SPECIAL MANAGEMENT AREA

Visual Resources

Management Study

For The

SEQUOIA NATIONAL PARK
PRESCRIBED FIRE MANAGEMENT PROGRAM

Prepared for
U.S. Department of the Interior
Sequoia and Kings Canyon National Parks

Prepared by
Center for Design Research
Department of Environmental Design
University of California, Davis

December 1987

SEQUOIA AND KINGS CANYON NATIONAL PARKS
DIVISION OF INTERPRETATION
SEQUOIA DISTRICT

February 2, 1988

MEMORANDUM

TO: Chief, Resources Management

FROM: Sequoia District Naturalist

SUBJECT: Comments: Visual Resources Management Study

The following comments are my hurried responses to the Greco/Dawson Visual Resources Management Study proposal from UC Davis.

On July 14th, I addressed the following comments to you regarding this proposal:

> I remain fundamentally uncomfortable with the thought of managing our forests to achieve any defined set of visual goals based on any specific criteria. To do so is to impose yet another human artifact on this forest -- something we ought to be very, very careful about doing. Our landscape architects have a professional view of what constitutes an interesting or pleasing landscape, but they know less than they realize about what makes that landscape work. (To be honest, I don't think anyone really knows very much.) As a result they fix upon elements of the present landscape that they find pleasing, and they begin to work to emphasize or preserve those elements regardless of our knowledge (or lack of knowledge) about what caused those particular scenes to exist.
>
> In this light I am very concerned about Kerry Dawson's proposal, which seems to be a license for landscape architects to involve themselves in a broad defining of what our forest ought to be. I had this conversation with Dawson, and he told me that my argument was false because we were managing and thus controlling the forest. Nevertheless I believe that what he proposes is an additional and dangerous new level of forest manipulation. If we follow this road, I suspect that someday we will look about as wise as the early rangers who like to see "good" deer and therefore shot "bad" lions here in Sequoia.

The above comments were written before Greco's field work last summer, but I fear that they are still valid. First, I think that the proposal, through its many small errors of fact, confirms our fear that the landscape architects are not adequately familiar with the operations of this forest. The following are some examples:

Special Management Area
Visual Resources Management Study
for the
Sequoia National Park
Prescribed Fire Management Program

Prepared for
U.S. Department of the Interior
National Park Service
Sequoia and Kings Canyon National Parks
Three Rivers, California

Prepared by
Center for Design Research
Department of Environmental Design
University of California, Davis
Davis, California

December 1987

Acknowledgements

This report was prepared under the direction of Kerry J. Dawson, Professor of Landscape Architecture at the University of California, Davis. Post graduate research assistant, E. Steven Greco, supervised the field work, draft preparation and graphic design. Special thanks to David Eng for his help with drafting, and Sarah Marvin for her help with landscape graphics and word processing. We all extend our gratitude to the Center for Design Research. Also special thanks to Larry Bancroft and Tom Nichols for their advice and essential insight.

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Summary

The purpose of this report is to provide ecologically acceptable visual resource guidelines for the Generals Highway SMA (between the Giant Forest Village and the General Sherman Tree) and the Congress Trail SMA. The guidelines consist of three areas of primary concern. The first two are guidelines for desired fire effects on the character of the landscape and on the character of individual giant sequoia features. These are for the Prescribed Fire Management Program. The last set of guidelines are designed to help enhance existing visual resources that are presently negatively impacted.

The guidelines are broken down into three separate categories of goals, objectives, and treatments. Management goals are broad topics of fundamental significance. Visual quality objectives are issues within the goals, and treatments are specific actions to achieve the stated objectives.

SMA's are defined in terms of their respective viewshed boundaries. Within these boundaries, visual resources are to be managed intensively to conserve the integrity of their delicate character. Outside these boundaries is beyond the scope of this report. A detailed data base has been field collected and assembled as a Visual Resources Inventory for each study area SMA (Appendix C).

The Visual Resources Management Treatment Recommendations section is a specific plan that has been prepared utilizing the guidelines and inventory information (Appendix D). The Summary Table (following the Conclusion) is an outline of the recommended guidelines; however, as it points out, much vital research is still needed in many aspects of fire ecology management.

Introduction

The focus of this report is to define and recommend guidelines for the treatment of visual resources within two Special Management Areas (SMA) of the giant sequoia- mixed conifer forest prescribed burning program at Sequoia National Park (Figure 1). They are the Generals Highway SMA (between Giant Forest Village and the General Sherman Tree) and the adjacent Congress Trail SMA. Both are located in Sequoia's Giant Forest. It is recognized that park visitation is extremely high in these areas, therefore, they warrant intensive management.

This study aims to identify specific visual concerns and to suggest ecologically acceptable management alternatives in these areas. Specific visual management goals and objectives have been formulated to assist park managers in making vital decisions regarding forest ecosystem aesthetics within the SMA's. Visual management treatments will also help in the planning process for the SMA burn units.

The methodology does not include, except by suggestion, specific firing techniques or fire prescriptions. Rather, it is designed to guide park managers in the formulation of such specific prescriptions and firing techniques. A system to monitor the future aesthetic qualities of fire effects in the SMA's is strongly recommended. It is needed to evaluate the effectiveness of the present techniques employed to achieve visual management goals and objectives, and also to aid in the predictability of fire effects for future prescribed burns.

In addition to these guidelines, recommendations are made for improving the General Sherman Tree area and suggestions to limit the visual resource impact of prescribed burns on the Tharp's Creek Unit.

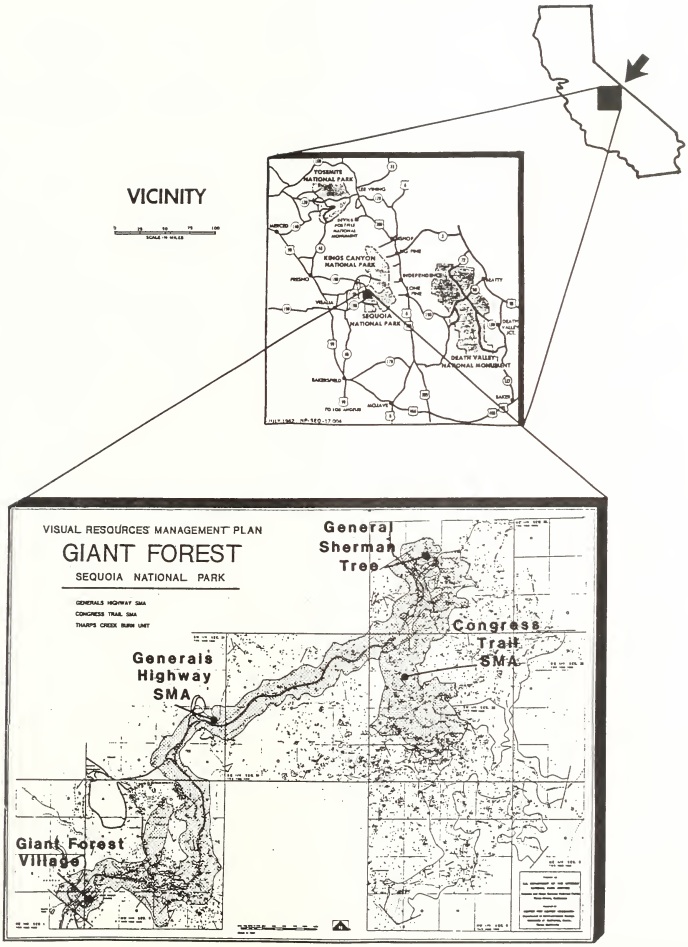

Figure 1: Vicinity and Study Area Location maps

Background

Prescribed burning began in Giant Forest in 1979. Since then several burns have been conducted (refer to Figure 2). The purpose of these burns has primarily been to reduce hazardous fuel accumulations and to restore the forest to a more natural state. The overall burn pattern on the landscape was designed to prevent or minimize the potential risk of a catastrophic fire sweeping across all of the Giant Forest plateau. In an effort to accomplish these objectives, park resource managers have been criticized for burning "too much, too fast." Consequently, an independent review was commissioned by National Parks Director, William Penn Mott, Jr.

The independent review of the sequoia-mixed conifer prescribed burning program of Sequoia and Kings Canyon National Parks by the Christensen Panel (1987) resulted in a report (Christensen et al 1987) and numerous recommendations to explicitly address aesthetic concerns within the park's "Showcase" areas. The Natural Resources Management Division has since changed the term "Showcase" to Special Management Areas (SMA), and this report will henceforth refer to them as SMA's. The Panel Report also recommended consultation with landscape architects in the development of burn plans with special emphasis on the SMA's. This report and the Landscape Architects consulting tour in July of 1987 are some preliminary results of the Panel's recommendations.

Special Management Areas are located in portions of the park that receive the heaviest visitation. As noted in the Sequoia and Kings Canyon Vegetation Management Plan (1987), these areas will be managed in such a manner "where maintenance of natural processes is guided more by scenic concerns." SMA's are divided into two categories: Landscape Management SMA's and Research Study SMA's. This report will concentrate on Landscape Management SMA's only. The following areas are currently designated as Landscape Management SMA's: General Sherman Tree and Congress Trail, General Grant Tree and Walk, Tharp's Log, Generals Highway (selected points in Giant Forest, Lost Grove, and Grant Grove), Crescent Meadow Road (selected points), Crescent Meadow / Tharp's Log Trail, Crescent Meadow Loop Trail,

Hazelwood Nature Trail, and the Round Meadow / Trail for All People.

The National Park Service Act of 1916 declared that "the fundamental purpose of [National Parks] is to conserve the scenery and, the natural and historic objects and the wildlife therein and to provide for enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations." Interpretation of this mandate has clearly demanded a sophisticated level of management since the release of the Leopold Report (Leopold et al 1963). The relationship between human aesthetics and natural process continues to evolve, and will do so as our knowledge broadens. Visual resources are a prime asset in our National Parks and must be managed and conserved to the maximum extent possible. Preservation of natural ecosystems and its processes are equally important to restore and maintain the dynamic character which ultimately formed the giant sequoia- mixed conifer forests prior to human interference. The Giant Forest should be retained for both aesthetic and ecological reasons; tney need not conflict.

As stated in the Panel Report (Christensen et al 1987), SMA's should not be seen as "static museums," created through "scene" management, but rather as a part of the dynamic ecosystem concept, sensitively managed to preserve scenic visual resources. The Prescribed Fire Management Program (1987) notes that the intension of management in these areas is not to apply a method of "greenscreening", existing behind it a dramatically different appearing landscape. Instead, these areas should be burned as more sensitive units with special attention given to specific goals and objectives for visual quality and interpretation, as complemented by associated resource objectives. In this regard, the term "dynamic scene" management is more appropriate.

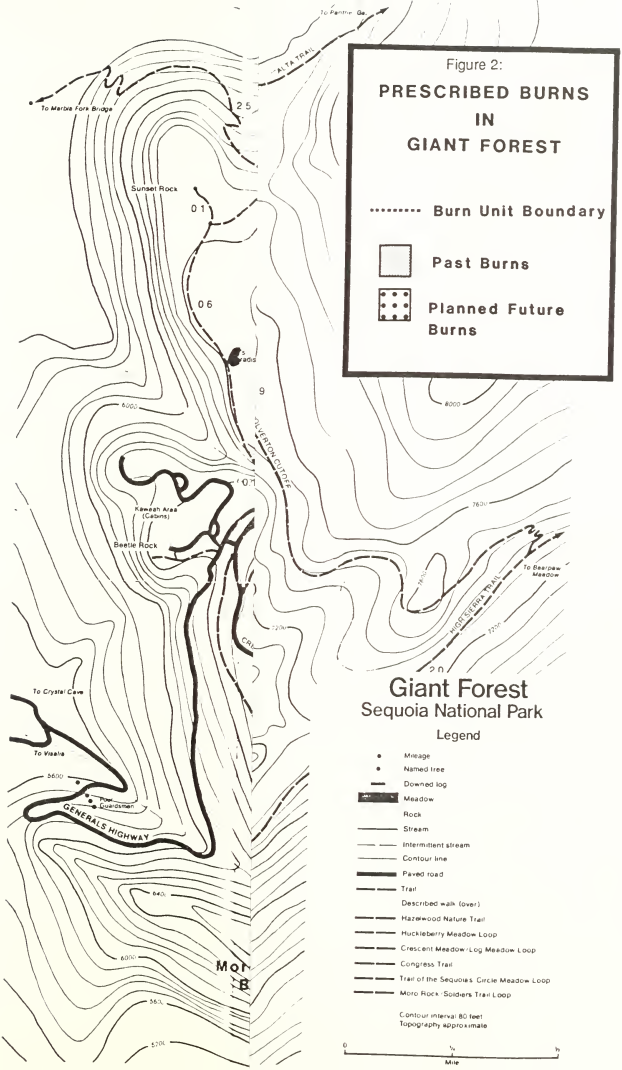
Figure 2:
PRESCRIBED BURNS
IN
GIANT FOREST
Burn Unit Boundary
Past Burns
Planned Future Burns
To Panther Ge
ALTA TRAIL
To Marble Fork Bridge
Sunset Rock
25
01
06
9
8000
TOKOPAH FALLS
101
Rawson Area (Cabins)
Beetle Rock
7600
To Bearpaw Meadow
HIGH SIERRA TRAIL
7200
20
To Crystal Cave
To Visalia
5600
Pine Log Crossing
GENERALS HIGHWAY
6400
6000
5600
5200
Mor
B
Giant Forest
Sequoia National Park
Legend
Mileage
Named tree
Downed log
Meadow
Rock
Stream
Intermittent stream
Contour line
Paved road
Trail
Described walk (over)
Hazelwood Nature Trail
Huckleberry Meadow Loop
Crescent Meadow-Log Meadow Loop
Congress Trail
Trail of the Sequoias Circle Meadow Loop
Moro Rock-Soldiers Trail Loop
Contour interval 80 feet
Topography approximate
0
½
1
Mile

Figure 2:

PRESCRIBED BURNS IN GIANT FOREST

Burn Unit Boundary

Past Burns

Planned Future Burns

GIANT FOREST

Sherman 1980

Rimrock 1985

Tharps Creek A 1987

Tharps Creek B 1987

Hercules 1982

Circle Meadow 1981

Key Hole 1987

Huckleberry 1979

Broken Arrow 1985

Class 1984

Prometheus 1984

Class 1984

Log Meadow 1980

Moro Rock Burn 1979

GENERAL SHERMAN TREE

GENERALS HIGHWAY

ALTA TRAIL

CONGRESS TRAIL

RIMROCK TRAIL

GIANT FOREST LODGE

GIANT FOREST VILLAGE

HAZELWOOD NATURE TRAIL

CRESCENT MEADOW ROAD

HUCKLEBERRY TRAIL

SOLDIERS TRAIL

MORO ROCK TRAIL

BEAR HILL TRAIL

SUGAR PINE TRAIL

TRAIL OF THE SEQUOIAS

WOLVERTON CUTOFF

HIGH SIERRA TRAIL

Giant Forest
Sequoia National Park

Legend

- Mileage
- Named tree
- Downed log
- Meadow
- Rock
- Stream
- Intermittent stream
- Contour line
- Paved road
- Trail
- Described walk (over)
- Hazelwood Nature Trail
- Huckleberry Meadow Loop
- Crescent Meadow/Log Meadow Loop
- Congress Trail
- Trail of the Sequoias Circle Meadow Loop
- Moro Rock/Soldiers Trail Loop

Contour interval 80 feet
Topography approximate

0 ½ 1 Mile

Study Objectives and Methodology

The objectives of the study were determined based on the specific needs of management and recommendations from the Panel Report (Christensen et al 1987).They are summarized below:

- To recommend ecologically acceptable visual resource management goals and objectives.
- To delineate the boundaries (dimensions) of the Special Management Areas.
- To inventory the visual resources within them.
- To recommend treatments to fulfill the visual quality objectives.

The methodology developed for assessing the visual resources at Sequoia and Kings Canyon National Parks can be applied to all roadways and trails within the park. The process model (Figure 3, page 9) graphically depicts the recommended methodology for SMA visual resources planning. It consists of four basic steps.

In the first step, formulation of visual management goals sets up broad descriptions for the various aspects of desired visual character within the SMA's. From these goals, more specific descriptions of visual character can be generated in the form of visual quality objectives. The objectives address specific topics that pertain to the overall goals. The SMA visual management goals and visual quality objectives center around the two main issues of fire effects and enhancement of impacted scenic resources.

Identification of the specific areas of study is the second step. The proximity of SMA's to one another is an important consideration in the selection process for studying them. Since most SMA's are not isolated case studies and many of the SMA's border and overlap onto other SMA's, it is rarely possible to make recommendations for one without studying several. This relationship should be a fundamental principle for the selection criteria of future SMA study areas.

In step three of the process, a visual resource inventory is conducted of the study areas selected in the second step. The objectives outlined in the first step determine the inventory data to be collected. The following factors are mapped on the Sequoia Inventory Maps (at a scale of 1"= 200'): primary viewshed boundaries, areas of SMA viewshed overlap, visual unit boundaries, visual elements and features (subunits), sightlines, and a visibility prominence rating including focal points, high, medium and low visibility categories for individual giant sequoia trees, logs and stumps.

The final step is visual management recommendations for the study SMA's. Based on the visual quality objectives, treatments are assigned to the management issues within the SMA's. They consist of: SMA boundaries; determination of burn unit size; a burn unit schedule for the sequencing of prescribed burns; measures to protect individual giant sequoia trees, logs, stumps; a management intensity scale for individual visual units; measures to protect "pockets" of understory adjacent to trails and roads; physical improvements to reduce visitation impacts, such as sidewalks and fencing; revegetation in high use and impacted areas; and whitewood thicket evaluations to enhance the visibility of giant sequoias impacted by the effects of fire suppression. These recommendations are designed to be implemented into specific burn plans.

METHODOLOGY: PROCESS MODEL

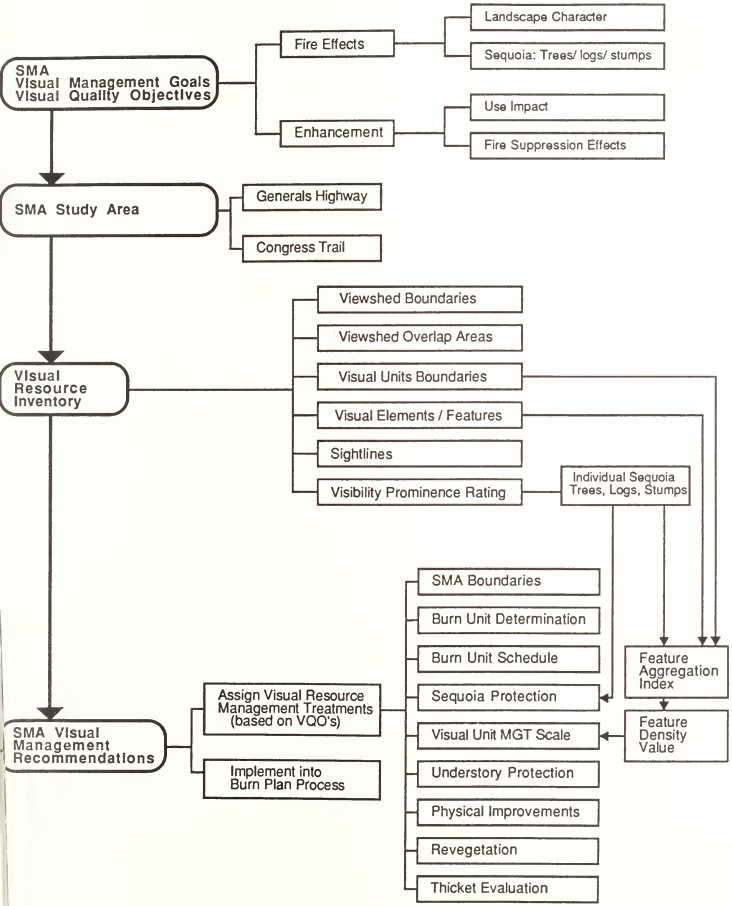

Figure 3: SMA Visual Resources Planning

SMA Visual Management Goals and Visual Quality Objectives

Overview

Fire management planning in SMA's requires the development of clear goals and specific objectives as a critical step in the prescribed fire planning process, as noted by Fischer (1983). The goals and objectives are the only available means to evaluate the effectiveness of management actions. Goals ought to be broad in scope and achievable through objectives that address more specific issues within each goal. Defining objectives is the first step toward fulfilling stated goals.

It is recommended that Sequoia National Park adopt visual resource management goals that preserve and enhance, appropriately, the park's visual qualities in an ecologically acceptable manner as mandated in the Christenson Report (1987). Visual quality objectives provide guidelines toward carrying out the visual management goals. The two pertinent topics of concern center around the issues of fire effects on the character of the landscape and on individual giant sequoias, and the issue of enhancement of currently impacted visual resources.

In the SMA's, the range of possible fire effect options vary widely. The best approach is to introduce fire on a gradual spatial and temporal basis to restore the forest to a more natural state. Reducing fuel accumulations is important, however, it is not necessary that this be the immediate objective of an SMA burn. We recommend that small scale burns be designed to maintain, or create visual and ecological diversity over an appropriate time scale. Since the giant sequoias are the primary visual resource in Giant Forest, the most visually prominent trees should receive the greatest protective measures to retain their present visual character. Maintaining high scenic and recreational values in The Giant Forest requires sensitive visual resource planning of fire effects and a strong interpretive program to effectively communicate fire ecology to the public.

It is well known that to exclude fire on very large scales (parkwide) could ultimately hinder the ability of the giant sequoia, a relict species, to survive and perpetuate the resource we enjoy today. Suppression has led to dangerous levels of fuel accumulation and a "vegetative tangle" described in the Leopold Report (1963) as being "depressing, not uplifting." On the other hand, to burn extensive areas in a short time scale could render them visually monocultural experiences of early succession and lack the interesting mosaic of various even aged stands described by Bonnicksen (1975) as characteristic of the giant sequoia-mixed conifer forest ecosystem. Large scale burns, conducted on a short time scale, run the risk of creating a desolate appearing landscape, also being "depressing, not uplifting." Gradual introduction of fire and maintaining a strong sense of visual diversity is a very important component of a successful visual resources management program.

The other major issue concerning visual resources at Sequoia National Park is the enhancement of impacted scenic resources. This is a result from both intensive visitational use and the effects of fire suppression. Use impact (loving the park too much) has created increased erosion and compaction around the bases of the giant sequoias consequently decreasing duff cover and exposing roots. Fire suppression has altered the basic forest structure forming a "vegetative tangle" the worst of which has allowed whitewood thickets to grow unchecked by natural process. In addition to the fuel load problem, these "overrepresented aggregation types" (Bonnicksen 1983) have grown around the giant sequoias blocking valuable visual resources. Measures to mitigate these effects would enhance the overall experience of visitation.

Fire Effects: Landscape Character

The dynamic appearance of landscape character is one of the major goals for desired fire effects within the SMA's. The vital aspects of this goal are rooted in the spatial and temporal arrangements of burns relative to

one another. The juxtaposition of prescribed burns can greatly enhance or detract from the visual diversity of the forest. The goal should not be to create large scale SMA experiences of an early successional stage, rather, management burns should concentrate on maintaining, or creating, successional diversity throughout the forest. Objectives to accomplish successional and visual diversity include small scale burns, random juxtaposition of burns (variety of burn unit contrasts), selected retention of foreground understory vegetation, and limiting the number of burn units treated each year. Variation in future burn unit boundaries will also help maintain an ecologically and visually diverse park environment.

Generally, the SMA planned prescribed burns should be small scale. More specifically, the planned burn units ought to be small relative to the mode of travel within a particular area. "Experiential residence time" is the amount of time a visitor spends experiencing a given SMA along a specified route. Walking and hiking have high residence times as compared to automobile travel having low residence times. As residence times increase, the size of the burn units should decrease. This principle will maintain visual diversity in terms of visual contrasts between burn units.

Limited research exists on the nature and extent of burn sizes in the sequoia- mixed conifer ecosystem. Kilgore and Taylor (1979) found that fires in the Redwood Mountain Grove area were small in size and generally confined to a single slope or drainage. They also report that fires ranged in size between 0.001 ha (a spot burn) to 16 ha (~40 acres). In the same study area, Harvey et al. (1980) confirm the small nature of these burns, suggesting they were about 10 ha (~25 acres). It should be noted, however, that extrapolating data from one site to another is not an entirely accurate guide for management. Unfortunately, specific fire history data for Giant Forest does not exist, as yet, and thus presents a problem for reconstructing a naturalistic fire regime in this area. Despite this, a small scale fire size in the SMA's is necessary to maintain an ecologically and visually diverse environment.

The timing of the small scale burns is especially important. We recommend that determination of the arrangement, or juxtaposition, of burn unit contrasts be done using a random digits table to establish a long

range schedule. The number of burns conducted each year should be restricted until more specific fire history records are collected for site specific areas. The schedule should be continually modified and revised as more accurate scientific research of fire history in Giant Forest is conducted.

