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DEMOGRAPHIC MONITORING OF ARABIS FECUNDA IN THE
PIONEER RANGE, BEAVERHEAD NATIONAL FOREST, MONTANA
1989-1991

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Introduction

Passage of the Federal Endangered Species Act of 1973 and subsequent recognition of the value of conserving biotic diversity (Wilson 1988) have resulted in many government agencies becoming active in species conservation. Surveys to determine the location and size of populations of rare species are being conducted on public lands throughout the west. These surveys are necessary in any species conservation program; however, knowing the location and size of populations at any one point in time is only the first step in a long-term protection strategy (Sutter 1986). Extinction is a process requiring an understanding of population dynamics (Menges 1986). Periodic inventories can detect trends but will do little to determine causality or help generate predictive hypotheses (Palmer 1987). Long-term conservation requires a knowledge of many life history parameters including fecundity, recruitment, survivorship, age structure, and population flux. Demographic monitoring techniques can provide information on factors regulating population density and persistence (Palmer 1987). This information, in turn, provides an essential basis for management decisions.

Sapphire rockcress (Arabis fecunda Rollins) is a rosette-forming perennial in the Mustard Family (Brassicaceae). This recently described species (Rollins 1984) is endemic to highly calcareous, azonal soils in the foothills of the Sapphire Range in Ravalli County and in the Pioneer Range in Beaverhead and Silver Bow counties, Montana (Lesica 1985, Schassberger 1988). Arabis fecunda generally occurs on steep, often eroding slopes with low vascular plant density. In Ravalli County, populations of A. fecunda are thought to be

threatened by livestock grazing and encroachment by an aggressive exotic weed, spotted knapweed (Centaurea maculosa) (Lesica 1985, Schassberger 1988). In Silver Bow and Beaverhead counties, populations may be threatened by mining activity and livestock grazing. Arabis fecunda is a candidate for listing as a threatened or endangered species by the U.S. Fish and Wildlife Service (USDI-FWS 1990) and is considered threatened in Montana (Lesica and Shelly 1991a).

Here I report the results of the first three years of a long-term demographic monitoring study at two sites in the Pioneer Range on Beaverhead National Forest.

Study Sites

Lime Gulch

Location: Five miles west of Interstate Highway 15 on the north side of Birch Creek Road, approximately 1/4 mile up Lime Gulch from the road; T5S R10W Sec14; approximately 6,200 ft elevation.

Vipond Park

Location: Approximately 12.5 miles west of Melrose on the Canyon Creek Road, at the corner of the road overlooking the kilns; T2S R10W Sec 8; 7,200 ft elevation.

Further information on the study sites and location of the transects can be found in Lesica and Shelly (1989).

Methods

In 1989 two permanent belt transects of 12 adjacent m^2 plots were established at each site following the methods outlined in Lesica (1987). Lime Gulch transects were read on 15 June 1989, 15 June 1990, and 14 June 1991. Vipond Park transects were read on 16 June 1989, 29 June 1990, and 3 July 1991. Individual *A. fecunda* plants were mapped and recorded using the following system:

- S = Seedling (rosette less than 15 mm diameter)
- R - indicates the number of rosettes (> 15 mm diameter) per plant
- I - indicates the total number of inflorescences (stems) per plant
- F - indicates the total number of fruits produced by the plant

Thus, a plant with two rosettes, three stems and a total of nine fruits would be recorded as R1-I3-F9. In cases where plants had not finished blooming, two flowers or flower buds were recorded as one fruit. Since a first year plant can bloom and set fruit (Lesica and Shelly, personal observation), the above system describes size rather than age classes.

At each site we collected 25 randomly-chosen fruits. We dissected each fruit and recorded the number of viable-appearing seeds in each.

Population growth rate was calculated by dividing the increase in individuals over the previous year divided by the number of individuals present in the plot the previous year.

Negative growth rates reflect a decreasing population size. Birth rates and death rates were calculated as the number of new plants or missing plants in year n divided by the total number of plants in year $n-1$ and multiplied by 100 to give a percentage.

Many of the plants at Vipond Park were still flowering when we read the transects in 1989, thus we read these transects later in subsequent years.

In 1990 the No. 10 quadrat of the Vipond Park East transect was so crowded that interpretation became impossible. In 1991 quadrat No. 8 also became too crowded for interpretation. The west half of quadrat 10 was deleted from analysis in 1990, and the west half of quadrat 8 was deleted in 1991. Consequently, summary statistics reported herein will not match exactly those from previous reports (Lesica and Shelly 1989, 1991b).

In 1991 I estimated canopy cover of all vascular plants as well as rock, bare soil and total vegetation in each quadrat. I estimated cover to the nearest 5% with two additional classes, $P=1-3\%$ and $T=0-1\%$, at the lower end of the scale.

Results and Discussion

The transects at Lime Gulch are in vegetation dominated by the grasses, Agropyron spicatum, Stipa comata and Oryzopsis hymenoides; total vegetation cover was ca. 40% (Table 1). Vegetation at the Vipond Park monitoring site was dominated by cushion-forming forbs

Table 1. Percent canopy cover of soil, rock, vegetation, dominant (>2%) plants and slope and aspect for Arabis fecunda monitoring transects at Lime Gulch and Vipond Park.

Lime Gulch		
% Canopy Cover	North	South
Rock	5.5	5.5
Soil	51.6	57.5
Total Vegetation	43.4	37.5
Agropyron spicatum	5.8	5.8
Carex filifolia	--	4.7
Stipa comata	6.6	15.0
Aristida longiseta	--	3.2
Carex rossii	7.9	--
Oryzopsis hymenoides	8.5	1.5
Artemisia frigida	1.8	1.5
Senecio canus	2.8	0.4
Aspect	260°	150°
Slope	21°	12°
Vipond Park		
% Canopy Cover	East	West
Rock	14.2	14.6
Soil	43.3	39.6
Litter & Basal Veg.	42.5	47.5
Total Vegetation	60.1	65.8
Agropyron spicatum	8.1	12.1
Carex filifolia	--	2.1
Haplopappus acaulis	18.8	12.9
Artemisia frigida	10.4	9.1
Phlox muscoides	7.5	11.3
Sedum lanceolatum	3.1	2.4
Oxytropis besseyi	0.4	2.1
Aspect	175°	195°
Slope	32°	30°

such as Haplopappus acaulis, Artemisia frigida, Phlox muscoides and Sedum lanceolatum. Agropyron spicatum was the only common grass (Table 1).

Over the two-year period of the study, Arabis fecunda populations at both Lime Gulch and Vipond Park increased in total number of plants as well as number of fruiting plants (Table 2). At Vipond Park I observed predation of A. fecunda inflorescences in both 1990 and 1991. In 1990 the inflorescences were chewed off, probably by grazing ungulates or rodents. In 1991 some plants had wilted inflorescence tops, possibly caused by a stem-mining insect. Damage did not appear extensive in either year.

Population growth was strongly positive both years at Lime Gulch, but was negative for the second year at Vipond Park (Table 2). The Vipond Park population showed a strong tendency for: (1) a larger proportion of plants to be in the reproductive class, (2) a larger number of fruits per inflorescence, and (3) a larger number of fruits per fruiting plant (Table 2). While birth and death rates were relatively constant at Lime Gulch over the two years, the Vipond Park population showed changes of ca. 100% between the two years (Table 2). In general, years that are better for recruitment are also better for survival. The mean number of seeds per fruit was relatively constant among years and between the two sites (Table 2).

