# CASA DIABLO GEOTHERMAL DEVELOPMENT PROJECT:

# DEER MIGRATION STUDY, SPRING 1987

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# INTRODUCTION

A proposal has been made to develop a geothermal electric generating plant in the southwest portion of Long Valley in Mono County, California. The development, known as the Casa Diablo Geothermal Project, has raised concerns with respect to potential deleterious impacts on migratory mule deer (*Odocoileus hemionus*) which use the project area and vicinity. The Biotic Assessment of the project prepared in January 1987 was considered by the management agencies involved to be deficient in data on migratory mule deer in the area. The present investigator was subsequently contracted to gather data to allow an assessment of the importance of the area to migratory deer through an annual cycle, i.e., spring, summer and fall. No wintering activity is to be expected. This report concerns only the period of spring migration.

This part of the Eastern Sierra Nevada is known for its visual and biological resources, and the quality of the natural environment. Among the most important components of this natural environment, symbolically, esthetically and economically, are the impressive numbers of mule deer. Only in the last three years has intensive ecological research on these animals been conducted. It is now known that more than half of the 6000 deer which winter near Bishop migrate to the north and pass near the town of Mammoth Lakes to get to their summer ranges (Kucera, unpubl.). The annual life cycle of deer in the Eastern Sierra Nevada may be divided into four periods: winter, spring migration and staging, summer, and fall migration. These seasonal movements are a response to the seasonal availability of habitat, and as parts of a component system, all are important in maintaining deer populations.

Most deer in this part of the Eastern Sierra winter at lower elevations some 20 airline miles to the southeast and east of the proposed geothermal area (Figure 1). Several "herds" as defined by the California Department of Fish and Game (DFG) are of concern in the present situation. These are the Buttermilk and Sherwin Grade herds, which winter in Round Valley, at the base of the eastern escarpment of the Sierra Nevada just west of Bishop, and the Casa Diablo herd, which winters between the Benton Range and the White Mountains, from the Casa Diablo Peak area north past the town of Benton (DFG 1984, 1985a, 1985b).

The spring migration begins in April, when deer leave their winter ranges and move to intermediate altitudes. They congregate in "staging areas" for as long as six weeks, feeding on spring vegetation and regaining condition lost over the winter, until they move to summer ranges. Here, mainly west of the Sierra Crest, fawns are produced and reared. The fall migration back to the winter range typically is more rapid than that of the spring, and usually is patterned by fall storms. Deer arrive on the winter range during September, October and November, breed in December and January, and begin the annual cycle again.

The objective of the present work is to describe and quantify the amount, timing and specific locations of mule deer use of the Casa Diablo Geothermal Project Area ("Study Area") during the Spring 1987 deer migration. This information is designed to meet the information needs of public resource management and planning agencies with respect to baseline