To increase visual diversity and maintain a sense of continuity along travel corridors, burn unit boundaries should span across roads and trails in some areas and remain adjacent to them in others. If roads and trails are always used as boundaries, one side will always look different than the other. This could lead to a confused perception of the forest to some visitors. Extended long range plans, or areas in need of a second prescribed burn, must include planned variation from the boundaries of the first prescribed burn. It is not recommended that the same boundaries be used for future burns. The return of fire should also be variable, both spatially and temporally. Variation is another very important aspect of visual and ecological diversity, as pointed out in the Christensen Report (1987).

Understory vegetation in the SMA's play a key role in forest ecosystem aesthetics. These groups of plants provide a visual focus, diversity of elements, and demonstrate essential "guides of scale" between visitors (human scale) and the large scale giant sequoias and older whitewoods (Figure 4). Some good examples in Giant Forest are the native Dogwoods (Cornus nuttallii) and Sierra chinquapin (Castanopus sempervirens) and Greenleaf manzanita (Arctostaphylos patula). Although some resprout after a fire, their rate of growth is slow. Their visual qualities and interpretive qualities are diminished for many years.

Figure 4: Understory vegetation acts as an intermediate scale between visitors and giant sequoias.

It is recommended that several "pockets" of mature understory vegetation groupings be retained in each burn unit within the SMA's. The preserved trees, shrubs, and groundcovers can act as seedbearing specimens to aid in promoting regeneration. These pockets could be selected according to micro-boundary determinants, such as small rock outcrops supplemented with fire lines, and excluded from spot burning during the burn. Harvey and others (1980) have conducted some research on fire effects on understory vegetation, but lacks a sufficiently long term evaluation. More scientific research and monitoring of understory regeneration is needed in Giant Forest. Until then, a conservative approach to burning understory vegetation adjacent to roads and trails should be implemented. The conservation of these plant groupings is vital toward maintaining a visually diverse forest ecosystem.

Treatments of designated SMA burn units should be "cooler" prescriptions as noted in the Grant Tree SMA plan. Taylor and Daniel (1983) confirm that fire intensity correlates with scenic quality and recreational acceptability in ponderosa pine forests. They found that in comparison to unburned areas, low intensity fires produced improved scenic quality ratings after 3-5 years, but that high intensity fires "seriously declined" in scenic quality ratings after the same time period.

Additional research is also needed on the effects of fire suppression. We recommend that several areas of Giant Forest be set aside and excluded from natural and prescribed fire. These control areas should represent a variety of slopes, aspects, and visited regions of the park. Beyond research, these areas could also be used for interpretive purposes.

Creating a diverse mosaic of burn treatments offers an excellent interpretive opportunity to display the various successional stages of the giant sequoia- mixed conifer forest ecosystem to the public (Figure 5). This goal allows visitors to experience and appreciate the regeneration of past burns, the effects of recent burns, and unburned areas in relatively short travelling distances. Bacon and Twombly (1979) demonstrated this concept for the management of ponderosa pine along highway viewshed corridors. Applying this technique would maintain visual diversity and increase visual penetration into the forest.

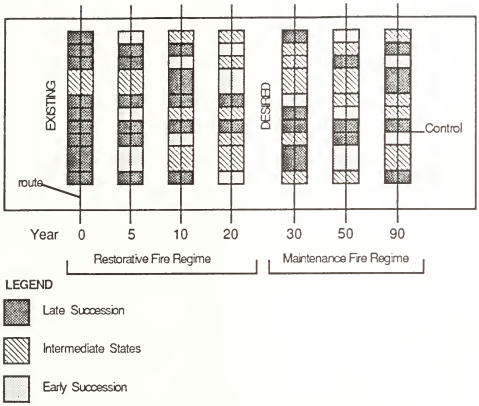

Figure 5 : Concept diagram of existing and desired forest character along SMA roads and trails.

Efforts to provide a high value interpretive program are essential to interface the public with the aesthetic implications of fire ecology in Giant Forest SMA's. Visitor center exhibits and guided tours will help engender an understanding and appreciation of the dynamic process of forest succession. Roadside and trailside interpretive displays in appropriate locations, with strong graphics can contribute to the accomplishment of this objective. The Hazelwood Nature Trail is an excellent example. Hammit (1979) indicates that the value of interpretive displays located in visually preferred areas can be more rewarding and more likely remembered. Proper placement of displays in the environment appear to aid in the memory process of park visitors.

Figure 6: Interpretive display at the General Sherman Tree Parking area.

It is recommended that prescribed fire be used to manage the SMA's until all of Giant Forest has been restored to more natural conditions. However, a completely natural fire regime is probably not possible to reestablish due to the concentration of human activity in these areas. Issues in conflict with a natural fire regime are public health, safety, liability, and the physical disturbances of development, such as roads, buildings, and fences. Facilities might be rotated in the future to avoid capital investment loss and safety problems while areas are returned to a more naturalistic regime.

A long range plan defining the small scale burns, a timetable for treatments, areas of preservation, and research areas is necessary to achieve desired visual quality objectives. In the case of natural fires in the SMA's (lightning strikes), the fires should be suppressed unless they meet with recommended prescriptions for that particular area. As stated in the Prescribed Fire Management Program (1987), unnatural conditions need not result in unnatural fire effects.

Fire Effects: Individual Giant Sequoia Trees, Logs and Stumps

Visual features in Giant Forest are highlighted by the grandeur and presence of a high density of giant sequoias. As a result of the appreciation this impressive resource receives, the sequoias are rendered unique natural / cultural objects in the landscape. In terms of environmental experience, Hammit (1979) reports that the most remembered scenes by visitors are characterized by visually distinct features. It appears there is a strong correlation between familiarity and preference of scenery. Familiarity was highest in both most preferred and least preferred scenes, indicating that visitors are adversely affected by negative features observed in their landscape experiences. It is recommended that this "imageability" of distinct features, namely the burning around giant sequoias, be a major management goal for visual resources in the SMA's of Sequoia National Park.

Public criticism of the prescribed burns has mostly centered around widespread charring and singeing of the giant sequoia's cinnamon colored bark. This negative aspect of imageability can be mitigated through the development of specific visual quality objectives. The degree of an individual sequoia's visibility from a road or trail will determine its degree of imageability, in terms of visitor memory recall. Therefore, the trees "most seen" should be preserved in a condition most favorable to a visually preferred state. Since the existing condition is currently enjoyed and appreciated by the public, it is safe to assume that maintaining that condition is favorable to a preferred state. This could be interpreted as "scene management", in the sense that a particular state is frozen through time, however, the landscape around the tree is changing dynamically to meet ecological goals.

Nevertheless, protecting all visible trees from fire effects is not desireable. For visitors to gain a sense of appreciation for a full range of fire effects, some of the less visibly prominent trees could provide this opportunity for a diversity of fire effects. To gain better insight and understanding of visitor sensitivity to singeing and charring on highly visible giant sequoias a special study would have to be conducted. Determining site specific thresholds of visual change might help park managers to more effectively manage the visual resources of the park. These thresholds could measure the degree of change a giant sequoia could withstand, minimizing the effects of negative imageability a visitor might experience. This subject could be the topic of future research, if conflicts arise regarding the nature of negative imageability.

Another issue surrounding the fire effects on individual giant sequoias is the concern of structural damage incurred to vulnerable scar damaged trees. Within the SMA's these trees represent a considerable public health, safety and liability issue. For these reasons, a goal to protect these severely damaged trees is recommended. The Sequoia Tree Inventory classifies scar damaged trees into three categories. Trees with less than 25 sq. ft. of scar damage are categorized as S1, trees with 25-100 sq. ft. of scar damage are categorized as S2, and trees with more than 100 sq. ft. of scar damage are categorized as S3. The S3 trees are therefore most susceptible to structural damage. In ecological terms, it is uncertain whether these trees are being subjected to unnatural fuel conditions, thus unnecessarily weakening and prematurely

shortening the life span of these trees. For these reasons (in addition to safety), efforts to minimize the risk of further weakening of the S3 trees are important objectives.

Figure 7: Severe fire damage of an S3 tree.

The last issue regarding protection of individual giant sequoias is the maintenance of visual and cultural values associated with horizontal features in the forest landscape experience. The preservation of a select number of highly visible sequoia logs (in addition to named logs) along trails and roadways is a strongly recommended objective. The interpretive value of these logs stems from the direct "involvement" the public has with these elements. The tactile experience of touching and climbing on these logs can engender a strong appreciation for the grandeur of the giant sequoias. They also demonstrate the dynamic nature of succession in the giant sequoia-mixed conifer ecosystem. Hammit (1979) suggests that prolonged contact with these features increases familiarity and, thus, preferences are likely to be enhanced. It is recommended that a balanced number of strategically located logs, especially the "walk-through" types, be excluded from prescribed burns.

Figure 8: Preservation of select giant sequoia logs is important.

Figure 9: An exposed root crown along the Congress Trail.

Enhancement of Visual Resources

The issues concerning enhancement of visual resources in Sequoia National Park arise from two sources of negative impact. The first is due to the effects of visitational overuse and the lack of facilities to accommodate the volume of use. The second impact is due to the effects of fire supression promoting the growth of whitewood thickets and limiting the visibility of numerous giant sequoias within the viewshed. Goals to alleviate these impacts would enhance the overall experience of the park.

One main objective is to redirect foot traffic in parking areas and on trails. This can be accomplished through the installation of physical improvements such as sidewalks, fencing, and revegetation (using site

specific native species) in the proper locations. Also, more prominent signs would help to direct visitors to their desired destinations and reduce confusion.

Many high visitation areas such as the Congress Trail, General Sherman Tree area, and Hazelwood Nature Trail are suffering from use degradation. Primarily, improper guidance of foot traffic (trampling) in these areas has caused the disintegration of duff and subsequent erosion of surface soil. As a result, dusty or muddy visitor environments with various biological and visual resource problems have been inadvertently created. Problems include erosion around the bases of sequoias exposing fibrous roots (figure 10), erosion and decay of asphalted edges in parking areas and on trails, and a lack of understory vegetative cover due to soil compaction. The goal to correct these situations is to rehabilitate these areas and prevent further degradation.

All SMA trailheads should have map displays with information indicating the trail route and length, and the location of the map site ("you are here"). To alleviate erosion around the bases of giant sequoias, a regular program to import duff, litter, and understory hardwood vegetation to high use areas is recommended. Altogether, these efforts will help to alleviate demanding visitational pressures.

Figure 10: Loving the trees too much: exposed roots of giant sequoia.

Figure 11: Doghair thickets encroaching on the views of giant sequoias.

The second major issue concerning enhancement of visual resources is the extensive ingrowth of whitewood thickets resulting in blocked views of giant sequoias. The sequoias affected by this problem are in potentially highly visible (high value) locations of the SMA viewshed. To increase their visibility would enhance the overall visitor experience and foster greater appreciation. In the absence of regular disturbance cycles, such as fire, a climax species (Abies concolor, or white fir) is capable of outcompeting subclimax species (Sequoiadendron giganteum, or giant sequoia). According to Bonnicksen (1983) these thickets, or "overrepresented aggregation types", are an unnatural ecological result of fire suppression and warrant mechanical removal to restore a more natural structure to the giant sequoia-mixed conifer forest.

Although entirely reconstructing all of Giant Forest in this manner may be infeasible due to expense, it is an idea worthy of trial in the smaller scale SMA planning units. An option to further minimize the cost of thicket removal could be to limit treatment to areas of "overrepresentation" proximate to visually valuable giant sequoias. Also, following prescribed burns the remaining standing dead trees that are pole sized and smaller should be removed from the viewshed. These treatments will fulfill both visual resource objectives and cost effective vegetation management objectives.

As pointed out in the Vegetation Management Plan (for the development zone, 1987), road construction has resulted in numerous dense whitewood thickets forming at the road's edge blocking many vistas. Management policies have been developed for several expansive vistas, but additional policies must be developed for individual enclosed vistas (or views) of the giant sequoias along the SMA viewsheds. These policies could be guided by techniques discussed earlier or those in place for the expansive vistas. A vegetation monitoring program should be established to evaluate the visual encroachment of thickets on an annual basis. The thickets should be mechanically removed according to vegetation management policies.

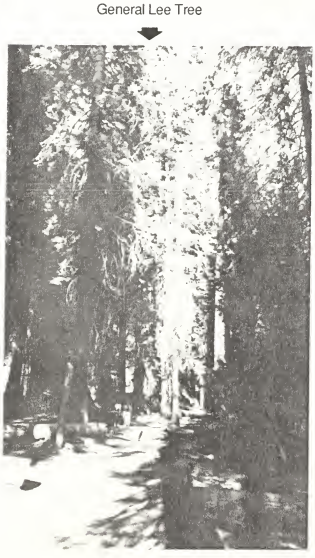

Figure12: Blocked view of the General Lee Tree. (View looking to the east-- from the trail leading to the McKinley Tree.)

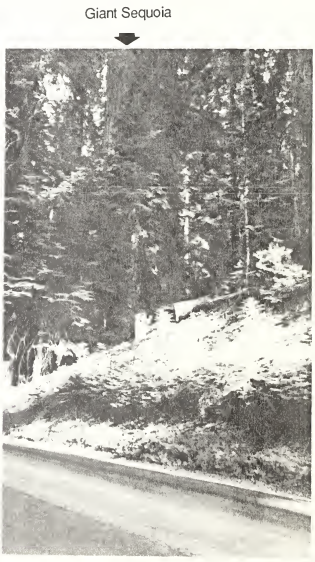

Figure 13: Typical blocked view of giant sequoias along the Generals Highway in Giant Forest. Also, note encroaching thickets next to road's edge.

Visual Resources Inventory

Overview

The Visual Resource Inventory is a descriptive data gathering process that identifies the areas seen, and physically locates visual and perceptual elements within the selected SMA study areas. The visual quality objectives outlined in the previous section determine the specific aspects of visual resources to be inventoried and mapped. It consists of seven parts: viewshed delineation, areas of SMA viewshed overlap, visual unit delineation, identification of special features and visual element subunits, location of sightlines, determination of giant sequoia visibility, and location of whitewood thicket areas.

Viewshed

A viewshed, or visual corridor, is a routed, physically bounded area of landscape, visible to an observer (Litton 1979). A viewshed delineates the dimensions of the "seen" environment in terms of visual penetration. The Giant Forest SMA's primarily contain enclosed views, with only minor extended views of expansive vista-type views. These enclosed views, the primary viewshed, consist of foreground and middleground views. The expansive views take advantage of a distant secondary viewshed containing background features. The terms foreground, middleground, and background refer to the level of discernible detail in a given landscape based on distance. Foregrounds are composed of greater detail than middleground views. In this study, secondary viewsheds have not been mapped because of their limited detail and remoteness of background views.

The viewsheds for the Generals Highway SMA and Congress Trail SMA were mapped onto the Sequoia Tree Inventory Maps at a scale of 1" = 200'. The boundaries were determined on site using a range finder instrument and field checked by indentifying the furthest specific visible tree on the Sequoia Inventory

Maps. The viewshed boundary is formed from a dynamic composition on a continuum of viewing points. The viewing points are representative of a number of observer positions accounting for several viewing orientations (Litton 1973).

Viewshed Overlap

In several areas, the viewsheds of SMA's overlap each other. This can include views that coincide, from a road, such as the Generals Highway, and views from a trail, such as the Congress Trail. Another example is the circular, or loop, nature of the Congress Trail. In the center of this loop, the landscape and trees are viewed from several viewing positions, or angles. These areas of viewshed overlap are important to treat carefully.

Note that only the areas of viewshed overlap are depicted on the Inventory Maps between the Generals Highway and the section of the Congress Trail nearest to the General Sherman Tree. However, the inside portion of the Congress Trail is almost entirely an overlap area.

Visual Units

Once the viewshed has been delineated, it can be subdivided into a series of spatially defined units (or "compartments"). These visual units are defined by Tetlow and Sheppard (1979) as "a portion of the landscape enclosed and limited by topography, bounding an obvserver's field of view. That spatial enclosure enables the viewer to accumulate and form a unified impression of his surroundings." Visual units describe the sequential events of experience along trails and roads. They are useful subdivisions for planning purposes.

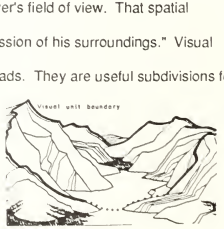

Figure 14: A typical visual unit enclosed by topography. (Reprinted from Tetlow and Sheppard, 1979)

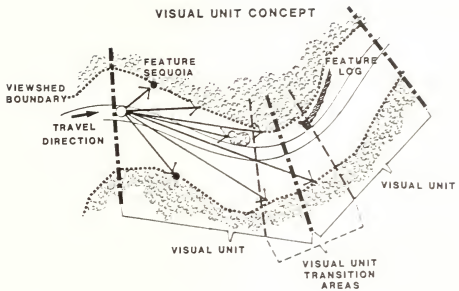

Figure 15: Highway visual unit concept: enclosed by vegetation and route.

Visual units vary in size and length of experience depending on the topography, vegetation, and mode of travel. Along the Generals Highway SMA , the visual units are generally small in size due to the numerous curves in the road and the enclosed nature of the views due to vegetation. When travelling in a car at 25 mph, experience of each highway visual unit is relatively rapid, creating a series of brisk visual impressions. Therefore, experiential "residence time" is low in each of the highway visual units. The Congress Trail visual units are considerably larger because of the nature of the topography and layout of the trail. Walking allows longer residence time in each unit, permitting a visitor's environmental impression to intensify over larger areas.

The relationship between visitation volume and residence time in a visual unit is an indicator of sensitivity to visual change. High volume exposes it to more people, but high residence time subjects it to longer scrutiny and a greater amount of visual detail. Both are of equal importance for planning in SMA's. Thus, despite low residence time in the Generals Highway visual units, the high volume of visitation justifies conservation efforts. The same relationship is true of the Congress Trail, that is, despite slightly lower visitation volume (than the Generals Highway), high residence time in those visual units strongly justifies conservation efforts.

Visual Elements and Features

Within each visual unit are special features and visual element subunits. These represent typical vegetation and landforms seen throughout the viewshed such as dogwoods and rock outcrops. Unique or special features are predominantly mature giant sequoia trees and logs. The combination of these special features and visual elements are what compose the primary visual environment in Sequoia National Park.

Figure 16: Dogwoods are strong visual elements along trails.

The Sequoia Tree Inventory Maps locate all known giant sequoia trees, logs and areas of reproduction. Visual elements other than sequoias have been added to these maps in their approximate locations. Mature understory and groundcover stands of chinquapin, ceanothus, manzanita, dogwoods, ferns and lupines interspersed with mixed conifers have been mapped adjacent to roadways and trails. They play a major role in providing visual diversity to park visitors in conjunction with feature elements. Hence, it is important to conserve as many of these special features and visual elements as possible to maintain a visually diverse environment and still achieve ecological goals.

Sightlines

The purpose of sightlines is to indicate viewer position, direction of view, and distance seen within the viewshed. These are especially important indicators for long distance views or unusual views. Sightlines extending through the primary viewshed boundary show points where extended (secondary) views exist. If vista clearing is an objective in the future, these points would be the best possible locations for consideration of this type.

Figure 17: A brief distant view from the Generals Highway (toward Clover Creek).

Visibility Prominence Rating: Individual Sequoia Tree / Log / Stump

A significant visual resource concern outlined in the visual quality objectives is protecting visually prominent giant sequoia features from extensive singeing and charring of the bark. Hammit (1979) found that park visitors most remembered distinct visual features, both positive areas and negative ones. Since the giant sequoias are distinct visual features in Sequoia National Park, it follows that the select, but relatively few, sequoias actually seen by visitors, along trails and roadways, will forge their memorable

impressions. The sequoias most likely to form the greatest impressions through imagery are the most visually prominent, or dominant, trees. Thus, a visibility prominence rating was developed to rank individual sequoia trees, logs, and stumps in terms of their relative visibility, or "imageability," from high use trails and roads. This information will enhance park managers' pre-fire planning capabilities to limit possible visual impacts.

The four levels of classification for visibility prominence are: focal points (very high visibility), high, medium, and low visibility. They are based on varying degrees of the factors distance, obscurity, and the dynamics of movement (viewing points). Usually a combination of two or all three will determine a sequoia's level of visibility. Table 1 and Figures 18 and 19 illustrate the guidelines for classification.

Focal points are the highest visually prominent level of the rating scheme. They are located in areas of low obscurity and typically close in distance (within 100') to the observer. However, focal points can also exist at a great distance (over 100') if a view is wide open, such as over a meadow, and garners enough widespread attention. High visibility situations commonly involve low obscurity and close distance, but fewer viewing points than focal points. Characteristic of medium visibility is moderate obscurity, varying in distance and viewing points. Typical low visibility situations are high obscurity, few viewing points, and increased distance. The remaining visibility prominence rating situations are listed in Table 1.

Figure 18: Generalized illustration of visibility prominence:
No. 1 = Focal Point
No. 2 = High
No. 3 = Medium
No. 4 = Low

Visibility Prominence Rating

obscurity / viewing points

	low obscurity / many v.p.	low obscurity / few v.p.	moderate / many obscurity / v.p.	moderate / few obscurity / v.p.	high obscurity / few v.p.
close (under 100')	Focal Point	High	High/ Medium	Medium/ Low	Low
far (over 100')	FP/ High	High/ Medium	Medium	Low	Low

Table 1: Visibility Prominence Rating Criteria Table

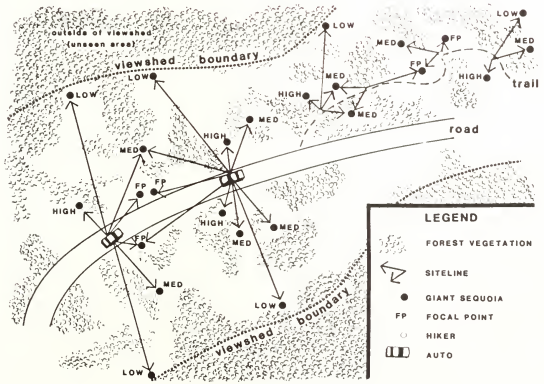

Figure 19: Conceptual diagramatic examples of giant sequoia feature visibility prominence ratings.

Visual Resources Management Treatment Recommendations

Overview

The SMA Landscape Management Plan (Appendix D) primarily identifies proposed burn units, planning units, past prescribed burns, burn exclusion areas and whitewood thicket problem areas. The burn units have been designed in accordance with the visual quality objectives to maintain a diverse visual character within the SMA study areas. Sections requiring additional research studies are classified as "planning units" and "SMA planning units" on the plan. Small intermittent areas of cultural value to be excluded from fire management are also indicated on the plan. Finally, whitewood thickets that block views of giant sequoias, and thickets that present future visual resource problems are identified for treatment.

Measures to protect visually prominent giant sequoias are based upon the visual prominence ratings. These are shown on the Visual Resource Inventory maps (Appendix C). The four categories of protection are scorch exclusion, minimal scorch, limited scorch, and unsuppressed scorch.

Protection of visual elements is meant to intentionally preserve small pockets of mature understory vegetation. These, too, are identified on the Visual Resource Inventory maps. A small number of giant sequoia logs have been selected for preservation as well. They are indicated on the SMA Landscape Management Plan.

An analysis of visual features within the visual units provides a guide for resource managers to evaluate planning and manpower requirements for planned burn units to achieve visual quality objectives. The visual features consist of giant sequoia trees, logs, stumps and special understory vegetation areas. A feature "density" value is generated for each visual unit and broken down into a management intensity scale.

Finally, an aesthetics monitoring program is strongly recommended to evaluate applied techniques to meet visual quality objectives. It could be incorporated into existing photographic monitoring programs.

Planning Units

The SMA Landscape Management Plan identifies several areas adjacent to the Generals Highway that require additional research. They are labelled as planning units and SMA planning units. The planning units are areas that are currently developed, including buildings and roads, and will undergo relocation procedures in the near future. These areas will need environmental mitigation plans, such as "naturalization" and revegetation plans, when development is removed. The SMA planning units are areas that are currently designated as SMA's. These areas will require additional visual resource assessments before future prescribed burn units can be planned. Also included on the plan are past prescribed burn unit areas.

The planning units, SMA's, and past burns on the plan (in Appendix D) are identified as follows:

AA	Kaweah Unit
BB	Village Unit
CC	Deer Creek Unit
DD	Hazelwood SMA Unit
EE	Round Meadow SMA Unit
FF	Pinewood Unit
GG	Rimrock Unit (1985)
HH	Gateway Unit (pocket exclusion area)
JJ	Sherman Tree SMA Unit
KK	Sherman Unit (1980)
LL	Wolverton Unit (proposed control)
MM	Hercules Unit (1982)

Burn Unit Determination and Schedule

Burn units were designed based on the Fire Effects Guidelines for SMA Landscape Character. Trail units are considerably smaller in size than highway units, because of the nature of experiential residence times within the visual units. Some burn units' boundaries include both sides of the Generals Highway, however, few burn units along the Congress Trail include both sides. Refer to the SMA Landscape Management Plan map(s) for specific proposed burn unit locations (Appendix D).

