAS19 | Gascoyne | Erong springs | 7 | 25.4789 | 116.8767 | 10.16 | 12.00 | 1.18 | A |
| ISD01 | Robinson | Lower Robinson | 1 | 16.8275 | 124.3194 | 12.38 | 13.00 | 1.05 | A |
| ISD01 | Robinson | Lower Robinson | 3 | 16.8275 | 124.3194 | 12.38 | 11.00 | 0.89 | A |
| ISD01 | Robinson | Lower Robinson | 7 | 16.8275 | 124.3194 | 12.38 | 12.00 | 0.97 | A |
| ISD02 | Isdell | Lower Isdell | 7 | 16.7619 | 125.0372 | 12.38 | 13.00 | 1.05 | A |
| ISD03 | Isdell | Lower Charnley | 7 | 16.3706 | 125.2083 | 12.38 | 11.00 | 0.89 | A |

**Table 4 *cont'd.*** AusRivAS observed/expected scores and associated bands for all north-western (<28°S) reference sites used to build new Dry season channel habitat model. 10th percentile O/E = 0.81 therefore bands: 0.62< B <0.80; 0.81< A <1.18; X >1.19.

| Site code | River system | Site name | Round | Latitude | Longitude | Expected | Observed | O/E | Band |
|---|---|---|---|---|---|---|---|---|---|
| ISD04 | Isdell | Upper Isdell | 7 | 16.7106 | 125.7950 | 12.38 | 14.00 | 1.13 | A |
| ISD06 | Isdell | Bell gorge | 7 | 16.9939 | 125.2039 | 12.38 | 12.00 | 0.97 | A |
| KEE01 | Keep | Big police hole | 7 | 15.7406 | 129.0725 | 12.38 | 9.00 | 0.73 | B |
| KER01 | King Edward | Kulumburu | 3 | 14.3408 | 126.6189 | 12.38 | 11.00 | 0.89 | A |
| KER02 | King Edward | Cole creek | 3 | 14.5719 | 126.4067 | 12.38 | 12.00 | 0.97 | A |
| KER02 | King Edward | Cole creek | 7 | 14.5719 | 126.4067 | 12.38 | 10.00 | 0.81 | A |
| KER04 | Mitchell | Upper Mitchell | 1 | 15.0306 | 125.7003 | 12.38 | 11.00 | 0.89 | A |
| KER04 | Mitchell | Upper Mitchell | 3 | 15.0306 | 125.7003 | 12.38 | 12.00 | 0.97 | A |
| KER04 | Mitchell | Upper Mitchell | 7 | 15.0306 | 125.7003 | 12.38 | 10.00 | 0.81 | A |
| KER05 | Mitchell | Mitchell falls | 3 | 14.8806 | 125.7167 | 12.38 | 14.00 | 1.13 | A |
| KER06 | Mitchell | Camp creek | 7 | 14.8828 | 125.7403 | 12.38 | 15.00 | 1.21 | X |
| KER07 | Mitchell | Crystal creek | 7 | 14.5425 | 125.7603 | 12.38 | 12.00 | 0.97 | A |
| LEN01 | Lennard | Lennard river pool | 1 | 17.3494 | 124.5075 | 12.38 | 12.00 | 0.97 | A |
| LEN01 | Lennard | Lennard river pool | 3 | 17.3494 | 124.5075 | 12.38 | 13.00 | 1.05 | A |
| LEN02 | Lennard | Fletcher creek | 1 | 17.1200 | 124.9878 | 12.38 | 11.00 | 0.89 | A |
| LEN02 | Lennard | Fletcher creek | 3 | 17.1200 | 124.9878 | 12.38 | 14.00 | 1.13 | A |
| LEN03 | Lennard | Lennard river gorge | 1 | 17.1664 | 125.2231 | 12.38 | 13.00 | 1.05 | A |
| LEN03 | Lennard | Lennard river gorge | 3 | 17.1664 | 125.2231 | 12.38 | 14.00 | 1.13 | A |
| LEN04 | Lennard | Richenda gorge | 1 | 17.4525 | 125.4353 | 12.38 | 10.00 | 0.81 | A |
| LEN04 | Lennard | Richenda gorge | 3 | 17.4525 | 125.4353 | 12.38 | 11.00 | 0.89 | A |
| LEN04 | Lennard | Richenda gorge | 7 | 17.4525 | 125.4353 | 12.38 | 13.00 | 1.05 | A |
| LEN07 | Lennard | Anne creek | 7 | 16.7681 | 124.8772 | 12.38 | 16.00 | 1.29 | X |
| LMR02 | Minilya | Joolabroo pool | 7 | 23.8275 | 114.6592 | 10.05 | 11.00 | 1.09 | A |
| MUR08 | Murchison | Kalamunda pool | 7 | 26.0106 | 117.1900 | 10.16 | 11.00 | 1.08 | A |
| MUR16 | Murchison | Bully pool | 7 | 27.6122 | 114.2628 | 10.16 | 10.00 | 0.98 | A |
| ONS01 | Robe | Waroo pool | 1 | 21.6631 | 115.9606 | 11.86 | 11.00 | 0.93 | A |
| ONS01 | Robe | Waroo pool | 3 | 21.6631 | 115.9606 | 11.86 | 11.00 | 0.93 | A |
| ONS01 | Robe | Waroo pool | 7 | 21.6631 | 115.9606 | 11.86 | 15.00 | 1.27 | X |
| ONS02 | Robe | Gnieraoora pool | 3 | 21.7386 | 116.1719 | 11.85 | 11.00 | 0.93 | A |