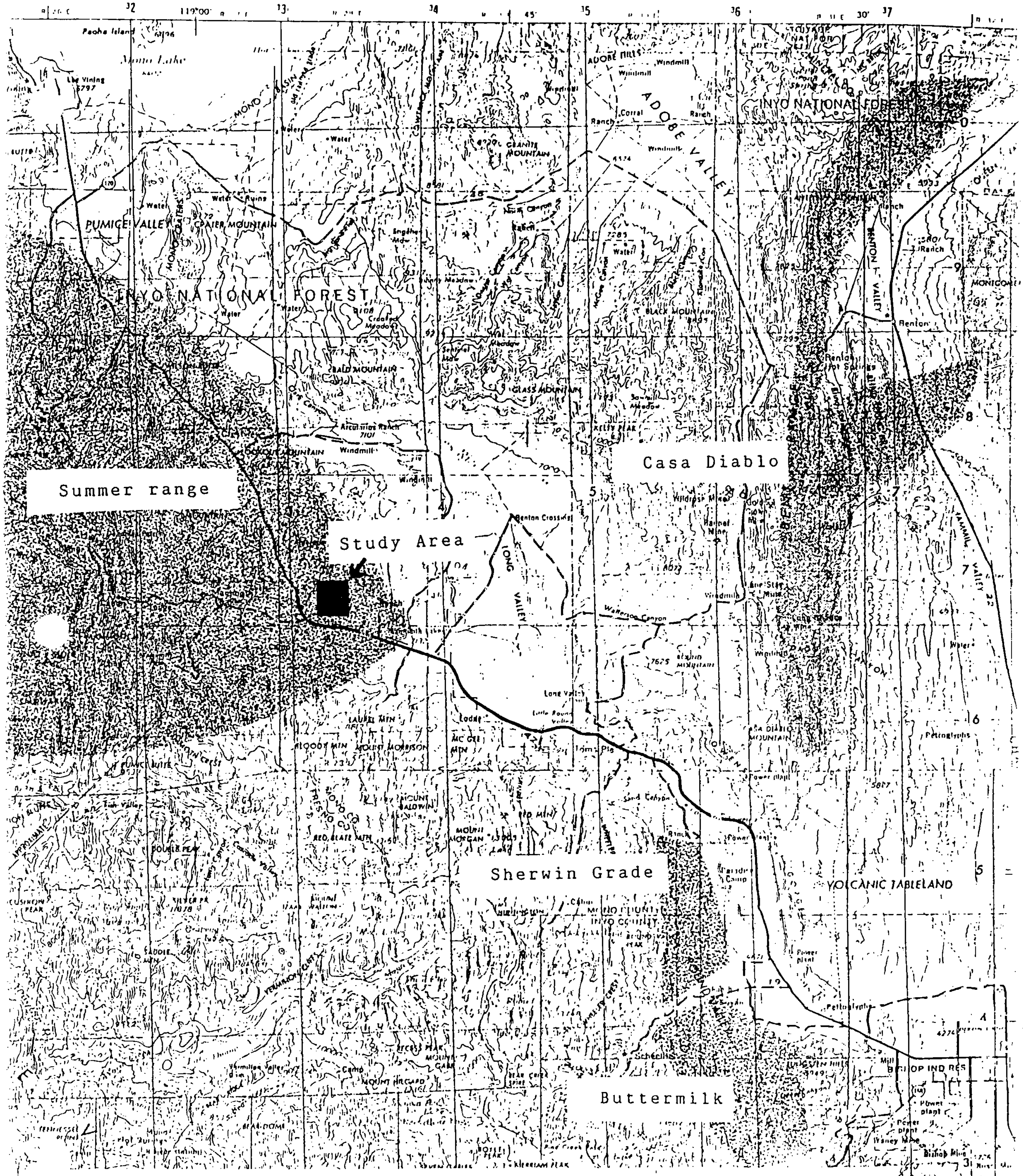



Figure 1. Regional map indicating locations of Buttermilk, Sherwin Grade and Casa Diablo Winter ranges, and approximate summer ranges of deer using the Long Valley area on migration.

conditions in the Study Area, and to assist in assessing impacts to deer of a geothermal development and designing measures to reduce those impacts.

## ACKNOWLEDGMENTS

This investigation was conducted under a contract from Environmental Management Associates, Brea CA. Some of the data presented here are from a larger investigation of Eastern Sierra deer supported by the Bishop Resource Area of the Bureau of Land Management, the California Department of Fish and Game, Inyo and Mono Counties, the University of California, Berkeley, and several private funding organizations. Most of the fieldwork was conducted by Timothy Taylor.

The data in this report are to be used solely for the purposes of planning and analyzing potential environmental impacts of the proposed Casa Diablo Geothermal Project, and are not for publication, citation, or other use without the permission of the author.

## STUDY AREA

The Casa Diablo Geothermal Study Area is located in portions of Sections 29 and 32 of T. 3 S, R. 28 E, Mono County, CA (Figure 2). It is immediately north of Highway 395, approximately 3 miles east of the town of Mammoth Lakes. The land is a mixture of both public and private ownership.

## METHODS

A track survey route was laid out on the dirt roads which pass through the Study Area (Figure 2). This route was divided and marked into 20 sections each 0.1 miles long except Section 1, which was 0.2 miles long. In adition, the dirt road leading from

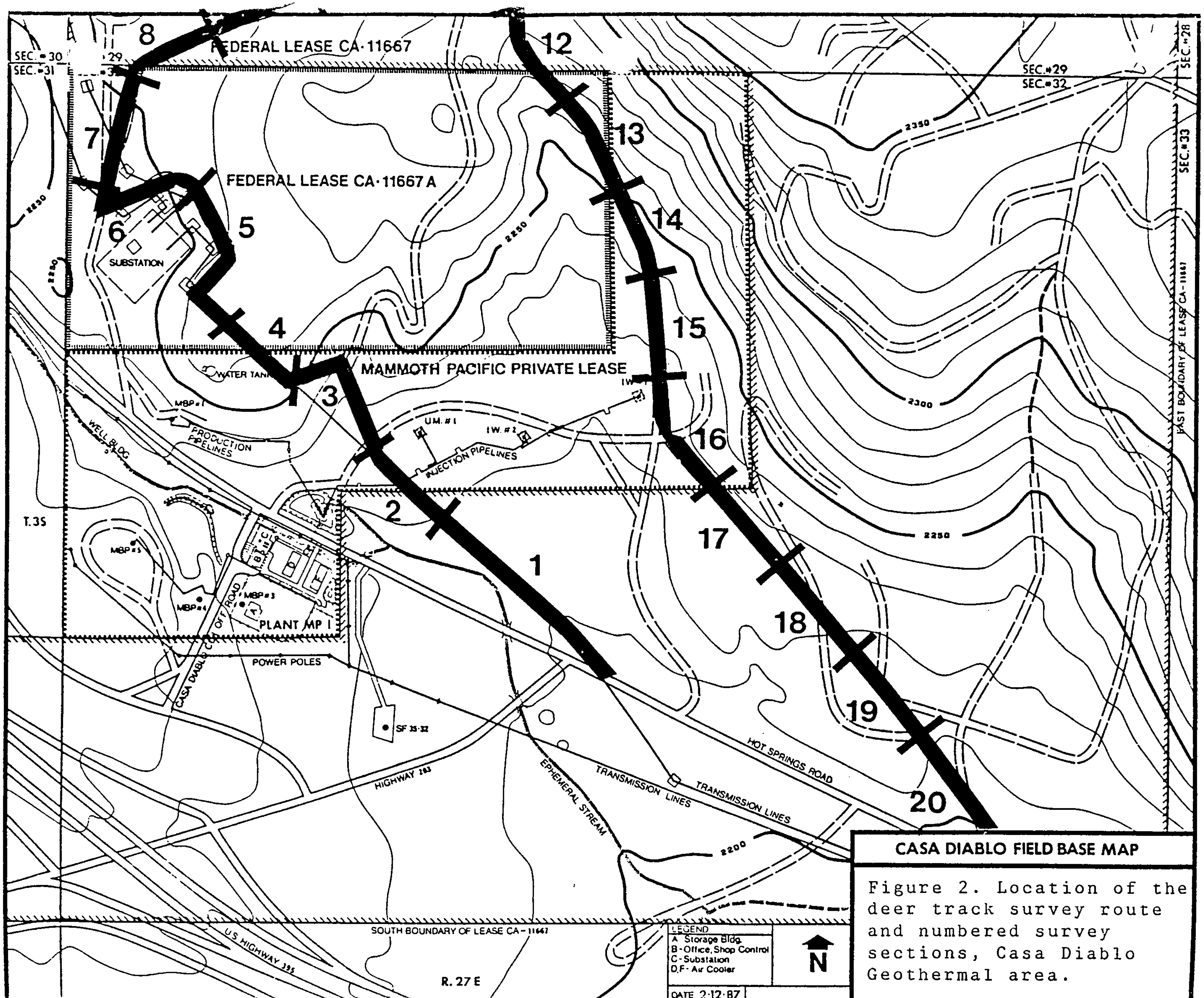



Figure 2. Location of the deer track survey route and numbered survey sections, Casa Diablo Geothermal area.

