**Appendix G**
**Section I: Conversion of incidence to prevalence**

We estimate the prevalence of viremia from incidence data (Personal Communication, Oliver 1999, reproduced in Table 6) and duration of viremia (Table 7). The annual data from NSW for the months of January through June over an 11-year period (1989-99) are provided in Table 6.0 for illustration. For simplicity, annual data for the remaining states are not provided. Consolidated incidence data over the 11-year period for all States are reproduced in Tables 6a-6m by individual months (January - December).

**Table 6.0**. **BLU Incidence in NSW (1988-1999)**

| | A | B | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|
| 3 | **BTV SEROCONVERSIONS IN ZONE OF POSSIBLE BTV TRANSMISSION** | | | | | | | |
| 4 | **SUMMARY BY STATE AND YEAR** | | | | | | | |
| 5 | | | | | | | | |
| 6 | **STATE** | **YEAR** | **JAN** | **FEB** | **MAR** | **APR** | **MAY** | **JUN** |
| 7 | **NSW** | 1988 | | | | | | |
| 8 | **NSW** | 1989 | 68.84 | 161.04 | 187.84 | 176.38 | 85.84 | 65.12 |
| 9 | **NSW** | 1990 | 0.00 | 0.00 | 0.00 | 0.00 | 4.58 | 4.71 |
| 10 | **NSW** | 1991 | 0.00 | 0.00 | 12.73 | 13.26 | 2.89 | 0.00 |
| 11 | **NSW** | 1992 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 12 | **NSW** | 1993 | 0.00 | 5.73 | 19.94 | 44.85 | 92.15 | 9.86 |
| 13 | **NSW** | 1994 | 7.84 | 44.02 | 137.40 | 224.10 | 94.94 | 8.68 |
| 14 | **NSW** | 1995 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 15 | **NSW** | 1996 | 0.00 | 0.00 | 10.17 | 37.88 | 13.20 | 0.00 |
| 16 | **NSW** | 1997 | 61.40 | 122.14 | 203.32 | 178.44 | 82.92 | 8.78 |
| 17 | **NSW** | 1998 | 0.00 | 20.08 | 46.40 | 104.18 | 182.15 | 136.33 |
| 18 | **NSW** | 1999 | 0.00 | 29.84 | 75.36 | 87.39 | 37.54 | 3.69 |

Incidence varies among BLU-affected areas in four States (NSW, NT, QLD and WA) and time (in months). These data reflect seasonal variations characteristic of BLU epidemiology. The units of incidence are seroconversions per 100 animal years at risk. Although Table 6.0 shows only incidence rates for NSW from January (column G) through June (column L), AQIS provided data for all four States and for all months of the year. These data were reproduced in the following Tables 6a-6l.

For illustration, the data for NSW in January are reproduced in the incidence column (column B) and the frequency column (column C) of Table 6a. During the years 1989 - 1999, incidence was 0 in 8 of the 11 years (1990-1993, 1995, 1996, 1998, 1998); incidence was 7.84 in one year (1994), incidence was 61.20 in one year (1997); and incidence was 68.84 in one year (1989).

**Appendix G**
**Section I: Conversion of incidence to prevalence**

**Table 6a-6l. Monthly BLU Incidence and Frequency over an 11 year period**

**Table 6a**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 250 | | NSW | | NT | | QLD | | WA | |
| 251 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 252 | Jan | 0 | 8 | 0 | 3 | 0 | 4 | 0 | 2 |
| 253 | | 7.84 | 1 | 4.96 | 1 | 2.08 | 1 | 5.57 | 1 |
| 254 | | 61.40 | 1 | 16.96 | 1 | 4.30 | 1 | 17.37 | 1 |
| 255 | | 68.84 | 1 | 20.73 | 1 | 36.45 | 1 | 50.67 | 1 |
| 256 | | | | 26.18 | 1 | 127.94 | 1 | 68.16 | 1 |
| 257 | | | | 76.41 | 1 | 344.66 | 1 | 72.27 | 1 |
| 258 | | | | 182.54 | 1 | | | 88.72 | 1 |
| 259 | | | | 222.52 | 1 | | | 108.60 | 1 |
| 260 | | | | 403.96 | 1 | | | | |