Natural boundaries for the SMA burn units are preferred to man-made boundaries. It is recognized that it is essential to use roads and trails in many cases due to economics, however, alternatives to their use should be explored. The following have been utilized to determine burn unit boundaries:

Streams / Drainages	Roads
Ridges	Old Fire Lines
Meadows	Rock Outcrops
Trails	New Fire Lines

Timing of the burn units is a very important aspect of this plan. The burn units have been designed to restore the Congress Trail and part of the Generals Highway (refer to maps) to more natural conditions over a period of 17 years. This can be achieved by treating one burn unit per year. A random digits table determined the burn schedule to create a variety of burn unit contrasts (refer to Table 2).

Following the restoration burn regime, a long term maintenance fire regime should be formulated for Giant Forest. It is recommended that this regime be based on area specific fire history research. For example, in the Redwood Mountain area, Kilgore and Taylor (1979) found fire return intervals on west-facing slopes to be about every 9 years, and on east-facing slopes to be about every 16 years. They also report mean fire-free intervals of 5 years on dry ridges of ponderosa pine and 15-18 years in moist sites of white fir. The average maximum fire-free interval was found to be 14-28 years. Nonetheless, their data also reveals that

Table 2: LANDSCAPE MANAGEMENT PLAN BURN SCHEDULE

Proposed Burn Units		Burn Date	Visual Unit Management Scale
A	Alta Unit	2002	3,2
B	East Pinewood Unit	1992	1,1,1,1
C	Lower Rimrock Unit	1998	1,1,3,3,1
D	Lower Sherman Creek Unit	1997	1,3
E	Cloister Unit	1989	3,2,2
F	Upper Congress Unit	2000	4,1
G	Upper Sherman Unit	1990	1,4,2
H	Upper Congress Trail Bridge Unit	2003	4
J	Lower Congress Trail Bridge Unit	1988	4,4
K	Lower Congress 1 Unit	2004	4
L	Lower Congress 2 Unit	1993	4
M	McKinley Unit	1996	4
N	General Lee Unit	1994	4
O	Upper President Unit	1999	4
P	Chief Sequoyah Unit	2001	4
Q	Lower President Unit	1995	4
R	Senate Unit	1991	4
I.	Tharp's Creek Unit	1987	N/A (non-SMA)
II.	Tharp's Creek Unit	1988	N/A
III.	Tharp's Creek Unit	1989	N/A
IV.	Tharp's Creek Unit	1990	N/A

some clusters of giant sequoias have escaped fire for up to 39 years.

Based on this data, a relatively accurate maintenance fire regime could be developed for the Redwood Mountain area, though it would be less accurate to apply this data to Giant Forest. Once specific fire history data is available for Giant Forest, it could be combined with a detailed slope analysis (pending the release of the 7 1/2' quadrangle maps of the park) for a more accurate maintenance fire regime.

The burn units in a maintenance fire regime should be varied as much as possible from previous prescribed burns. It is not recommended that the same burn unit boundaries be used more than once if they are unnatural boundaries (trails or roads). Using the same boundaries runs an ecological risk of creating a static mosaic of forest succession. Maintenance burn regime units should concentrate more on creating new fire lines that travel across trails instead of being bound by them. It is recommended that the timing of these burn units also be variable.

Whitewood Thicket Problem Areas

The visual quality objectives regarding visual enhancement specify the mechanical removal of extensive ingrowth of whitewood thickets throughout the viewshed of the SMA's. These thickets are blocking numerous, potentially valuable views of giant sequoias and are considered "unnatural" growths as a result of fire suppression. The thickets have been mapped on the SMA Landscape Management Plan in two ways (Appendix D). Existing blocked views (Figures 20-22) are indicated by cross hatched lines, and visually encroaching thickets (Figures 11 and 23) are shown as grouped straight lines. The encroaching thickets do not present a problem at the moment this report has been prepared, however, they will cause visual penetration problems in the future. They should be monitored photographically and evaluated for mechanical removal on an annual basis. It is recommended that this be incorporated into the Vegetation Management Plan (for the development zone).

Figure 20: A blocked roadside view of a group of giant sequoias.

Figure 21. A blocked trailside view of a giant sequoia.

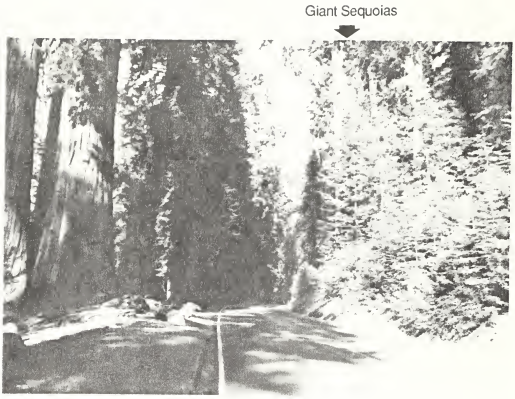

Figure 22: A thicket (right side) blocks the views of giant sequoias along the Generals Highway.

Figure 23: Small, but dense, thickets at the road's edge require annual evaluation for selective removal.

Figure 24: The year following a prescribed burn, dead saplings should be removed from the foreground views of roads and trails.

Figure 25: Whitewoods removed from around the base of a giant sequoia can be flush cut the following year.

Figure 26: Preservation of selective logs (fallen sequoias) is important to the experience and character of the trail.

Figure 27: Pre-fire crew meetings are essential to explain burn objectives and to achieve desireable results.

Giant Sequoia Protection

As discussed in the visual quality objectives, it is the "imageability", or mental imagery, of the giant sequoias that is vital toward forming visitor impressions. The visibly prominent trees are most apt to form these impressions. Therefore measures to protect these trees are important for conserving valuable visual resources. The four categories of giant sequoia protection are: scorch exclusion, minimal scorch, limited scorch, and unsuppressed scorch (Figure 28, next page). Some techniques to execute these measures are listed in Appendix K of the Prescribed Fire Management Program 1987. It is recommended that this list be continually updated with new procedures of successful firing techniques.

To properly understand the descriptions of the four categories of giant sequoia protection, the definitions of singeing and charring are necessary. In this report, "singeing" is bark ignition to a depth under one half an inch (<1/2"). "Charring" is considered bark ignition to a depth over one half an inch (>1/2").

1. Scorch Exclusion

A. Fire should not be allowed to come within ten feet (10') of the bases of designated trees, logs, or stumps.

B. Radiant heat sources (hot spots) should be reduced in pre-burn preparation, or suppressed in intensity during a fire if giant sequoia features are potentially threatened.

C. Applies to:

- All named trees, logs, and stumps (Well-Known Objects).
- Selective groups of focal point trees, logs, and stumps.
- Severely scar damaged trees (selective S3).
- Selective pockets of understory vegetation.

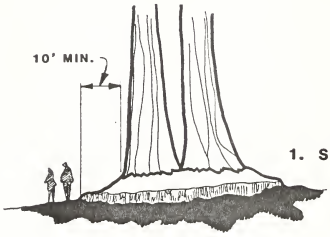

Figure 28: Illustrative examples of desired fire effects.

2. Minimal Scorch

A. Bark ignition *charring* should occur no higher than the duff layer on the visible portions of the tree.

B. Bark ignition *singeing* should occur no higher than the duff layer on the visible portions of the tree. Singeing should be suppressed immediately upon detection.

C. Proximate radiant heat sources should be reduced in intensity in pre-burn preparation or suppressed during a burn if it poses a threat (smoking bark usually indicates a problem).

D. Applies to all:

- Focal point trees.
- High visibility trees.
- S3 trees

3. Limited Scorch

A. Bark ignition *charring* should be contained below the duff layer on the visible portions of the tree.

B. Bark ignition *singeing* should be less than 12 ft. in height on the visible portions of the tree. Suppression of singeing is necessary if it continues burning above 12 ft.

C. Radiant heat sources should be monitored.

D. Applies to all:

- Medium visibility trees.

4. Unsuppressed Scorch

A. Bark ignition *charring* should be monitored.

B. Resultant bark ignition *singeing* should not be suppressed.

C. Applies to all:

- Low visibility trees.

Understory Protection

Retention of small pockets of understory vegetation is recommended in the SMA burn units. They offer opportunities to maintain visual diversity and increase the rate of regeneration by providing some "seed trees." Often, these pockets grow among rock outcrops and might have escaped fire in a more natural ecosystem. Natural burns undoubtedly missed several areas creating a mosaic of vegetation characteristic of the sequoia-mixed conifer ecosystem. The preferred pockets for retention would be growing among rocks that could be supplemented with fire lines to ensure their survival.

The giant sequoia protection measure, scorch exclusion, provides some guidelines for understory protection. Areas and specific locations of understory vegetation recommended for protection are mapped on the Visual Resource Inventory maps (Appendix C). Prior to a burn, these maps could be consulted for the presence of desired understory vegetation.

Figure 29: Rocks around groups of understory plants make ideal "pockets" for preservation.

Visual Unit Feature Analysis

The goal behind the feature analysis is to provide park managers with a tool to assess the relative difficulty of achieving the desired visual quality objectives. The Management Scale will give an indication of the pre-burn planning intensity and (burn) manpower requirements that would be necessary. Formulation of the Visual Unit Management Scale consists of five steps: a tabulation of features per visual unit, Feature Aggregation Index calculations, visual unit square acreage determination, Feature Density Value calculations and, finally, a breakdown of those values into the Visual Unit Management Scale.

The first step is simply a tabulation of the number of focal points, high and medium visibility giant sequoias, and understory pocket areas, within each visual unit (see Table 3). Low visibility sequoias are excluded due to their minimal value in the primary viewshed.

Step two is the Feature Aggregation Index (FAI). It is a "weighted" point value system to give a cumulative, relative score to each visual unit. The Feature Aggregation Index (FAI) measures the relative magnitude of outstanding visual features in each visual unit. Each feature is assigned a point value as follows:

focal points = 4 points each

high visibility = 3 points each

medium visibility = 2 points each

understory pocket areas = 1 point each

The quantity (N) of each type of feature is then multiplied by its respective point value and totalled. The formula is:

	Focal Points	High Visibility	Medium Visibility	Understory Areas
Feature Aggregation Index =	[4(N)]	+ [3(N)]	+ [2(N)]	+ [1(N)]

The FAI is then divided by the square acreage of each visual unit to yield a Feature Density Value (FDV):

$$\text{Feature Density Value} = \frac{\text{Feature Aggregation Index}}{\text{Square Acres of Each Visual Unit}}$$

This is an important number, because it is an indicator of the feature magnitude per unit area. The range of these FDV's are then broken down to furnish a management scale indicative of the different management intensities required for each visual unit area. The range of FDV's and the subsequent Visual Unit Management Scale ratings are shown as follows:

Visual Unit Management Scale				Management Intensity
1	=	0 - 3	FDV	: low
2	=	4 - 7	FDV	: medium / low
3	=	8 - 11	FDV	: medium / high
4	=	> 12	FDV	: high

See Table 3 for a list of Visual Unit Management Scale ratings for each visual unit. The purpose of the Visual Unit Management Scale is simply to allow park resource managers to plan visual resources more effectively. To achieve the desired visual quality objectives, many useful tools are necessary. However, nothing can replace the most valuable tool of experience.

Table 3:

SMA Visual Unit #	Focal Point Trees	High Visibility Trees	Medium Visibility Trees	Understory Pockets	Feature Aggregation Index	Square Acres	Feature Density Value	Visual Unit Management Scale
Generals Highway								
1	10	8	5	4	78	12.5	6.2	2
2	9	7	5	0	67	6.4	10.4	3
3	47	10	17	0	252	25.4	9.9	3
4	29	34	13	6	250	15.4	16.2	4
5	9	2	3	0	48	6.6	7.3	3
6	4	3	8	4	49	8.3	5.9	2
7	4	0	0	5	21	9.2	2.3	1
8	0	1	2	0	7	7.3	0.9	1
9	0	0	1	4	6	8.6	0.7	1
10	0	1	0	11	14	6.1	2.3	1
11	4	5	3	5	42	4.2	10.1	3
12	13	1	5	1	66	8.4	7.9	3
13	2	0	4	3	19	6.2	3.1	1
14	5	4	4	2	42	4.4	9.5	3
15	1	0	2	2	14	3.1	4.5	2
16	1	1	2	1	12	2.4	5.0	2
17	4	3	3	1	32	9.0	3.6	1
18	13	8	6	4	92	6.7	13.8	4
19	6	1	5	8	45	6.8	6.6	2
Congress Trail								
1	20	9	1	6	115	11.0	10.5	3
2	45	37	17	10	335	22.7	14.8	4
3	8	15	2	4	85	6.4	13.2	4
4	16	3	7	11	98	7.9	12.4	4
5	35	33	17	6	279	16.4	17.0	4
6	54	7	9	5	297	11.2	26.5	4
7	38	13	12	8	223	12.8	17.4	4

Monitoring of Aesthetics in the SMA's

To evaluate the effectiveness of management techniques, a monitoring program is recommended. The two areas of concern are the fire effects on individual giant sequoia features, and the encroachment of whitewood thickets on valuable views of giant sequoias. Both are important issues worthy of photographic monitoring programs.

The issue of fire effects could be incorporated into the existing photographic program being conducted for prescribed burns. The whitewood thicket problem could be incorporated into the Vegetation Management Program. Documentation of management efforts is essential to demonstrate propitious accomplishments.

SMA's in Sequoia National Park

It is recommended that the current list of Special Management Areas be retained and studied before treating these areas with prescribed fire. SMA's must be planned wholistically, that is, adjacent areas (SMA's) have to be studied collectively to prepare appropriate visual resource recommendations. For example, the Generals Highway overlaps on several other SMA's, such as Round Meadow, Hazelwood Nature Trail and Crescent Meadow Road. These areas should be given high priority to study in the near future. Additionally, it is recommended that the Generals Highway be studied and evaluated from Commissary Curve (Crystal Cave Road entrance) to Giant Forest Village.

General Sherman Tree Area

The visual quality objectives also specify that impacted visual resources be rehabilitated. The General Sherman Tree parking lot and walkway areas are highly degraded and need prompt revitalization (Figures 30-32). The accompanying diagram (Figure 33) of the aforementioned areas identify specific physical improvement recommendations needed to redirect foot traffic and enhance the visual environment. Revegetation behind some of the fences will greatly improve the appearance of this heavily visited part of the park. The world's largest living entity deserves a comparable receiving area.

Figure 30: A lack of walkways to direct foot traffic has resulted in a "trampled" appearing environment. Signs are also needed to reduce confusion in this area.

Figure 31: The impact in the parking area has also resulted in dusty or muddy visitor environments. The asphalt edging needs replacement due to decay.

Figure 32: From the parking area, the sign to the Congress Trail is hidden by a trash can. A more prominent display is needed at this junction to direct visitors to the General Sherman Tree and Congress Trail. In addition, walkways are needed adjacent to the entry road and around the parking lot.

GENERAL SHERMAN TREE Parking Area

Figure 33:
Physical Improvements Recommendations

LEGEND

- Existing Walkway
- Proposed Walkway
- Existing Fences
- Proposed Fences
- Area of Revegetation
- Existing Signs
- Proposed Signs

To Leaning Tree

Proposed Trailhead Map Display Area

To Sherman Tree

To Sherman Tree

Mass of Boulders

Mass of Boulders

Mass of Boulders

ROCK LEDGE

To Bridge

Display Area

Entry Road

Parking Lot

Mass of Boulders

Mass of Boulders

Generals Highway

N

0 10 25 50 100

Scale in Feet

GENERAL SHERMAN TREE Parking Area

Figure 33:
Physical Improvements Recommendations

Tharp's Creek Burn Unit

The Trail of the Sequoias lies adjacent to the Congress Trail SMA. In many areas it contains a very high density of giant sequoia features. For these reasons, it is recommended that the last section of the Tharp's Creek Burn Unit be subdivided into three separate burns, conducted over three years (refer to Table 2, page 33, and the Landscape Management Plan maps, Appendix D).

By performing the burns in this manner, the landscape character will remain more diverse. The smaller scale burns also allow fire crews to better control undesired fire effects on the giant sequoias. Additionally, it is reommended that techniques to protect trailside (highly visible) giant sequoias be tested in these burn units before using them in the designated SMA burn units.

Figure 34: It is recommended that this fallen giant sequoia (K-20, NW 1/4 Sec. 5) be excluded from the burn for both cultural value and the potential radiant heat threat to nearby living giant sequoias.

Conclusion

The detailed data base developed for the Prescribed Fire Management Program will provide park resource managers with tools to achieve the desired fire effects for the landscape and giant sequoia visual resources. The primary objectives are to maintain a diverse landscape appearance and retain the present visual conditions of the giant sequoias most visibly prominent. Enhancement opportunities strive to increase the appreciation of visitors' experiences in the park.

Creating favorable conditions for the perpetuation of the giant sequoia (Sequoiadendron giganteum) is supported. The current management policies using prescribed fire management is the best approach possible. However, the presence of "unnaturally" heavy fuel loads need not result in unnatural ecological or visual effects, as indicated in the Christensen Report (1987). This report has strived to present ecologically acceptable alternatives to address the problem of human aesthetics and the role of fire in the giant sequoia-mixed conifer ecosystem. They need not conflict.

Perhaps the most fundamental problem is not ecological or aesthetic, but rather a budgetary issue. Funding is a critical aspect to the success of any park resource program. Prescribed fire management is a relatively young and minimally researched field in the National Park Service. Our understanding of natural processes continues to expand only because funding for essential research is made available. It is strongly recommended that the Prescribed Fire Management Program be given permanent status and increased long-term funding to meet vitally important research and management needs. Prescribed burns in the SMA's will require more time for planning and labor intensive site preparation. Success can be achieved in fringe benefit areas such as visual resources only if the means to do so are made available.

The positive attitude and analytical approach of the Natural Resources Management Division is reassuring that state-of-the-art management practices are sought out and applied. It is encouraged that management goals, objectives and methods be continuously reevaluated for maximum benefit and effectiveness.

Fire Effects Guidelines: SMA Landscape Character

Goals	Objectives	Treatments
1. Gradual spatial and temporal introduction of a restorative fire regime to create a variety of successional stages in the forest (diverse visual character).	**1.1** Small scale burn units. **1.2** Size of burn units should vary relative to visitor mode of travel. **1.3** Retain mature groupings of understory plants. **1.4** Random juxtaposition of burn unit contrasts. **1.5** Limit the number of burns treated each year. **1.6** Fire history data should determine a restorative burn regime.	**1.1a**: Burns should range in size between 0.001 ha (spot burn) to 16 ha (~25ac) within the viewshed. **1.1b**: Predetermine all burn units for entire SMA's. **1.2a**: Larger burn units along roads and smaller units along trails. **1.2b**: Burn unit boundaries should cross roads and trails in some areas. **1.3a**: Selectively exclude mature "pockets" of understory plants adjacent to roads and trails. **1.3b**: Plan maximum use of micro-boundary determinants, i.e. rock outcrops, in conjunction with fire lines. **1.3c**: Avoid spot burning understory vegetation. **1.4a**: Sequence the burn units by random digits to determine burn unit contrasts. **1.5a**: Treat one burn unit per year. **1.6a**: Restorative burn regime of 15-18 years in SMA's. **1.6b**: Use "cooler" prescriptions in SMA's.
2. Establish long term plans for a maintenance prescribed fire regime.	**2.1** Continue fire history research in Giant Forest. **2.2** Establish research plots to study the effects of various fire regimes. **2.3** Maintenance fire regime strong in variation of spatial and temporal qualities.	**2.1a**: Research is needed in the areas of fire return intervals (frequency), fire intensity, extent (sizes)of fires, and long term monitoring understory vegetation regeneration in the Giant Forest area. **2.2a**: Establish control areas to study the effects of fire suppression. **2.2b**: Selected controls should be variable in slope, aspect and visited areas of Giant Forest. **2.3a**: Avoid using the same boundaries for future burn units. **2.3b**: Fire return intervals of specific areas should be variable within a range of years indicative of presuppression activity (between 9-39 years, depending on slope and aspect)

Goals	Objectives	Treatments
3. Intensify efforts to educate the public about fire ecology through high value interpretation programs.	**3.1** Exhibit various stages of forest succession in short distances along trails and roadways. **3.2** Control areas will show the effects of fire suppression.	**3.1a**: Develop interpreter, or self-guided tours using maps and descriptive text to show the various stages of forest succession following fires. **3.1b**: Install roadside and trailside interpretive displays for general information and / or to correspond to guided tours. **3.2a**: Incorporate control areas in SMA's to allow easy public access (to unburned areas).
Fire Effects Guidelines: Individual Sequoia Trees, Logs and Stumps		
4. Prevent negative "imageability" of singeing and charring.	**4.1** Preserve the present condition of the giant sequoias most seen in the viewshed. **4.2** Provide a full range of fire effects.	**4.1a**: Protect named trees, logs and stumps (well-known objects) by applying scorch exclusion techniques. **4.1b**: Protect focal point and high visibility trees and stumps by applying minimal scorch techniques. **4.2a**: Allow limited scorch on medium visibility trees. **4.2b**: Allow unsupressed scorching on low visibility trees.
5. Manage certain sections of the SMA's intensively.	**5.1** Use the *Visual Unit Management Scale* to identify sections of critical and subcritical importance for preburn planning and manpower requirements to control undesired fire effects.	**5.1a**: A rating of "4" indicates a very high density of sensitive giant sequoia features and requires appropriate planning and manpower. **5.1b**: A rating of "3" indicates a high density. **5.1c**: A rating of "1" or "2" indicates moderate or low density.
6. Limit "structural" fire damage to vulnerable giant sequoia trees.	**6.1** Control ecologically significant effects of weakening on existing scar damaged trees.	**6.1a**: Minimize ignition of S3 (over 100 sq. ft.) scar damaged trees. **6.1b**: Monitor ignition of S1 and S2 scar damaged trees, especially if fluted bark is present. **6.1c**: Remove heavy fuel loads from around the bases of the trees.

Goals	Objectives	Treatments
7. Maintain diverse character of horizontal elements along trails and roadways.	**7.1** Preserve logs of cultural interest for interpretative and visual value.	**7.1a**: Protect selected focal point and high visibility logs with fire lines and suppress fire that jumps these lines. **7.1b**: Protected logs should be spaced along trails and roads using the visual units as an experiential guide.
8. Establish a continuing program to evaluate management effectiveness for visual resources.	**8.1** Incorporate an aesthetics monitoring program.	**8.1a**: Photograph focal point and high visibility trees, logs and stumps before and after burns. **8.1b**: Evaluate burn techniques relative to fire effects.
Enhancement Guidelines for Visual Resources		
9. Rehabilitate areas impacted by visitor use and prevent further degredation.	**9.1** Redirect foot traffic in parking areas and on trails. **9.2** Reduce trampling effects around giant sequoias in high use areas.	**9.1a**: Install physical improvements, i.e. fences and sidewalks in the General Sherman Tree parking lot. **9.1b**: Revegetate areas behind fences in the parking area with low growing, native (area specific) species. **9.1c**: Install additional and more prominent signs in high use areas. **9.2a**: Import duff and litter to place around the bases of affected giant sequoias, if fences are not present.
10. Utilize maximum use of available visual resources to enhance visitor experience and appreciation of the park.	**10.1** Increase the visibility of impacted giant sequoias surrounded by thickets of whitewoods as a result of the effects of fire suppression. **10.2** Prevent encroaching roadside dog hair thickets of whitewoods from obstructing views of giant sequoias. **10.3** Maintain vistas of named trees.	**10.1a**: Vegetation management of thickets blocking views of sequoias should concentrate on selective mechanical removal of these whitewoods. **10.1b**: Foreground dead or charred saplings should also be mechanically removed the year following a prescribed burn. **10.1c**: Reassess the visibility of the affected tree(s) and reclassify it on the Visual Resource Inventory. **10.2a**: Photographically monitor the effects created by these thickets. **10.2b**: Assess encroaching thicket growth annually and remove them as in 9.1a. **10.3a**: Existing vistas of the Sherman Tree, McKinley Tree, etc. should be preserved. **10.3b**: Blocked vistas, i.e. the General Lee Tree, should be opened up by mechanical removal of whitewoods up to 12" dbh. **10.3c**: These vistas should be listed and photographically monitored for encroachment.