Hot Springs Road to well SF 35-32 was included in the surveys.

Beginning on 21 April 1987, the entire route was cleared of tracks and a tracking substrate prepared by dragging it with a "sled" of automobile tires pulled by a vehicle. This was done in late afternoon, and the following morning, the route was walked or driven and all deer tracks observed on the road were counted, both by survey section and by direction of travel. Data recorded were the number of individual deer making the observed tracks and their direction of travel. Because the route was dragged each evening before a survey to obliterate all tracks, the tracks counted on the surveys were made by animals within approximately the previous 12-18 hours. Recording tracks by survey section was designed to give a quantitative picture of the local pattern of deer movement in the Study Area. Recording tracks by direction of movement was designed to allow separation of back-and-forth or very localized movements from migrational movements.

## RESULTS

### 1. Timing of deer activity

Figure 3 shows the total number of tracks made by individual deer throughout the period of study, presented without regard to direction of movement. A pattern of a gradual increase in the number of tracks throughout the period is apparent, with the greatest number of tracks counted, 20, on 13 June.

Figure 4 shows the breakdown of tracks counted on the surveys by direction of movement. Movements to the north and west are generally in the direction of the spring migration; those to the south and east west are opposite. Thus, subtracting the south and east-moving tracks from the north and west-moving ones,

Figure 3. Total deer tracks counted on surveys in the PLES geothermal site, Spring 1987.

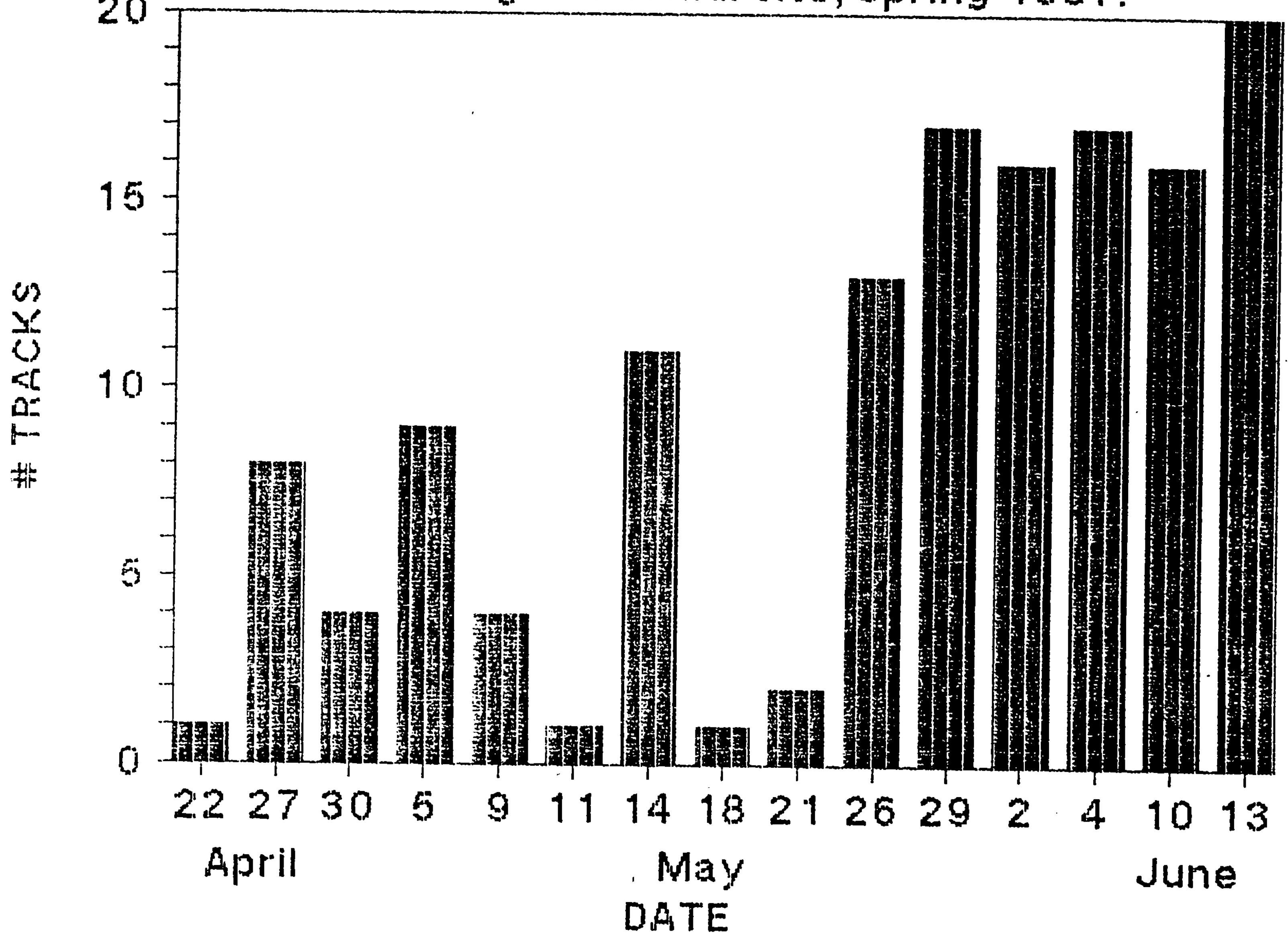
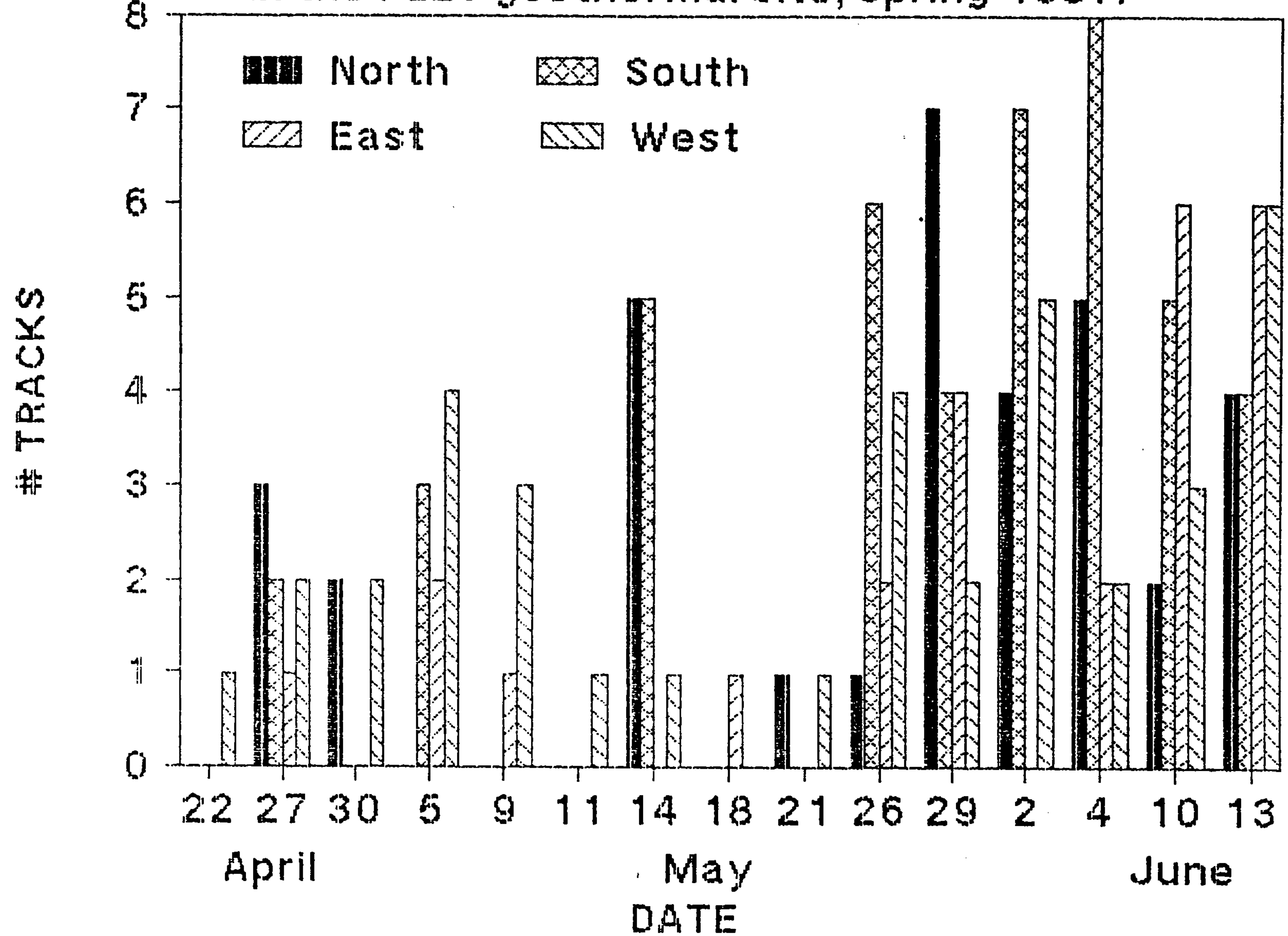


