Appendix 2:

Documentation for GSL Waterbird Survey Analyses

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These notes summarize the approach we took in analyzing the 1997-1999 waterbird survey data during the April 3-5, 2000 meeting in Boise.

Basic Data Tables

Workbook GSLBdNames.xls contains the species, species groups, and codes.

Workbook "Data.xls" contains data used for the analyses. It has the following worksheets, each of which was saved using TruBasic as a separate file with the same name and a "csv" extension for analyses.

Species (just the codes; sorted with groups first, then species by total number recorded)

Areas (Table 1)

- 1 Area Number (sequential numbers for the transects, 1 to 54)
- 2 Area code
- 3 Name
- 4 Expansion factor (4 for the Bays; 1 otherwise)

Dates

- 1 Area number (not codes)
- 2 Year
- 3 Julian date (Table 2)
- 4 Assigned Period *
- 5 Error *
- 6 Real Period *

* Assigned Period is the period number assigned for the survey, chosen to maximize the number of different periods with a survey. Real Period is the 10-day interval that the survey was actually in. If the survey was run during the intended interval then error is 0 and Real Period = Assigned Period. Otherwise, error is the number of days outside of the interval and Real Period is the period that the survey was run in.

Points (Table 3)

- 1 Area number
- 2 Year
- 3 Point number
- 4 Point type (1=Random; 2=Drainage)

Counts

- 1 Area number (not codes)
- 2 Year
- 3 Julian date
- 4 Point number (0=not a point count)
- 5 Species code
- 6 Number recorded

Notes:

1. In 1999, during periods 3,4, and 5, results reported for Area 5A actually covered 5A and 5B. We handled this by adding rows in the Dates file for these 3 periods. Thus the Dates file contains records saying area 5B was run but Counts does not include any records from area 5B during these periods. Tallies of the number of surveys, from Dates, and of the number of birds from Counts are correct, but comparisons of 5A vs. 5B must exclude periods 3-5 in 1999.

2. Program Change.dat modifies the Dates file. It changes area codes to area numbers, extracts year from date, changes mm/dd to Julian date, and adds "period." Period is the nominal period-the period the survey date actually falls in. Alternate period is our suggested designation for cases in which no survey occurs within a period but surveys occur in the surrounding periods, one of them within a few days of the period lacking a survey. "Error in alt. period" is the number of days by which the survey is outside the alternate period. The Alternate Periods are added manually in Excel. Error in alt. period is added by program AddPer.2. Program Change.cts modifies the Counts files. It changes area codes to area numbers, extracts year from date, and changes mm/dd to Julian date.

Calculation of Means per Survey

Most of the analyses were done with program Analysis.cts (Figure 1). It uses a "species list" which includes all of the groups identified by Don Paul and all single species for which more than 10 individuals were recorded 1997-1999 (about 85 species). It first reads the Dates file into an array. It then prepares a data table for each species (and species group) either in a specified year or for all years. For a given species, it reads each record in Counts and determines whether the year and species should be included in the analysis. If so, it records the number counted. The program, thus, gets the number of counts, and the number of birds counted for every transect and period. It then calculates means per transect-period and optionally stores this data in a file, CellMns.

For analyses of restricted areas, the program eliminates rows and/or periods that are not to be included and then calculates row means, SEs, and CVs and column totals. It

also calculates the mean of the column totals and the SE and CV of this mean. These results are stored in the file RowMns and ColTots.

Figure 1. Arrays used in program Analysis.cts to calculated means/survey for each areaperiod (CellMns) area for all periods (RowMns) and for selected areas (those with largely complete data) within each period (ColTots). Grand means, SEs, and CVs are contained within the array ColTots.



2. Next it extracted areas with largely complete data, excluded period 18 (surveys later than period 17), and filled in missing data (taking the average of immediately adjacent means). It then calculated and saved **RowMns** and **ColTots** (which includes the grand mean and its SE and CV).