The two populations are at different elevations and in very different topographic positions. The Lime Gulch site is in a sheltered canyon, while the Vipond Park site is 1000 ft. higher on a wind-exposed, open, south-facing upper slope. Dominant vegetation and

Table 2. Population growth and measures of fecundity for Arabis fecunda populations at Lime Gulch and Vipond Park from 1989 to 1991.

	Lime Gulch		
	1989	1990	1991
Density (plants/24 m ²)	370	444	519
Non-fruiting Plants	364	286	392
Fruiting Plants	6	158	127
%Fruiting Plants	2%	36%	24%
Total Fruits	19	1462	1782
Total Inflorescences	11	437	309
Fruits/ Inflorescence	1.7	3.3	5.8
Fruits/Fecund Plant	3.2	9.3	14.0
Seeds/Fruit ($\pm$ SD, n=25)	31.1 $\pm$ 5.6	34.3 $\pm$ 7.6	33.8 $\pm$ 7.6
Births	--	149	198
Birth Rate	--	40%	45%
Deaths	--	67	126
Death Rate	--	18%	28%
Population Growth	--	22%	17%

	Vipond Park		
	1989	1990	1991
Density (plants/24 m ²) ¹	351	496	415
Non-fruiting Plants	265	287	312
Fruiting Plants	86	209	103
%Fruiting Plants	25%	42%	25%
Total Fruits	1002	3914	1370
Total Inflorescences	169	402	190
Fruits/ Inflorescence	5.9	9.7	7.2
Fruits/Fecund Plant	11.6	18.7	13.3
Seeds/Fruit ($\pm$ SD, n=25)	34.2 $\pm$ 10.5	26.0 $\pm$ 10.3	35.7 $\pm$ 9.9
Births	--	228	160
Birth Rate	--	65%	32%
Deaths	--	89	241
Death Rate	--	25%	49%
Population Growth	--	41%	-16%

¹ At Vipond Park East Transect the west halves of plots 8 and 10 were deleted from analysis. See Methods.

topographic position suggest that Vipond Park is the harsher and less productive of the two sites. It is probably also more variable in terms of climatic fluctuations both within and among years. These environmental differences may help explain the differences in A. fecunda life history at the two sites. Arabis fecunda has the demographic characteristics of a short-lived perennial at Lime Gulch, while at Vipond Park, it behaves more like a biennial, with shorter average lifespans, higher fecundity, and a tendency for plants to be monocarpic. In 1990 the Vipond Park population had a very high proportion of plants that "bolted." These plants produce a very large and fecund inflorescence from the terminal bud followed by death of the whole rosette and often the entire plant. At Vipond Park, death of plants that bolted in 1990 was in large part responsible for the high death rate in 1990-91 (see Appendix A).

These differences, if they are consistent over a period of years, have implications for species management and reserve design. Although differences in A. fecunda life history between the two sites may be due, in part, to phenotypic plasticity, it is likely that there are genetic differences as well. These differences should be preserved in any reserve design system. The larger fluctuations in population growth at Vipond Park suggest that this population is more prone to local extinction than the more stable Lime Gulch population (Diamond 1984, Pimm et al. 1988), especially during periods of extreme environmental conditions. Thus, if average climate stays the same, long-term persistence of A. fecunda is more likely at the Lime Gulch site. However, if the climate becomes warmer (Peters 1988, Henderson-Sellers 1990), sites at higher elevations may be more likely to persist.

Further monitoring is needed in order to determine if patterns detected during the first two years remain constant.

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Literature Cited

- Diamond, J. M. 1984. "Normal" extinctions of isolated populations. Pages 191-246 in M. H. Nitecki, editor. Extinctions. University of Chicago Press, Chicago, Illinois, USA.
- Henderson-Sellers, A. 1990. Modelling and monitoring 'greenhouse' warming. Trends in Ecology and Evolution 5: 270-275.
- Lesica, P. 1985. Report on the conservation status of Arabis fecunda, a potential candidate species. Submitted to the U.S. Fish and Wildlife Service, Office of Endangered Species, Denver, CO.
- Lesica, P. 1987. A technique for monitoring nonrhizomatous, perennial plant species in permanent belt transects. Natural Areas Journal 7: 65-68.
- Lesica, P. and J. S. Shelly 1989. Demographic monitoring of Arabis fecunda in the Pioneer Range. 1989 establishment report. Unpublished report to the Montana Natural Heritage Program, Helena, MT.
- Lesica, P. and J. S. Shelly. 1991a. Sensitive, threatened and endangered vascular plants of Montana. Montana Natural Heritage Program Occasional Publication No. 1, Helena.
- Lesica, P. and J. S. Shelly. 1991b. Demographic monitoring of Arabis fecunda in the Pioneer Range, Beaverhead National Forest, Montana. 1990 Progress Report. Unpublished report to the Montana Natural Heritage Program, Helena, MT.
- Menges, E. S. 1986. Predicting the future of rare plant populations: demographic monitoring and modeling. Natural Areas Journal 6: 13-25.
- Palmer, M. E. 1987. A critical look at rare plant monitoring in the United States. Biological Conservation 39: 113-127.
- Peters, R. L. 1988. Effects of global warming on species and habitats: An overview. Endangered Species Update 5(7): 1-8.
- Pimm, S. L., H. L. Jones, J. Diamond. 1988. On the risk of extinction. American Naturalist 132: 757-785.
- Rollins, R. C. 1984. Studies in the Cruciferae of western North America II. Contributions to the Gray Herbarium 214: 1-18.
- Schassberger, L. A. 1988. An update of the report on the conservation status of Arabis fecunda, a candidate threatened species. Report to the U.S. Fish and Wildlife Service, Office of Endangered Species, Denver, CO.

Sutter, R. D. 1986. Monitoring rare plant species and natural areas - ensuring the protection of our investment. *Natural Areas Journal* 6: 3-5.

USDI-Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants: Review of plant taxa for listing as endangered or threatened species; Notice of review. *Federal Register* 55: 6184-6229.

Wilson, E. O. 1988. *Biodiversity*. National Academy Press, Washington D.C.

Appendix A. Performance of individual Arabis fecunda plants in permanent monitoring transects on Beaverhead National Forest. See Methods for description of codes. Individuals are identified by letters within each plot. A "b" indicates plants that have "bolted," produced a large, multi-branched inflorescence from the terminal bud.

Vipond Park West

Plot

	<u>1989</u>	<u>1990</u>	
1.	R2-I3-F12	R1	R1
b	R3	R2-I1-F11	R1
c	R2	R2	--
d	R1-I2-F7	R1-I2-F10	--
e	R1	--	--
f	R1-I4-F29	R1-I1-F43b	--
g	R1	--	--
h	S	--	--
i	R1	R1-I1-F5	R2-I3-F13
j	S	--	--
k	R1	R2-I5-F29	--
l	S	R1	--
m	R1	--	--
n	R1-I1-F25	R1-I1-F14	--
o	R1-I3-F15	R1-I1-F44b	--
p	R1-I3-F9	R1-I1-F3	R1
q	R6-I5-F29	--	--
r	R1	S	S
s	R1	S	S2
t	R1	R1	S
u	--	R1	--
v	--	S	--
w	--	S	--
x	--	S3	S2
y	--	R1	R1-I1-F2
z	--	R3	R2S7
aa	--	S3	--
bb	--	R2-I2-F8	R1
cc	--	R1	R1-I3-F6
dd	--	S1	R2
ee	--	R2	--
ff	--	R1	R1-I4-F22
gg	--	R1	S5-I4-F23b
hh	--	S	R1
ii	--	--	R1
jj	--	--	R1
kk	--	--	R1