**Table 6b**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 266 | | NSW | | NT | | QLD | | WA | |
| 267 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 268 | Feb | 0 | 5 | 0 | 3 | 0 | 1 | 0 | 3 |
| 269 | | 5.73 | 1 | 12.69 | 1 | 3.43 | 1 | 18.13 | 1 |
| 270 | | 20.08 | 1 | 16.19 | 1 | 4.59 | 1 | 19.80 | 1 |
| 271 | | 29.84 | 1 | 114.43 | 1 | 18.08 | 1 | 22.23 | 1 |
| 272 | | 44.02 | 1 | 147.61 | 1 | 39.73 | 1 | 35.32 | 1 |
| 273 | | 122.14 | 1 | 236.64 | 1 | 40.42 | 1 | 101.03 | 1 |
| 274 | | 161.04 | 1 | 253.38 | 1 | 65.52 | 1 | 111.23 | 1 |
| 275 | | | | 269.49 | 1 | 88.19 | 1 | | |
| 276 | | | | 947.25 | 1 | 135.04 | 1 | | |

**Appendix G**
**Section I: Conversion of incidence to prevalence**

## Table 6c

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 282 | | NSW | | NT | | QLD | | WA | |
| 283 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 284 | Mar | 0 | 3 | 0 | 2 | 0 | 1 | 0 | 3 |
| 285 | | 10.17 | 1 | 9.26 | 1 | 11.09 | 1 | 25.30 | 1 |
| 286 | | 12.73 | 1 | 37.69 | 1 | 12.93 | 1 | 25.80 | 1 |
| 287 | | 19.94 | 1 | 137.46 | 1 | 32.55 | 1 | 32.75 | 1 |
| 288 | | 46.40 | 1 | 151.15 | 1 | 52.00 | 1 | 64.43 | 1 |
| 289 | | 75.36 | 1 | 203.59 | 1 | 98.89 | 1 | 129.42 | 1 |
| 290 | | 137.40 | 1 | 363.30 | 1 | 105.66 | 1 | 196.40 | 1 |
| 291 | | 187.84 | 1 | 473.75 | 1 | 111.73 | 1 | | |
| 292 | | 203.32 | 1 | 623.96 | 1 | 117.62 | 1 | | |
| 293 | | | | 960.59 | 1 | 142.36 | 1 | | |

## Table 6d

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 299 | | NSW | | NT | | QLD | | WA | |
| 300 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 301 | Apr | 0 | 3 | 0 | 2 | 11.84 | 1 | 0 | 5 |
| 302 | | 13.26 | 1 | 26.01 | 1 | 12.41 | 1 | 12.98 | 1 |
| 303 | | 37.88 | 1 | 26.89 | 1 | 20.84 | 1 | 26.23 | 1 |
| 304 | | 44.85 | 1 | 81.66 | 1 | 21.64 | 1 | 352.59 | 1 |
| 305 | | 87.39 | 1 | 118.91 | 1 | 35.47 | 1 | 373.11 | 1 |
| 306 | | 104.18 | 1 | 120.21 | 1 | 109.32 | 1 | | |
| 307 | | 176.38 | 1 | 124.40 | 1 | 152.66 | 1 | | |
| 308 | | 178.44 | 1 | 244.69 | 1 | 162.20 | 1 | | |
| 309 | | 224.10 | 1 | 449.31 | 1 | 171.25 | 1 | | |
| 310 | | | | 1662.64 | 1 | 256.77 | 1 | | |

**Appendix G**
**Section I: Conversion of incidence to prevalence**

**Table 6e**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 316 | | NSW | | NT | | QLD | | WA | |
| 317 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 318 | May | 0 | 2 | 0 | 2 | 6.88 | 1 | 0 | 5 |
| 319 | | 2.89 | 1 | 28.60 | 1 | 11.61 | 1 | 14.22 | 1 |
| 320 | | 4.58 | 1 | 29.20 | 1 | 15.95 | 1 | 27.98 | 1 |
| 321 | | 13.20 | 1 | 38.40 | 1 | 19.42 | 1 | 51.20 | 1 |
| 322 | | 37.54 | 1 | 39.23 | 1 | 25.15 | 1 | 120.60 | 1 |
| 323 | | 82.92 | 1 | 74.32 | 1 | 86.46 | 1 | 182.50 | 1 |
| 324 | | 85.84 | 1 | 94.17 | 1 | 94.00 | 1 | | |
| 325 | | 92.15 | 1 | 164.44 | 1 | 107.65 | 1 | | |
| 326 | | 94.94 | 1 | 311.54 | 1 | 242.48 | 1 | | |
| 327 | | 182.15 | 1 | 647.72 | 1 | 245.42 | 1 | | |