I Aı mi arı	ray w/ fewer rows and ssing data filled * (this ray not save)	17	RowMns mn, SE, CV
	ColTots		Mn, SE, CV for Co. Tots.
Areas 9B, 34B	excluded due to missing , 35, 36, 36A, 36B, 39, 40	data: 10, 0, 43, 44.	11, 14, 19, 19 <i>A</i>

Points Analysis

These analyses were carried out with program Analysis.pts. Analysis.pts stores Dates and Points and then uses these to build the array NPts(p,[R,D]) which has the number of random and drainage points surveyed in each period. The program then reads through counts. When it finds a point count it looks in Points to see if the record is useful for this analysis and, if it is, gets the period from Dates. The program prints out the means/survey for random and drainage points and the differences. These are regarded as a random (systematic) sample from which the grand mean, and its SE and CV, are calculated.

The Points spreadsheet was constructed from Manning's list of point types for each year with the following modifications. We excluded pt. 2 at Area 5a (I-80, North-N) because, according to the list, results from pt. 1 and pt. 2 were to be added and treated as a single point. By excluding pt. 2, we kept the sample size for this area correct. 1999 was assumed to be like 1998 except that we excluded W. Layton point 1 (it was done a few times early but then not again) and E Promontory-N because the types were not clear (according to Manning).

In constructing NPts, the program reads thru Dates and looks for a match in Points. When no match is found, it does not add anything to Points. Thus, excluding these records from Points results in them being excluded from the sample sizes even though they occur in Dates. Similarly, in reading thru Counts, when a point record is found we look for it in Points. If it isn't found, then no birds are added so the record is excluded. The one needed change is that records for point 2 at Area 5a DO need to be included. This was handled by changing the point number to 1.

Analyses to Address the Questions Don Paul Posed

Paul and Manning prepared a list of questions to be addressed. Our work on each is summarized below.

III.2. Bird Use Days

We used ColTots grand mean and its SE to calculate bird use days for each group (using 170 days in the study period). Eighty percent CIs are the estimated bird use days $\pm 1.28 \times SE$.

We did all years; estimates for 1999 only and for other species can be added using the ColTots worksheet.

III.3. Grand total bird numbers by period

We summed the ColTots across species (using only the species groups) to get number present in each period.

III.4. All lake suite totals by period

We used the entries from ColTots for 1997-1999 and 1999 only.

III.5&6. Shoreline activity and habitat analysis by area groups

Manning's additional notes indicated that for these two tasks we should prepare a table with species (avocets/stilts, gulls, SNPL, peeps) as rows and periods as columns and that the cell entries should be means/survey for each of the areas. We did not do Howard Slough because there was too much missing data from this area. We did do the other five areas, and we did 1999 and 1997-1999 for each one. The output was called TaskIII.6. We obtained the reduced arrays using program Analysis.1 and modifying the Shrink subroutine so that it only extracted which ever rows from CellMns that we wanted. We also nullified the statements to print row means.

We did not yet address the question "What habitat is there?"

III.7. Comparison of bird numbers and species richness at random and drainage point samples.

Analysis.pts was used to calculate the means/survey for random and drainage points and the difference. Manning is analyzing these results.

III.8. How well do point samples predict bird numbers and species in the associated survey area?

Manning has the means per random point and transect. She will address this issue by converting both to densities. Subsequent analysis can be carried out in the same was as to address question 7 above.

Table 1.	Areas		
Number	Code	Name	ExpFact
1	1	TIMPIE SPRINGS WMA	1
2	2	STANSBURY ISLAND NO.	1
3	3A	STANSBURY SOUTH- N	1
4	3B	STANSBURY SOUTH- S	1
5	5A	I 80 NORTH- N	1
6	5B	I-80 NORTH- S	1
7	6	SALTAIR	1
8	7	ASSOCIATED DUCK CLUB	1
9	8A	KENNECOTT- GOGGIN	1
10	8B	KENNECOTT- LEE CREEK	1
11	8C	KENNECOTT- ISSR	1
12	9A	AUDUBON LAKESIDE- S	1
13	9B	AUDUBON NORTH	1