Figure 4. Deer tracks by direction of movement in the PLES geothermal site, Spring 1987.



respectively, yields a crude estimate of the net number of deer moving through between the the dragging of the route and the survey. This is shown in Figure 5, in which the number of tracks heading south was subtracted from those heading north, and the number of tracks heading east was subtracted from those heading west, on each survey. Negative numbers may be interpreted as indicating predominantly localized, nondirectional movements. As indicated in Figure 5, most migrational movements in the Study Area occurred throughout late April and May. Beginning in late May, the negative net track numbers indicate fewer directional or migrational movements and more local movements, likely from deer on what will be their summer range.

2. Locations of deer movements

Figure 6 presents the total number of deer tracks by survey section counted during the spring of 1987. The large number of tracks indicated for Section 1 is somewhat misleading because that section is twice as long as the others. With this in mind, the distribution of tracks in the survey sections appears rather uniform. The net tracks by survey section are presented in Figure 7. No consistent pattern of movements is indicated. It is apparent that directional movements occurred in Sections 8, 10-12 and 18-20, which correspond to the most northerly and northwesterly, and southwesterly portions, respectively, of the Study Area.

Additionally, on the road to well SF 35-32, single sets of west-moving tracks were observed on 10, 18, 21 and 26 May. Throughout the survey period, only two deer were observed; on 4 June, 2 adult females were seen near Sections 10 and 11. No

Figure 5. Net numbers of tracks by direction of movement in the PLES geothermal site, Spring 1987.