| ONS03 | Robe | Nyeetberry pool | 1 | 21.8600 | 116.5117 | 11.86 | 9.00 | 0.76 | B |
| ONS03 | Robe | Nyeetberry pool | 3 | 21.8600 | 116.5117 | 11.86 | 10.00 | 0.84 | A |
| ONS03 | Robe | Nyeetberry pool | 7 | 21.8600 | 116.5117 | 11.86 | 15.00 | 1.27 | X |
| ONS06 | Robe | Chalyarn pool | 7 | 21.7542 | 116.0347 | 11.86 | 13.00 | 1.10 | A |
| PEN01 | Durack | Wilson creek pool | 1 | 15.5767 | 127.7483 | 12.38 | 10.00 | 0.81 | A |
| PEN01 | Durack | Wilson creek pool | 3 | 15.5767 | 127.7483 | 12.38 | 14.00 | 1.13 | A |
| PEN02 | Durack | Lower Durack pool | 1 | 15.5592 | 127.6758 | 12.38 | 9.00 | 0.73 | B |
| PEN02 | Durack | Lower Durack pool | 3 | 15.5592 | 127.6758 | 12.38 | 10.00 | 0.81 | A |
| PEN03 | Durack | Bamboo creek | 1 | 15.9044 | 127.3469 | 12.38 | 11.00 | 0.89 | A |
| PEN03 | Durack | Bamboo creek | 3 | 15.9044 | 127.3469 | 12.38 | 16.00 | 1.29 | X |
| PEN03 | Durack | Bamboo creek | 7 | 15.9044 | 127.3469 | 12.38 | 15.00 | 1.21 | X |
| PEN04 | Durack | Royston creek | 1 | 16.0733 | 127.2136 | 12.38 | 12.00 | 0.97 | A |
| PEN04 | Durack | Royston creek | 3 | 16.0733 | 127.2136 | 12.38 | 15.00 | 1.21 | X |
| PEN05 | Durack | Upper Durack | 3 | 16.8789 | 127.1950 | 12.38 | 15.00 | 1.21 | X |
| PEN05 | Durack | Upper Durack | 7 | 16.8789 | 127.1950 | 12.38 | 14.00 | 1.13 | A |
| PEN06 | Chamberlain | Chamberlain river | 7 | 16.5669 | 127.7386 | 12.38 | 13.00 | 1.05 | A |
| PEN07 | Forrest | Forrest river | 7 | 15.2281 | 127.3347 | 12.38 | 14.00 | 1.13 | A |
| PHC01 | Sherlock | Errawallana spring | 3 | 21.6336 | 117.7736 | 11.86 | 10.00 | 0.84 | A |
| PHC01 | Sherlock | Errawallana spring | 7 | 21.6336 | 117.7736 | 11.86 | 12.00 | 1.01 | A |
| PHC02 | Yule | Cangan pool | 3 | 21.6972 | 118.6286 | 11.86 | 12.00 | 1.01 | A |
| PHC02 | Yule | Cangan pool | 7 | 21.6972 | 118.6286 | 11.86 | 15.00 | 1.27 | X |
| PHC03 | Yule | Cunmagnunna pool | 1 | 21.9439 | 118.9656 | 11.86 | 9.00 | 0.76 | B |
| PHC03 | Yule | Cunmagnunna pool | 7 | 21.9439 | 118.9656 | 11.84 | 13.00 | 1.10 | A |
| PHC05 | Maitland | Miaree pool | 7 | 20.8558 | 116.6111 | 11.86 | 15.00 | 1.27 | X |
| PHC08 | Harding | Karrawingina pool | 7 | 21.0797 | 117.1339 | 11.86 | 13.00 | 1.10 | A |
| PHC10 | George | Python pool | 7 | 21.3353 | 117.2375 | 11.86 | 12.00 | 1.01 | A |
| PHC18 | Sherlock | Kangan pool | 7 | 21.0981 | 117.6275 | 11.86 | 13.00 | 1.10 | A |
| PRR01 | Prince regent | Upper Prince Regent | 7 | 15.8950 | 125.7122 | 12.38 | 11.00 | 0.89 | A |
| PRR02 | Prince regent | Youwanjela creek | 7 | 15.7058 | 125.4878 | 12.38 | 10.00 | 0.81 | A |
| PRR03 | Prince regent | Perpendicular creek | 7 | 15.4283 | 125.3078 | 12.38 | 12.00 | 0.97 | A |
| PRR04 | Glenelg | Glenelg river | 7 | 15.7136 | 125.0156 | 12.38 | 10.00 | 0.81 | A |
| SDB03 | Rudall | Number eleven pool | 7 | 22.5178 | 122.0894 | 11.86 | 13.00 | 1.10 | A |
| SDB04 | Rudall | Kalkan kalkan soak | 7 | 22.5536 | 122.1744 | 11.86 | 13.00 | 1.10 | A |
| SDB05 | Rudall | Coondecoon pool | 7 | 22.4792 | 122.5167 | 11.86 | 14.00 | 1.18 | A |
| SDB06 | Rudall | Desert queen baths | 7 | 22.4658 | 122.2597 | 11.86 | 11.00 | 0.93 | A |
| WOO01 | Wooramel | Wooramel north pool | 7 | 25.7767 | 116.0475 | 10.16 | 10.00 | 0.98 | A |
| WOO02 | Wooramel | Bilung pool | 7 | 25.7067 | 115.9889 | 10.16 | 9.00 | 0.89 | A |
| WOO03 | Wooramel | Callytharra spring | 7 | 25.8756 | 115.5019 | 10.16 | 10.00 | 0.98 | A |
| WOO07 | Wooramel | Inouendy pool | 7 | 25.8147 | 116.2586 | 10.16 | 9.00 | 0.89 | A |