2.	R2	R2-I2-F16b	--
b	R1	--	--
c	R1	R1-I1-F1	--
d	R2	R2-I1-F11b	--
e	R3	--	--
f	R1	--	--
g	R1	R1-I1-F19	--
h	R1	--	--
i	R1	--	--
j	R1-I1-F18	--	--
k	R3	--	--
l	R1-I1-F22	--	--
m	R1-I1-F20	--	--
n	R1-I2-F17	R1-I2-F10	R1-I1-F18b
o	R1	--	--
p	R1	R1	R1-I1-F5b
q	R2-I1-F13	R2-I2-F40b	--
r	R2-I4-F21	R1-I1-F0	--
s	R1-I5-F33	--	--
t	R1	R1	R1S3
u	R1	R1	R1-I4-F4
v	R1	R1	R1-I1-F5
w	R1-I1-F16	--	--
x	R1	R1-I1-F23b	--
y	R3-I1-F5	--	--
z	R2	R2-I4-F0b	R1-I1-F9b
aa	R1	R1-I3-F12	--
bb	R1	R1-I1-F25b	--
cc	R1	R1-I1-F2	--
dd	R1	--	--
ee	R1	S	S3-I4-F24b
ff	R1	R1-I1-F32b	--
gg	R1	--	--
hh	R1	R2-I2-F26b	--
ii	R1	--	--
jj	R1	--	--
kk	R1	--	--
mm	--	R1-I1-F21b	--
nn	--	R1-I1-F2	R1
oo	--	S2	R2
pp	--	R1	--
qq	--	S	R1
rr	--	R1	R1-I3-F15
ss	--	R2	R1-I2-F9
tt	--	R1	--
uu	--	R1	R1
vv	--	R1-I1-F16	--
ww	--	R1-I1-F10	R1-I1-F7b
xx	--	R1	--
yy	--	R1	--
zz	--	S	--

aaa	--	R2	--
bbb	--	R1-I1-F2	R1-I4-F18
ccc	--	R1	--
ddd	--	R1-I1-F2	R1-I1-F22b
eee	--	--	R1S1
fff	--	--	R1
ggg	--	--	S2
hhh	--	--	R1
iii	--	--	R1
jjj	--	--	S2
kkk	--	--	R1
lll	--	--	R1
mmm	--	--	S

3.	S	--	--
b	R1	R1-I1-F4	R1-I2-F10
c	R1	R1-I1-F16b	--
d	R1	S3	--
e	R1	R1-I1-F19b	--
f	R1-I3-F9	R1-I1-F22b	--
g	R1-I2-F17	R1-I5-F26	--
h	R1	--	--
i	R2	R2-I2-F36b	--
j	--	R2S3	--
k	--	R1	--
l	--	S	--
m	--	S	--
n	--	R1-I2-F13	--
o	--	R1-I4-F22	R1-I1-F3
p	--	S	--
q	--	R1-I5-F26	--
r	--	R1	--
s	--	R1-I1-F2	R1
t	--	S	--
u	--	S	--
v	--	--	R2
w	--	--	S

4.	R2-I2-F9	R2-I2-F49b	--
b	R1	R1-I1-F5	--
c	R1	--	--
d	R1-I2-F13	--	--
e	R1	R1	R1
f	R1-I3-F18	R2-I1-F24b	--
g	R1	R1	--
h	R1	--	--
i	R2	R2-I2-F2	R1
j	R1-I3-F6	R2-I2-F6	R2
k	R1	--	--
l	R1	R1	R1

m	R2	S2	--
n	R1	R1	R1
o	R1	S	--
p	R1	--	--
q	R1	R1	R1
r	R1	R1	R3-I3-F9
s	R2-I1-F5	R2-I1-F3b	R1-I1-F4
t	R1-I1-F3	R1-I1-F27b	--
u	R4	--	--
v	R1	--	--
w	R1	--	--
x	R1	R1-I2-F10	R1
y	R1	R2-I1-15b	--
z	R1	R1	R1
aa	R1	R1	R1-I2-F7
bb	--	S	S
cc	--	S	S
dd	--	R2	--
ee	--	R1	--
ff	--	R1	--
gg	--	R1	R1-I1-F2
hh	--	R1-I2-F12	--
ii	--	R1S2-I3-F14	--
jj	--	--	R1
kk	--	--	S
ll	--	--	S
mm	--	--	R1
nn	--	--	R2-I1-F2
5.	R2	R5	R2
b	S	S4	R1S3
c	R1	R1	R1-I3-F14
d	R1	S	R1-I2-F6
e	S	--	--
f	S	--	--
g	R1	R1-I1-F2	R1-I1-F9
h	S	--	--
i	R8	--	--
j	R4	R3-I4-F23	R3
k	R1	--	--
l	--	R1-I1-F43b	--
m	--	S2-I2-F6	S5-I1-F6b
n	--	R1	--
o	--	--	S
p	--	--	S4
q	--	--	R1
6.	R1	R1-I1-F53b	--
b	R1	R1	R1-I1-F17
c	R1-I2-F11	R1-I2-F19	--
d	S7	--	--

e	S5	S4	R1-I4-F33
f	S	--	--
g	S2	--	--
h	R1	R2-I1-F28b	--
i	S	R1-I1-F9b	--
j	S8	R5-I1-F8	--
k	R1	R1-I3-F10	--
l	R1	R1-I1-F28b	--
m	R1	R1	--
n	R1	R1	R1-I4-F27
o	S	S	--
p	R1	R1-I1-F49b	--
q	R1	--	--
r	R1	R1-I4-F17	--
s	S5	R3-I1-F4b	--
t	--	S	R1
u	--	R2	--
v	--	R1	--
w	--	R2	S2
x	--	S	--
y	--	R2-I1-F11b	R1-I1-F14b
z	--	S3	--
aa	--	S	--
bb	--	--	S
cc	--	--	R2
dd	--	--	R4-I1-F11b
ee	--	--	R2
7.	R5	--	--
b	R1	R1-I5-F18	R1-I2-F15
c	R1-I3-F11	--	--
d	R1-I3-F11	R1-I6-F40	R1
e	R1	R1	R1
f	R2-I1-F2	R2-I1-F0	R2-I1-F6
g	R1	R1	R1
h	R1	R1-I1-F34b	--
i	R1	R1-I2-F11	R1-I1-F7
j	R1	R1	R1-I3-F25
k	R1	--	--
l	S	R1	--
m	R1-I1-F8	R1	--
n	R1-I2-F8	R1-I1-F4	--
o	R1	R1	S2
p	S	S3	--
q	S	R1	R1
r	R1	--	--
s	R1	R1-I1-F2	R1
t	--	R1-I1-F1	R1
u	--	R1-I1-F22b	--
v	--	R1-I6-F23b	--
w	--	R1S1	--

x	--	R1	--
y	--	R2-I3-F27b	R1
z	--	S	--
aa	--	--	R1
bb	--	--	S2
cc	--	--	R2
dd	--	--	S
ee	--	--	S
ff	--	--	R1
gg	--	--	S
8.	S	R1	R1-I4-F17
b	R3	R2-I1-F5	R1S1
c	S	S	--
d	R2	R2-I1-F23b	R1
e	R2	R2-I1-F1	R1
f	R1	--	--
g	R1-I1-F7	--	--
h	R1	R1-I2-F2	S7-I1-F16b
i	R1-I1-F6	R1	--
j	R1-I1-F5	R1-I1-F23b	--
k	--	R2	R2-I1-F7
l	--	R1	--
m	--	R1	--
n	--	--	S
o	--	--	R2
p	--	--	R1
q	--	--	R1
9.	R1-I2-F7	--	--
b	S	R1	R1
c	R1-I4-F26	--	--
d	R1	R1-I2-F6	R1
e	R1	R1-I1-F23b	--
f	R1-I2-F11	R1-I1-F30b	--
g	R1	R1	R1
h	R1	--	--
i	R1-I1-F3	R1-I1-F2	--
j	R1	--	--
k	R2	R2	R2
l	R2	--	--
m	R1-I1-F4	R2-I1-F27b	R1
n	R1	R1	--
o	--	R1-I2-F8	--
p	--	R1	--
q	--	S	R1
r	--	S	R1
s	--	R1	R1-I1-F4
t	--	S2	--
u	--	R1	R1-I1-F7
v	--	R1	--