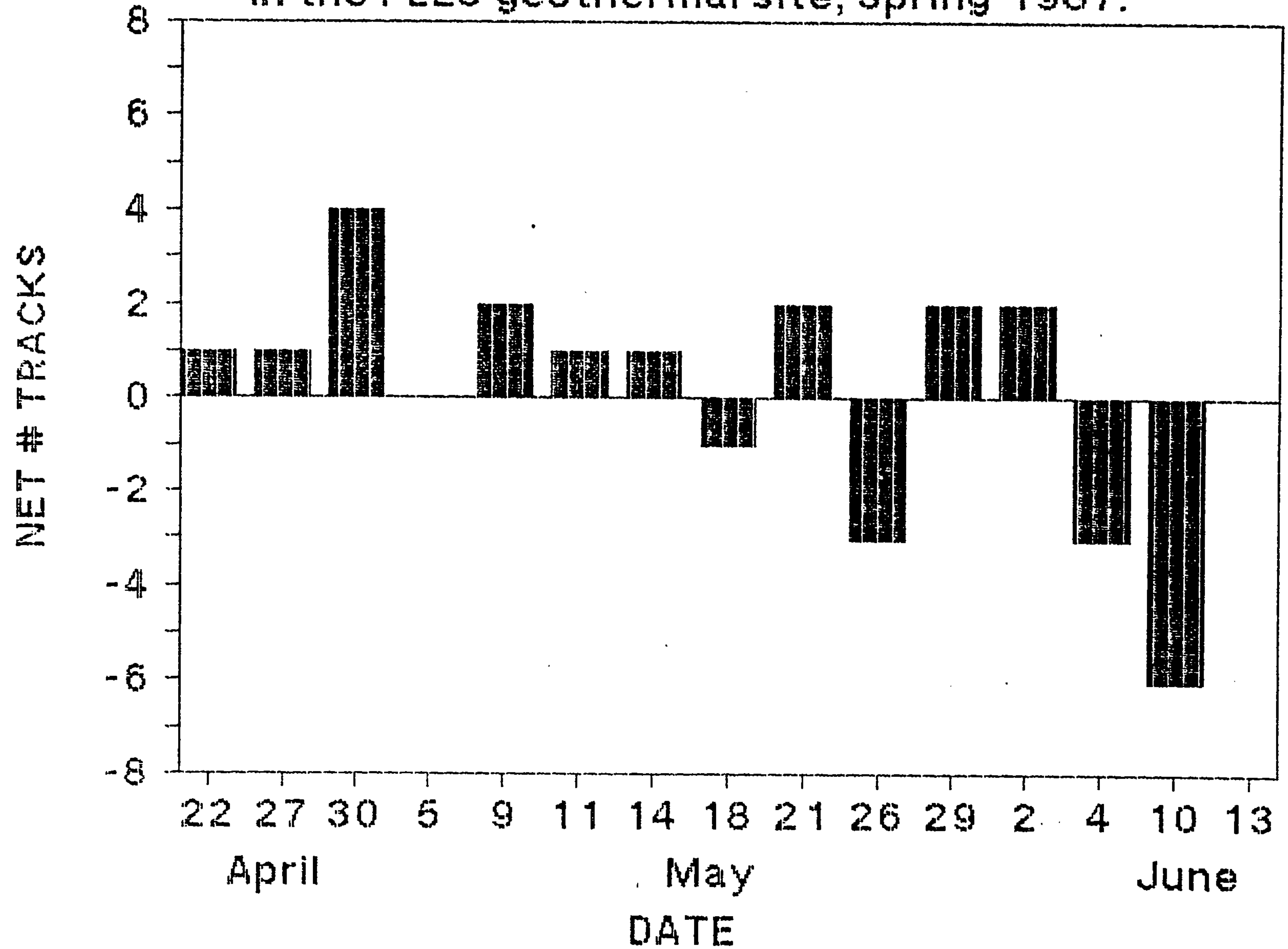


Figure 6. Total numbers of tracks counted by survey section in the PLES geothermal site, Spring 1987.