**Table 5.** AusRivAS observed/expected scores and associated bands for all north-western (<28°S) test sites given by new Dry season channel model. 10th percentile O/E=0.81 bands: 0.24< D <0.42; 0.43< C <0.61; 0.62< B <0.80; 0.81< A <1.18; X >1.19.

| Site code | River system | Site name | Round | Latitude | Longitude | Expected | Observed | O/E | Band |
|---|---|---|---|---|---|---|---|---|---|
| ASH06 | Ashburton | Kazput pool | 1 | 22.9767 | 117.1956 | 11.85 | 8.00 | 0.67 | B |
| ASH06 | Ashburton | Kazput pool | 3 | 22.9767 | 117.1956 | 11.78 | 7.00 | 0.59 | C |
| ASH06 | Ashburton | Kazput pool | 7 | 22.9767 | 117.1956 | 11.73 | 10.00 | 0.85 | A |
| ASH07 | Ashburton | Wyloo pool | 7 | 21.9283 | 115.0228 | 11.85 | 12.00 | 1.01 | A |
| ASH08 | Ashburton | Nanutarra pool | 7 | 22.5450 | 115.4969 | 11.16 | 11.00 | 0.99 | A |
| ASH12 | Ashburton | Gorge creek pool | 7 | 24.1631 | 118.0394 | 10.93 | 12.00 | 1.10 | A |
| DEG03 | De Grey | Marble bar pool | 7 | 21.1875 | 119.7114 | 11.86 | 12.00 | 1.01 | A |
| DEG05 | De Grey | Skull springs | 7 | 21.8642 | 121.0072 | 11.86 | 11.00 | 0.93 | A |
| DEG07 | De Grey | Yarrie south | 7 | 20.6894 | 120.2406 | 11.86 | 14.00 | 1.18 | A |
| DRY03 | Drysdale | Barton plains | 7 | 14.2600 | 126.9033 | 12.38 | 14.00 | 1.13 | A |
| DRY05 | Gibb | Gibb river | 7 | 15.7106 | 126.6478 | 12.38 | 15.00 | 1.21 | X |
| DRY06 | Drysdale | Miners pool | 7 | 15.6800 | 126.4028 | 12.38 | 15.00 | 1.21 | X |
| FIT06 | Fitzroy | Gap creek channel | 3 | 18.6589 | 125.8778 | 12.38 | 5.00 | 0.40 | D |
| FIT07 | Fitzroy | Dimond gorge | 7 | 17.6533 | 126.0267 | 12.38 | 10.00 | 0.81 | A |
| FIT09 | Fitzroy | Jubilee downs | 7 | 18.3569 | 125.3028 | 12.38 | 10.00 | 0.81 | A |
| FIT11 | Fitzroy | Old Leopold yard | 7 | 17.8631 | 125.8847 | 12.38 | 10.00 | 0.81 | A |
| FIT12 | Fitzroy | Calder yard | 7 | 18.2422 | 126.2544 | 12.38 | 13.00 | 1.05 | A |
| FIT14 | Fitzroy | Noonkanbah crossing | 7 | 18.5106 | 124.8297 | 12.38 | 14.00 | 1.13 | A |
| FIT17 | Fitzroy | Wyloo yard | 7 | 18.0356 | 127.1828 | 12.38 | 10.00 | 0.81 | A |
| FOR03 | Fortescue | Cherewondina pool | 3 | 21.6967 | 117.3306 | 11.85 | 5.00 | 0.42 | D |
| FOR04 | Fortescue | Railway pool | 1 | 21.8567 | 117.6183 | 11.86 | 9.00 | 0.76 | B |
| FOR04 | Fortescue | Railway pool | 3 | 21.8567 | 117.6183 | 11.86 | 10.00 | 0.84 | A |
| FOR07 | Fortescue | Whaleback creek | 1 | 23.3522 | 119.7083 | 11.86 | 6.00 | 0.51 | C |
| FOR07 | Fortescue | Whaleback creek | 3 | 23.3522 | 119.7083 | 11.86 | 6.00 | 0.51 | C |
| FOR08 | Fortescue | Northwest coastal hwy | 7 | 21.2978 | 116.1433 | 11.86 | 13.00 | 1.10 | A |
| FOR11 | Fortescue | Mootana pool | 7 | 21.8256 | 117.5511 | 11.85 | 12.00 | 1.01 | A |
| FOR12 | Fortescue | Hooley creek | 7 | 21.8911 | 118.0356 | 11.86 | 14.00 | 1.18 | A |
| FOR13 | Fortescue | Marillana creek | 7 | 22.7864 | 119.2414 | 11.86 | 15.00 | 1.27 | X |
| FOR14 | Fortescue | Roy Hill pool | 7 | 22.6617 | 119.9847 | 11.85 | 8.00 | 0.67 | B |
| GAS01 | Gascoyne | Chinaman's pool | 3 | 24.8603 | 113.6811 | 10.16 | 11.00 | 1.08 | A |
| GAS01 | Gascoyne | Chinaman's pool | 7 | 24.8603 | 113.6811 | 10.16 | 8.00 | 0.79 | B |
| GAS08 | Gascoyne | Fishy pool | 7 | 24.9594 | 114.6553 | 10.16 | 9.00 | 0.89 | A |
| GAS09 | Gascoyne | Mooka springs | 7 | 24.8814 | 114.9742 | 10.16 | 11.00 | 1.08 | A |
| GAS11 | Gascoyne | Windarrie pool | 7 | 24.0000 | 116.2347 | 10.13 | 11.00 | 1.09 | A |
| GAS13 | Gascoyne | Mummil pool | 7 | 24.5572 | 116.2458 | 10.07 | 10.00 | 0.99 | A |
| GAS14 | Gascoyne | Yinnetharra cattle pool | 7 | 24.6075 | 116.0508 | 10.92 | 10.00 | 0.92 | A |
| GAS15 | Gascoyne | Sawback pool | 7 | 25.0594 | 117.7928 | 10.09 | 10.00 | 0.99 | A |
| GAS17 | Gascoyne | Wanderong pool | 7 | 25.2306 | 118.6956 | 10.16 | 11.00 | 1.08 | A |
| GAS18 | Gascoyne | North branch pool | 7 | 24.9403 | 119.3672 | 10.15 | 11.00 | 1.08 | A |
| ISD05 | Charnley | Pearson river | 7 | 16.1261 | 125.5681 | 12.38 | 13.00 | 1.05 | A |
| KER08 | King Edward | Theda | 7 | 14.8047 | 126.4961 | 12.38 | 16.00 | 1.29 | X |
| KER09 | King Edward | Doongan | 7 | 15.1203 | 126.1258 | 12.38 | 14.00 | 1.13 | A |
| LEN05 | Lennard | Windjana gorge | 7 | 17.4075 | 124.9444 | 12.38 | 11.00 | 0.89 | A |
| LEN08 | Lennard | Poulton pool | 7 | 17.4100 | 125.2553 | 12.38 | 15.00 | 1.21 | X |
| LMR01 | Minilya | Minilya pool | 1 | 23.8675 | 113.9778 | 10.16 | 7.00 | 0.69 | B |
| LMR01 | Minilya | Minilya pool | 3 | 23.8675 | 113.9778 | 10.16 | 9.00 | 0.89 | A |
| LMR01 | Minilya | Minilya pool | 7 | 23.8675 | 113.9778 | 10.16 | 7.00 | 0.69 | B |
| LMR03 | Minilya | Bee well pool | 1 | 23.8583 | 115.3942 | 10.15 | 4.00 | 0.39 | D |
| LMR03 | Minilya | Bee well pool | 3 | 23.8583 | 115.3942 | 10.15 | 8.00 | 0.79 | B |
| LMR03 | Minilya | Bee well pool | 7 | 23.8583 | 115.3942 | 11.07 | 13.00 | 1.17 | A |
| LMR05 | Lyndon | Chinkia creek | 7 | 23.3636 | 114.2378 | 9.99 | 10.00 | 1.00 | A |
| LMR07 | Lyndon | Bowera pool | 7 | 23.6036 | 113.9942 | 10.16 | 9.00 | 0.89 | A |
| LMR08 | Minilya | Williambury pool | 7 | 23.8650 | 115.1478 | 11.19 | 12.00 | 1.07 | A |
| LMR10 | Yannarie | Chearie pool | 7 | 23.2642 | 115.2069 | 11.08 | 14.00 | 1.26 | X |
| LMR12 | Lyndon | Windalia | 7 | 23.2894 | 114.7933 | 10.96 | 11.00 | 1.00 | A |
| MUR01 | Murchison | Bullock pool | 1 | 27.8194 | 114.7769 | 10.16 | 9.00 | 0.89 | A |
| MUR01 | Murchison | Bullock pool | 3 | 27.8194 | 114.7769 | 10.16 | 9.00 | 0.89 | A |
| MUR01 | Murchison | Bullock pool | 7 | 27.8194 | 114.7769 | 10.16 | 10.00 | 0.98 | A |
| MUR02 | Murchison | Coolabulla pool | 1 | 27.4939 | 115.6447 | 10.16 | 10.00 | 0.98 | A |
| MUR02 | Murchison | Coolabulla pool | 3 | 27.4939 | 115.6447 | 10.16 | 6.00 | 0.59 | C |
| MUR02 | Murchison | Coolabulla pool | 7 | 27.4939 | 115.6447 | 10.16 | 12.00 | 1.18 | A |
| MUR03 | Murchison | Gum creek billabong | 1 | 26.9869 | 115.9769 | 10.16 | 8.00 | 0.79 | B |
| MUR04 | Murchison | Elizabeth springs | 1 | 26.5889 | 116.3769 | 10.16 | 9.00 | 0.89 | A |
| MUR04 | Murchison | Elizabeth springs | 3 | 26.5889 | 116.3769 | 10.16 | 7.00 | 0.69 | B |
| MUR04 | Murchison | Elizabeth springs | 7 | 26.5889 | 116.3769 | 10.16 | 11.00 | 1.08 | A |
| MUR05 | Murchison | Sheila's bend | 1 | 26.0364 | 116.6850 | 10.16 | 10.00 | 0.98 | A |
| MUR05 | Murchison | Sheila's bend | 3 | 26.0364 | 116.6850 | 10.16 | 10.00 | 0.98 | A |

**Table 5** ***cont'd.*** AusRivAS observed/expected scores and associated bands for all north-western test sites assessed using new Dry season channel model. $10^{th}$ percentile O/E=0.81 bands: 0.24< D <0.42; 0.43< C <0.61; 0.62< B <0.80; 0.81< A <1.18; X >1.19.