w	--	R1-I5-F16	R1-I1-F7
x	--	R1	R1
y	--	R2	R2
z	--	S	S1
aa	--	R1-I1-F53b	--
bb	--	--	R1
cc	--	--	S
dd	--	--	R1
10.	R1	R1	R1-I2-F6
b	R3-I1-F9	--	--
c	R3	R2-I3-F5	--
d	R3-I1-F1	R2-I5-F11b	R1-I1-F2
e	R2	R2	R2
f	R1	S	--
g	R1	R1-I1-F27b	--
h	R1	R1-I1-F4	R1
i	R3	R2	R1
j	--	S2	--
k	--	S	S
l	--	S	S
m	--	S	R1
n	--	--	R2-I1-F8b
o	--	--	S
11.	R1	R1S1	R1-I1-F8b
b	R1	R1-I3-F8	R1-I2-F12
c	S3	R1S2	R5
d	R2-I3-F13	--	--
e	R1	R1-I1-F3	R1-I2-F11
f	R1	R1-I1-F15b	--
g	S	R1-I1-F10	--
h	--	R1-I1-F32b	--
i	--	R1S2	R3
j	--	R1	R1
k	--	R1-I1-F23b	--
l	--	S2-I2-F9b	--
m	--	R1S1	R5
n	--	--	R1-I1-F14b
o	--	--	S
12.	S	R1-I1-F3	--
b	R3	--	--
c	R1	R1-I4-F22	R1-I2-F21b
d	R1-I1-F4	R1-I2-F2	R1-I4-F36
e	R1	R1-I1-F2	--
f	R1	R1	R1-I1-F6
g	S	R1	S2
h	S	--	--
i	S2	--	--
j	S	R1	--

k	S	S	R1
l	R1	R1-I1-F27b	--
m	R1	R1	R1
n	R1	R1-I1-F5	R1
o	R1	R1-I1-F52b	--
p	R1	R1-I1-F19b	--
q	R1-I3-F11	R1-I1-F46b	--
r	R4-I1-F3	R3-I1-F24b	R2-I1-F7
s	R1	R1-I1-F37b	--
t	R1	R1-I1-F50b	--
u	R1	R1-I1-F3	R1
v	--	R1	R1
w	--	--	R1
x	--	--	S
y	--	--	S
z	--	--	R1
aa	--	--	S
bb	--	--	S3
cc	--	--	S
dd	--	--	R1
ee	--	--	S
ff	--	--	S
gg	--	--	R1

Vipond Park East

Plot 19891990

1.	R1	R1	R1-I1-F25b
b	S	R1-I1-F4	R1-I5-F19
c	R1-I2-F5	R1-I1-F45b	--
d	R2	R2-I2-F54b	--
e	R3	--	--
f	R2	R1S1	R2-I1-F4
g	R2	--	--
h	R1-I2-F8	--	--
i	R1	R1-I1-F50b	--
j	S	R1	R1
k	S	R1	R1S1
l	--	S2	--
m	--	R1-I1-F19b	--
n	--	S	S
o	--	R1	R1
p	--	S	R1
q	--	R1	R1
r	--	R1-I2-F15	R1
s	--	R1	R1
t	--	R1	R1-I1-F3
u	--	R1	--

v	--	R1-I1-F20b	--
w	--	R1	R2
x	--	S2	R1
y	--	R1-I3-F12	--
z	--	R1	R1
aa	--	R1	R1
bb	--	--	S
cc	--	--	R1
dd	--	--	R1
ee	--	--	S
ff	--	--	S2
gg	--	--	R1
hh	--	--	R1
ii	--	--	S
jj	--	--	R1
kk	--	--	R1
ll	--	--	R2
mm	--	--	R1
2.	R1	R1-I1-F21b	--
b	R1	R2	R3-I2-F21b
c	S	--	--
d	R1	R1-I1-F2	R1-I1-F10
e	S	R1	R1
f	R3-I3-F20	R3-I1-F3	S2
g	R1	R1-I1-F2	S2
h	R2-I2-F4	R2-I2-F40b	--
i	--	S1-I1-F4	--
j	--	R1	R1
k	--	R1	R1S1
l	--	S	R1
m	--	S	S3
n	--	R1-I1-F9b	--
o	--	S	R4-I1-F5
p	--	R1	--
q	--	R1	R1
r	--	R1	--
s	--	S	--
t	--	R1	--
u	--	R1	R1
v	--	S	R1
w	--	R1	--
x	--	R1-I5-F25	--
y	--	R1	S
z	--	S	S
aa	--	R1	R1
bb	--	S	R1
cc	--	S	S2
dd	--	--	S
ee	--	--	R1
ff	--	--	R1

gg	--	--	S3
hh	--	--	S2-I1-F3
ii	--	--	S1-I1-F4
jj	--	--	S
kk	--	--	S
ll	--	--	S
mm	--	--	R1
nn	--	--	S
oo	--	--	R1
pp	--	--	S
qq	--	--	S
3.	R1-I1-F3	--	--
b	R1	--	--
c	R1-I1-F3	R1-I1-F32b	--
d	R1-I3-F13	R1-I1-F14b	--
e	R1	--	--
f	S	R1-I1-F38b	--
g	R1-I1-F5	R1-I1-F29b	--
h	R1-I4-F16	--	--
i	R1-I1-F3	S	S
j	R1-I2-F9	S	R1-I1-F51b
k	S2	R2-I4-F29b	--
l	R1	R1-I1-F9b	--
m	R1	R1-I6-F33	--
n	R1	R1-I1-F10b	--
o	R1-I2-F4	R1-I1-F24b	--
p	--	S	--
q	--	R1-I1-F19b	--
r	--	R1-I1-F27b	--
s	--	S	R1
t	--	--	S
u	--	--	S
v	--	--	R1
w	--	--	R2-I3-F14
x	--	--	S
y	--	--	S
z	--	--	R1
aa	--	--	S
4.	R1	R1	--
b	R4	R3-I3-F18b	--
c	R3-I1-F1	R4-I4-F21b	--
d	R1	R1	R1-I1-F9
e	R1	--	--
f	R1-I1-F2	--	--
g	--	R3	R3
h	--	S	--
i	--	S	--
j	--	S2	S
k	--	S	--