Number	Code	Name	ExpFact
14	10	CRYSTAL LAKESIDE	1
15	11	FARM BAY LAKESIDE	1
16	12	FARMINGTON BAY WMA	1
17	13	WEST FARMINGTON	1
18	14	ANTELOPE ISLAND EAST	1
19	15	ANTELOPE ISLAND WEST	1
20	16	ANT ISLAND CAUSEWAY	1
21	17A	WEST KAYSVILLE	1
22	17B	WEST KAYSVILLE	1
23	18	WEST LAYTON	1
24	19	H SLOUGH WMA- D & P	1
25	19A	H SLOUGH WMA- BEACH	1
26	19B	H SLOUGH WMA- DIKE	1
27	19C	H SLOUGH WMA- POND	1
28	20	OGDEN BAY WMA	1
29	21	OGDEN BAY LAKESIDE	1
30	22	OGDEN BAY NORTH	1
31	23	RAINBOW	1
32	24	SOUTH H CRANE WMA	1
33	25	HAROLD CRANE WMA	1
34	27	SOUTH BEAR RIVER	1
35	28	WILLARD SPUR	1
36	29A	BEAR RIVER REFUGE	1
37	29B	BEAR RIVER REFUGE RD	1
38	30	BEAR RIVER CLUB	1
39	32	PUB SHOOT GRNDS WMA	1
40	33	SALT CREEK WMA	1
41	34A	EAST PROMONTORY- N	1
42	34B	EAST PROMONTORY- S	1
43	35	LOCOMOTIVE SPGS WMA	1
44	36	SALT WELLS FLAT WHA	1
45	36A	SALT WELLS- SHORE	1
46	36B	SALT WELLS FLAT WHA	1
47	37	BEAR RIVER BAY	4
48	38	OGDEN BAY	4
49	39	FARMINGTON BAY	4
50	40	MAGCORP	1
51	41	NEW STATE DUCK CLUB	1
52	42	EAST FARMINGTON BAY	1
53	43	DEARDENS KNOLL	1
54	44	JORDAN RIVER	1