**Table 6f**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 333 | | NSW | | NT | | QLD | | WA | |
| 334 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 335 | Jun | 0 | 4 | 0 | 2 | 4.54 | 1 | 0 | 4 |
| 336 | | 3.69 | 1 | 5.66 | 1 | 4.77 | 1 | 11.21 | 1 |
| 337 | | 4.71 | 1 | 12.82 | 1 | 7.32 | 1 | 22.36 | 1 |
| 338 | | 8.68 | 1 | 34.26 | 1 | 10.03 | 1 | 39.01 | 1 |
| 339 | | 8.78 | 1 | 35.26 | 1 | 17.15 | 1 | 65.08 | 1 |
| 340 | | 9.86 | 1 | 52.57 | 1 | 37.61 | 1 | 76.93 | 1 |
| 341 | | 65.12 | 1 | 53.12 | 1 | 67.13 | 1 | 186.12 | 1 |
| 342 | | 136.33 | 1 | 57.11 | 1 | 73.19 | 1 | | |
| 343 | | | | 127.47 | 1 | 182.50 | 1 | | |
| 344 | | | | 247.74 | 1 | 365.00 | 1 | | |

**Appendix G**
**Section I: Conversion of incidence to prevalence**

**Table 6g**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 350 | | NSW | | NT | | QLD | | WA | |
| 351 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 352 | Jul | 0 | 9 | 0 | 6 | 0 | 1 | 0 | 5 |
| 353 | | 12.38 | 1 | 1.68 | 1 | 6.52 | 1 | 25.58 | 1 |
| 354 | | 83.85 | 1 | 10.11 | 1 | 6.70 | 1 | 69.62 | 1 |
| 355 | | | | 30.07 | 1 | 17.37 | 1 | 83.66 | 1 |
| 356 | | | | 44.29 | 1 | 19.14 | 1 | 141.29 | 1 |
| 357 | | | | | | 21.07 | 1 | | |
| 358 | | | | | | 52.29 | 1 | | |
| 359 | | | | | | 70.02 | 1 | | |
| 360 | | | | | | 254.30 | 1 | | |

**Table 6h**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 366 | | NSW | | NT | | QLD | | WA | |
| 367 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 368 | Aug | 0 | 9 | 0 | 6 | 0 | 3 | 0 | 7 |
| 369 | | | | 4.94 | 1 | 9.75 | 1 | 118.29 | 1 |
| 370 | | | | 22.83 | 1 | 21.77 | 1 | 225.32 | 1 |
| 371 | | | | 81.41 | 1 | 22.59 | 1 | | |
| 372 | | | | 89.94 | 1 | 36.06 | 1 | | |
| 373 | | | | | | 36.62 | 1 | | |
| 374 | | | | | | 337.11 | 1 | | |

**Appendix G**
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**Table 6i**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 380 | | NSW | | NT | | QLD | | WA | |
| 381 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 382 | Sep | 0 | 10 | 0 | 7 | 0 | 4 | 0 | 6 |
| 383 | | | | 23.88 | 1 | 10.02 | 1 | 23.79 | 1 |
| 384 | | | | 35.56 | 1 | 10.98 | 1 | 40.65 | 1 |
| 385 | | | | 78.68 | 1 | 28.42 | 1 | 65.22 | 1 |
| 386 | | | | | | 92.44 | 1 | | |
| 387 | | | | | | 122.84 | 1 | | |

**Table 6j**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 393 | | NSW | | NT | | QLD | | WA | |
| 394 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 395 | Oct | 0 | 11 | 0 | 7 | 0 | 4 | 0 | 4 |
| 396 | | | | 4.31 | 1 | 0.57 | 1 | 18.41 | 1 |
| 397 | | | | 6.90 | 1 | 2.26 | 1 | 22.00 | 1 |
| 398 | | | | 11.21 | 1 | 48.11 | 1 | 57.47 | 1 |
| 399 | | | | | | 52.33 | 1 | 57.89 | 1 |
| 400 | | | | | | 74.91 | 1 | 119.35 | 1 |