l	--	R1-I2-F2	S4
m	--	S	--
n	--	R1	R3-I2-F11
o	--	--	S
p	--	--	S
q	--	--	R1
r	--	--	S
s	--	--	S
t	--	--	R1
5.	R1	R1	R2-I2-F14
b	R1	R1-I4-F18	R1-I1-F7
c	R1	--	--
d	R1	R1	R1
e	S	R1	R1S1
f	S	--	--
g	S	R1	R1
h	R2	R2-I1-F5	R2-I1-F3
i	S	S	S
j	S	--	--
k	S	R1	R1
l	S	--	--
m	S	R1-I1-F8b	--
n	R1-I1-F25	--	--
o	R1	R1	R1
p	R1-I4-F9	R1-I1-F21b	--
q	--	S	R3
r	--	R1	--
s	--	S3	R1S1
t	--	S	S
u	--	R1-I2-F11	--
v	--	R1	R1-I2-F8
w	--	S	--
x	--	--	R1
y	--	--	S2
z	--	--	S2
6.	R2	R1-I1-F6	R1
b	S	S	--
c	R2	R2	--
d	R1	R1-I1-F8b	--
e	R2	R2-I5-F31b	--
f	R1	R2	R3
g	R1	--	--
h	R4-I1-F1	S	R1
i	R1-I4-F19	R1-I1-F26b	--
j	R2	R4-I4-F74b	R1
k	R1	R1	R2
l	R1	--	--
m	R1	R1	R1-I1-F41b
n	R2-I3-F15	R2-I6-F21b	--

o	R1-I1-F13	R1S3	R4
p	--	R1	R1
q	--	R1	S
r	--	R1	R1-I4-F21
s	--	R1-I7-F43	R1-I2-F12
t	--	--	R1
u	--	--	R1
v	--	--	S3
w	--	--	S
7.	R1-I1-F4	R2-I2-F17b	--
b	R1-I1-F9	R1-I1-F42b	--
c	R1	R1-I2-F2	R1-I1-F74b
d	R1-I3-F14	R3-I4-F28b	--
e	R1	--	--
f	S4	R5	--
g	S	--	--
h	R1	R1-I1-F4	--
i	R3	R4-I2-F4	R3-I1-F11
j	S2	R2	R2
k	R1-I2-F8	R1-I1-F19b	--
l	R1	R1	--
m	R1	R1-I1-F3	--
n	R1	R1-I1-F3	--
o	R1	R1-I1-F16b	--
p	--	R1	--
q	--	R1	--
r	--	S	--
s	--	R1	R1-I1-F15b
u	--	--	R1
v	--	--	S
w	--	--	R4-I2-F12
8e	R1	R1-I2-F3	--
f	S	--	--
g	S	--	--
j	R1-I1-F3	R1-I4-F15	R1-I1-F7
k	R1-I3-F14	R1-I1-F37b	--
z	R1	R1	--
bb	S	S	R1
cc	S	S	R1
dd	S	S	R1
ee	R1	R1-I7-F41	--
ff	R2-I4-F28	S	R1-I1-F5
gg	S	R1-I2-F19b	--
hh	R1	R1-I1-F31b	--
ii	R3-I3-F9	R1-I1-F31b	--
jj	R1	R1-I4-F21b	--
kk	S	--	--
ll	S	--	--
mm	S	S1-I1-F17b	--

oo	--	R1	R1-I2-F8
pp	--	S	R1
qq	--	R1	--
YY	--	R1	R1
zz	--	S3	R2-I2-F23b
aaa	--	R1	--
bbb	--	R1	R1-I1-F5
eee	--	R1-I7-F41	R1S2
fff	--	S	R1
ggg	--	R1	--
hhh	--	R1-I1-F5	--
iii	--	--	R1
jjj	--	--	S
kkk	--	--	S2
lll	--	--	S2
mmm	--	--	S
nnn	--	--	R1
9a	S	R1	R2
b	S	--	--
c	R1	R1-I2-F10	R1-I2-F16b
d	R2	R2-I2-F6	R2-I4-F19
e	R2	R1-I6-F39	R6
f	R1	R1-I2-F4	R1-I3-F7
g	R1	R1	R2-I3-F9
h	R1-I1-F22	R2S1	R1
i	R1-I5-F11	R1-I1-F17b	--
j	R1-I2-F7	R2-I2-F22b	--
k	R2	R2S2-I2-F55b	R3-I1-F2
l	R1-I3-F10	R1-I1-F46b	--
m	R1	R1	S5
n	R1-I1-F10	--	--
o	R1-I1-F2	--	--
p	R2-I1-F8	S2-I2-F17b	--
q	S	S2-I1-F24b	--
r	S	R1	--
s	R1	S2-I1-F19b	--
t	R1	R1-I1-F40b	--
u	R1	R1-I1-F27b	--
v	R1	R1-I1-F15b	--
w	R1-I1-F25	R1-I1-F41b	--
x	R1-I1-F6	R1-I1-F52b	--
y	--	S	--
z	--	S	S
aa	--	S	R1
bb	--	R1-I1-F29b	--
cc	--	S	--
dd	--	R2	S2
ee	--	S	R1
ff	--	S	R1
gg	--	R1	R1

hh	--	S3	S5
ii	--	S	R1
jj	--	S2	R1
kk	--	R1	R1-I1-F28b
ll	--	R1-I9-F44b	--
mm	--	R1	R1-I1-F21b
nn	--	R1	--
oo	--	R1	--
pp	--	S	--
qq	--	R1	R4-I4-F2
rr	--	R1	--
ss	--	R2-I2-F8	R3
tt	--	--	R1
uu	--	--	S
vv	--	--	R1
ww	--	--	R1
xx	--	--	S3
yy	--	--	S
zz	--	--	S
aaa	--	--	R1
bbb	--	--	R2
ccc	--	--	S
ddd	--	--	S
eee	--	--	S
fff	--	--	S
ggg	--	--	R2
hhh	--	--	R1
iii	--	--	R1
jjj	--	--	R1
kkk	--	--	S2
lll	--	--	R2S3
mmm	--	--	R1
10b	R1	R1-I1-F14b	--
c	R1	R1	S
d	R2-I1-F6	R2-I1-F2b	--
e	R1	R1-I2-F1	--
f	R1-I1-F23	--	--
g	R2	S4-I1-F0	--
h	R3	--	--
i	R1	--	--
j	R1	R2	R2-I1-F2
k	R1	R1-I1-F17b	--
s	R1	S2	R2-I2-F29b
t	R1-I1-F26	R5	S2
u	--	S	--
v	--	R2	--
w	--	S	--
x	--	R1	R1S1-I1-F5b
y	--	S	R1
z	--	S2	--

aa	--	R1-I1-F29b	--
bb	--	R1-I6-F30	R2-I6-F44
cc	--	--	S5
dd	--	--	R1
ee	--	--	R1
ff	--	--	S
gg	--	--	R2
hh	--	--	R1
ii	--	--	R1
11.	S2	S1	R2
b	R1	R1	R1-I1-F3
c	S3	S2	S3
d	R1	--	--
e	R1-I1-F35	R1-I4-F14	--
f	R1-I3-F12	--	--
g	R1	R1-I1-F4	R2-I2-F5
h	--	R1	--
i	--	S	--
j	--	S	R1
k	--	S	R1
l	--	S	S
m	--	R2-I4-F14	R1-I1-F27b
n	--	S	--
o	--	S	--
p	--	S	--
q	--	S	R1
r	--	S	R1
s	--	S	R1
t	--	R1	R1-I1-F47b
u	--	R1	--
v	--	R10	R8
w	--	S2	--
x	--	R3-I3-F6	R1
y	--	R1	S5-I1-F0b
z	--	R1	--
aa	--	R1	R2
bb	--	R1	R1
cc	--	S	R1
dd	--	S	--
ee	--	R2	R1S7-I5-F9b
ff	--	R4-I6-F8	--
gg	--	--	S2
hh	--	--	R3
ii	--	--	R1
jj	--	--	S
kk	--	--	R1
ll	--	--	R1
mm	--	--	S3
nn	--	--	R1

oo	--	--	R1
pp	--	--	S
qq	--	--	R1
rr	--	--	R2
ss	--	--	R1
12.	R1	R2	R2S1
b	R1	--	--
c	--	S2	--
d	--	R1	R1
e	--	R3-I1-F7b	R1S6-I1-F10b
f	--	R3-I1-F5	R1-I1-F9b
g	--	R4-I1-F7b	--
h	--	S3	S3
i	--	R1	R1S3
j	--	S5	S6
k	--	S	--
l	--	S	S3
m	--	R1	R4
n	--	--	R1
o	--	--	R1
p	--	--	R1
q	--	--	R1
r	--	--	R1
s	--	--	R1
t	--	--	R1
u	--	--	R2-I1-F13b
v	--	--	S5