| Site code | River system | Site name | Round | Latitude | Longitude | Expected | Observed | O/E | Band |
|---|---|---|---|---|---|---|---|---|---|
| MUR05 | Murchison | Sheila's bend | 7 | 26.0364 | 116.6850 | 10.16 | 10.00 | 0.98 | A |
| MUR07 | Murchison | Mt Gould pool | 7 | 25.9089 | 117.3733 | 10.16 | 9.00 | 0.89 | A |
| MUR09 | Murchison | Bellair spring | 7 | 26.0128 | 116.8697 | 10.16 | 10.00 | 0.98 | A |
| MUR10 | Murchison | Ero pool | 7 | 26.3861 | 117.4608 | 10.16 | 9.00 | 0.89 | A |
| MUR11 | Murchison | Impey pool | 7 | 26.8017 | 116.2731 | 10.16 | 9.00 | 0.89 | A |
| MUR12 | Murchison | Bingangwah spring | 7 | 27.5817 | 116.7572 | 10.16 | 11.00 | 1.08 | A |
| MUR13 | Murchison | Boora pool | 7 | 27.5539 | 116.6483 | 10.16 | 10.00 | 0.98 | A |
| MUR14 | Murchison | Snell pool | 7 | 27.6681 | 116.0442 | 10.16 | 10.00 | 0.98 | A |
| MUR15 | Murchison | Balinoo bridge | 7 | 27.5281 | 115.7728 | 10.16 | 11.00 | 1.08 | A |
| MUR17 | Murchison | Mills pool | 7 | 27.3017 | 115.3808 | 10.16 | 9.00 | 0.89 | A |
| ONS04 | Robe | Yalleen pool | 7 | 21.6992 | 116.4286 | 11.86 | 11.00 | 0.93 | A |
| ONS05 | Robe | Millstream/Yarraloola rd | 7 | 21.7222 | 116.2153 | 11.85 | 12.00 | 1.01 | A |
| ONS07 | Cane | Jabadder pool | 7 | 21.9831 | 115.5508 | 11.79 | 10.00 | 0.85 | A |
| ONS08 | Cane | House pool | 7 | 22.0969 | 115.6192 | 11.13 | 12.00 | 1.08 | A |
| ORD01 | Ord | Blue holes pool | 1 | 17.5614 | 128.2525 | 12.38 | 11.00 | 0.89 | A |
| ORD01 | Ord | Blue holes pool | 3 | 17.5614 | 128.2525 | 12.38 | 14.00 | 1.13 | A |
| ORD01 | Ord | Blue holes pool | 7 | 17.5614 | 128.2525 | 12.38 | 12.00 | 0.97 | A |
| ORD02 | Ord | Black Elvire river | 7 | 18.4197 | 127.8450 | 12.38 | 12.00 | 0.97 | A |
| ORD03 | Ord | Kitty's knob | 7 | 17.4061 | 128.8114 | 12.38 | 9.00 | 0.73 | B |
| ORD05 | Ord | Dunham river rock bar | 7 | 15.7958 | 128.6792 | 12.38 | 11.00 | 0.89 | A |
| ORD07 | Ord | Button's crossing | 7 | 15.6219 | 128.6908 | 12.38 | 10.00 | 0.81 | A |
| ORD08 | Ord | Wilson river | 7 | 16.6489 | 128.1075 | 12.38 | 13.00 | 1.05 | A |
| ORD09 | Ord | Dunham Great nthn hwy | 7 | 16.1556 | 128.3658 | 12.38 | 15.00 | 1.21 | X |
| ORD10 | King | Emma gorge | 7 | 15.8972 | 128.1317 | 12.38 | 9.00 | 0.73 | B |
| PHC04 | Yule | Poonthune pool | 1 | 20.7878 | 118.7136 | 11.86 | 11.00 | 0.93 | A |
| PHC04 | Yule | Poonthune pool | 3 | 20.7878 | 118.7136 | 11.86 | 8.00 | 0.67 | B |
| PHC04 | Yule | Poonthune pool | 7 | 20.7878 | 118.7136 | 11.86 | 12.00 | 1.01 | A |
| PHC06 | Turner | Chinnamon pool | 7 | 21.0172 | 118.7203 | 11.86 | 14.00 | 1.18 | A |
| PHC11 | Yule | Yandeyarra pool | 7 | 21.2719 | 118.3761 | 11.86 | 14.00 | 1.18 | A |
| PHC14 | Harding | Downstream Roebourne | 7 | 20.7797 | 117.1456 | 11.86 | 11.00 | 0.93 | A |
| PHC15 | Harding | Pinanular pool | 7 | 20.9564 | 117.1111 | 11.86 | 14.00 | 1.18 | A |
| PHC16 | Sherlock | Nunyerry pass | 7 | 21.5206 | 117.9369 | 11.86 | 15.00 | 1.27 | X |
| PHC17 | Sherlock | Powereena pool | 7 | 21.3303 | 117.8975 | 11.86 | 15.00 | 1.27 | X |
| PHC20 | Maitland | Maitland coastal | 7 | 20.8200 | 116.5914 | 11.86 | 13.00 | 1.10 | A |
| PRR05 | Sale | Sale river | 7 | 16.0256 | 124.9306 | 12.38 | 11.00 | 0.89 | A |
| SDB01 | Savory | Burranbar pool | 7 | 23.7925 | 120.4358 | 10.13 | 10.00 | 0.99 | A |
| SDB02 | Savory | Savory two | 7 | 23.7500 | 121.0106 | 11.79 | 5.00 | 0.42 | D |
| WOO04 | Wooramel | Nunnery pool | 7 | 25.8642 | 115.5331 | 10.16 | 10.00 | 0.98 | A |
| WOO05 | Wooramel | Meedo pool | 7 | 25.7422 | 115.1183 | 10.16 | 10.00 | 0.98 | A |
| WOO06 | Wooramel | Mundilya pool | 7 | 25.6650 | 114.8467 | 10.16 | 12.00 | 1.18 | A |