**Table 6k**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 406 | | NSW | | NT | | QLD | | WA | |
| 407 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 408 | Nov | 0 | 10 | 0 | 8 | 0 | 2 | 0 | 2 |
| 409 | | | | 10.14 | 1 | 2.54 | 1 | 3.36 | 1 |
| 410 | | | | 72.34 | 1 | 3.84 | 1 | 18.99 | 1 |
| 411 | | | | | | 11.80 | 1 | 50.55 | 1 |
| 412 | | | | | | 24.37 | 1 | 78.79 | 1 |
| 413 | | | | | | 30.66 | 1 | 97.49 | 1 |
| 414 | | | | | | 45.85 | 1 | 205.35 | 1 |
| 415 | | | | | | 61.68 | 1 | 294.21 | 1 |

**Appendix G**
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**Table 6l**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 421 | | NSW | | NT | | QLD | | WA | |
| 422 | | Incidence | Freq | Incidence | Freq | Incidence | Freq | Incidence | Freq |
| 423 | Dec | 0 | 8 | 0 | 5 | 0 | 3 | 0 | 3 |
| 424 | | 8.75 | 1 | 41.74 | 1 | 2.80 | 1 | 13.77 | 1 |
| 425 | | 32.75 | 1 | 58.34 | 1 | 4.48 | 1 | 22.90 | 1 |
| 426 | | 62.80 | 1 | 71.74 | 1 | 21.40 | 1 | 75.96 | 1 |
| 427 | | | | 85.85 | 1 | 54.57 | 1 | 105.75 | 1 |
| 428 | | | | 105.87 | 1 | 62.50 | 1 | 196.58 | 1 |
| 429 | | | | | | 66.19 | 1 | 252.47 | 1 |

**Table 6m. Monthly BLU Incidence in Affected Areas**

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 452 | **Incidence Rate** | | | | |
| 453 | | NSW | NT | QLD | WA |
| 454 | Jan | 12.55183 | 86.75138 | 57.26931 | 45.70803 |
| 455 | Feb | 34.80509 | 181.6074 | 43.88734 | 34.19368 |
| 456 | Mar | 63.01413 | 269.1601 | 68.48106 | 52.67697 |
| 457 | Apr | 78.77052 | 259.5193 | 95.44105 | 84.98926 |
| 458 | May | 54.20068 | 129.7821 | 85.50188 | 39.64985 |
| 459 | Jun | 21.56013 | 56.90875 | 76.92508 | 40.06966 |
| 460 | Jul | 8.7486 | 8.61528 | 49.71241 | 35.57198 |
| 461 | Aug | 0 | 19.91277 | 51.54624 | 38.1791 |
| 462 | Sep | 0 | 13.81268 | 29.41202 | 14.40744 |
| 463 | Oct | 0 | 2.24098 | 19.79834 | 30.56899 |
| 464 | Nov | 0 | 8.24743 | 20.08096 | 83.19349 |
| 465 | Dec | 9.481618 | 36.35403 | 23.55016 | 74.16008 |

The data from the preceding Tables 6a-6l are compiled in Table 6m to show the expected incidence rate for each State and month estimated using the @Risk probability function @RiskDiscrete.

A problem with the use of @RiskDiscrete by States and months is that the correlation of incidence rates between individual States and months is not considered. The result of not addressing correlation at this time is uncertain. However, the implementation of this refinement is not expected to affect the results significantly.

**Appendix G**
**Section I: Conversion of incidence to prevalence**

## Duration of Viremia

The Australian Quarantine and Inspection Service obtained the duration of viremia data shown in Table 7 from a monitoring program in sentinel herds in the affected area. As part of this program, AQIS monitors disease throughout the country by monitoring viremia and vector fauna in sentinel cattle herds (NAMP, 1997-98; NAMP,1996-97; Gibbs and Homan 1992).