Lime Gulch North

1.	R1	R1-I1-F3	R1
b	S	R1	R1
c	R1	R1	R1-I3-F16
d	S	R1	
e	R1	R1	R1
f	R1	R1	R1
g	S	R1	R1
h	--	S	R1
i	--	R1	R1
j	--	R1	R1
k	--	S	R1
l	--	--	S
m	--	--	S
n	--	--	S
o	--	--	S
p	--	--	S
q	--	--	S
r	--	--	S
s	--	--	S
t	--	--	S
u	--	--	S
v	--	--	S
w	--	--	S
x	--	--	S
y	--	--	S
2.	R1	R1	--
b	S	R1	R1
c	S	S	R1
d	S	R1	R1-I2-F6
e	R1	R1	R1-I3-F10
f	S	R1	R1-I3-F13
g	R1	R1-I3-F10	R1-I5-F12
h	S	R1	R1
i	R1	R1-I2-F9	R1
j	R1	R1	R1-I3-F8
k	R1	--	--
l	R2	R2	R2
m	R1	R1-I1-F1	--
n	R1	R1	R1
o	S	S	S
p	R1	R1	R1-I5-F8
q	S	R1	--
r	R1	--	--
s	R1	R2-I3-F9	--
t	R1	R1	R1
u	S	R1	R1
v	--	S	R1
w	--	R1	R1

x	--	S	R1-I2-F9
y	--	S2	R2
z	--	R1	R1
aa	--	R1	R1-I2-F6
bb	--	R1	R1
cc	--	S	R1
dd	--	S	S
ee	--	--	S
ff	--	--	S2
gg	--	--	S2
hh	--	--	R1
ii	--	--	R1
jj	--	--	R1
kk	--	--	S
ll	--	--	R1
mm	--	--	S
nn	--	--	S
3.	S	R1	R1
b	R1	--	--
c	R2	R2	R1-I1-F21b
d	R4	R4	R5-I4-F32b
e	S	S	R1
f	R1	R1	--
g	R2	S	R2-I7-F20
h	R1	R1-I2-F4	R1-I2-F6
i	R1	R1-I6-F24	R1-I1-F33b
j	S	--	--
k	R1	--	--
l	R1	R1-I4-F15	S
m	R3	R3-I2-F14b	S
n	--	R1	R1-I1-F4
o	--	S	S
p	--	R1	R1S3
q	--	S	S
r	--	S	--
s	--	--	R1
t	--	--	R1
4.	R1	R1-I3-F4	--
b	R2	R2-I2-F10	R2-I2-F33b
c	R1	R1-I3-F5	R1-I5-F24
d	R4	R1-I4-F17	--
e	R1	R2-I2-F4	R2-I1-F11b
f	R1	R1-I2-F26b	--
g	R1	R1	R1
h	--	R1	R1-I1-F13b
i	--	R1	R1
j	--	R1	R1
k	--	R1	--
l	--	S	S

m	--	S	R1
n	--	--	R1
o	--	--	R1-I1-F1
p	--	--	R1
q	--	--	R1
r	--	--	R1
s	--	--	R1
5.	R1	R1	R1
b	S	R1	R1
c	S	R2	R3-I2-F24b
d	R1	R1	R2
e	R1	R1	R1
f	S	S	R1
g	S	S	R1
h	R1	--	--
i	R1	R1-I1-F4	R1-I1-F27b
j	R1	R1	R1-I4-F16
k	--	R1	R1
l	--	S	--
m	--	S	S
n	--	--	S
o	--	--	R1
p	--	--	S
q	--	--	R1
r	--	--	R1
s	--	--	R1
t	--	--	R1
u	--	--	R1
v	--	--	R2
w	--	--	R1S1
x	--	--	R1
6.	R2	R2	R2-I3-F11
b	R1	R1	R2S3
c	R1	R1-I3-F12	R1-I8-F28
d	R1	R2-I1-F15b	--
e	R1-I2-F1	--	--
f	S	--	--
g	S	--	--
h	R1	S	--
i	R1	R1-I3-F8	R1-I1-F3
j	R1	R1	--
k	R1-I2-F5	R5-I5-F20b	R1-I1-F44b
l	R1	R1-I7-F21	--
m	R1	R2	R2-I5-F18
n	--	R1-I3-F7	--
o	--	--	S
p	--	--	R1
q	--	--	R1-I4-F13

7.	R1	R1	R1-I2-F6
b	R1-I2-F6	R1-I5-F20	--
c	R1	R1-I7-F62b	--
d	R1	--	--
e	R1	R1-I2-F4	--
f	S	--	--
g	R1	R1-I4-F15	R1-I6-F15
h	R1	R1-I2-F10	R1
i	R1	R1-I1-F3	R1-I6-F22
j	S	S	R1
k	S	R1	R1
l	R1	R1	R1-I4-F13
m	R1	R1	R1
n	R4	R4-I3-F18b	R2
o	R1	R1	R1-I1-F3
p	S2	R2	R2-I2-F5
r	--	R1	R1-I1-F3
s	--	R2	R2-I1-F8b
t	--	S	S
u	--	R1-I2-F7	--
v	--	R1	--
w	--	R1	S5
x	--	--	S
y	--	--	S
z	--	--	S
aa	--	--	S
bb	--	--	S
cc	--	--	S
dd	--	--	S
ee	--	--	S
ff	--	--	S
gg	--	--	S
hh	--	--	S
ii	--	--	S
jj	--	--	S
kk	--	--	S
8.	R1	R1-I1-F17b	--
b	R1	R1-I3-F3b	--
c	R1	R1-I3-F15	--
d	S	R1	S3
e	R1	R1-I5-F22b	--
f	R1	R1-I7-F16b	--
g	R1	R2	R2-I5-F13
h	R1	--	--
i	R1	S	R1
j	R1	S	--
k	R1	R1-I1-F6b	--
l	S	S	R1
m	S	R1	R1
n	S	S	--

o	R1	R1	--
p	S	S	R1
q	R1	R1	R1
r	R1	R1	R1
s	R1	--	--
t	R1	R4-I1-F5	--
u	R1	R1-I2-F10	R1-I2-F5
v	R1	R1-I2-F8	--
w	S	R1	R1-I1-F7
x	S	S	R1
y	R1	R1-I5-F38b	--
z	--	R1	--
aa	--	R3	--
bb	--	S2	--
cc	--	S	--
dd	--	--	S
ee	--	--	S
ff	--	--	S
gg	--	--	R1
hh	--	--	R1-I4-F11
ii	--	--	R2
jj	--	--	S
kk	--	--	S
ll	--	--	S
mm	--	--	S
nn	--	--	R1
oo	--	--	R1
pp	--	--	R1
qq	--	--	S
9.	R1	R1	R1-I4-F24
b	R2	R1-I2-F18b	--
c	R1	R4	R1-I2-F20
d	R1	S3-I1-F1	R2
e	R1	R1-I1-F2	R1-I9-F32
f	R1	R1-I4-F8	R1-I5-F31
g	R1	R1-I4-F14b	--
h	R1	R1-I1-F3	R1-I1-F7
i	R1	R1	R1
j	R1	R1	R1-I2-F4
k	R1	R1	--
l	S	S	--
m	R1	--	--
n	R1	R1	R1
o	R1	R1	R1-I6-F14
p	R1	R1-I4-F13	S5-I1-F4
q	R1	R1-I3-F14	--
r	R1	R1-I6-F36	--
s	S	R1	R1
t	S	--	--
u	R1	R1	R1