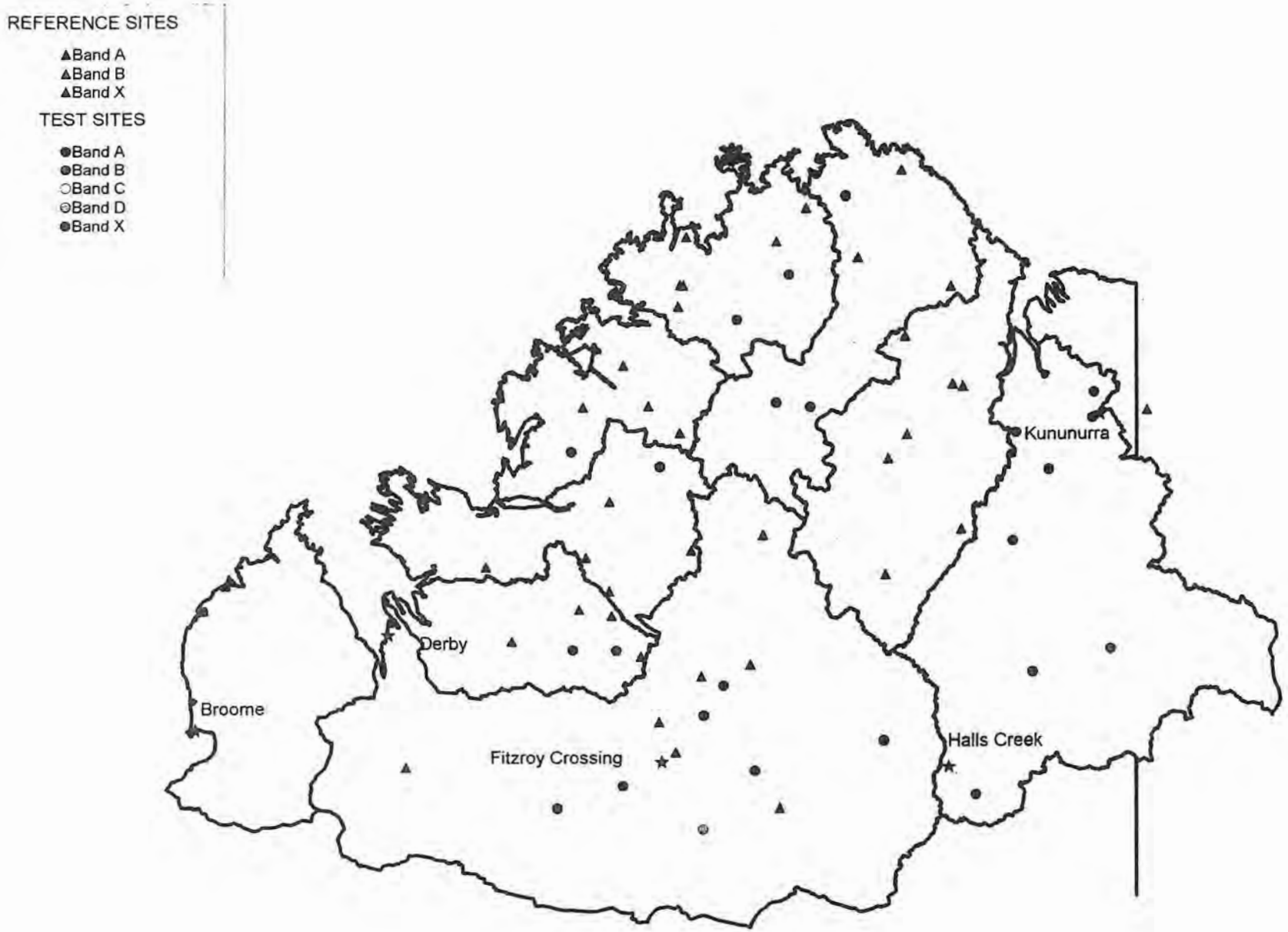



Fig.1. Assessment of reference and test sites using new Dry season channel model:Timor Sea Drainage Division

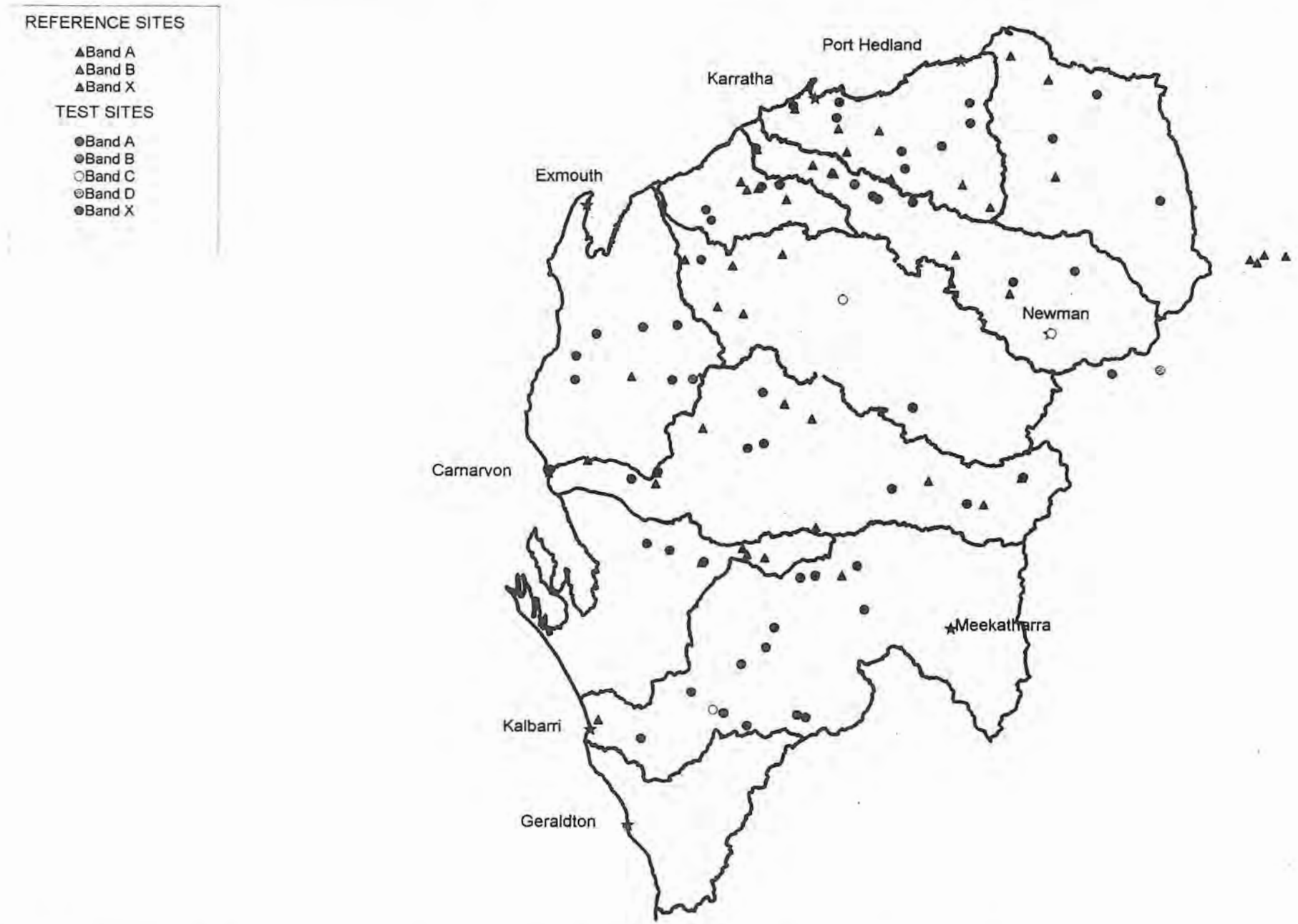



Fig. 2. Assessment of reference and test sites using new Dry season channel model:Indian Ocean Drainage Division

# PART B

**Report on any work conducted in the State by agencies other than the lead agent that involved use of AusRivAS methods**

AusRivAS methods were used by staff of the University of Western Australia to assess a number of sites on the Canning River as part of a larger study determining ecological condition and water requirements downstream from the Canning dam. Results are unavailable at this stage.

A pilot study of drains and streams on the Swan Coastal plain was conducted by the Water and Rivers Commission to investigate the utility of AusRivAS protocols for rural drains. Twenty three sites were sampled in November 1999. CALM, the lead agency for the MRHI in WA, demonstrated the sampling protocol and assisted with the collection of samples. CALM staff commenced identifying the invertebrates to species level in November 1999 and will complete the identifications in January 2000.

The Collie Water Advisory Group (CWAG) is comprised of staff from Department of Resources Development, Collie Shire, Water and Rivers Commission, Department of Minerals and Energy and the Department of Environmental Protection. CWAG is currently reviewing the water resources management strategy for the Collie Basin, an area that is subject to intense coal-mining pressure. As part of this review we assessed 15 sites in the Collie Basin using AusRivAS methods. Results are given in Table 6.