**Table 7: Duration of Viremia**

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | **Duration of detectable viremia in 477 natural bluetongue virus infections of sentinel cattle pastured near Darwin** | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 11 | | | **Number of Cattle Showing Viremia** | | | | | | | | |
| 12 | Duration of Viremia | | BLU Serotype | | | | | | | | |
| 13 | Weeks | Days | 1 | 3 | 9 | 15 | 16 | 20 | 21 | 23 | Total |
| 14 | 1 | 7 | 34 | 22 | 0 | 1 | 13 | 30 | 4 | 15 | 119 |
| 15 | 2 | 14 | 45 | 17 | 1 | | 21 | 25 | 20 | 9 | 138 |
| 16 | 3 | 21 | 35 | 16 | | | 26 | 10 | 27 | 8 | 122 |
| 17 | 4 | 28 | 7 | 5 | | | 18 | 9 | 8 | 5 | 52 |
| 18 | 5 | 35 | 9 | 5 | | | 12 | 3 | | | 29 |
| 19 | 6 | 42 | 2 | 1 | | | 1 | 4 | | | 8 |
| 20 | 7 | 49 | 2 | | | | 2 | 2 | | | 6 |
| 21 | 8 | 56 | | | | | 0 | 2 | | | 2 |
| 22 | 12 | 84 | | | | | 1 | | | | 1 |
| 23 | | Total | 134 | 66 | 1 | 1 | 94 | 85 | 59 | 37 | 477 |
| 24 | | | | | | | | | | | |
| 25 | Ave Duration (days): | | 17.1 | 16.4 | 14.0 | 7.0 | 22.1 | 17.7 | 18.6 | 14.6 | 18.1 |

The data in Table 7 reflect viremia detected in 477 sentinel cattle pastured near Darwin and are reported by individual serotype for completeness. However, the value for duration of viremia used subsequently in this assessment represents an average value for all serotypes. The average duration of viremia for all serotypes is 18.1 days (Table 7, the cell located in column K, line 25, subsequently designated Cell K25).

Prevalence values are calculated using the formula $p_2 = ID$, where

$p_2$ = prevalence or proportion of viremic cattle in the affected region,

I = incidence or number of new cases of viremic cattle in the affected region for any given year, and

D = duration of viremia

The incidence rates in Tables 6a-6m are expressed as the number of seroconversions per 100 animal years at risk. As mentioned previously, the duration of viremia used is the average of 18.1 days for all States and all months (see Table 7). Therefore, $p_2 = I / 100 / 365 * D$ (division by 100

and 365 are needed to convert incidence to number of seroconversions per animal days at risk). The prevalence values obtained using this approach are reported in Table 8 by State and month.

**Table 8. Prevalence of Viremia**

| | H | I | J | K | L | M |
|---|---|---|---|---|---|---|
| 452 | **Prevalence (= IR * Duration assuming Duration of 18.1 days)** | | | | | |
| 453 | | NSW | NT | QLD | WA | |
| 454 | Jan | 0.006224 | 0.043019 | 0.028399 | 0.0226662 | |
| 455 | Feb | 0.01726 | 0.090057 | 0.021763 | 0.0169563 | |
| 456 | Mar | 0.031248 | 0.133474 | 0.033959 | 0.026122 | |
| 457 | Apr | 0.039062 | 0.128693 | 0.047328 | 0.0421454 | |
| 458 | May | 0.026878 | 0.064358 | 0.0424 | 0.019662 | |
| 459 | Jun | 0.010691 | 0.028221 | 0.038146 | 0.0198702 | |
| 460 | Jul | 0.004338 | 0.004272 | 0.024652 | 0.0176398 | |
| 461 | Aug | 0 | 0.009875 | 0.025561 | 0.0189326 | |
| 462 | Sep | 0 | 0.00685 | 0.014585 | 0.0071445 | |
| 463 | Oct | 0 | 0.001111 | 0.009818 | 0.0151589 | |
| 464 | Nov | 0 | 0.00409 | 0.009958 | 0.0412549 | |
| 465 | Dec | 0.004702 | 0.018028 | 0.011678 | 0.0367753 | |

The probability values for Branch Point 2, which are dependent on the number of viremic animals entering the facility, must be combined with those estimated for Branch Point 3 to estimate a final probability. The approach is discussed in Section III of this appendix.