v	R1	R1-I1-F47b	--
w	R1	R1	R1-I1-F3
x	S	R1	R1S1
y	R1	--	--
z	R1	R1	R1
aa	R1	--	--
bb	R1	R1-I1-F6	S5-I3-F6
cc	S	--	--
dd	--	R1	R1
ee	--	S	--
ff	--	S	--
gg	--	R1	--
hh	--	S	S
ii	--	R1	R1
jj	--	R1	--
kk	--	R1	R1
ll	--	--	R1
mm	--	--	S
nn	--	--	R1
oo	--	--	R1
qq	--	--	S
rr	--	--	R2-I1-F3
ss	--	--	R1
tt	--	--	R1
10.	R1	R1	R1-I2-F13
b	R1	R1	R1-I2-F9
c	R1	R1S1	S
d	R1	R1-I4-F4	R2
e	R1	--	--
f	R2	--	--
g	S	R1	--
h	R1	R1-I2-F9	R1-I1-F4
i	S	R1	R1
j	R1	R1	R1
k	--	S	R1
l	--	S	R1S1
m	--	--	R1
n	--	--	R1
o	--	--	R1
p	--	--	S
q	--	--	S
r	--	--	R1
11.	R1	R1-I1-F1	--
b	R1	R1-I3-F12	--
c	R1	R1-I2-F5	--
d	S	R1-I1-F5b	--
e	R1	R1-I1-F2	R1-I1-F15b
f	R1	--	--
g	R1	R1	R1-I1-F13b

h	R1	R1-I1-F2	R1-I2-F6
i	R1	R1-I2-F2	R1-I1-F3
j	R1	R1	R3-I2-F28b
k	--	--	R1
l	--	--	R1
m	--	--	R1
n	--	--	R1
12.	R1	R1-I5-F8	--
b	R1	R1-I1-F1	--
c	R1	R1-I3-F6	--
d	R3	R3-I2-F10b	S
e	S	R1	R1
f	R1	R1	--
g	R1	R1-I7-F24	--
h	R1	R1-I2-F6	--
i	S	R1	R1-I2-F8
j	R1	R1-I3-F7	R1-I1-F3
k	R1	R1	R1-I1-F5
l	--	R1	R1
m	--	R1-I3-F11	R1-I1-F14b
n	--	--	R1
o	--	--	R1
p	--	--	R1
q	--	--	S
r	--	--	S
s	--	--	R1
t	--	--	S

Lime Gulch South

1.	R1	R1	R1-I2-F10
b	S	R1	R1-I1-F3
c	S	R1-I3-F14	R1-I5-F19
d	S	R1	--
e	R1	R1-I1-F5	R1-I1-F32b
f	--	S	R1
g	--	R1	R1
h	--	S	R1
i	--	S	--
j	--	S	R1
k	--	R4	R4-I1-F4
l	--	R1	R1
m	--	R1	R1
n	--	R1	R1-I1-F1
o	--	S	R1
p	--	--	R1
q	--	--	R1
r	--	--	S2
s	--	--	S2
t	--	--	S

u	--	--	R2
2.	R2	R1	R1-I5-F10b
b	R1	R1S1-I1-F5	R1
c	R1	R3	R3-I2-F32b
d	R1	R1-I3-F10	R2-I2-F46b
e	R1	R1	R1
f	S	R1	R1
g	S	R1	R1
h	S	R1	R1
i	S	R1	R1-I2-F6
j	R1	R1-I2-F4	R4
k	R1	R1	R1
l	S	S	R1
m	--	R1	R1-I1-F2
n	--	R1	R1-I5-F20
o	--	R1	R1
p	--	S	R1
q	--	R1	R1-I3-F5
r	--	S	R1
s	--	R1-I1-F3	R1-I1-F34b
t	--	S	R1
u	--	R1	R1-I1-F31b
v	--	--	R1
w	--	--	S
x	--	--	S
y	--	--	R1-I1-F11
z	--	--	R1
aa	--	--	R1
bb	--	--	R1
cc	--	--	S
dd	--	--	S
ee	--	--	S2
ff	--	--	S
gg	--	--	S
hh	--	--	S
ii	--	--	S
jj	--	--	S3
kk	--	--	R1
ll	--	--	R1
3.	R1	R1	R1
b	S	--	--
c	R1	R1	--
d	R1	R1-I3-F14	R1
e	R1	--	--
f	R1	R1-I2-F5	R1-I4-F18
g	R3	--	--
h	R1	--	--
i	S	R2	R2-I2-F10
j	R1	--	--

k	R6	R5-I1-F5	R5-I7-F56b
l	R1	--	--
m	R1	R1-I1-F0	R1
n	R1	R1-I3-F8	R1
o	S	R1	R1
p	R1	R1-I5-F12	--
q	S	--	--
r	S	R1	R1
s	R2	R2-I1-F0	R1-I5-F17
t	R1	R1-I1-F3	R1S1
u	--	S	R1
v	--	S	--
w	--	S	R1
x	--	R1-I4-F7	--
y	--	S	R1
z	--	R1	S
aa	--	R1	R1
bb	--	R1	R1
cc	--	--	R1
dd	--	--	R1
ee	--	--	R1
ff	--	--	R1
gg	--	--	R2
hh	--	--	S
ii	--	--	R1
jj	--	--	R1
kk	--	--	S
ll	--	--	S
mm	--	--	S
nn	--	--	S
oo	--	--	S
pp	--	--	R1
4.	R1	R1-I2-F2	R1
b	R1	--	--
c	R4	--	--
d	R4	R3-I2-F8	R2
e	R1	--	--
f	R1	--	--
g	R1	R1-I6-F8	--
h	S	R1	--
i	R1	R1-I1-F1	R1-I6-F23
j	S	R1	R1
k	R1	R1-I3-F9	R2-I1-F5
l	S	S	R1
m	R1	R1	R1
n	R1	R1-I2-F8b	--
o	--	R1	R1
p	--	S	R1
q	--	S	R1
r	--	--	R1

s	--	--	R1
t	--	--	S
u	--	--	R1
v	--	--	S
w	--	--	S
x	--	--	S
5.	R1	--	--
b	R1	R1-I1-F18b	--
c	R1	R1-I1-F4	R1
d	R1	--	--
e	R1	R1-I1-F1	--
f	R3	R2	S2
g	R1	--	--
h	R3	R6-I1-F1	R6-I4-F24b
i	S	--	--
j	R1	R1-I1-F2	R1-I1-F1
k	S	R1	R1
l	S	R1	S3
m	S	R1	R1-I1-F3
n	R2-I1-F0	R2-I1-F6	R1
o	R1	--	--
p	R1	S	R1
q	R1	R1-I3-F10	--
r	S	S2	R2
s	S	--	--
t	S	--	--
u	S	--	--
v	R1	R1	R1-I2-F8
w	R2	--	--
x	R1	R1	R1
y	R6	--	--
z	R1	R1-I5-F14	R1
aa	R2	S2	R1
bb	S	S	R1
cc	R4	--	--
dd	R3	--	--
cc	--	R1-I3-F9	R1
dd	--	S	R1
ee	--	R1-I1-F0	--
ff	--	S	S2
gg	--	S	S
hh	--	R5	R2-I1-F7
ii	--	R1	--
jj	--	R1	R1-I2-F7
kk	--	R1	R1
ll	--	S	S2
mm	--	S	--
nn	--	S	S
oo	--	S	R1
pp	--	S	--