Table 2. Julian Dates

Mth	Day .	JDay	Mth	Day J	lDay	Mth	Day .	JDay	Mth I	Day .	JDay	Mth	Day .	IDay	Mt	Day	JDay
Jan	1	1	Mar	1	60	May	1	121	Jul	1	182	Sep	1	244	No	v 1	305
	2	2		2	61		2	122		2	183		2	245		2	306
	3	3		3	62		3	123		3	184		3	246		3	307
	4	4		4	63		4	124		4	185		4	247		4	308
	5	5		5	64		5	125		5	186		5	248		5	309
	6	6		6	65		6	126		6	187		6	249		6	310
	/	/		/	66		/	127		/	188		/	250		/	311
	8	8		8	67		8	128		8	189		8	251		8	312
	10	10		10	60		10	129		10	190		10	252		10	313
	10	10		10	09 70		10	121		10	100		10	200		10	314 215
	12	12		12	70		12	132		12	192		12	255		12	315
	13	13		13	72		13	133		13	194		13	256		13	317
	14	14		14	73		14	134		14	195		14	257		14	318
	15	15		15	74		15	135		15	196		15	258		15	319
	16	16		16	75		16	136		16	197		16	259		16	320
	17	17		17	76		17	137		17	198		17	260		17	321
	18	18		18	77		18	138		18	199		18	261		18	322
	19	19		19	78		19	139		19	200		19	262		19	323
	20	20		20	79		20	140		20	201		20	263		20	324
	21	21		21	80		21	141		21	202		21	264		21	325
	22	22		22	81		22	142		22	203		22	265		22	326
	23	23		23	82		23	143		23	204		23	266		23	327
	24	24		24	83		24	144		24	205		24	267		24	328
	25	25		25	84		25	145		25	206		25	268		25	329
	26	26		26	85		26	146		26	207		26	269		26	330
	21	21		21	00 97		21	147		21	200		21	270		21	333
	20	20 20		20 20	07 88		20 20	140		20 20	209		20 20	271		20	332 333
	30	30		20	80		30	150		30	210		30	272		20	334
	21	31		31	90		31	151		31	212		00	210		00	004
	51	01		51	50		01										
Feb	1	32	Apr	1	91	Jun	1	152	Aug	1	213	Oct	1	274	De	c 1	335
Feb	1 2	32 33	Apr	1 2	91 92	Jun	1 2	152 153	Aug	1 2	213 214	Oct	1 2	274 275	De	c 1 2	335 336
Feb	1 2 3	32 33 34	Apr	1 2 3	91 92 93	Jun	1 2 3	152 153 154	Aug	1 2 3	213 214 215	Oct	1 2 3	274 275 276	De	c 1 2 3	335 336 337
Feb	1 2 3 4	32 33 34 35	Apr	1 2 3 4	91 92 93 94	Jun	1 2 3 4	152 153 154 155	Aug	1 2 3 4	213 214 215 216	Oct	1 2 3 4	274 275 276 277	De	c 1 2 3 4	335 336 337 338
Feb	1 2 3 4 5	32 33 34 35 36	Apr	1 2 3 4 5	91 92 93 94 95	Jun	1 2 3 4 5	152 153 154 155 156	Aug	1 2 3 4 5	213 214 215 216 217	Oct	1 2 3 4 5	274 275 276 277 278	De	c 1 2 3 4 5	335 336 337 338 339
Feb	1 2 3 4 5 6 7	32 33 34 35 36 37	Apr	1 2 3 4 5 6 7	91 92 93 94 95 96 07	Jun	1 2 3 4 5 6	152 153 154 155 156 157	Aug	1 2 3 4 5 6 7	213 214 215 216 217 218 210	Oct	1 2 3 4 5 6 7	274 275 276 277 278 279	De	c 1 2 3 4 5 6	335 336 337 338 339 340
Feb	1 2 3 4 5 6 7	32 33 34 35 36 37 38 30	Apr	1 2 3 4 5 6 7	91 92 93 94 95 96 97	Jun	1 2 3 4 5 6 7	152 153 154 155 156 157 158 150	Aug	1 2 3 4 5 6 7 8	213 214 215 216 217 218 219 220	Oct	1 2 3 4 5 6 7 8	274 275 276 277 278 279 280 281	De	c 1 2 3 4 5 6 7	335 336 337 338 339 340 341 342
Feb	1 2 3 4 5 6 7 8 9	32 33 34 35 36 37 38 39 40	Apr	1 2 3 4 5 6 7 8 9	91 92 93 94 95 96 97 98 90	Jun	1 2 3 4 5 6 7 8	152 153 154 155 156 157 158 159 160	Aug	1 2 3 4 5 6 7 8 9	 213 214 215 216 217 218 219 220 221 	Oct	1 2 3 4 5 6 7 8 9	274 275 276 277 278 279 280 281 282	De	c 1 2 3 4 5 6 7 8 9	335 336 337 338 339 340 341 342 343
Feb	1 2 3 4 5 6 7 8 9	32 33 34 35 36 37 38 39 40 41	Apr	1 2 3 4 5 6 7 8 9	91 92 93 94 95 96 97 98 99	Jun	1 2 3 4 5 6 7 8 9	152 153 154 155 156 157 158 159 160 161	Aug	1 2 3 4 5 6 7 8 9	 213 214 215 216 217 218 219 220 221 222 	Oct	1 2 3 4 5 6 7 8 9	274 275 276 277 278 279 280 281 282 283	De	c 1 2 3 4 5 6 7 8 9	335 336 337 338 339 340 341 342 343 344
Feb	1 2 3 4 5 6 7 8 9 10 11	32 33 34 35 36 37 38 39 40 41 42	Apr	1 2 3 4 5 6 7 8 9 10 11	91 92 93 94 95 96 97 98 99 100 101	Jun	1 2 3 4 5 6 7 8 9 10 11	152 153 154 155 156 157 158 159 160 161 162	Aug	1 2 3 4 5 6 7 8 9 10 11	 213 214 215 216 217 218 219 220 221 222 223 	Oct	1 2 3 4 5 6 7 8 9 10 11	274 275 276 277 278 279 280 281 282 283 283	De	c 1 2 3 4 5 6 7 8 9 10 11	335 336 337 338 339 340 341 342 343 344 345
Feb	1 2 3 4 5 6 7 8 9 10 11 12	32 33 34 35 36 37 38 39 40 41 42 43	Apr	1 2 3 4 5 6 7 8 9 10 11 12	91 92 93 94 95 96 97 98 99 100 101 102	Jun	1 2 3 4 5 6 7 8 9 10 11 12	152 153 154 155 156 157 158 159 160 161 162 163	Aug	1 2 3 4 5 6 7 8 9 10 11 12	 213 214 215 216 217 218 219 220 221 222 223 224 	Oct	1 2 3 4 5 6 7 8 9 10 11 12	274 275 276 277 278 279 280 281 282 283 284 285	De	c 1 2 3 4 5 6 7 8 9 10 11	335 336 337 338 339 340 341 342 343 344 345 346
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13	32 33 34 35 36 37 38 39 40 41 42 43 44	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13	91 92 93 94 95 96 97 98 99 100 101 102 103	Jun	1 2 3 4 5 6 7 8 9 10 11 12 13	152 153 154 155 156 157 158 159 160 161 162 163 164	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13	 213 214 215 216 217 218 219 220 221 222 223 224 225 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13	274 275 276 277 278 279 280 281 282 283 284 285 286	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13	335 336 337 338 339 340 341 342 343 344 345 346 347