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Appendix

A. Vegetation Map and Legends

B. 15' Quadrangle Map

C. Visual Resources Inventory Maps

D. SMA Landscape Management Plan Maps

OY14
PF 04
PF Y1
WR 04
P 02
S 03
S 04
32
PF 03
Gm
31
PF 03
Pinewood Camp
PF 04
S 03
PF 02
S OY24
PF OY14
S 04
P 01
PF 01
W 04
PF 02
GSwfsp5-H
WFspgs3-
Round Mdw
DEER
CR
SPp5H
SPp15-H
GSwfsp5=H
Circle Meadow
WFsp4=M
HWY
GENERALS
LITTLE
Sspwf5-H
Fgssp3=
GIANT
Pspwf5-H/BM
5
WF3-M
SPp5H
SPwfp5-H
6
WFsppgs4=M
Tharps Log
CREEK
WFspgs4=M
Crescent Meadow
Log Meadow
Psp5=H
Huckleberry Meadow
FOREST
WFspgs4=M
CRESCENT
WFsppgs4=M
MEADOW
ROAD
WFgssp4=M
P3-H
P5-H
GSwfsp5=H
P5H/BM
GSsp5-H
WFspp3=
Pwf5-H
WF2=L
KB
WFsppgs/4=M
WFp4=M
Pspwf4=M
Pwf4=M
P5-H/BM
P4-M
Pwfgs4=M
Pspwf4=M
COp3=H
P4=M
Pic4=M
MORO
BOBCAT POINT
HD
M

LEGEND

Vegetative Types/Species Composition

	Type	Color	Species
Ponderosa Pine	P		p
Jeffrey Pine	J		p
Giant Sequoia	GS		gs
Sugar Pine	SP		sp
White Fir	WF		wf
Red Fir	RF		rf
Lodgepole Pine	LP		lp
Incense Cedar	IC		ic
Juniper	JO		jo
Western White Pine	W		w
White Bark Pine	PA		wb
Pinyon Pine	PM		pm
Foxtail Pine	PB		pb
Mountain Hemlock	MH		mh
California Black Oak	CO		co
Oak Savanna	LO		
Blue Oak			bo
Live Oak			lo
Other Hardwoods	HD		
Chaparral	CH		
Montane Brush	BM		
Meadow	M		
Foothill Grass	G		

Non-vegetative Types

Barren Rock	K	
Rock-with high shrubs	KB	

Stand Size Class

1 - 0" to 4.9" DBH

2 5" to 10.9" DBH

3 11" to 20.9" DBH

4 21"+ DBH, <180 yrs old
low to medium decode

5 21"+ DBH, >180 yrs old
medium to high decod

Vegetative Cover Class

No Symbol 0-9 % cc

— 10-39 %

= 40-69 %

≡ 70-100 %

Overstory Decodence Rat

L Low

M Medium

H High

LEGEND

For specific definitions see separate legend sheet accompanying set of maps

FOREST TREE TYPES

- S Sequoia
- P Ponderosa pine
- W White fir
- R Red fir
- PF Pine-Fir (lower elevation)
- LF Pine-Fir (upper elevation)
- WR White fir - Red fir

WOODLAND TREE TYPES

- Hn Aspen - Cottonwood
- Hb Black oak
- Hc Live oak
- Hd Live oak-Pinyon
- Hf Foothill oak

HERBACEOUS TYPES

- Gm Meadow
- Gr Rocky meadow
- Gf Foothill grass

SUBALPINE TREE TYPES

- L Lodgepole pine
- A Whitebark-Foxtail pines
- J Juniper

BRUSH TYPES

- Bm Montane brush
- Bf Foothill brush

ROCK TYPES

- K Barren rock
- KH Rock-Woodland
- KB Rock-Brush
- KG Rock-Grass

AGE CLASS OF FOREST TREE TYPES

- O Old growth stands
- Y Young growth stands
- OY Two-storied stands

STAND DENSITY OF FOREST TREE AND LODGEPOLE PINE TYPES

- 1 1- 9% crown coverage
- 2 10-39% crown coverage
- 3 40-69% crown coverage
- 4 70-100% crown coverage

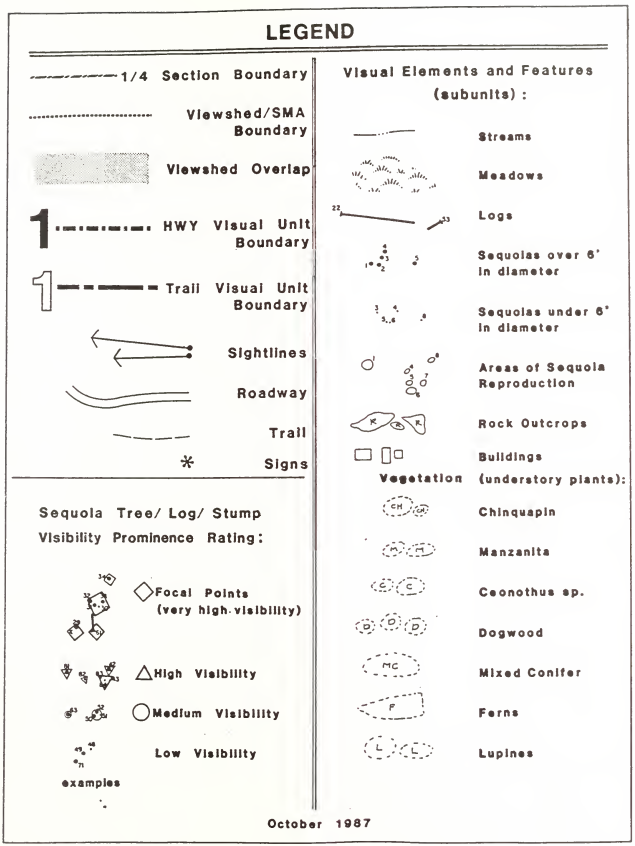
Appendix B

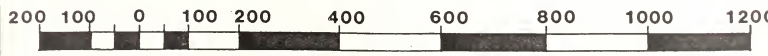
Chimney Rock
Lost Grove
Cabin Mdw
Silliman Pass
Twin Lakes
Beville Lake
Ferguson Mdw
Colony Meadow
Cahoon Gap
Mt Silliman
Crescent L
Muir Grove
Campground
Dorst Creek
Clover Creek
Silliman Mdw
Little Baldy Saddle
Little Baldy
Halstead Mdw
Table Meadows
Skagway Grove
Pine Ridge
Hidden Spring
Cascade Cr
Sequoia National Park
Tokopah Valley
Tokopah Falls
Tokopah River
Aster L
Moose Lake
Lodgepole
Campgrounds
Heather L
Pear Lake
Emerald L
Crystal Cave
Suwanee Grove
Halstead Creek
Ski Hut
Long Mdw
Alta Peak
Corrals
Panther Gap
Tharps Rock
Yucca Ridge
Sunset Rock
Sherman Cr
Gen Sherman Tree
Panther Peak
Alta Mdw
Campgrounds
Pinewood Camp
Giant Forest
Circle Mdw
Kaweah Camp
Beetle Rock
Colony Peak
Marble Fork
Crescent Mdw
Tharps Log
Little Blue Dome
Ranger Station
Sugarbowl Dome
Admiration Point
Marble Falls
Colony Mill Ranger Station
Panorama Point
Generals Highway
Deer Ridge
Moro Rock
Bobcat Point
Sevenmile Hill
Panther Creek
Cedar Cr
Switchback Peak
Deep Canyon
Amphitheater Point
Ridge
Middle Fork
Kaweah River
Redwood Meadow Grove
Redwood Mdw
Ash Peaks
Ash Peaks Lookout
Campground
Buckeye Flat
Sequoia
Castle Creek Grove
Gaging Sta
Potwisha Campground
Hospital Rock Ranger Station
Cactus Point
Frys Point
Paradise Creek
Dome Creek
Castle Rocks
Little Sand Mdw
Ash Mountain (Nat Park Hdqrs)
River
Gaging Station
Lookout
Milk Ranch Peak
Paradise Cave
Paradise Ridge
Paradise Peak
Red Hill
Oriole Grove
Pine Top Mtn
Hammond
River Hill
Atwell Grove
Atwell Mill Ranger Station
Silver City
Camp Conifer
Campground
Mineral King
Conifer Ridge
Redwood Creek
Squirrel Creek
Cruningen Cr
Oak Grove
East Fork
Forest Service Station
Mineral King (Mineralking PO)
Kaweah
Lookout Point Ranger Station
Fork
Tar Gap
Case Mtn
Case Mtn Grove
Cinnamon Gap
Horse Creek Grove
Eden Creek Grove
Mosquito Lakes
Eagle Cr
Horse Creek
Coffeepot Canyon
Clover Creek
Horn Mtn
Salt Creek
White Chief Peak
Homers Nose
Cahoon Mdw
Evelyn Lake
Cahoon Rock Lookout
Homers Nose Grove
Palmer Cave
Cahoon Mtn
Ranger Station
Hockett Meadows
Blossom Lakes

Appendix C

Visual Resources Inventory Maps

1. Map Legend
2. Map Key of Study Sections
3. Generals Hghway SMA
4. Congress Trail SMA


LEGEND
1/4 Section Boundary
Viewshed/SMA Boundary
Viewshed Overlap
1
HWY Visual Unit Boundary
1
Trail Visual Unit Boundary
Sightlines
Roadway
Trail
Signs
Sequoia Tree/ Log/ Stump Visibility Prominence Rating:
Focal Points (very high visibility)
High Visibility
Medium Visibility
Low Visibility
examples
Visual Elements and Features (subunits):
Streams
Meadows
Logs
Sequoias over 6' in diameter
Sequoias under 6' in diameter
Areas of Sequoia Reproduction
Rock Outcrops
Buildings
Vegetation (understory plants):
Chinquapin
Manzanita
Ceonothus sp.
Dogwood
Mixed Conifer
Ferns
Lupines
October 1987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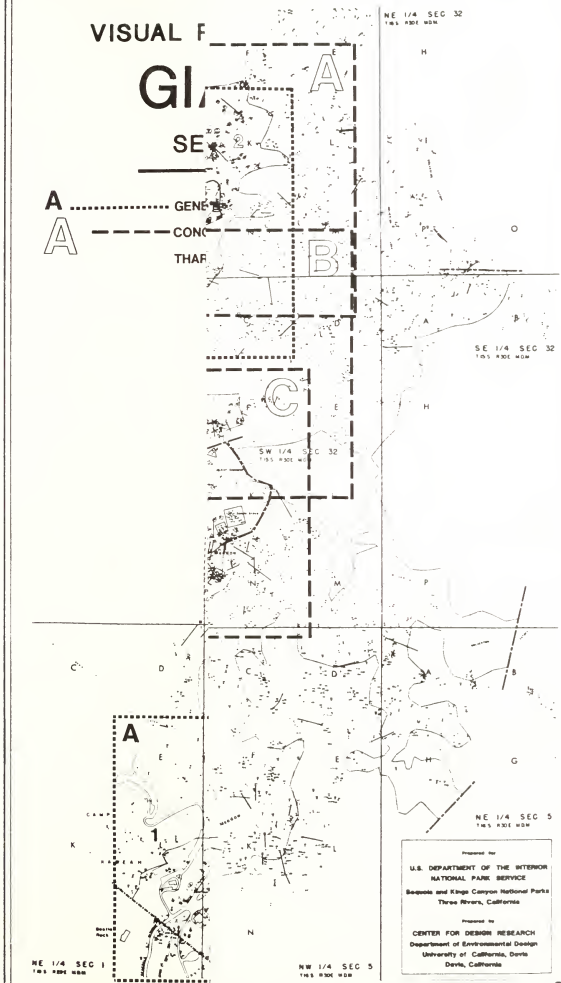
SCALE IN FEET



65

MAP KEY of Study Sections

VISUAL RESOURCES MANAGEMENT STUDY

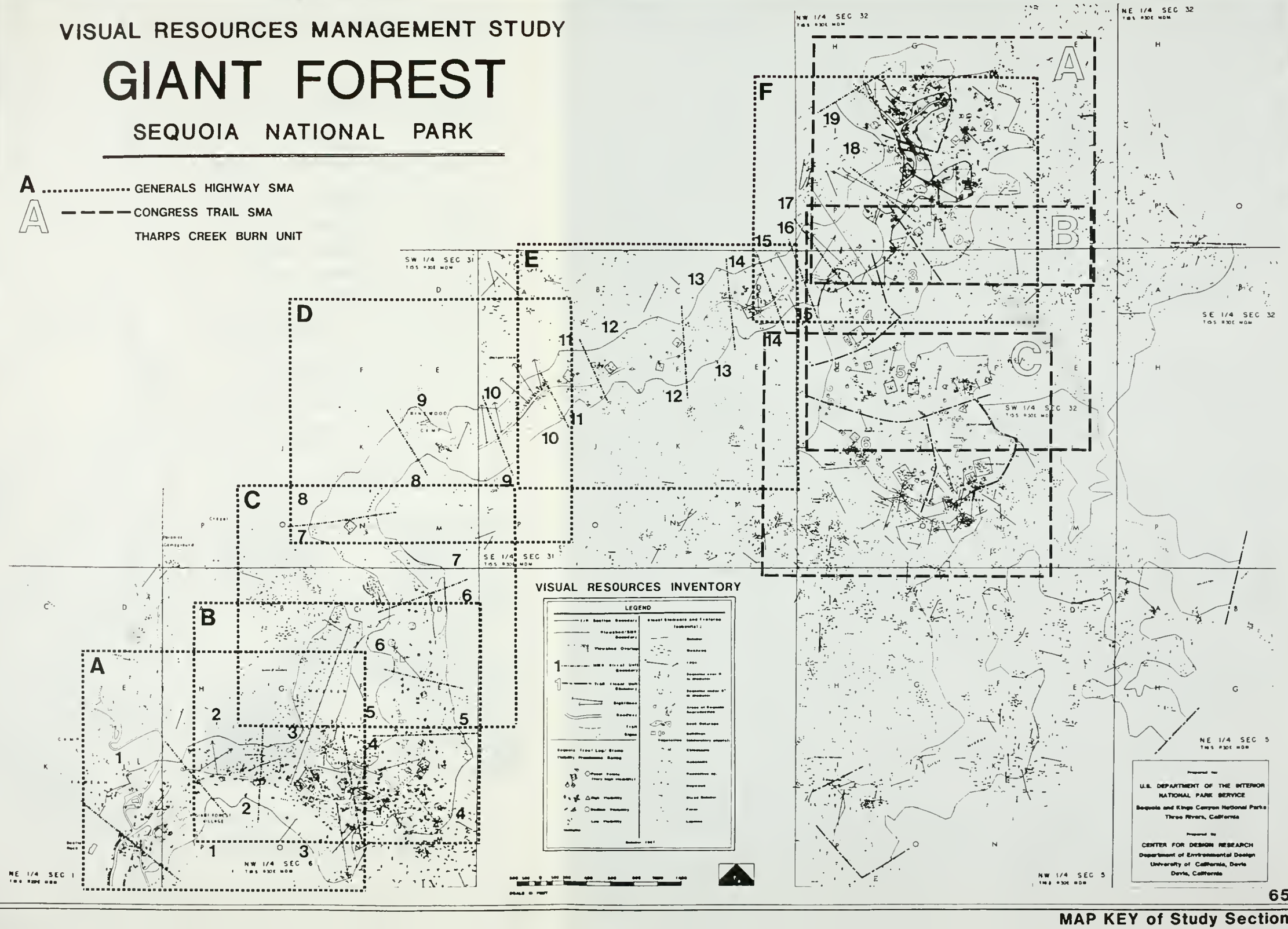
GIANT FOREST

SEQUOIA NATIONAL PARK

A ..... GENERALS HIGHWAY SMA

A ———— CONGRESS TRAIL SMA

THARPS CREEK BURN UNIT

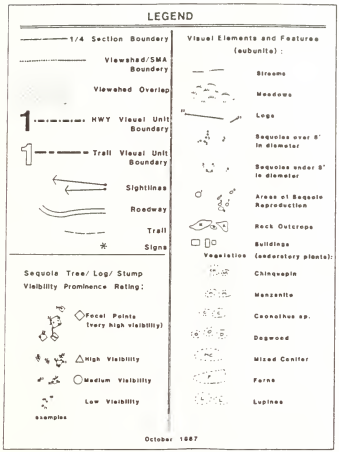


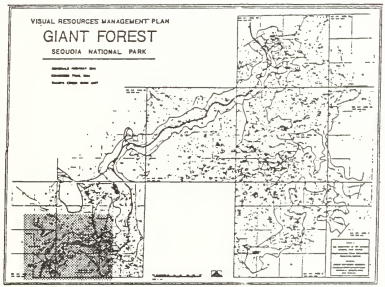
65

MAP KEY of Study Sections

VISUAL RESOURCES INVENTORY

Generals Highway SMA



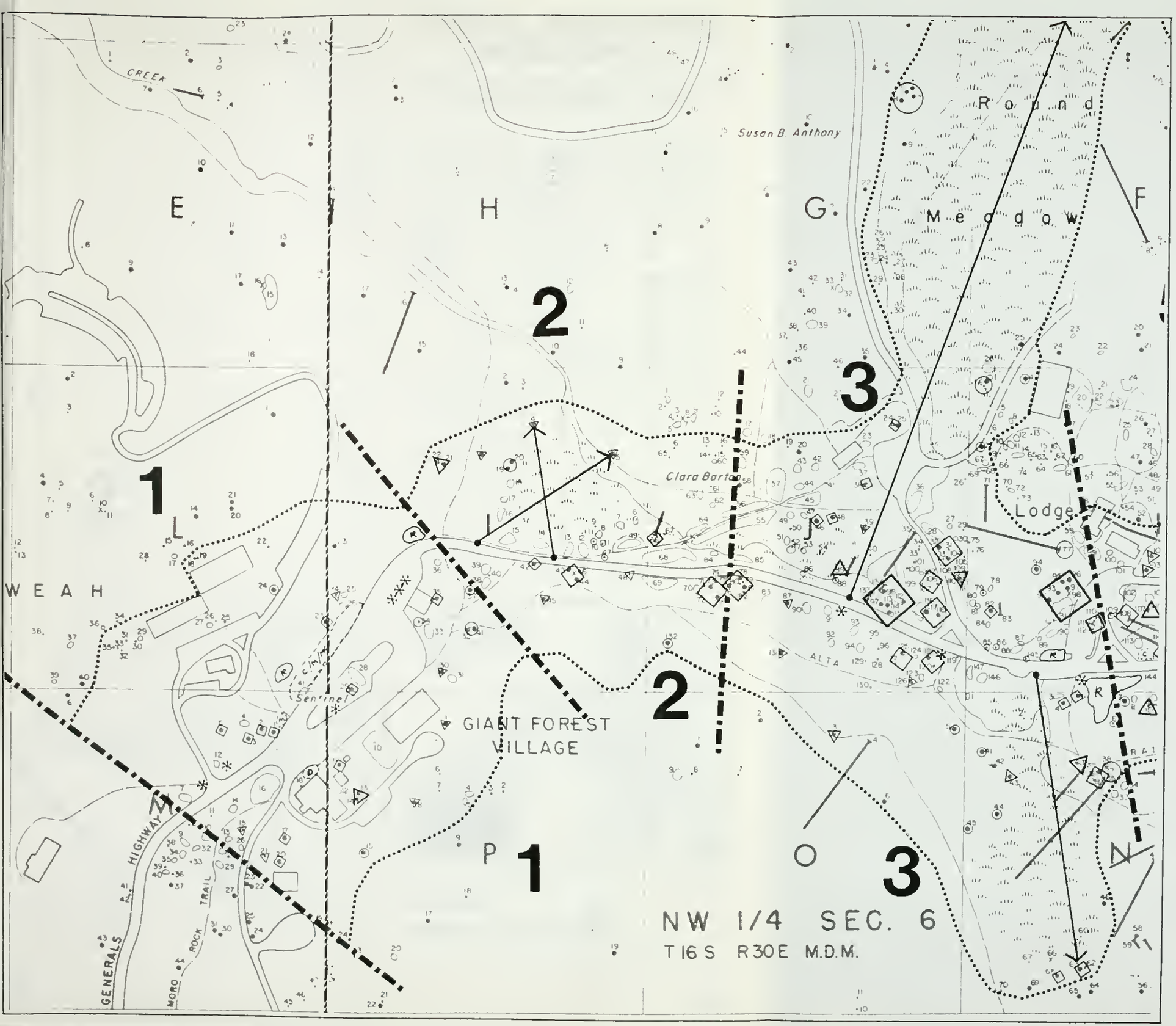


map key:

STUDY SECTION- A

VISUAL RESOURCES INVENTORY

Generals Highway SMA



LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- Viewshed Overlap
- 1 HWY Visual Unit Boundary
- 1 Trail Visual Unit Boundary
- Sightlines
- Roadway
- Trail
- * Signs

Sequoia Tree/ Log/ Stump Visibility Prominence Rating:

- ◇ Focal Points (very high visibility)
- △ High Visibility
- ○ Medium Visibility
- Low Visibility

examples

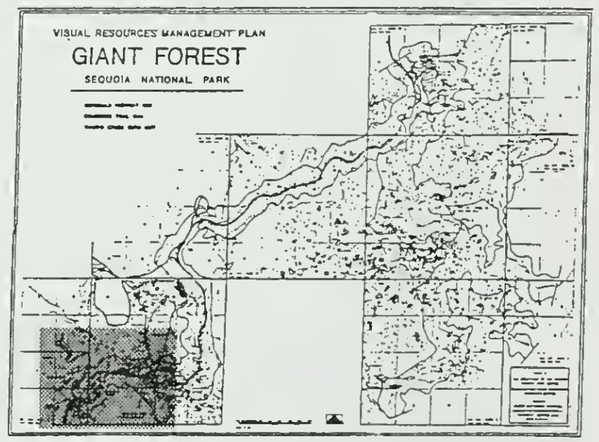
Visual Elements and Features (subunits):

- Streams
- Meadows
- Logs
- Sequoias over 6' in diameter
- Sequoias under 6' in diameter
- d Areas of Sequoia Reproduction
- Rock Outcrops
- Buildings

Vegetation (codominant plants):

- Chinquapin
- Manzanita
- Ceanothus sp.
- Dogwood
- Mixed Conifer
- Ferns
- Lupines

October 1987

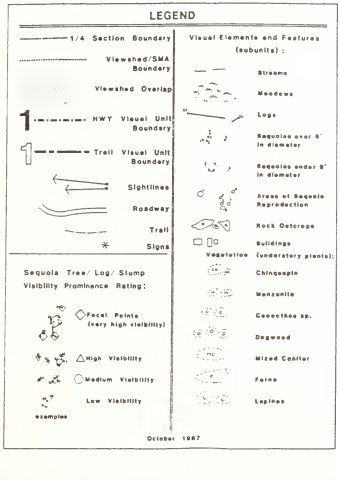


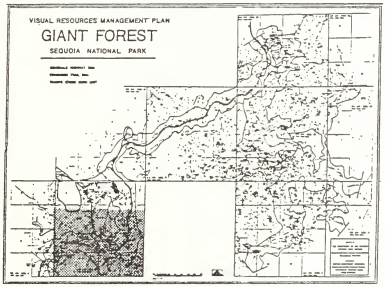
map key:

STUDY SECTION- A

VISUAL RESOURCES INVENTORY

Generals Highway SMA



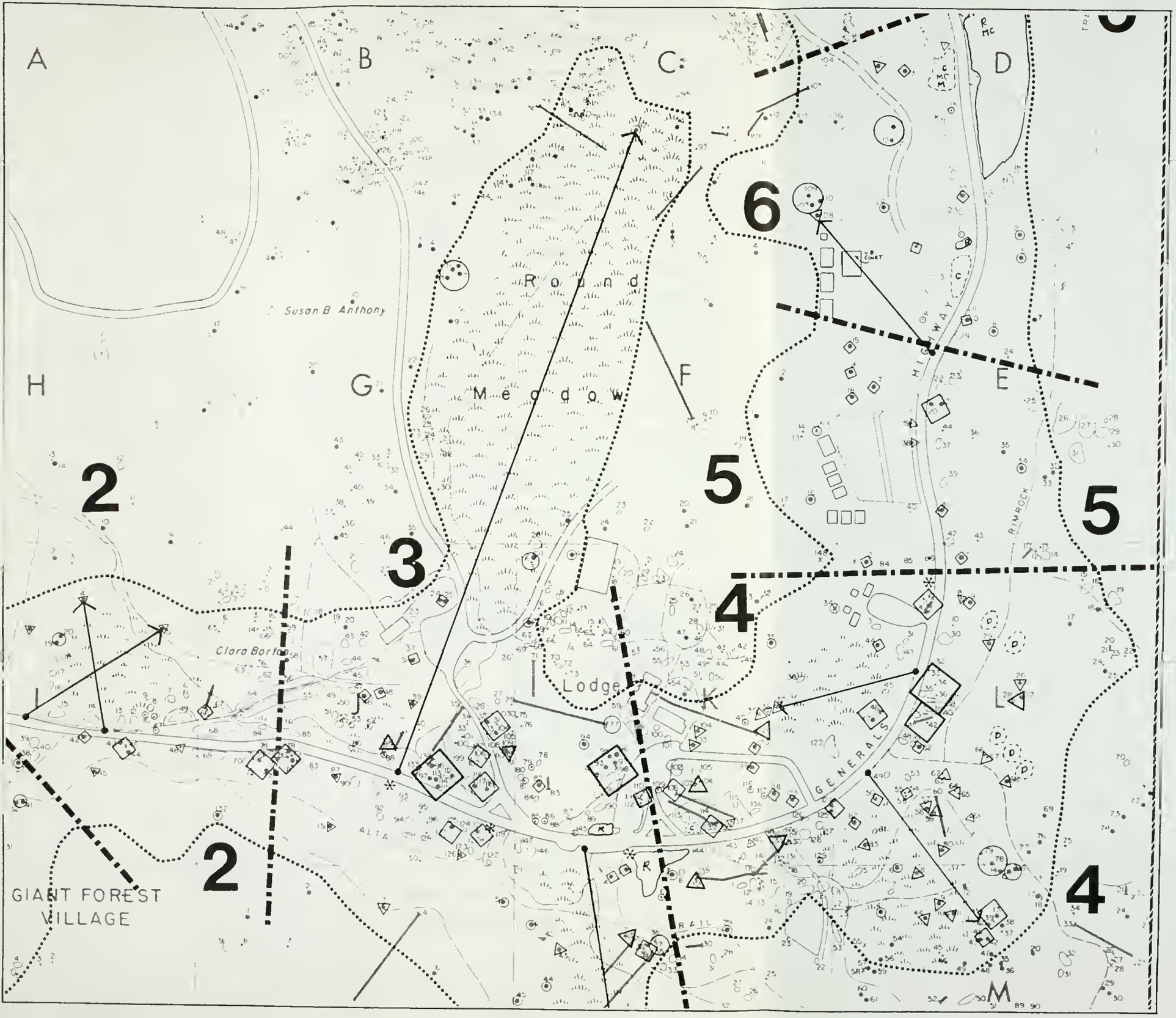


map key:

STUDY SECTION- B

VISUAL RESOURCES INVENTORY

Generals Highway SMA



LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- Viewshed Overlap
- 1 HWY Visual Unit Boundary
- 1 Trail Visual Unit Boundary
- Sightlines
- Roadway
- Trail
- Signs

Sequoia Tree/ Log/ Stump Visibility Prominence Rating:

- Focal Points (very high visibility)
- High Visibility
- Medium Visibility
- Low Visibility

examples

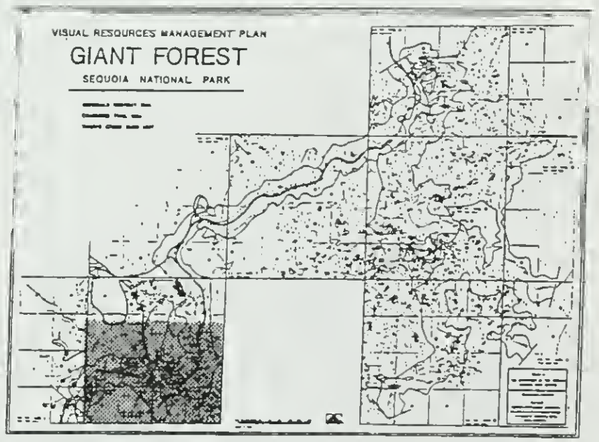
Visual Elements and Features (subunits):

- Streams
- Meadows
- Logs
- Sequoias over 6' in diameter
- Sequoias under 6' in diameter
- Areas of Sequoia Reproduction
- Rock Outcrops
- Buildings

Vegetation (understory plants):

- Chinquapin
- Manzanita
- Ceanothus sp.
- Dogwood
- Mixed Conifer
- Firs
- Lupines

October 1987

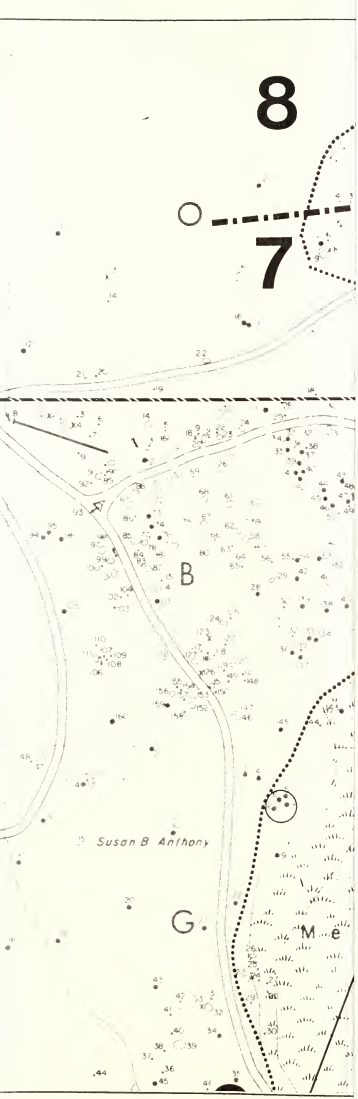


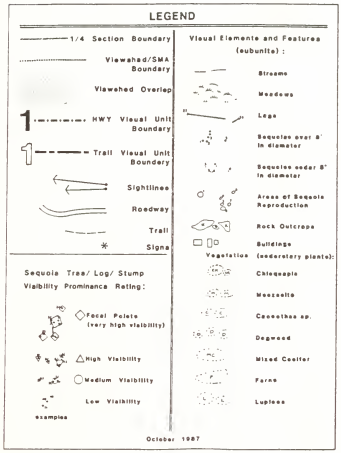
map key:

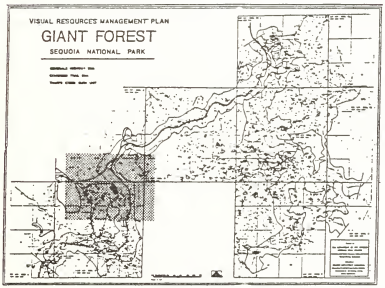
STUDY SECTION- B

VISUAL RESOURCES INVENTORY

Generals Highway SMA





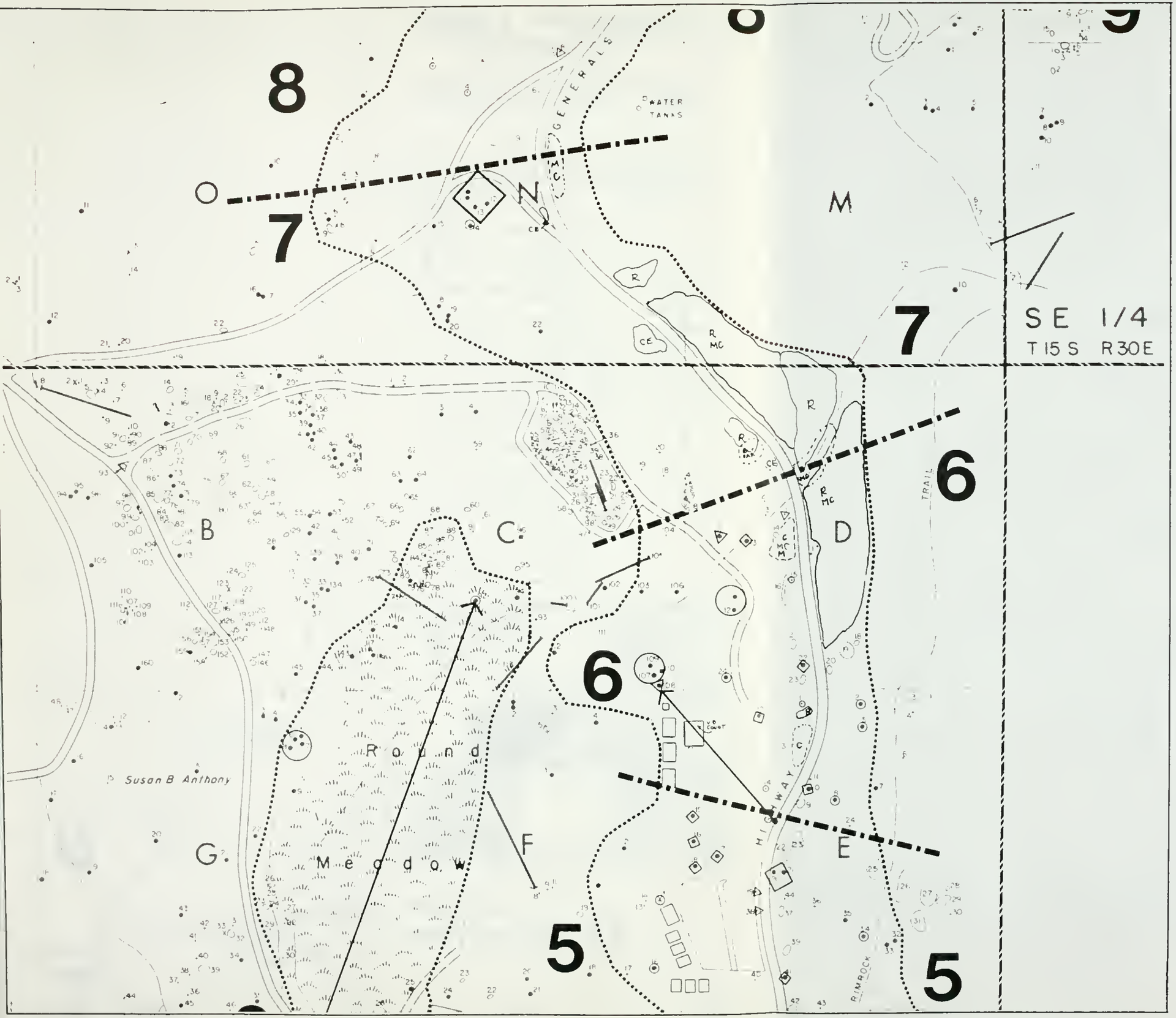


map key:

STUDY SECTION- C

VISUAL RESOURCES INVENTORY

Generals Highway SMA



LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- Viewshed Overlap
- 1 HWY Visual Unit Boundary
- 1 Trail Visual Unit Boundary
- Sightlines
- Roadway
- Trail
- * Signs

Sequoia Tree/ Log/ Stump Visibility Prominence Rating:

- ◇ Focal Points (very high visibility)
- △ High Visibility
- ○ Medium Visibility
- Low Visibility

examples

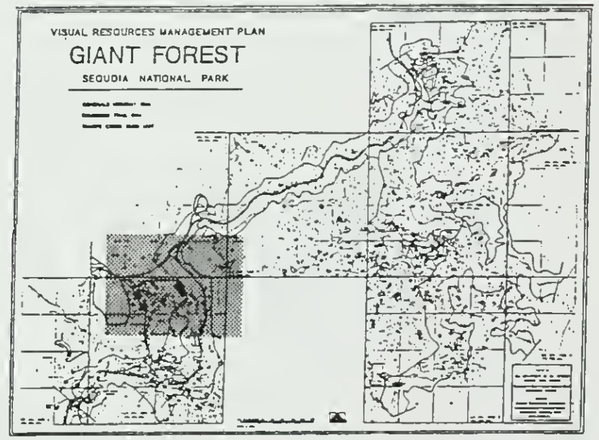
Visual Elements and Features (subunits):

- Streams
- Meadows
- Logs
- Sequoias over 6' in diameter
- Sequoias under 6' in diameter
- Areas of Sequoia Reproduction
- Rock Outcrops
- Buildings

Vegetation (understory plants):

- Chinquapin
- Manzanita
- Ceanothus sp.
- Dogwood
- Mixed Conifer
- Ferns
- Lupines

October 1987



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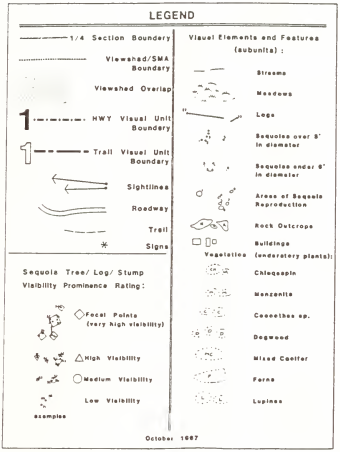
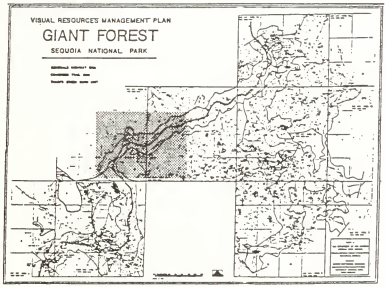
STUDY SECTION- C

VISUAL RESOURCES INVENTORY

Generals Highway SMA





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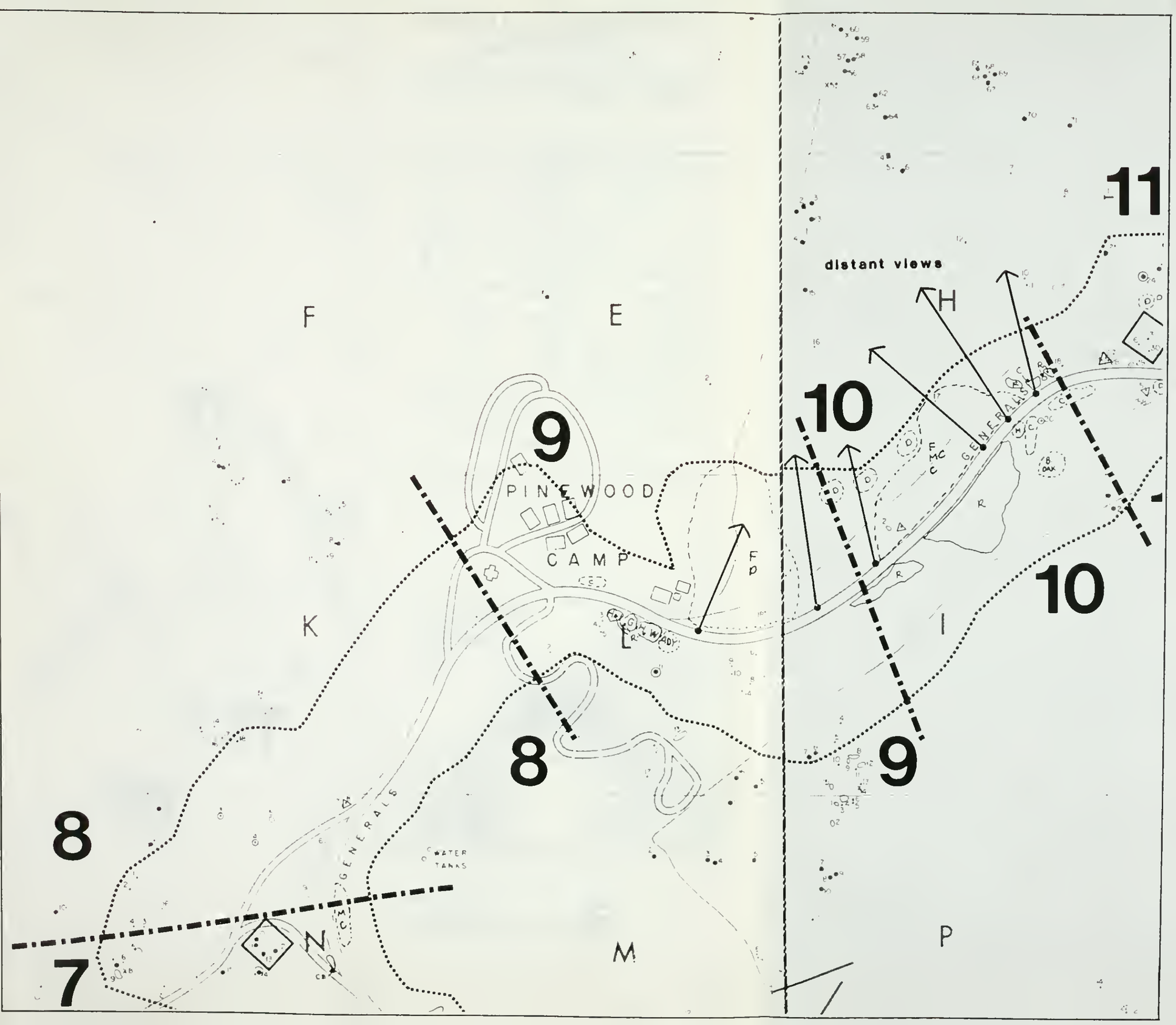
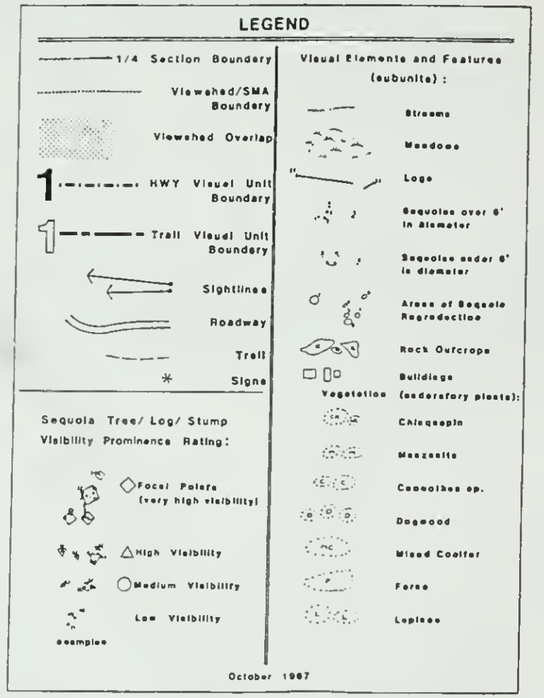
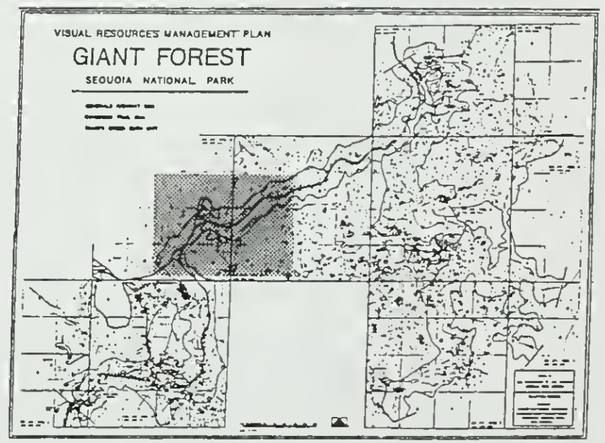
STUDY SECTION- D

VISUAL RESOURCES INVENTORY

Generals Highway SMA





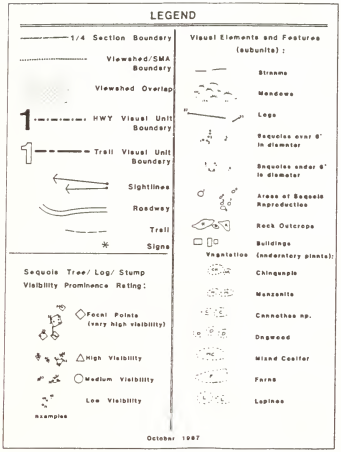


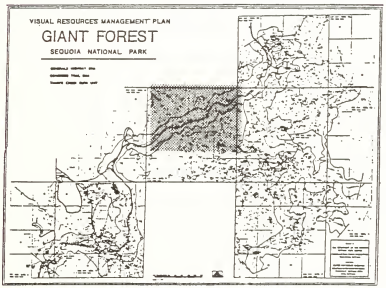
map key:

STUDY SECTION- D

VISUAL RESOURCES INVENTORY

Generals Highway SMA



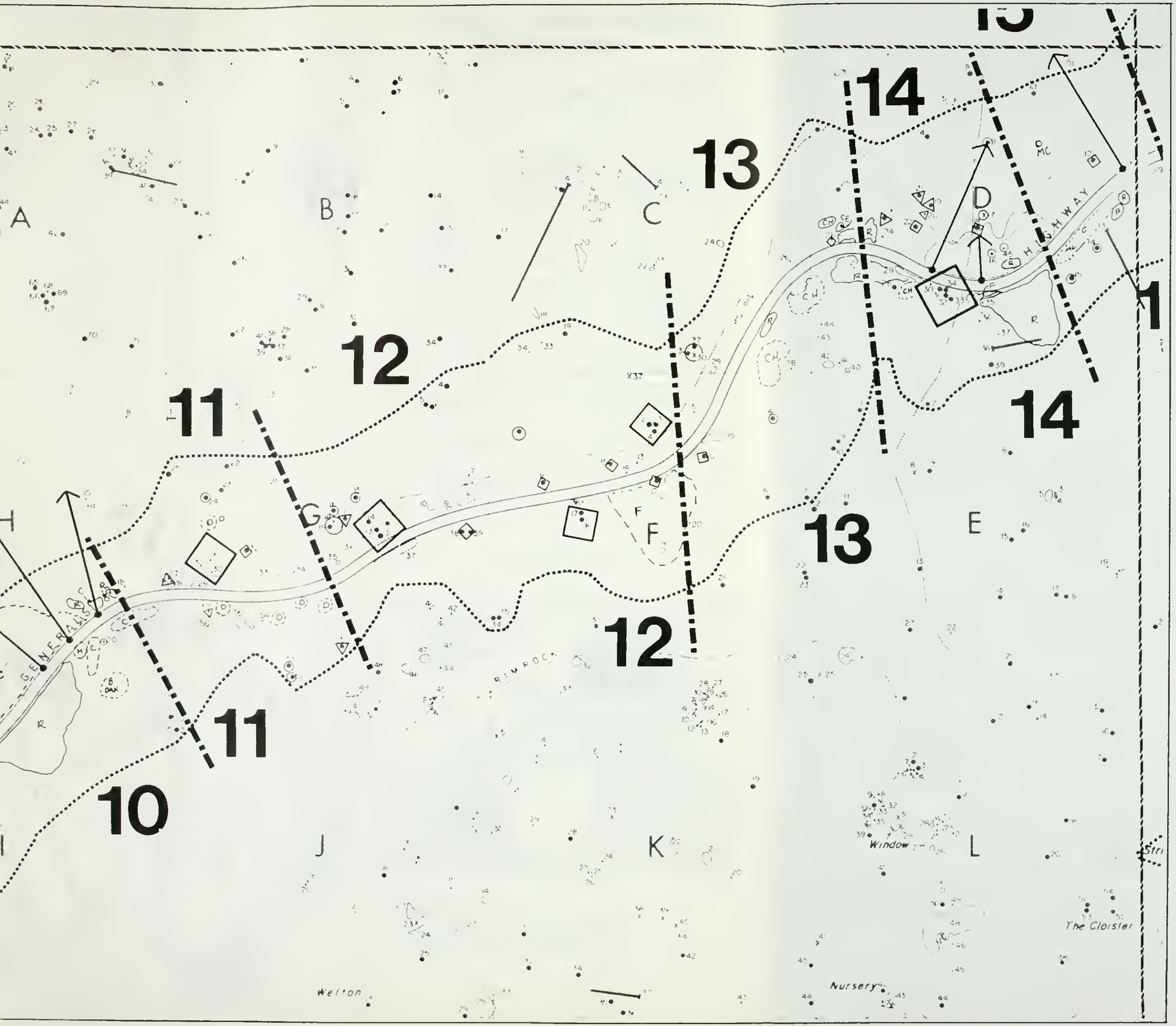


map key:

STUDY SECTION- E

VISUAL RESOURCES INVENTORY

Generals Highway SMA



LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- Viewshed Overlap
- 1 HWY Visual Unit Boundary
- 1 Trail Visual Unit Boundary
- Sightlines
- Roadway
- Trail
- Signs

Sequoia Tree/ Log/ Stump Visibility Prominence Rating:

- Focal Points (very high visibility)
- △ High Visibility
- ○ Medium Visibility
- Low Visibility

examples

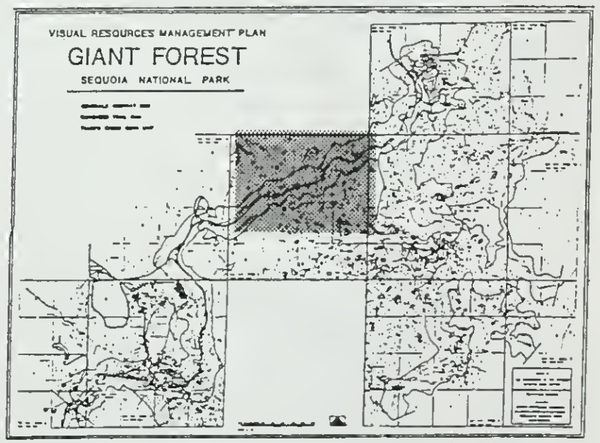
Visual Elements and Features (subunits):