qq	--	S	--
rr	--	R1	
ss	--	R1	R1-I1-F3
tt	--	R1-I2-F16	R1-I3-F13
uu	--	S	R1
vv	--	R1-I2-F6	R1
ww	--	S	R1
xx	--	R1	R1
yy	--	S	R1
zz	--	--	R1
aaa	--	--	R1
bbb	--	--	R1
ccc	--	--	S
ddd	--	--	R1
eee	--	--	S
fff	--	--	S
ggg	--	--	S
hhh	--	--	S
iii	--	--	S
jjj	--	--	R1
kkk	--	--	S
lll	--	--	R1
mmm	--	--	S
nnn	--	--	R3S1-I1-F6
6.	R2	R1-I2-F13b	--
b	S	R1	R1
c	S	R1-I3-F5	S
d	S2	S2	--
f	S	--	--
g	R1	R1	--
h	R1	R1-I2-F17b	--
i	S	R1	R1
j	R1	R1-I1-F1	R1-I1-F18b
k	R1	R1-I2-F7	R1-I5-F9
l	S	R1	--
m	R1	R1-I1-F1	R1-I3-F12
n	R3	R3	R3S1-I1-F9b
o	R1	R1	R1
p	S	R1	R1
q	R1	--	--
r	R1	R1-I4-F8	--
s	R1	--	--
t	R2	R2-I2-F1	--
u	R1	R2-I4-F0	--
v	R1	--	--
w	--	S	S
x	--	R1	R1-I1-F1
y	--	S	S
z	--	R1-I9-F24	R1-I1-F36
aa	--	R1	R1S1

bb	--	S	R1
cc	--	R1-I1-F4	S
dd	--	R1	R1
ee	--	S	R1
ff	--	R1	S4
gg	--	R4-I4-F1	R1S1-I2-F3
hh	--	--	R1
ii	--	--	S
jj	--	--	S
kk	--	--	S
ll	--	--	S
mm	--	--	S
nn	--	--	R1
oo	--	--	S
pp	--	--	S
qq	--	--	R1
rr	--	--	S
7.	R1	R1	--
b	R1	R1	R1-I1-F6
c	R1	R1-I3-F3	--
d	S	--	--
e	R1	R1S2	R2-I4-F14b
f	R5	R1-I3-F25b	--
g	--	R1	R1-I1-F41b
h	--	R1-I1-F1	S
i	--	R1-I3-F1	--
j	--	R3-I1-F2	R2
k	--	--	S
l	--	--	S
m	--	--	R1
n	--	--	S
o	--	--	R1
p	--	--	S
8.	R1	R2	--
b	R1	R1-I2-F3	R1-I1-F4
c	R1	R1-I2-F5	R1
d	R1	R2-I2-F6	--
e	R1	R2S3	R5-I2-F25b
f	S	--	--
g	R1	R1	R1
h	R1	R4	R3-I3-F18b
i	R1	R1-I1-F4	R1
j	R1	R2	R2
k	R1	R2S1	R3
l	--	S	R1
m	--	S	S
n	--	R1	R1
o	--	S7(?)	R1S1-I1-F4
p	--	R1	R1

q	--	--	S
r	--	--	R
s	--	--	R1
t	--	--	S
u	--	--	R1
9.	R1	R1	--
b	R1	R1	R1
c	S	--	--
d	R1	R1-I1-F2	R1-I5-F30
e	R2-I3-F4	--	--
f	R1	R4	R5-I5-F34b
g	R1	R4	G6-I6-F36b
h	R1	R1-I5-F17b	--
i	S	--	--
j	R1	R1-I3-F13	--
k	S	--	--
l	R4	R3	--
m	R1	R2S3	R6
n	R1	R1-I6-F14	--
o	R2	R2-I3-F2	R2S1
p	R1	S	R1
q	R1	R1-I1-F0	S4-I2-F1
r	R2	R2-I9-F19	--
s	--	R1	--
t	--	S	R1
u	--	R1-I1-F2	R1
v	--	R1	R1
w	--	S	R1
x	--	R2	R2
y	--	R1-I1-F6	S6-I1-F2
z	--	--	R1
aa	--	--	R1
bb	--	--	R1-I1-F18b
cc	--	--	S
dd	--	--	R1S1
ee	--	--	S
10.	R1	R1-I1-F13b	--
b	R1	R1-I1-F8b	--
c	R2	--	--
d	R1	R3-I2-F4	--
e	R1	R1-I2-F5	R1-I1-F21b
f	R1	R1-I8-F29	--
g	S	--	--
h	R1	R1-I3-F4	R1-I1-F0
i	R1	R1-I1-F5	--
j	R1	R1-I3-F2	--
k	R1	--	--
l	R1	R1S1	R1-I1-F14b
m	R1	R1-I4-F14	--

n	S	R1	R1-I1-F5
o	R2	S2	R1S1
p	R2	R1S1	--
q	R1	--	--
r	R1	R1-I4-F8	--
s	R2	R2	R1
t	R1	R1-I1-F5	R1-I1-F13
u	S	S	--
v	R3	R1S1	--
w	S	R1	--
x	R1	--	--
y	R3	R1S3	R1S2-I1-F5
z	R1	--	--
aa	R1	--	--
bb	R1	R1-I3-F8	--
cc	R1	S5	S5
dd	R1	R1	--
ee	--	R1	R1
ff	--	S	--
gg	--	S	R1
hh	--	R3	R1-I3-F25b
ii	--	S3	R3
jj	--	R1	R1-I3-F17b
kk	--	--	R1
ll	--	--	S
mm	--	--	S
nn	--	--	S
oo	--	--	S
pp	--	--	R1
11.	R1	R1-I4-F8	--
b	R1	--	--
c	R5	--	--
d	R1	--	--
e	R1	R1-I2-F17b	--
f	R1	R1-I3-F12	--
g	R1	--	--
h	R1	R1-I2-F31b	--
i	R1	R1	R1
j	R2	R3-I7-F20	--
k	R1	--	--
l	R6	R3-I2-F6	R3-I1-F10b
m	R3	--	--
n	S	R1	R1
o	R1	R1-I1-F14b	--
p	R1	--	--
q	S	S	R1
r	S	R1	R1
s	R1	--	--
t	--	R1	R1
u	--	S	--

v	--	S	--
w	--	R1	R1
x	--	R1	--
y	--	S	R1S1
z	--	R1-I2-F2	R1-I1-F25b
aa	--	R1	--
bb	--	R1-I1-F2	S
cc	--	--	S
dd	--	--	R1
ee	--	--	S
ff	--	--	R1
gg	--	--	S
hh	--	--	R1
ii	--	--	R1
12.	R1	R1-I3-F1	R1-I2-F4
b	R1	R1-I5-F16	--
c	R1	R1-I1-F0	--
d	R1	R1-I5-F1	--
e	R2-I1-F3	R1-I2-F2	--
f	S	R1	R1
g	--	R1	R1
h	--	R1-I1-F6	--
i	--	R1	R1
j	--	R1-I1-F2	R1-I1-F5
k	--	--	R1
l	--	--	S
m	--	--	R1

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