**Table 6.** Collie Basin sites assessed in early 1999 using AusRivAS methods as part of the Western Australian First National Assessment of River Health and the Collie Water Quality Management Strategy review. $10^{th}$ percentile O/E = 0.85 therefore bands: 0.53 <= C <= 0.68; 0.69 <= B <= 0.84; 0.85 <= A <= 1.15; X >= 1.16

| Site code | River system | Site name | Expected | Observed | O/E | Band |
|---|---|---|---|---|---|---|
| COL06 | Collie | Duderling Pool | 5.38 | 6.00 | 1.12 | A |
| COL08 | Collie | Sanctuary Pool | 5.85 | 5.00 | 0.86 | A |
| COL10 | Collie | Broken concrete crossing | 5.37 | 5.00 | 0.93 | A |
| COL11 | Collie | Rickety Bridge | 8.14 | 5.00 | 0.61 | C |
| COL14 | Collie | Long Pool | 5.69 | 4.00 | 0.70 | B |
| COL15 | Collie | Walker's Pool | 5.66 | 4.00 | 0.71 | B |
| COL16 | Collie | B. Cox's Pool | 5.29 | 5.00 | 0.94 | A |
| COL17 | Collie | Chinaman's Pool | 6.79 | 4.00 | 0.59 | C |
| COL25 | Collie | Cardiff Pool | 5.64 | 6.00 | 1.06 | A |
| COL26 | Collie | Graham's Pool | 5.13 | 4.00 | 0.78 | B |
| COL27 | Collie | Piavanini's Pool | 4.56 | 5.00 | 1.10 | A |
| COL28 | Collie | Buckingham Bridge | 5.36 | 6.00 | 1.12 | A |
| COL29 | Collie | Buckingham Pumphouse | 7.03 | 7.00 | 1.00 | A |
| COL30 | Collie | Collie-Williams Road | 6.09 | 6.00 | 0.98 | A |
| COL31 | Collie | Pool on scenic route | 5.72 | 4.00 | 0.70 | B |

**Report on training activities conducted in the period since the previous Milestone**

In February 1999 two staff, Stuart Halse and Mike Scanlon, attended the annual taxonomic workshop in Albury, NSW. Both staff found this a worthwhile exercise for two reasons. First, it allows them to keep pace with the constant changes and advances in aquatic invertebrate taxonomy. Second, it provides an excellent opportunity to discuss problem issues with staff from other States and Territories.

A new staff member, Jim Cocking has recently joined our team and is currently learning the protocols for sampling, identification and quality control.

**Report on the details and results of internal quality control undertaken since the previous Milestone**
A small amount of quality control has been performed whereby staff members identify a sample, then have another staff member check the sample to confirm the accuracy of their identifications. To date only minor errors in counting the number of individuals in a family have been encountered. Earlier this year we automated our quality control reporting procedure to ensure that all physical, chemical and biological data are cross-checked when entered onto the database.

**Report on how any deficiencies detected during internal or external quality control have been addressed**
There has been no need to address any deficiencies.

**Report on communications and technology transfer activities performed since the previous Milestone, including details of community involvement in the program**
We have developed a Geographic Information System (GIS) based AusRivAS model for use by Ribbons of Blue, and school and community groups. The model was developed in conjunction with the Water and Rivers Commission and uses GIS to display biological and chemical data on a map of the State. Users point to the AusRivAS site closest to the area they are interested in and the model lists the macroinvertebrate families that would be expected to occur in the absence of environmental disturbance.

The Western Australian AusRivAS program has been heavily promoted in recent months. In May the Department of Conservation and Land Management hosted a thematic seminar titled "Aquatic Invertebrate Conservation" at which the FNARH and AusRivAS models featured prominently. More recently, we have given talks about the FNARH to a number of local groups including the Inland Aquatic Group, the WA Insect Study Group, and the Darling Range Naturalists Club.

Since the last Milestone report two scientific papers have been published in the journal Freshwater Biology. The references are given below and reprints attached (Appendices A and B).

Smith, M.J., Kay, W.R., Edward, D.H.D., Papas, P.J., Richardson, K.St J., Simpson, J.C., Pinder, A.M., Cale, D.J., Horwitz, P.H.J., Davis, J.A., Yung, F.H. and Halse, S.A. (1999). AusRivAS: using macroinvertebrates to assess ecological condition of rivers in Western Australia. *Freshwater Biology* **41**:269-282.

Kay, W.R., Smith, M.J., Pinder, A.M., McRae, J.M., Davis, J.A. and Halse, S.A. (1999). Patterns of distribution of macroinvertebrate families in rivers of north-western Australia. *Freshwater Biology* **41**:299-316.

# PART C

**Names and contact details of relevant staff working on the project**

Details are given in Table 7.

**Table 7.** Names and contact details of relevant staff working on the Western Australian First National Assessment of River Health.

| Principal Research Scientist | Technical Officer | Technical Officer |
|---|---|---|
| Dr Stuart Halse | Michael Scanlon | Jim Cocking |
| CALMScience | CALMScience | CALMScience |
| PO Box 51 | PO Box 51 | PO Box 51 |
| Wanneroo | Wanneroo | Wanneroo |
| Western Australia 6948 | Western Australia 6948 | Western Australia 6948 |
| Email: stuarth@calm.wa.gov.au | Email: mikesc@calm.wa.gov.au | Email: jimc@calm.wa.gov.au |
| Ph (08) 94055136 | Ph (08) 94055176 | Ph (08) 94055130 |
| Fax (08) 93061641 | Fax (08) 93061641 | Fax (08) 93061641 |

**Any staffing or resource problems, their management and potential solutions**

Due to uncertainty about funding and continuity of the project, two of the original Monitoring River Health Initiative staff members, Mick Smith and Winston Kay, have recently left the FNARH team. The hand-over of duties to other staff members has gone smoothly but will cause problems toward the end of the project.

**Any commercial and scientific considerations or discoveries made in carrying out the project**

As AusRivAS models are refined, and people become more aware of their availability, there is a need to establish who has right to access the models. Recently, we have been approached by several environmental consultancy firms who wished to use the models in conjunction with their own research. To date we have not allowed them access because models have not been refined; however, as improved models are produced there is need to establish a formal protocol to be followed when further approaches occur. Also, there is a need to decide whether or not the models should be available free of charge when they are being used for private purposes.

**Any variations proposed to the project or project schedule**

No.