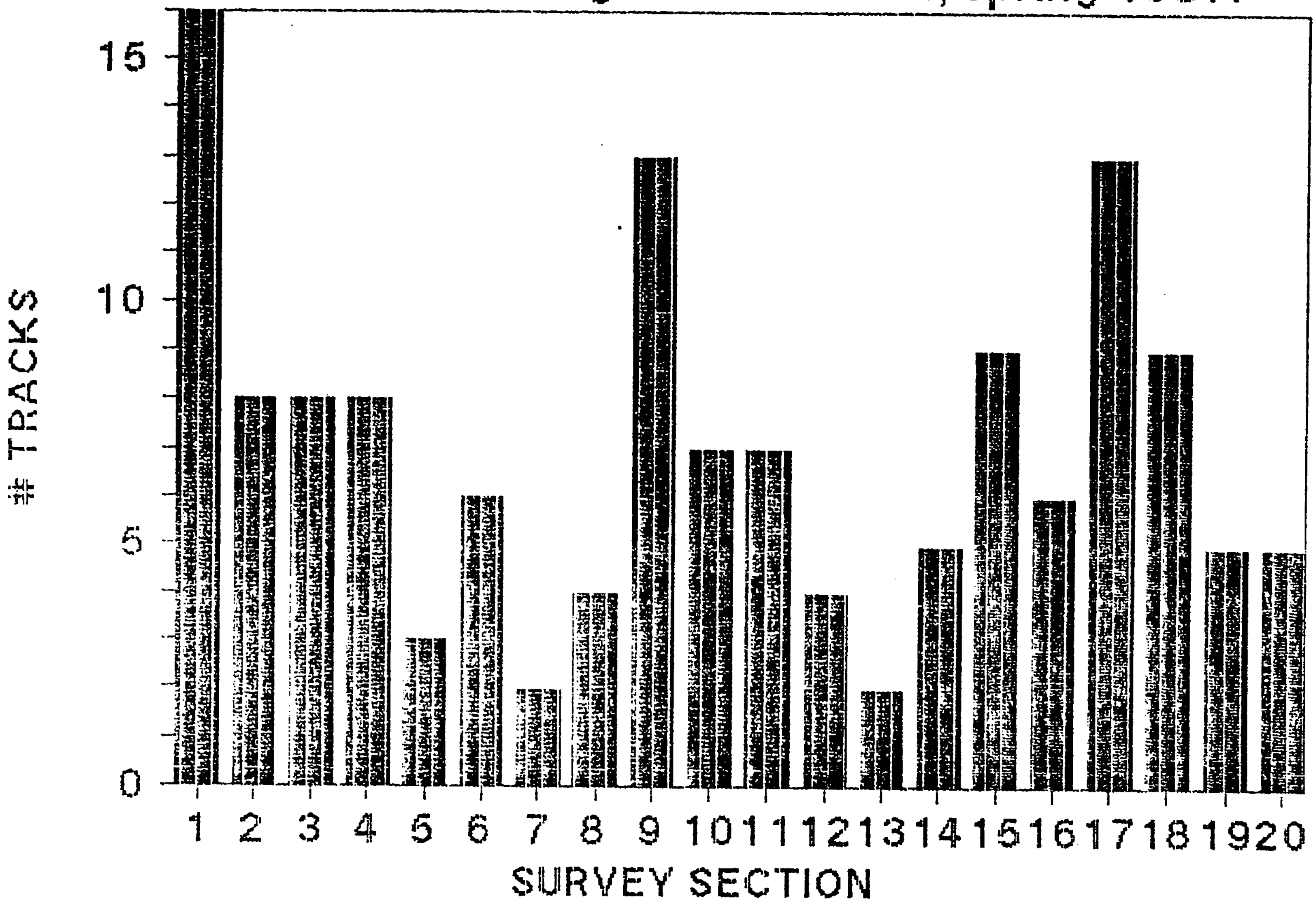
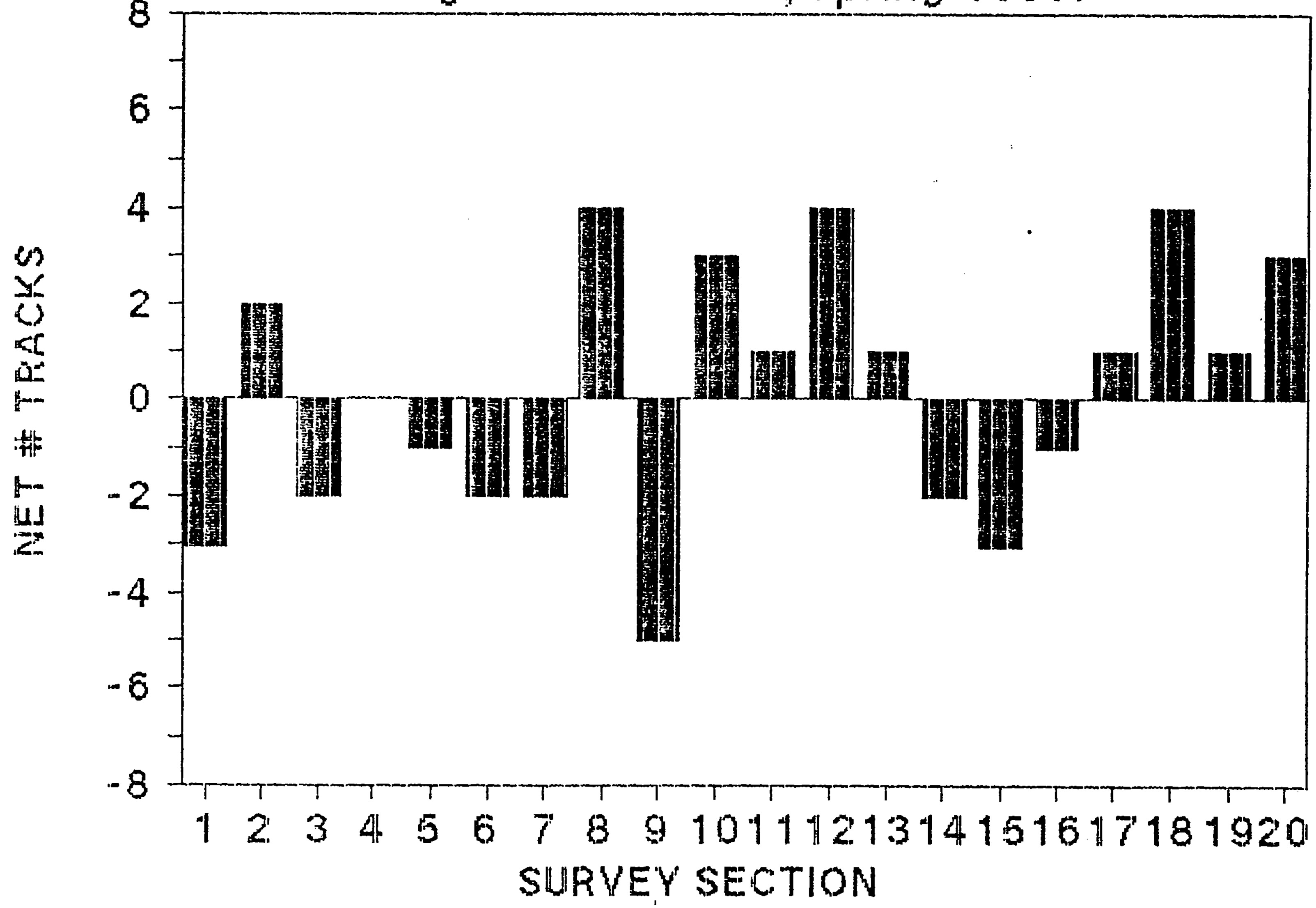


Figure 7. Net numbers of tracks by survey section, PLES geothermal site, Spring 1987.



specific areas of deer movement or well-defined concentration areas were apparent from covering the area on foot.

## DISCUSSION

Results of the spring 1987 track surveys indicate a generally somewhat dispersed pattern of deer activity in and movement through the Study Area. No well-defined migration trails were observed, and the track counts indicate deer activity in all sections. One could make the rather weak case that Figure 7 shows a preference for the less developed portions of the area, i.e., Sections 8, 10-13, and 17-20, but the data are hardly compelling.