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14	32 33 34 35 36 37 38 39 40 41 42 43 44 45	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14	91 92 93 94 95 96 97 98 99 100 101 102 103 104	Jun	1 2 3 4 5 6 7 8 9 10 11 12 13 14	152 153 154 155 156 157 158 159 160 161 162 163 164 165	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14	 213 214 215 216 217 218 219 220 221 222 223 224 225 226 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14	274 275 276 277 278 279 280 281 282 283 284 285 286 287	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14	335 336 337 338 340 341 342 343 344 345 346 347 348
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	91 92 93 94 95 96 97 98 99 100 101 102 103 104	Jun	1 2 3 4 5 6 7 8 9 10 11 2 13 14 15	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106	Jun	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 288 289	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107	Jun	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 5 16 17 18	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108	Jun	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	 213 214 215 216 217 218 220 221 222 223 224 225 226 227 228 229 230 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	274 275 276 277 278 280 281 282 283 284 285 286 287 288 289 290 291	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 8 9	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 6 17 18 19	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108	Jun	1 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 8 9	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 231	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 9	 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 9 20 1	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109	Jun	1 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 9 20	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	335 336 337 338 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 20	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111	Jun	1 2 3 4 5 6 7 8 9 10 11 23 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 20	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 292	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 20	335 336 337 338 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 2	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 22	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111	Jun	1 2 3 4 5 6 7 8 9 10 11 23 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 22	213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 225	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 20	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 292	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	335 336 337 338 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 3 24	32 33 34 35 36 37 38 39 40 41 42 43 44 50 51 52 53 54 55	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 3 4	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113	Jun	1 2 3 4 5 6 7 8 9 10 11 23 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 34	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 3 4	 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 226 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 3 4	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 3 4	335 336 337 338 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 357
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	32 33 34 35 36 37 38 39 40 41 42 43 44 56 47 48 950 51 52 354 55	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 32 4 25	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114	Jun	1 2 3 4 5 6 7 8 9 10 11 23 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 32 4 25	 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 32 4 25	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 290 291 292 293 294 295 296 297 298	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 22 23 25	335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 358