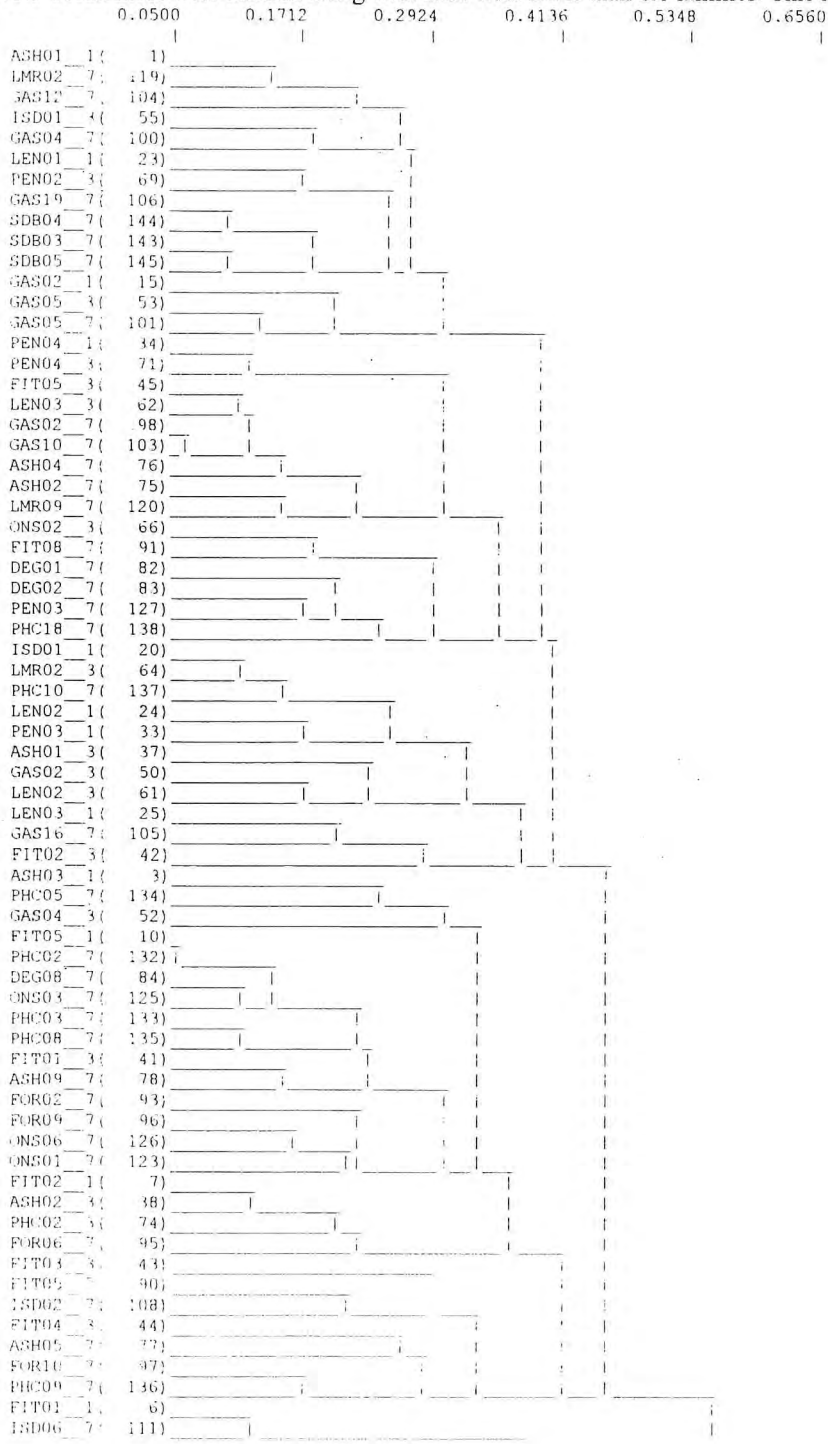
**When new models are constructed, details of these refined models including:**
**Results of reference site classifications**

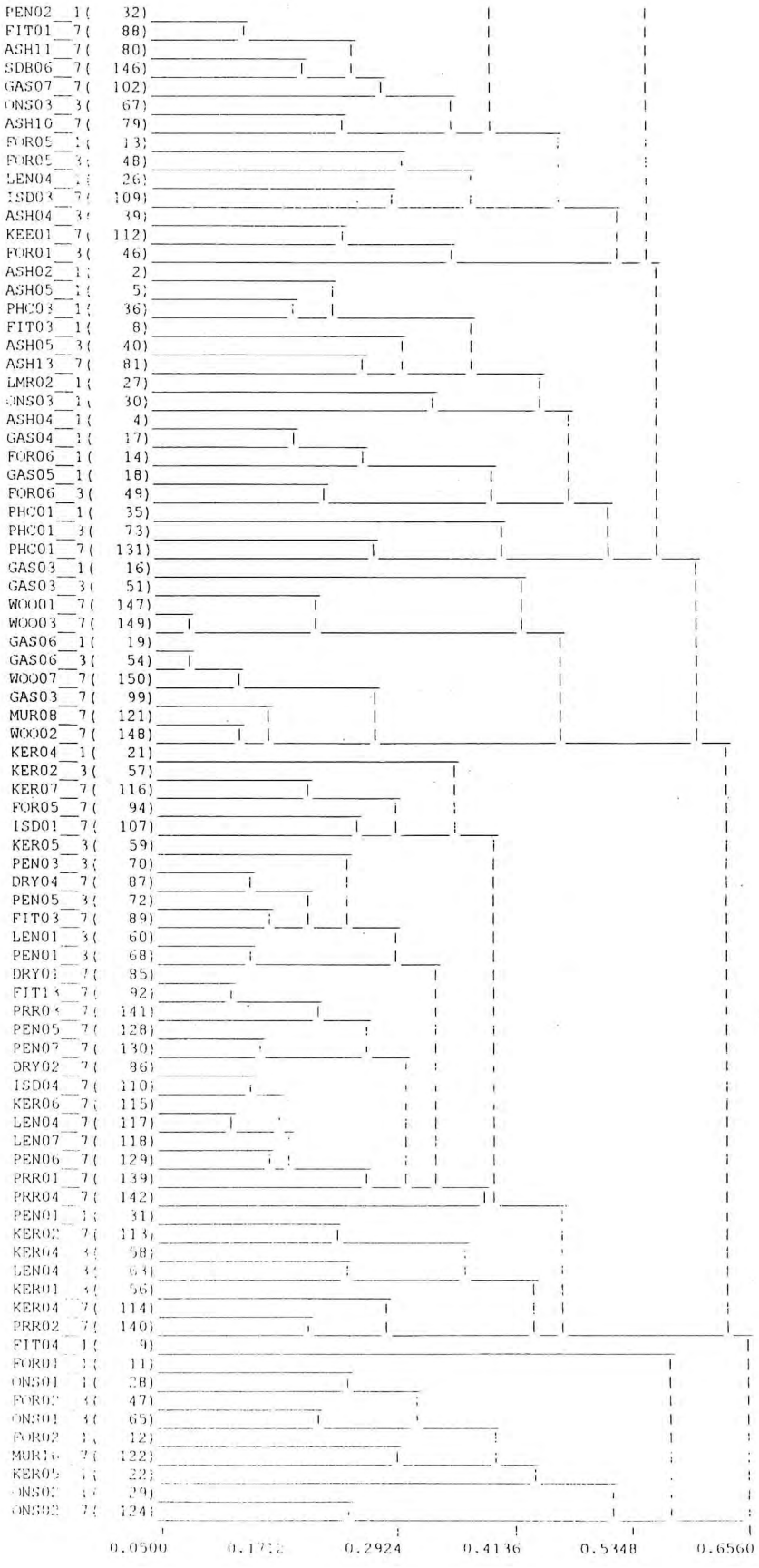
The new Dry season channel model for north-western Australia was finished on 7 July 1999. It is based on reference site data from sampling rounds 1, 3 and 7. It covers the north-west region of Western Australia (ie. all rivers < 28° latitude or north of, and including, the Murchison River). It is based on dry season data for the channel habitat. All reference sites (categories Ref 1-3 inclusive) were used. Presence/absence data were used for the classification. Before masking there were 158 sites and 84 families.