- Streams
- Meadows
- Logs
- Sequoias over 6' in diameter
- Sequoias under 6' in diameter
- Areas of Sequoia Reproduction
- Rock Outcrops
- Buildings

Vegetation (understory plants):

- Chinquapin
- Manzanita
- Ceanothus sp.
- Dogwood
- MC Mixed Conifer
- Ferns
- Lupines

October 1987

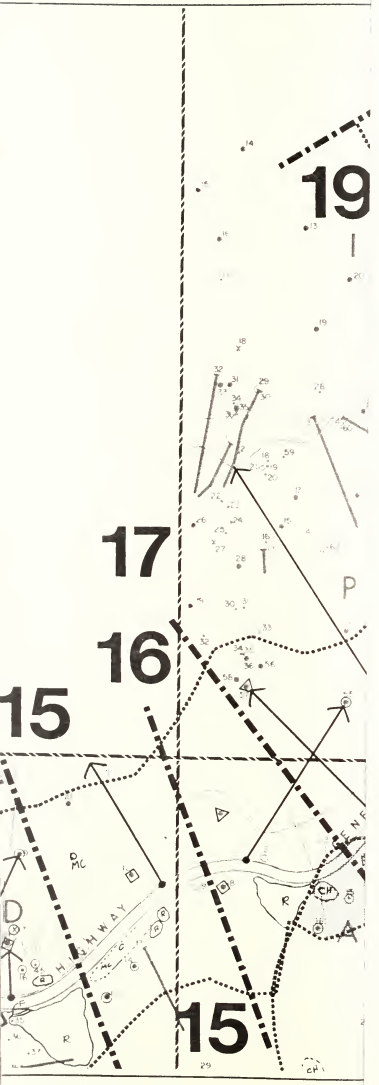


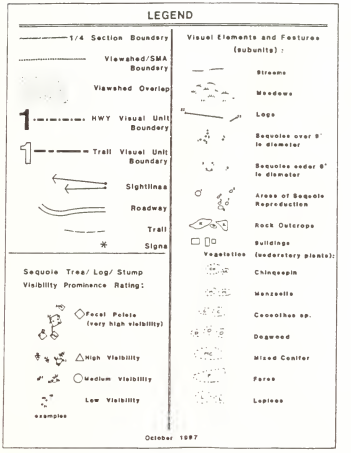
map key:

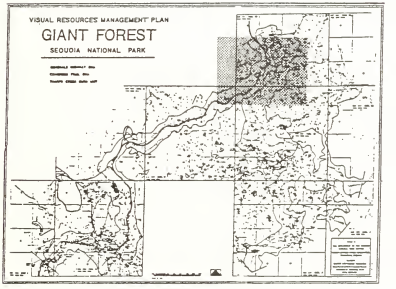
STUDY SECTION- E

VISUAL RESOURCES INVENTORY

Generals Highway SMA





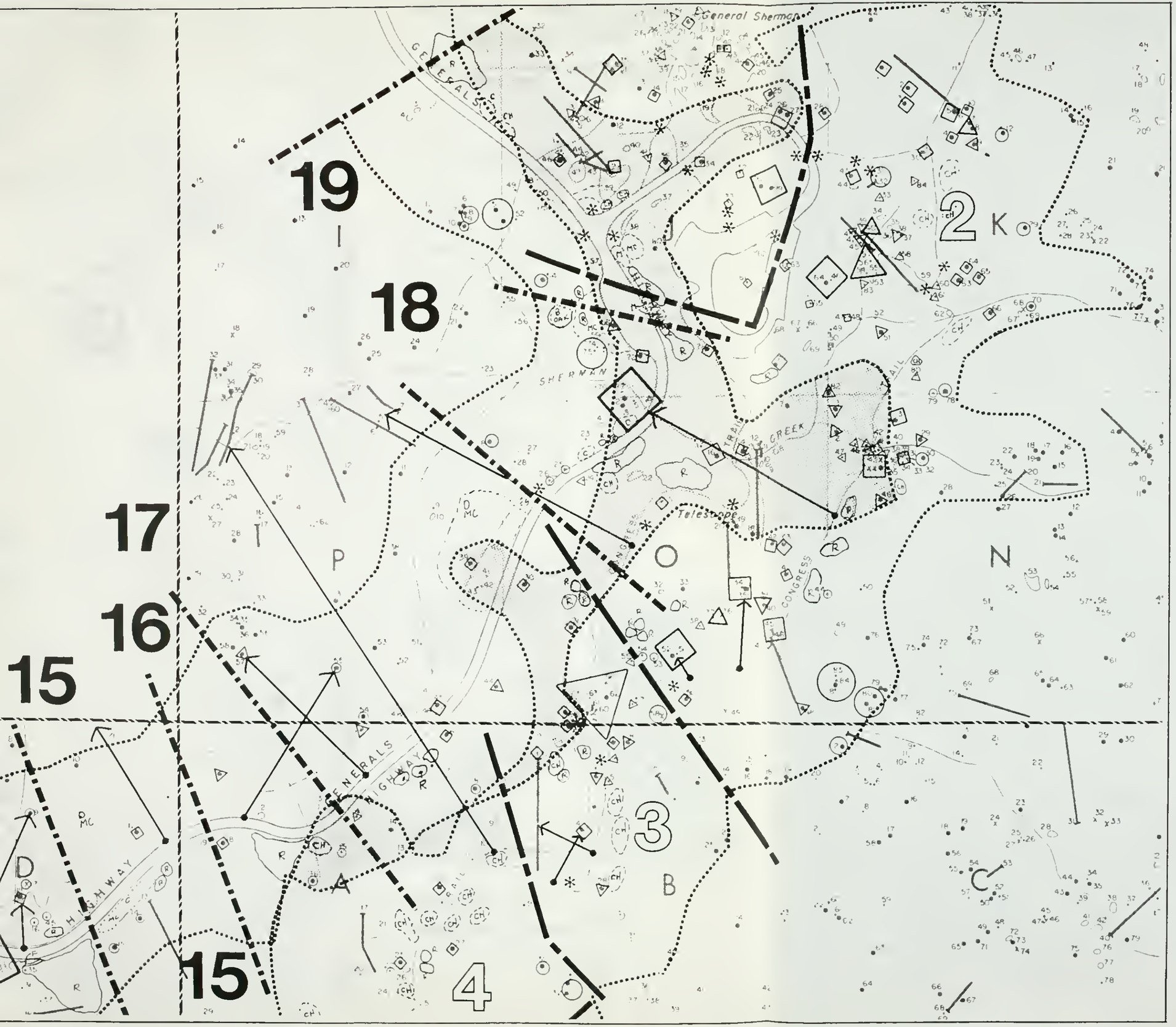


map key:

STUDY SECTION- F

VISUAL RESOURCES INVENTORY

Generals Highway SMA



LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- Viewshed Overlap
- 1 HWY Visual Unit Boundary
- 1 Trail Visual Unit Boundary
- Sightlines
- Roadway
- Trail
- * Signs

Sequoia Tree/ Log/ Stump Visibility Prominance Rating:

- Focal Points (very high visibility)
- High Visibility
- Medium Visibility
- Low Visibility

examples

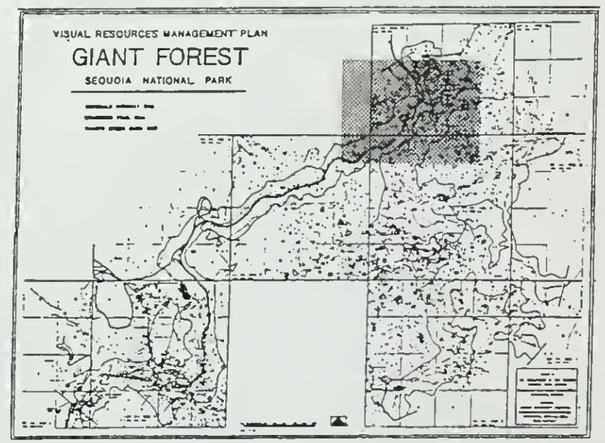
Visual Elements and Features (subunits):

- Streams
- Meadows
- Logs
- Sequoias over 8' in diameter
- Sequoias under 8' in diameter
- Areas of Sequoia Reproduction
- Rock Outcrops
- Buildings

Vegetative (understory plants):

- Chinquapin
- Manzanita
- Ceanothus sp.
- Dogwood
- MC Mixed Conifer
- Forbs
- Lupines

October 1987

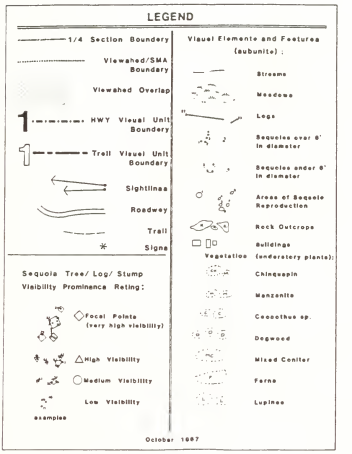


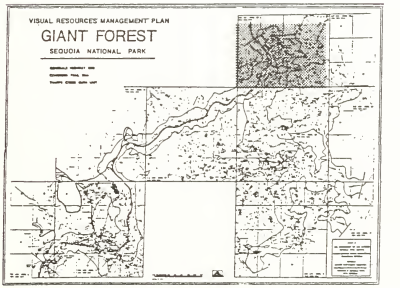
map key:

STUDY SECTION- F

VISUAL RESOURCES INVENTORY

Congress Trail SMA



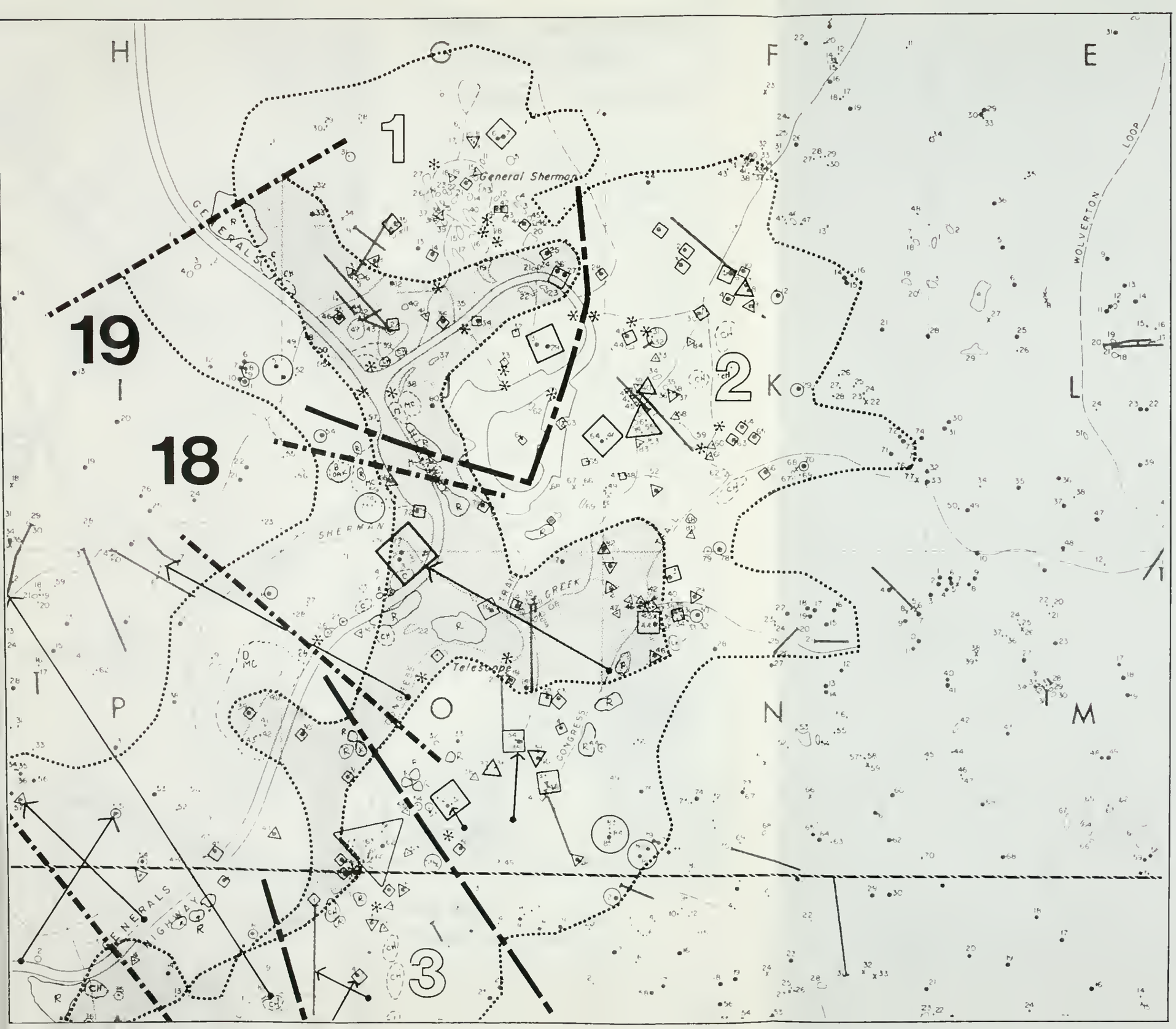


map key:

STUDY SECTION- A

VISUAL RESOURCES INVENTORY

Congress Trail SMA



LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- Viewshed Overlap
- 1 HWY Visual Unit Boundary
- 1 Trail Visual Unit Boundary
- Sightlines
- Roadway
- Trail
- * Signs

Sequoia Tree/ Log/ Stump Visibility Prominence Rating:

- ◇ Focal Points (very high visibility)
- △ High Visibility
- ○ Medium Visibility
- Low Visibility

examples

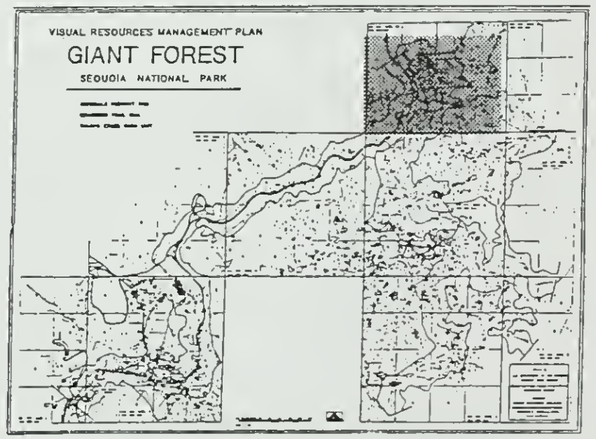
Visual Elements and Features (subunits):

- Streams
- Meadows
- Logs
- Sequoias over 8' in diameter
- Sequoias under 8' in diameter
- Areas of Sequoia Regeneration
- Rock Outcrops
- Buildings

Vegetation (understory plants):

- Chinquapin
- Manzanita
- Ceanothus sp.
- Dogwood
- Mixed Conifer
- Ferns
- Lupines

October 1987

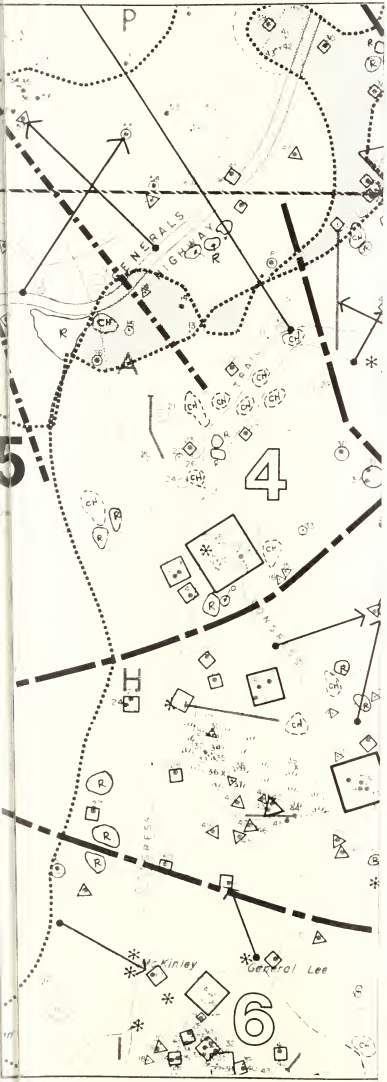


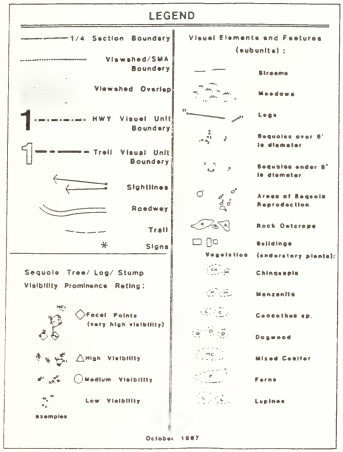
map key:

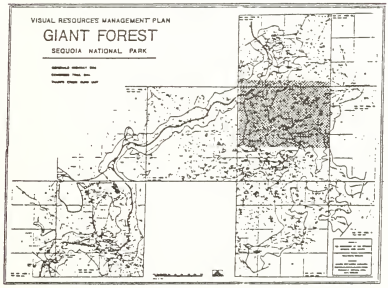
STUDY SECTION- A

VISUAL RESOURCES INVENTORY

Congress Trail SMA





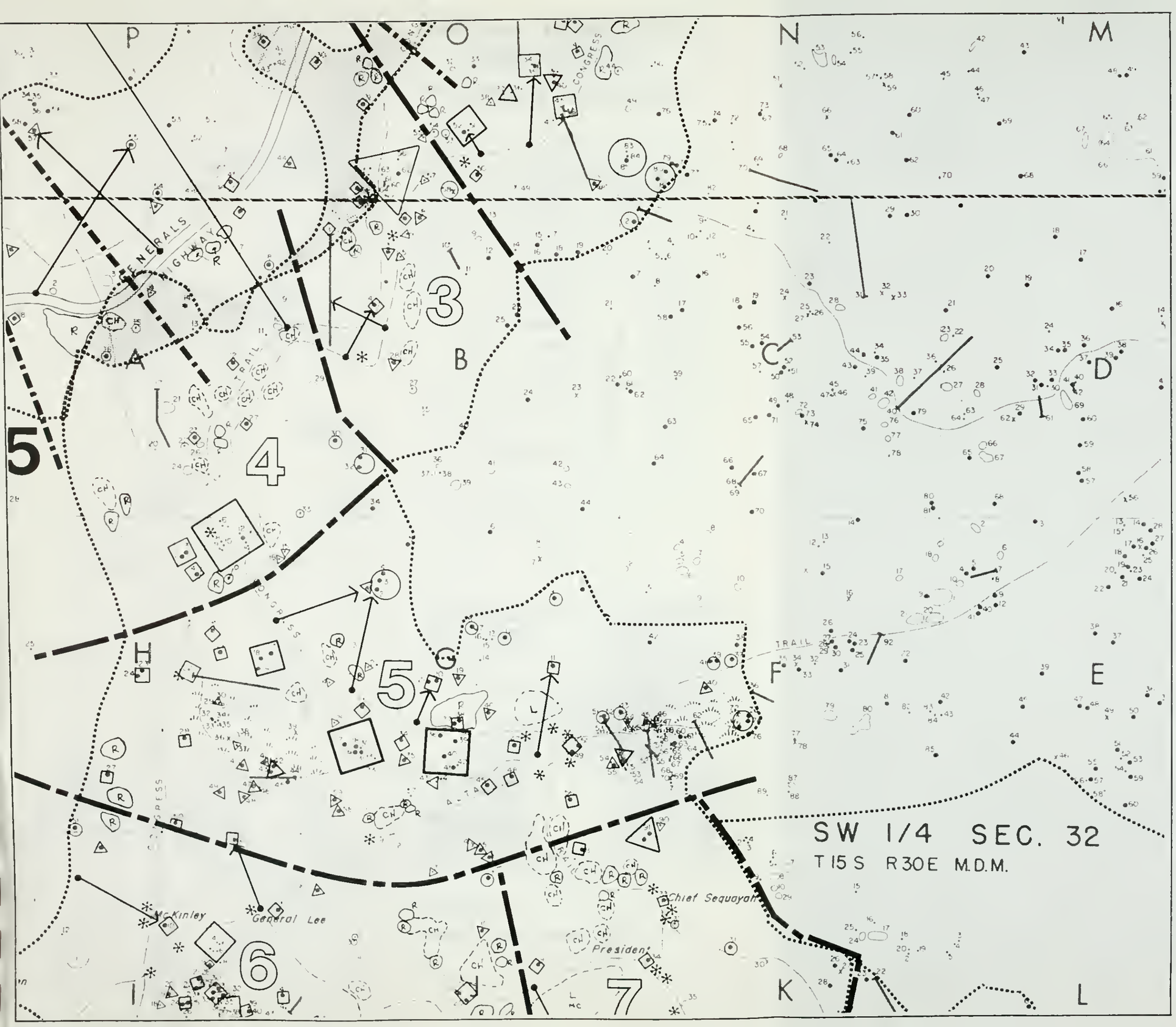


map key:

STUDY SECTION- B

VISUAL RESOURCES INVENTORY

Congress Trail SMA



LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- Viewshed Overlap
- 1 HWY Viewt Unit Boundary
- 1 Trail Viewt Unit Boundary
- Sightlines
- Roadway
- Trail
- Signs

Sequoia Tree/ Log/ Stump Visibility Prominence Rating:

- Focal Points (very high visibility)
- High Visibility
- Medium Visibility
- Low Visibility

examples

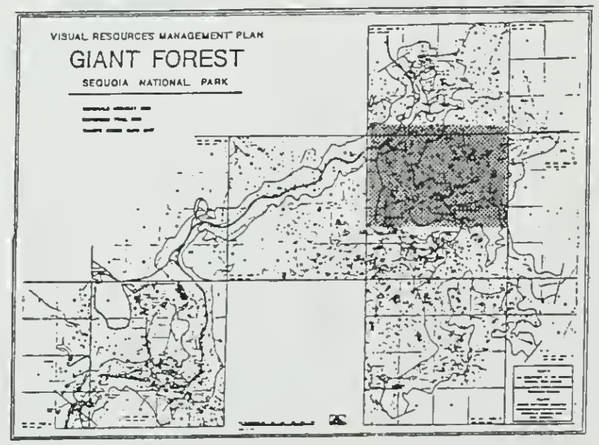
Visual Elements and Features (subunits):

- Streams
- Meadows
- Logs
- Sequoias over 6' in diameter
- Sequoias under 6' in diameter
- Areas of Sequoia Reproduction
- Rock Outcrops
- Buildings

Vegetation (understory plants):

- Ceanothus
- Manzanita
- Cercocarpus sp.
- Dogwood
- Mixed Conifer
- Pines
- Lupines

October 1987

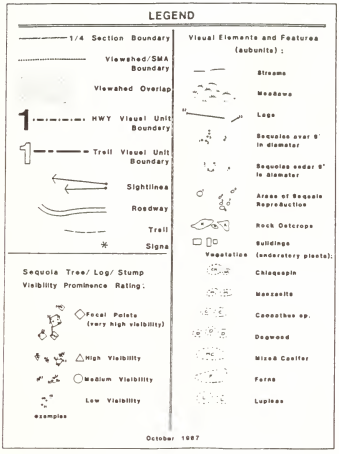


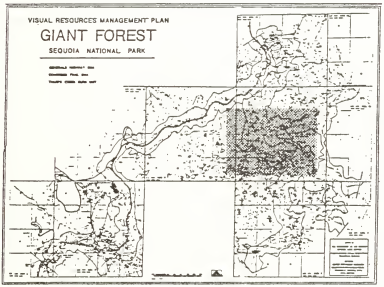
map key:

STUDY SECTION- B

VISUAL RESOURCES INVENTORY

Congress Trail SMA



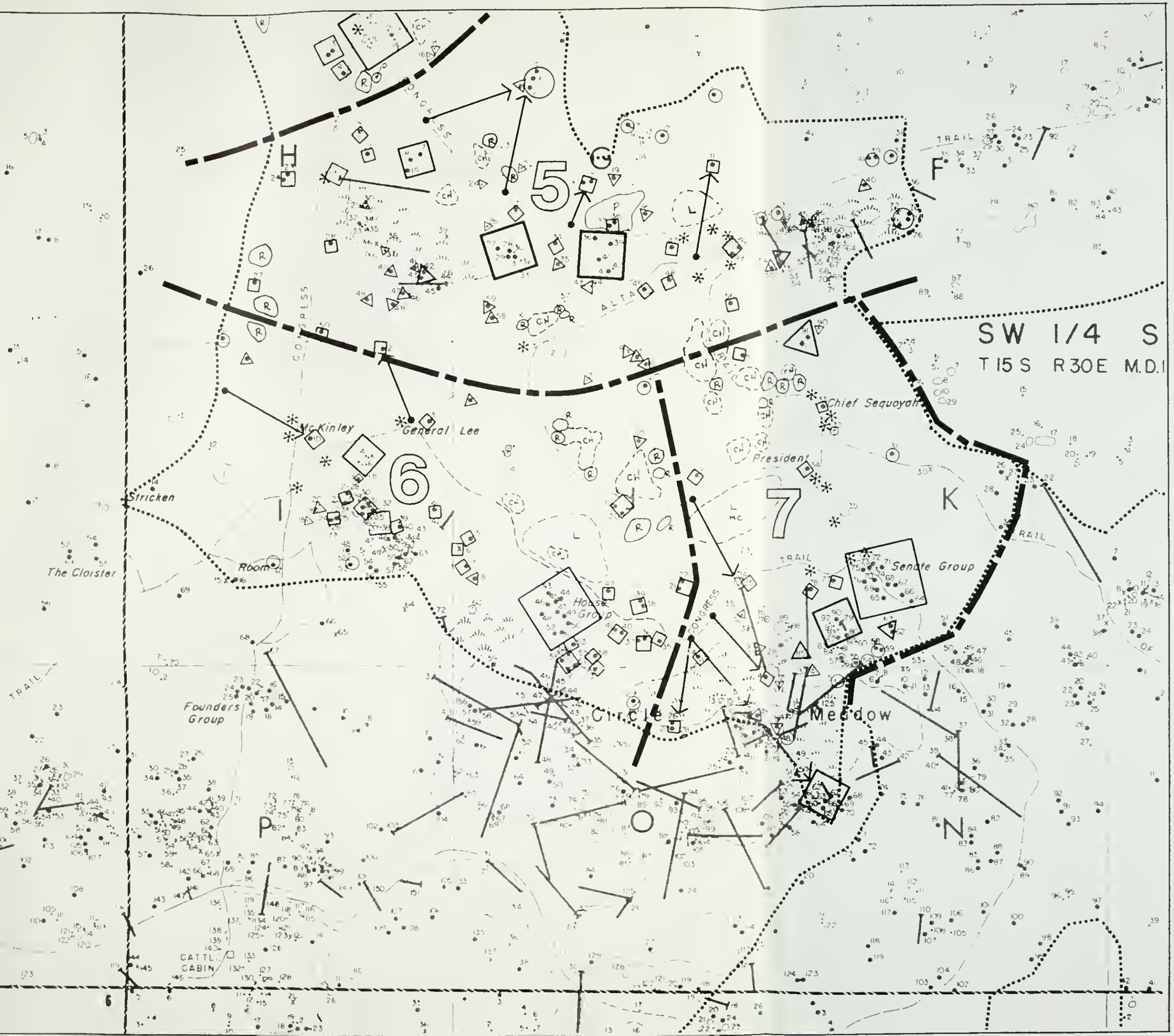


map key:

STUDY SECTION- C

VISUAL RESOURCES INVENTORY

Congress Trail SMA



LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- Viewshed Overlap
- 1 HWY Visual Unit Boundary
- 1 Trail Visual Unit Boundary
- Sightlines
- Roadway
- Trail
- Signs

Sequoia Tree/ Log/ Stump Visibility Prominance Rating:

- Focal Points (very high visibility)
- High Visibility
- Medium Visibility
- Low Visibility

examples

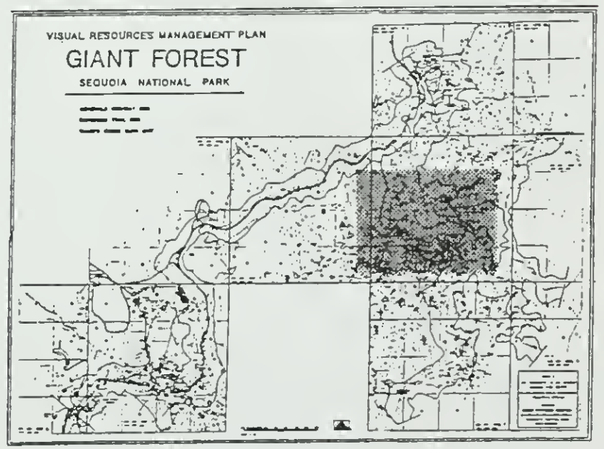
Visual Elements and Features (subunits):

- Streams
- Meadows
- Logs
- Sequoias over 6' in diameter
- Sequoias under 6' in diameter
- Areas of Sequoia Regeneration
- Rock Outcrops
- Saddlebags

Vegetation (understory plants):

- Ceanothus
- Manzanita
- Ceanothus sp.
- Dogwood
- Mixed Conifer
- Ferns
- Lupines

October 1987



map key:

STUDY SECTION- C

Appendix D

SMA Landscape Management Plan Maps

1. Map Legend
2. Map Key of Study Sections
3. Generals Highway SMA
4. Congress Trail SMA
5. Tharp's Creek Burn Unit

LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- 1 Hwy Visual Units
- A Burn Unit Boundary
- AA SMA Planning Units / Past Burn Units / Planning Units
- Areas of Fire Exclusion
- Blocked views of Sequoias
- Encroaching thickets to be monitored
- Sequoias over 6' in diameter
- Sequoias under 6' in diameter
- Areas of Sequoia Reproduction
- Logs
- Trails
- Roadways
- Streams

Management Intensity Scale

Visual Unit Management Scale

1= Low management intensity (0-3 FDV)

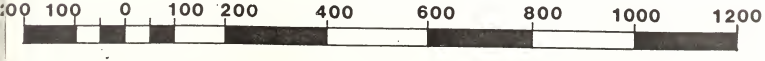
2= Med/ Low management intensity (4-7 FDV)

3= Med/ High management intensity (8-11 FDV)

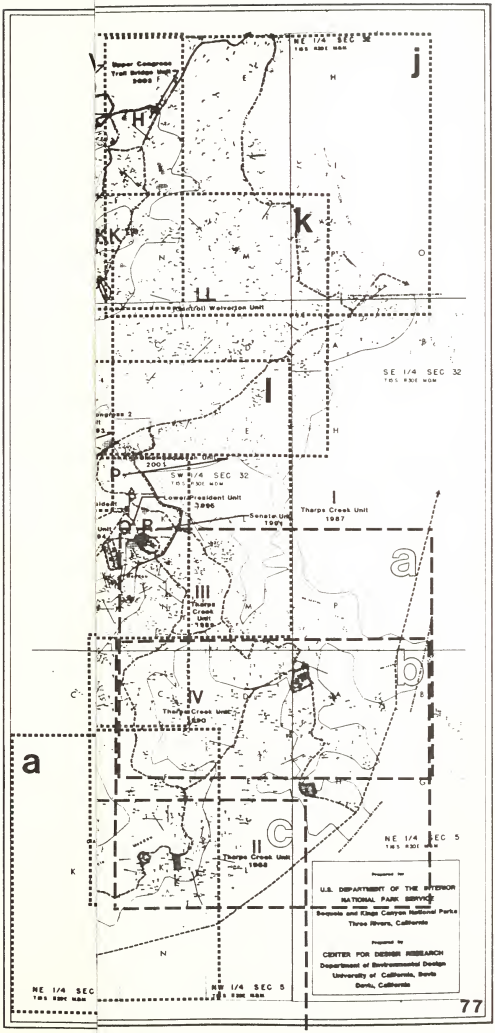
4= High management intensity (12+ FDV)

SMA Visual Unit #	Feature Aggregation Index	Square Acres	Feature Density Value	Visual Unit Management Scale
Generals Highway				
1	78	12.5	6.2	2
2	67	6.4	10.4	3
3	252	25.4	9.9	3
4	250	15.4	16.2	4
5	48	6.6	7.3	3
6	49	8.3	5.9	2
7	21	9.2	2.3	1
8	7	7.3	0.9	1
9	6	8.6	0.7	1
10	14	6.1	2.3	1
11	42	4.2	10.1	3
12	66	8.4	7.9	3
13	19	6.2	3.1	1
14	42	4.4	9.5	3
15	14	3.1	4.5	2
16	12	2.4	5.0	2
17	32	9.0	3.6	1
18	92	8.7	13.8	4
19	45	6.8	6.6	2
Congress Trail				
1	115	11.0	10.5	3
2	335	22.7	14.8	4
3	85	6.4	13.2	4
4	98	7.9	12.4	4
5	279	18.4	17.0	4
6	297	11.2	26.5	4
7	223	12.8	17.4	4

October 1987



SCALE IN FEET



Map Key of Study Sections

VISUAL RESOURCES MANAGEMENT PLAN

GIANT FOREST

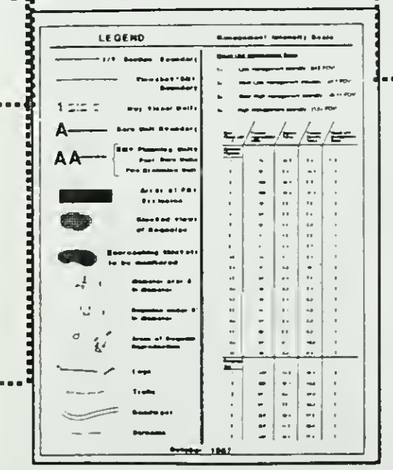
SEQUOIA NATIONAL PARK

GENERALS HIGHWAY SMA

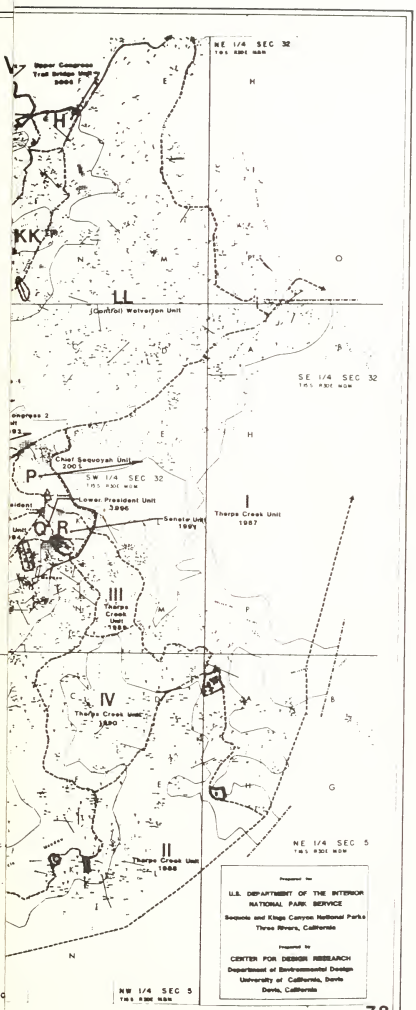
CONGRESS TRAIL SMA

THARPS CREEK BURN UNIT

SMA LANDSCAPE MANAGEMENT PLAN



Map Key of Study Sections


NE 1/4 SEC 32
T16S R30E MDM
Upper Congress Trail Bridge Unit 2006
H
KK
LL
(Control) Wolverton Unit
SE 1/4 SEC 32
T16S R30E MDM
Congress 2
Chief Sequoyah Unit 2001
P
SW 1/4 SEC 32
T16S R30E MDM
Lower President Unit 3996
Senator Unit 1995
Thorpe Creek Unit 1987
C R
III
Thorpe Creek Unit 1988
IV
Thorpe Creek Unit 1990
II
Thorpe Creek Unit 1988
NE 1/4 SEC 5
T16S R30E MDM
Prepared for
U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Sequoia and Kings Canyon National Parks
Three Rivers, California
Prepared by
CENTER FOR DESIGN RESEARCH
Department of Environmental Design
University of California, Davis
Davis, California
NE 1/4 SEC
T16S R30E MDM
NW 1/4 SEC 5
T16S R30E MDM

VISUAL RESOURCES MANAGEMENT PLAN

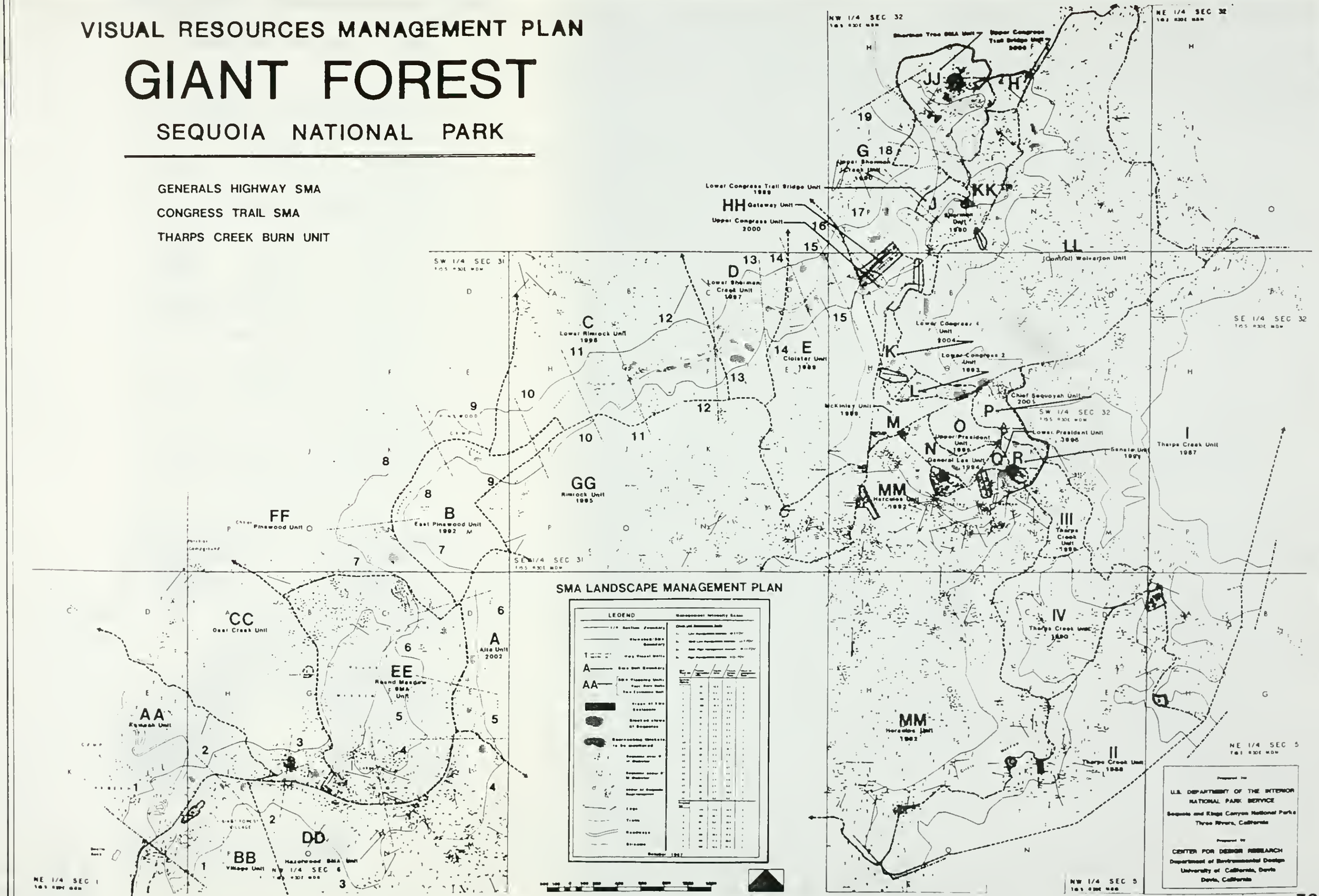
GIANT FOREST

SEQUOIA NATIONAL PARK

GENERALS HIGHWAY SMA

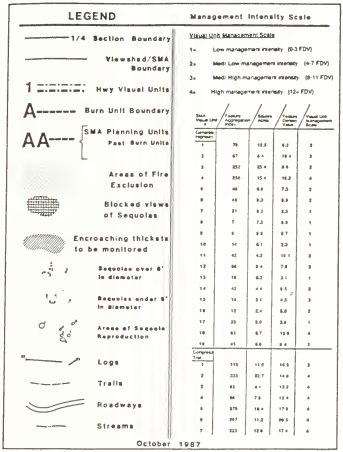
CONGRESS TRAIL SMA

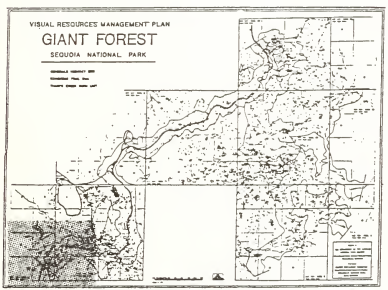
THARPS CREEK BURN UNIT



VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA





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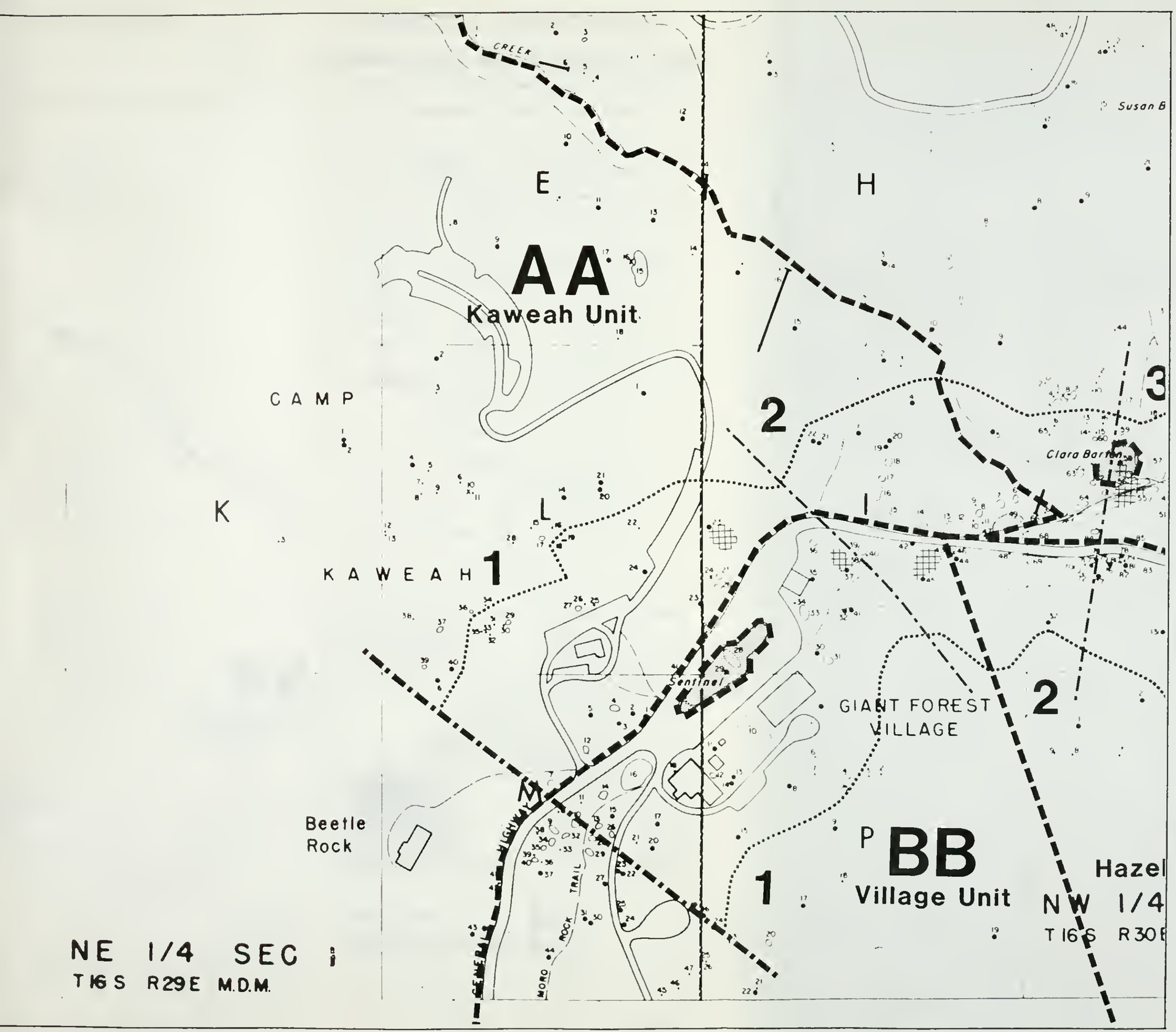
STUDY SECTION- **a**

NE 1/4 SE
T16S R29E M.D.M.

VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA



LEGEND

- 1/4 Section Boundary
- Viewshed/SMA Boundary
- 1 Hwy Visual Units
- A Burn Unit Boundary
- AA SMA Planning Units / Past Burn Units
- Areas of Fire Exclusion
- Blocked views of Sequoias
- Encroaching thickets to be monitored
- Sequoias over 8' in diameter
- Sequoias under 8' in diameter
- Areas of Sequoia Reproduction
- Logs
- Trails
- Roadways
- Streams

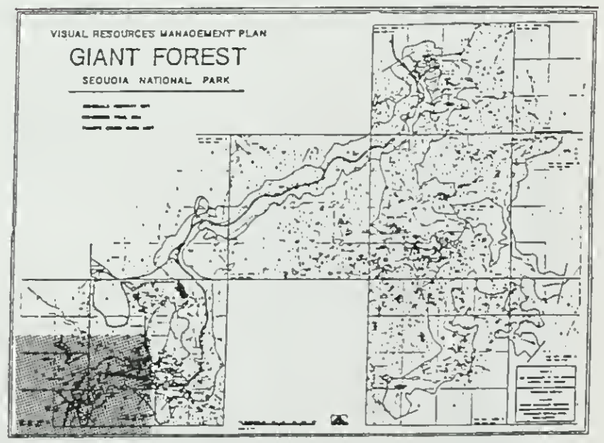
Management Intensity Scale

Visual Unit Management Scale

1 = Low management intensity (0-3 FDV)
2 = Medi/ Low management intensity (4-7 FDV)
3 = Medi/ High management intensity (8-11 FDV)
4 = High management intensity (12+ FDV)

SMA Visual Unit #	Autumn Aggregation Index	Sequoia Acres	Autumn Complexity Value	Visual Unit Management Score
Generals Highway				
1	79	12.3	6.3	2
2	67	6+	12.4	3
3	252	25+	8.6	3
4	250	15.4	16.3	4
5	44	6.6	7.3	2
6	41	6.2	7.6	2
7	21	6.3	3.3	1
8	7	7.3	2.6	1
9	2	6.6	0.7	1
10	74	6.1	3.3	1
11	42	4.2	10.1	2
12	46	2.4	7.9	2
13	14	6.2	3.1	1
14	42	4.6	6.3	2
15	14	3.1	4.3	2
16	12	2.4	6.8	2
17	33	6.9	3.3	1
18	62	6.7	13.2	4
19	41	6.6	3.4	2
Congress Trail				
1	110	11.6	10.2	3
2	333	22.7	14.6	4
3	61	6+	13.2	4
4	96	7.3	12.4	4
5	275	16+	17.6	4
6	197	11.2	20.2	4
7	223	22.6	17.4	4