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 6 7 8 9 20 21 22 23 24 25 26	32 33 34 35 36 37 38 39 40 41 42 43 44 56 47 48 95 51 52 53 54 55 55 57	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 32 4 25 26	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116	Jun	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 7 8 9 10 11 12 13 14 15 16 17 8 9 20 21 22 23 24 25 26	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26	 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26	274 275 276 277 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 294 295 296 297 298 299	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26	335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 6 7 8 9 10 11 12 23 24 25 26 27	32 33 34 35 36 37 38 39 40 41 42 43 44 50 51 52 54 55 56 57 58	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 3 24 25 26 27	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117	Jun	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 9 20 21 22 23 24 25 26 27	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177	Aug	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 3 24 25 26 27	 213 214 215 216 217 218 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 3 24 25 26 27	274 275 276 277 280 281 282 283 284 285 286 287 288 290 291 292 293 294 295 294 295 296 297 298 299 300	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 6 7 8 9 10 11 12 13 14 15 16 7 18 9 20 21 22 23 24 25 26 27 28	32 33 34 35 36 37 38 39 40 41 42 43 44 56 47 48 49 51 52 54 55 56 57 58 59	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 6 7 18 19 20 21 22 3 24 25 26 27 28	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118	Jun	$\begin{array}{c} 1\\ 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\end{array}$	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179	Aug	$\begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \end{array}$	 213 214 215 216 217 218 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	274 275 276 277 280 281 282 283 284 285 286 287 288 290 291 292 293 294 295 294 295 296 297 298 299 300 301	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 7 8 9 10 11 12 13 14 15 16 7 8 9 10 11 22 23 24 25 26 27 28	32 33 34 35 36 37 38 39 40 41 42 43 44 54 6 47 48 49 51 22 34 55 56 57 58 59	Apr	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 6 7 7 8 9 20 21 22 23 24 25 26 27 28 29	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119	Jun	$\begin{array}{c} 1\\ 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 9\\ 20\\ 21\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\end{array}$	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180	Aug	$\begin{array}{c}1\\1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\\22\\23\\24\\25\\26\\27\\28\\29\end{array}$	 213 214 215 216 217 218 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 	Oct	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	274 275 276 277 288 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363
Feb	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 7 8 9 20 21 2 23 24 25 26 27 28	32 33 34 35 36 37 38 39 40 41 42 43 44 54 6 47 48 9 51 52 54 55 56 57 58 59	Apr	1 2 3 4 5 6 7 8 9 10 11 2 13 14 15 16 17 8 19 20 21 22 23 24 25 26 27 28 29 30	91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120	Jun	$\begin{array}{c} 1\\ 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 9\\ 20\\ 21\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \end{array}$	152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181	Aug	$\begin{array}{c}1\\1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\9\\20\\21\\22\\23\\24\\25\\26\\27\\28\\29\\30\end{array}$	 213 214 215 216 217 218 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 	Oct	$\begin{array}{c}1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\9\\20\\21\\22\\23\\24\\25\\26\\27\\28\\29\\30\end{array}$	274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303	De	c 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 9 20 21 22 23 24 25 26 27 28 29 30	 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364

Area			1997		19	98	1999	
No.	Code	Name	R	D	R	D	R	D
3	3a	Stansbury South-N	1		1		1	
4	3b	Stansbury South-S	1		1		1	
5	5a	I-80 North-N	1,2*		1,2*		1,2*	
7	6	Saltair	1,3	2	1,3	2	1,3	2
9	8a	Kennecott-Goggin	2	1	2	1	2	1
10	8b	Kennecott-Lee Creek	1		1		1	
12	9a	Audubon Lakeside-S	1		1		1	
13	9b	Audubon North	1		1		1	
15	11	Farm Bay Lakeside	2	1,3	1,2,3		1,2,3	
17	13	West Farmington	1	2,3	1	2,3	1	2,3
19	15	Antelope Island West	1,2		1,2		1,2	
22	17b	West Kaysville	1,2,3	4				
23	18	West Layton	2	1,3	2	1,3	2	3
25	19a	Howard Slough Beach	2	1	1,2		1,2	
45	34a	East Promontory-N	2	1,3	2	1,3		
		Total	19	12	19	8	18	5

Table 3. Points at random and drainage locations surveyed in 1997-99.

* Results from points 1 and 2 added and treated as a single point.