*Classification*

First we masked families (columns) with fewer than 15.3 occurrences (10%), then we masked sites (rows) with fewer than 8.1 families (10%). This left 150 sites and 39 families. The dendrogram for these data is given (Figure 3). There were no obvious bio-geographically relevant groups so we assigned sites to groups on the basis of region (Kimberley, Pilbara and Gascoyne).

**Figure 3.** Classification of aquatic invertebrate communities from north-west Dry season channel sites. Families with fewer than 15.3 occurrences were masked along with sites with fewer than 8.1 families. This left 150 sites and 39 families.




PEN02__1( 32)
FIT01__7( 88)
ASH11__7( 80)
SDB06__7( 146)
GAS07__7( 102)
ONS03__3( 67)
ASH10__7( 79)
FOR05__1( 13)
FOR05__3( 48)
LEN04__1( 26)
ISD03__7( 109)
ASH04__3( 39)
KEE01__7( 112)
FOR01__3( 46)
ASH02__1( 2)
ASH05__1( 5)
PHC03__1( 36)
FIT03__1( 8)
ASH05__3( 40)
ASH13__7( 81)
LMR02__1( 27)
ONS03__1( 30)
ASH04__1( 4)
GAS04__1( 17)
FOR06__1( 14)
GAS05__1( 18)
FOR06__3( 49)
PHC01__1( 35)
PHC01__3( 73)
PHC01__7( 131)
GAS03__1( 16)
GAS03__3( 51)
WOO01__7( 147)
WOO03__7( 149)
GAS06__1( 19)
GAS06__3( 54)
WOO07__7( 150)
GAS03__7( 99)
MUR08__7( 121)
WOO02__7( 148)
KER04__1( 21)
KER02__3( 57)
KER07__7( 116)
FOR05__7( 94)
ISD01__7( 107)
KER05__3( 59)
PEN03__3( 70)
DRY04__7( 87)
PEN05__3( 72)
FIT03__7( 89)
LEN01__3( 60)
PEN01__3( 68)
DRY01__7( 85)
FIT13__7( 92)
PRR04__7( 141)
PEN05__7( 128)
PEN07__7( 130)
DRY02__7( 86)
ISD04__7( 110)
KER06__7( 115)
LEN04__7( 117)
LEN07__7( 118)
PEN06__7( 129)
PRR01__7( 139)
PRR04__7( 142)
PEN01__1( 31)
KER02__7( 113)
KER04__3( 58)
LEN04__3( 63)
KER01__3( 56)
KER04__7( 114)
PRR02__7( 140)
FIT04__1( 9)
FOR01__1( 11)
ONS01__1( 28)
FOR07__3( 47)
ONS01__3( 65)
FOR02__1( 12)
MUR16__7( 122)
KER05__1( 22)
ONS07__1( 29)
ONS02__7( 124)
0.0500
0.1712
0.2924
0.4136
0.5348
0.6560

**Result of Discriminant Function analyses**

*Checks for normal distribution and outliers*

All variables were checked for normal distribution prior to DFA. Transformations were performed where necessary. The variables ALTI, SLOP, RAIN, MRWI AND ALKA were $Log_{10}$ (X) transformed. DFS and SIZE were Square-root transformed. 3 site/date combinations were dropped because they had data points which were extreme outliers. These were GAS06__1 (Very high turbidity), PHC09__7 (Very high top oxygen) and ASH09__7 (Very high top & bottom oxygen). This left 147sites and 39 families.

*Stepwise discriminant analysis*

We found 17 variables (Table 8) were suitable for stepwise discriminant analysis, however, the two chemical variables LALK and TURB were not used because they are unreliable as predictive variables (experience has shown us that large fluctuations in water chemistry occur in episodic river systems). Stepwise discriminant analysis was performed on the remaining 15 variables. Of these, eight variables (LATI, LONG, LRAN, LALT, TEMP, TOPO, SHET AND LMRW) were significant predictors ($P < 0.05$). Only the first 5 were used for discriminant analysis LATI, LONG, LRAN, LALT, TEMP.

**Table 8**. Normally distributed variables used for stepwise analysis when building the new north-west Dry season channel model.

| Code | Variable | Units |
|---|---|---|
| LATI | Latitude | Decimal degrees |
| LONG | Longitude | Decimal degrees |
| LALT | $Log_{10}$ (Altitude) | M |
| LSLP | $Log_{10}$ (Slope) | M $Km^{-1}$ |
| SDFS | Square root (Distance from source) | M |
| DCAT | Discharge category | Log category score |
| LRAN | $Log_{10}$ (Mean annual rainfall) | mm |
| LMRW | $Log_{10}$ (Mean river width) | M |
| TEMP | Water temperature | °C |
| LALK* | $Log_{10}$ (Alkalinity) | Mg $L^{-1}$ ($CaCO_3$) |
| TURB* | Turbidity | Nephelometric turbidity units |
| DETD | Density of detritus | Score from1 – 5 (1 = sparse, 5 = dense) |
| TOPO | Dissolved oxygen near surface | % |
| BOTO | Dissolved oxygen near substrate | % |
| SHET | Substrate heterogeneity | Score from1 – 6 (1 = homogeneous, 6 = heterogeneous) |
| SURF | Heterogeneity of visible surface area | Score from1 – 6 (1 = homogeneous, 6 = heterogeneous) |
| SSZE | Square root (Substrate particle size) | Score (based on Wentworth classification values) |

*Discriminant function analysis*

Step 1 Started with 147 sites. Four sites were dropped because they mis-classified (ASH10_7, ASH11_7, ASH13_7, and LMR09_7), then seven sites were dropped because O/E < 0.75. These were FIT04_1, FOR05_1, KER05_1, LMR01_1, ONS02_1, ONS02_7, and PHC01_1). Resubstitution error 0.0238% (three sites). Cross validation error 0.0298% (four sites).

Step 2 Started with 136 sites. One site (LMR02_3) was dropped because it mis-classified. Started again with 135 sites. There were no misclassifications. Two sites had O/E's of 0.73 but these were retained in the model. Resubstitution error 0.0%. Cross validation error 0.0%.

The north-west Dry season channel model is based on 135 sites (61 Kimberley, 49 Pilbara and 25 Gascoyne) and 39 families. The 10$^{th}$ percentile O/E score = 0.81. Bands for the model are given in Table 9.

**Table 9**. Bands and associated O/E ranges for the new north-west Dry season channel model.

| Band | Rating | O/E range |
|---|---|---|
| X | Slightly richer than reference quality | X >=1.20 |
| A | Equivalent to reference quality | 0.81 <= X <= 1.19 |
| B | Below reference quality | 0.62 <= X <= 0.80 |
| C | Well below reference quality | 0.43 <= X <= 0.61 |
| D | Impoverished | 0.24 <= X <= 0.42 |

**Environmental variables used to discriminate between the site groups**

Predictions are based on the 5 variables given in Table 9.

**Table 9**. Five predictor variables used in the new north-west Dry season channel model.

| Code | Variable | Units |
|---|---|---|
| LATI | Latitude | Decimal degrees |
| LONG | Longitude | Decimal degrees |
| LRAN | $Log_{10}$ (Mean annual rainfall) | mm |
| LALT | $Log_{10}$ (Altitude) | M |
| TEMP | Water temperature | °C |

**Data reports**

Supplied on disk with this report are:

1. Biological and environmental data for all sites sampled from spring 1994 to autumn 1998
2. Biological and environmental data, and O/E scores for spring 1998

Data reports have been produced according to the templates supplied by EA and are in Excel 5.0 format.