Nevertheless, deer movement through the area was apparent, and the number of animals involved can be at least roughly estimated. On the assumption that the period of spring migration was 15 April to 2 June, the 12 surveys covered approximately 25% of the 48 days in this period. The net number of tracks during this period was 13 (Figure 5). Assuming this to be a reasonable approximation of the number of deer actually moving through between the time the road was dragged and when tracks were counted the next morning, a total of 52 (13/0.25) deer moved through the Study Area during the survey period. This does not take into account those deer that may have moved through during the day. Making the assumption that 75% of deer would migrate at night (between dragging and counting) and 25% would migrate during the day, a grand total of 69 (45/0.75) deer moving through during the spring period can be estimated, given the stated assumptions.

This estimate of 69 deer is meant only as an approximation of the number of deer using the Study Area on spring migration.

Potential sources of error, e.g., multiple counts of the same animal, or tracks missed because of poor tracking medium, are impossible to quantify. However, the precise number is not important; what matters is the estimate of magnitude. There certainly are not hundreds or thousands of animals using the area, as is the case in other local areas, but likely there are dozens. This movement does not appear to be concentrated in any localized portion of the Study Area, but is dispersed throughout it, which may not be surprising given its relatively small area and lack of extreme topography. It is likely that deer from three designated "herds" are involved: the Buttermilk, Sherwin Grade, and the Casa Diablo herds. Radioed or otherwise marked deer from all three herds have been observed in the vicinity of the Study Area.

Recent radio-telemetry information indicates that, in general, most of the Buttermilk and Sherwin Grade deer which migrate north do so along the base of the mountains west of Highway 395. Likewise, most Casa Diablo deer move along the base of the Glass Mountains northwest of the Study Area. A portion of each herd, however, does move near or right through the Study Area. The specific areas used as migration corridors are probably dictated as such by both local topography and tradition.

Impacts of geothermal development on these migrating deer are difficult to predict precisely, but in a general sense are a function both of the location, amount and kinds of changes associated with the development, and of the availability of potential alternate travel routes. It seems to be the case that deer activity is rather dispersed throughout the area. The locations of the proposed project facilities (Fig. 8), including a number of proposed wells, pipelines, and a transmission line and access road, as well as the power plant site, in general are adjacent to the existing geothermal plant and facilities. Assuming a "worst case" scenario, one in which deer completely avoid the proposed facilities and associated human disturbance, it is difficult to see how making several dozen deer move several hundred yards around the facilities would constitute a great hardship. Given the existing terrain, such an avoidance would likely have a trivial impact on migrating deer. Of course, certain facilities, e.g., fences, pipelines, etc., could be designed to minimize any impacts to deer and to facilitate their passage.

From the standpoint of deer migration, the locations of the proposed facilities (Figure 8) are preferable to those of the alternate site (Figure 9). This latter alternative would move the power plant to the northeast, across Hot Springs Road, and effectively increase the area impacted by the project. In general, the more concentrated an area of disturbance, the less will be its deleterious impacts.

Thus, at present, alternate routes for spring migration exist, giving deer an opportunity to avoid the project area if developed. However, there are proposals for additional developments in the region. Although it is impossible to discuss thoroughly the impacts of a project without reference to the context in which the project occurs, a regional summary and analysis taking such additional projects into account are not within the scope of the present work. No doubt the consequences

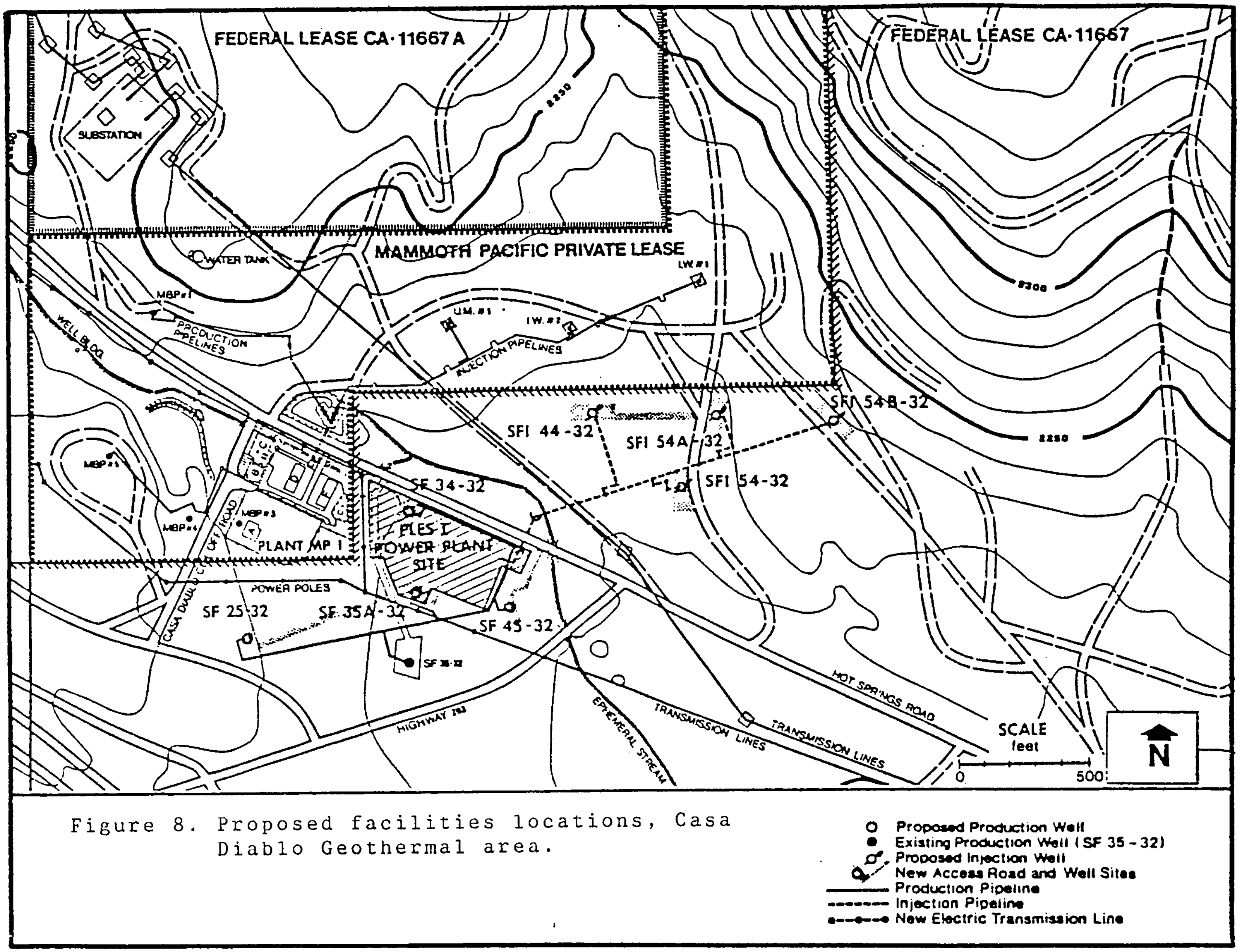



Figure 8. Proposed facilities locations, Casa Diablo Geothermal area.

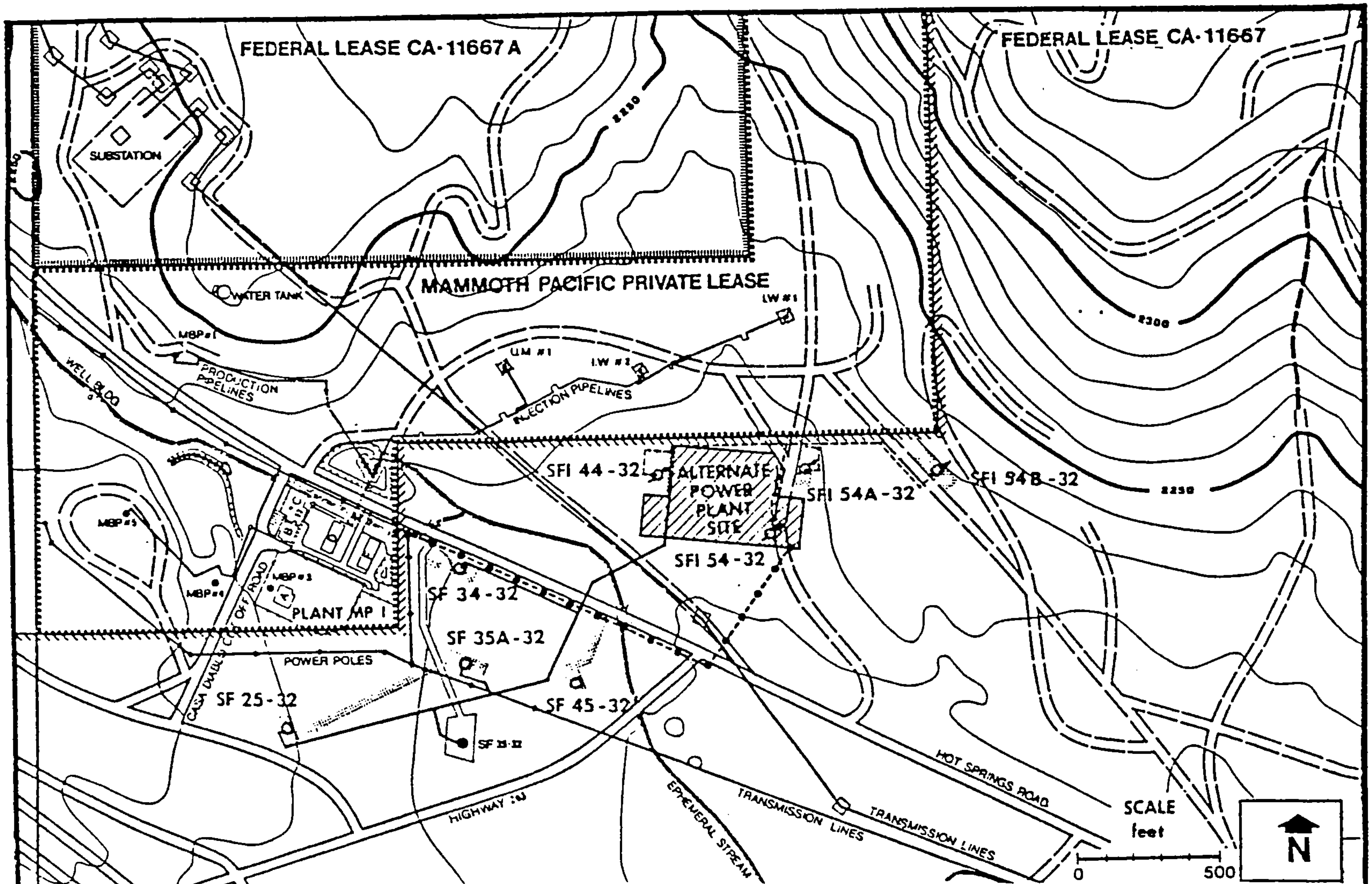



Figure 9. Alternate facilities locations, Casa Diablo Geothermal area.

of some of these proposed projects, because of their nature, size, and/or geographic location, are potentially much greater than those to be anticipated from Casa Diablo. Others may be more benign. A comprehensive study of the cumulative impact of potential development, however desirable from a resource management perspective, is not possible within the time constraints of this project.

The present investigation and discussion indicate that the Casa Diablo Geothermal Project, considered by itself, will likely not have a significant impact upon the spring migration. In the worst and unlikely case that deer avoid the project entirely, there are at present alternate routes available to allow migrating deer to reach their summer ranges. Thus, the Casa Diablo Geothermal Project by itself will likely have minimal negative impact.

# LITERATURE CITED

California Department of Fish and Game. 1984. Buttermilk Deer Herd Management Plan. Prep. by Tom Blankinship, Bishop CA. 56pp.

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