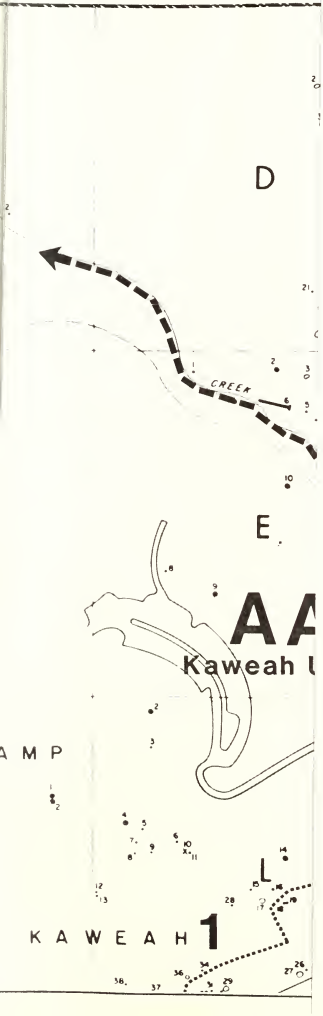
October 1987

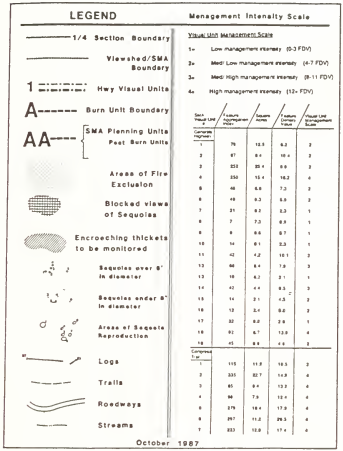


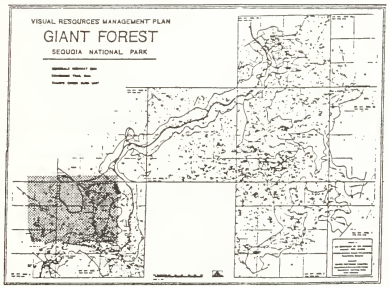
map key:
STUDY SECTION- **a**

VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA







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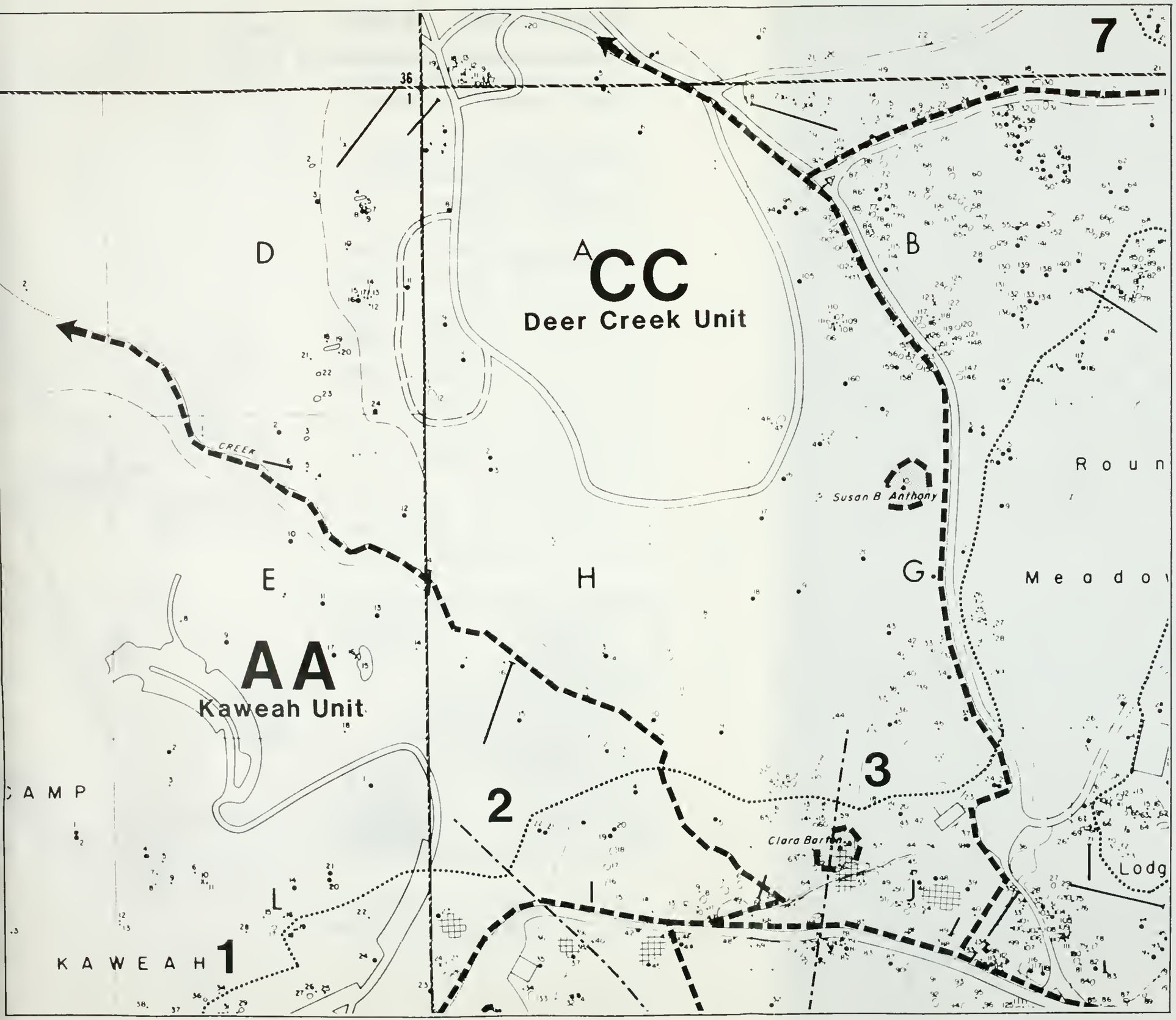
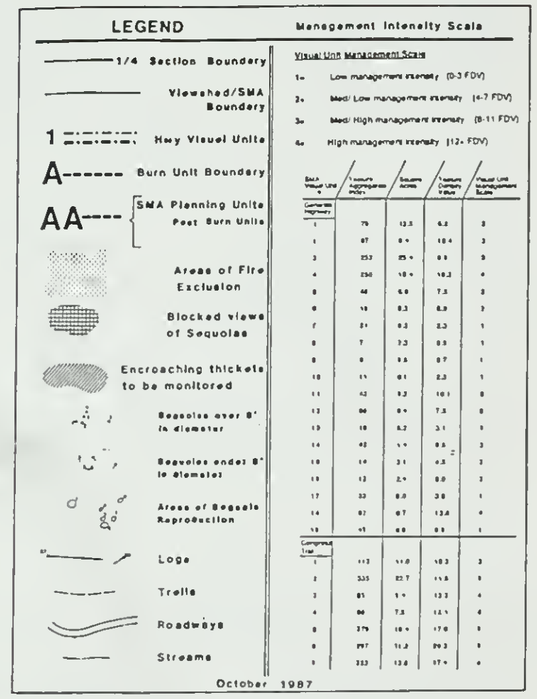
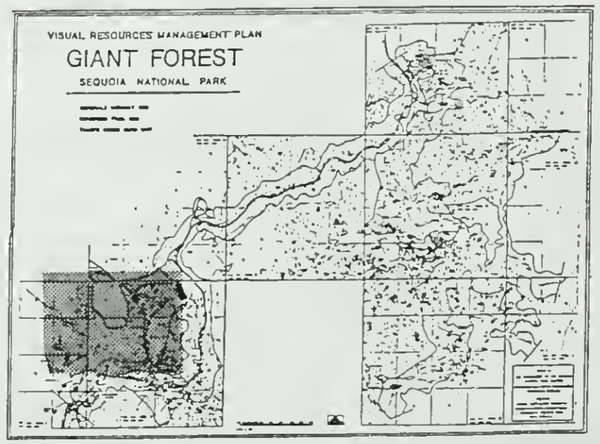
STUDY SECTION- b

VISUAL RESOURCES
Landscape Management Pla

Generals Highway SMA







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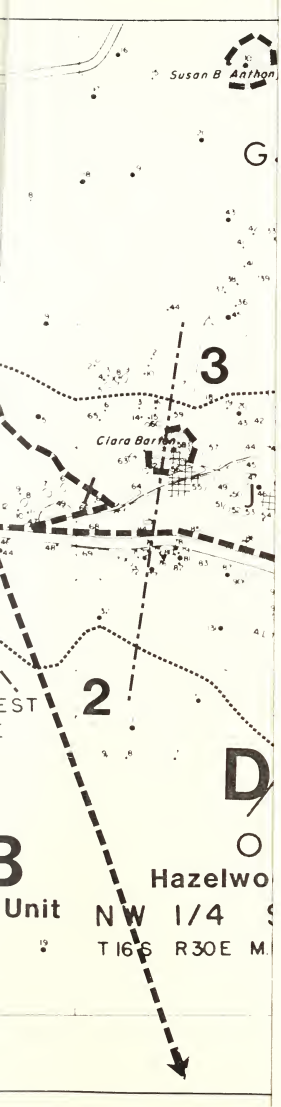
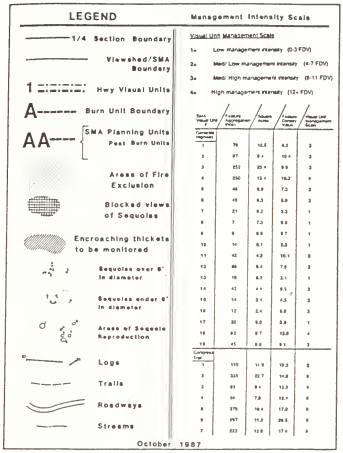
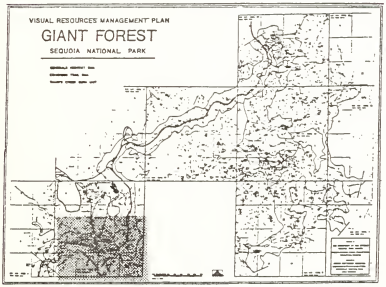


VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA





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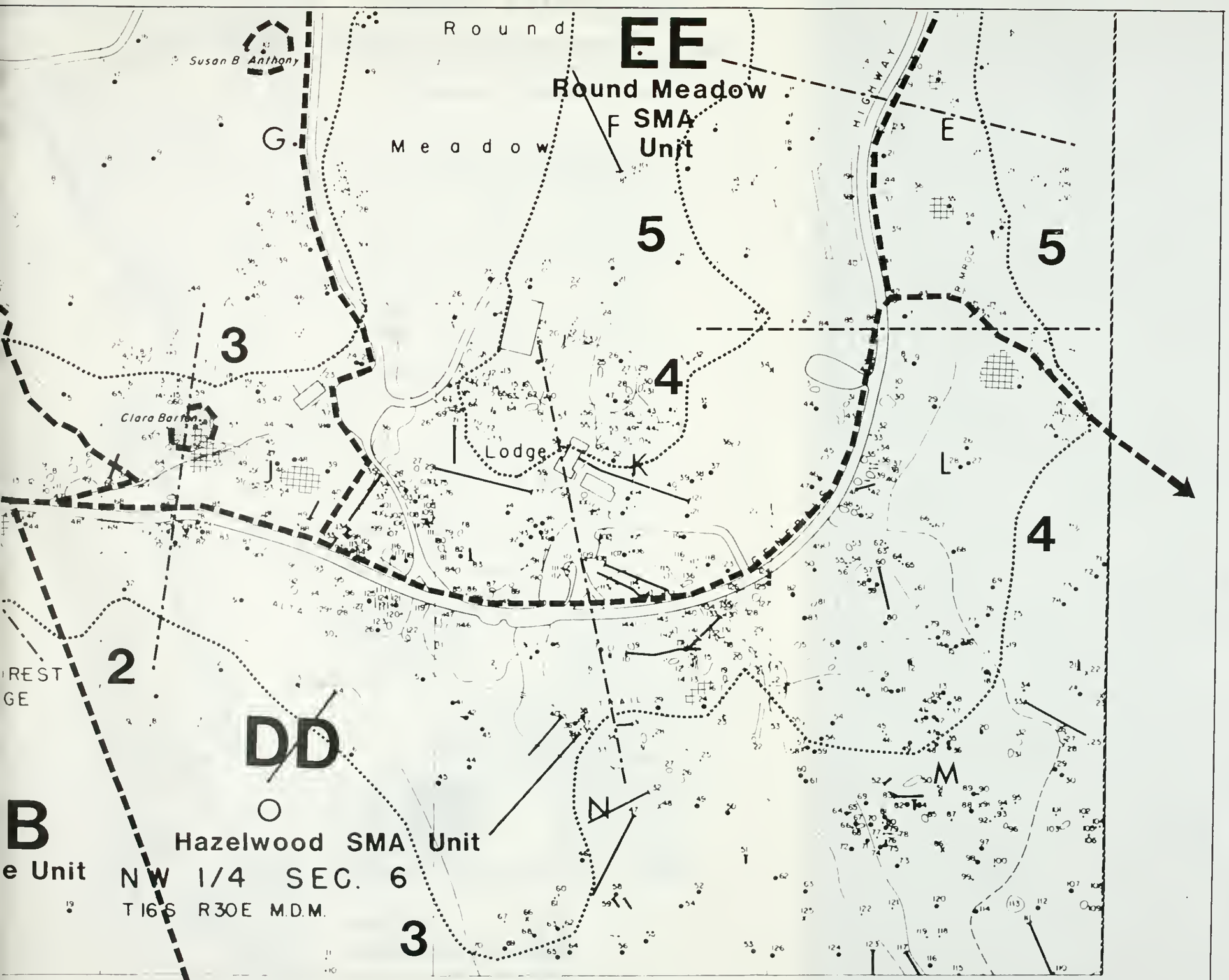
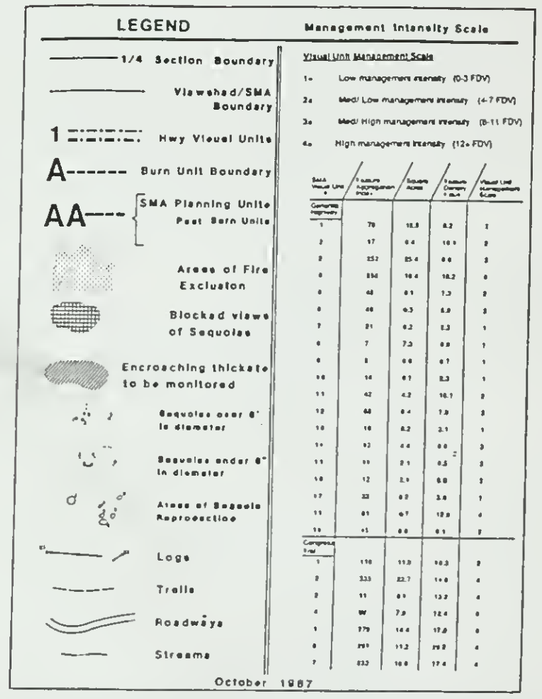
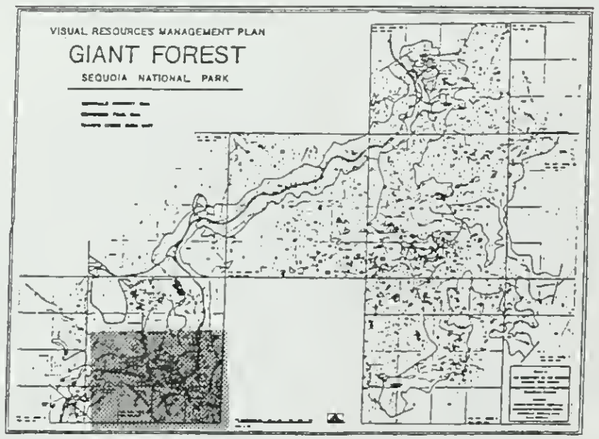
VISUAL RESOURCES
Landscape Management Pla

Generals Highway SMA







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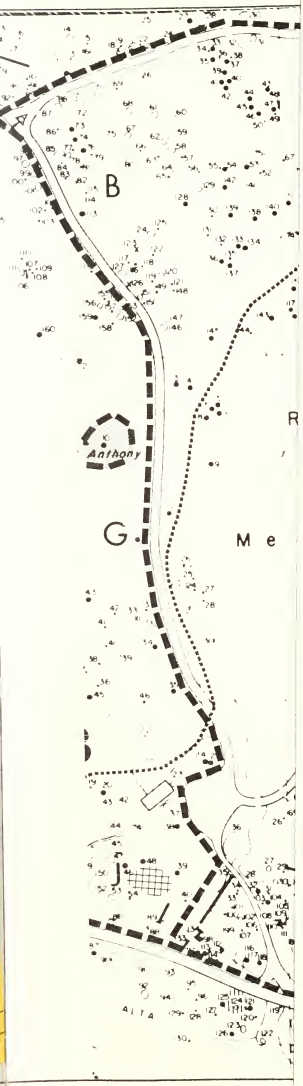
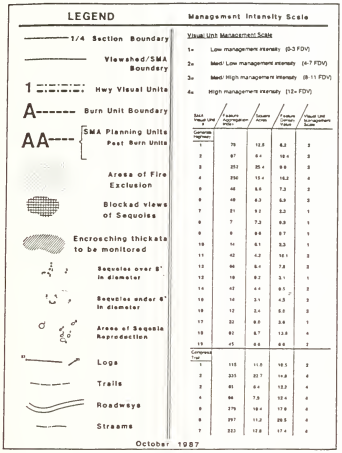
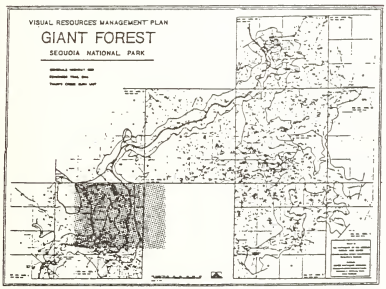
VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA







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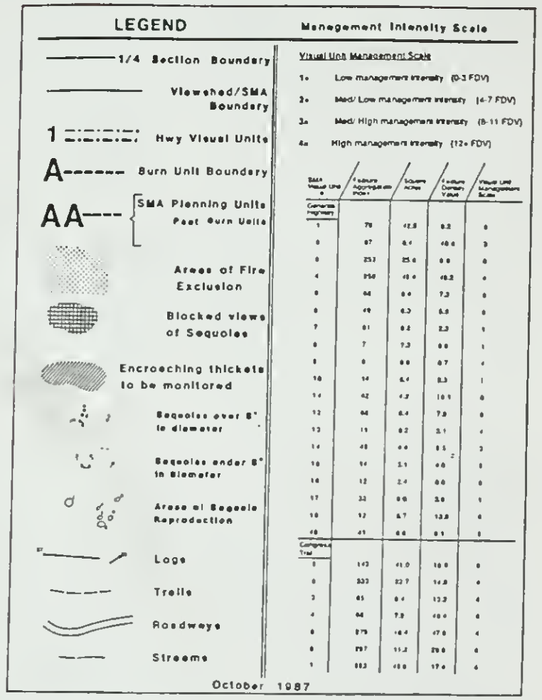
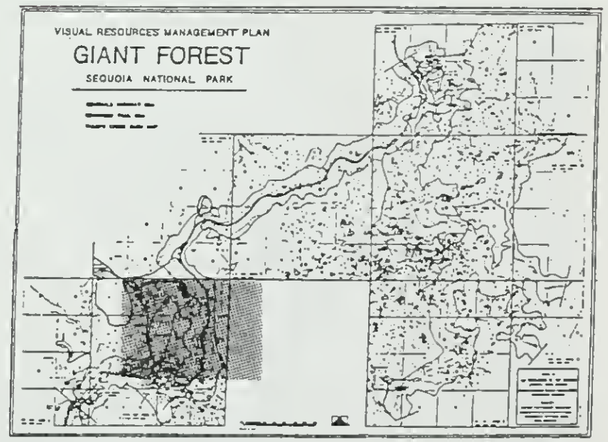
VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA





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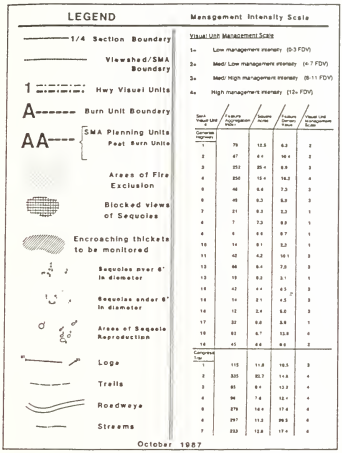
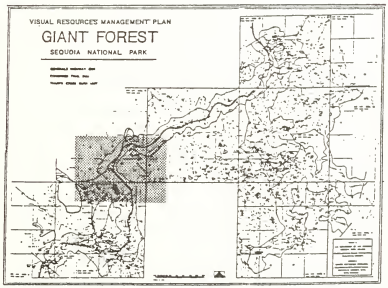
VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA





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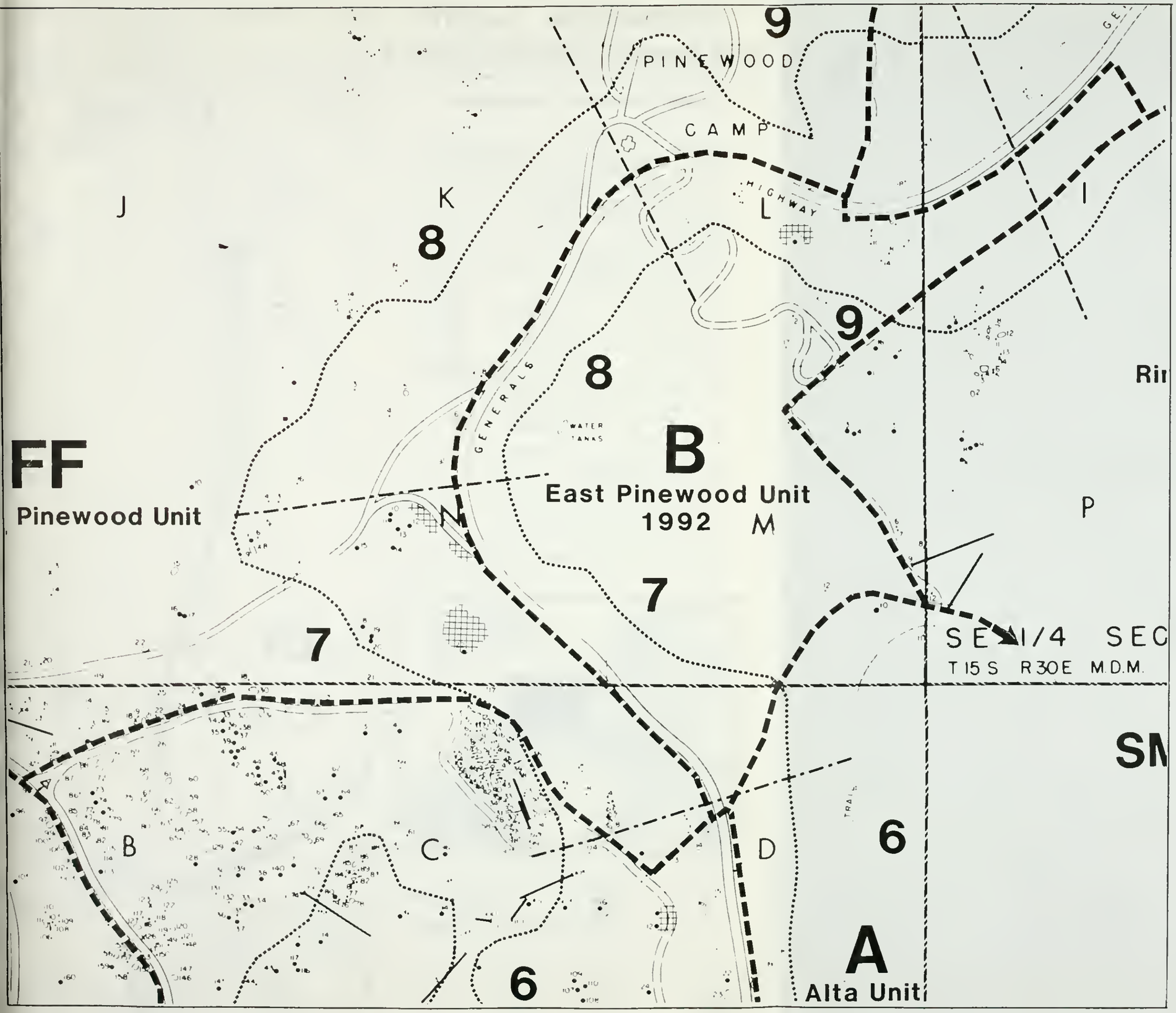
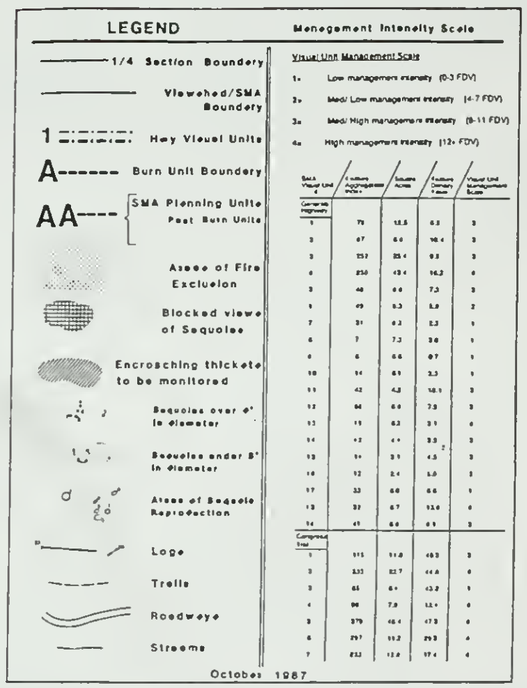
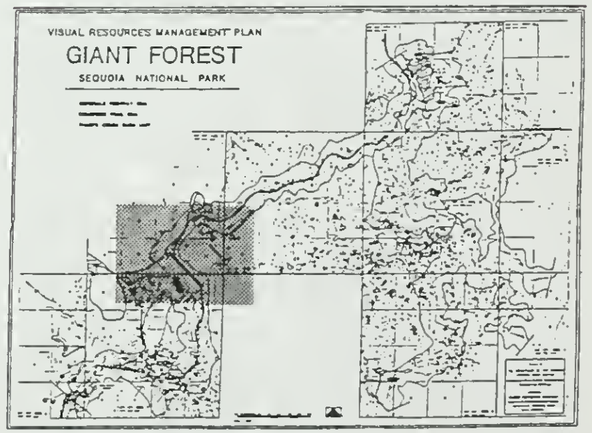
VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA







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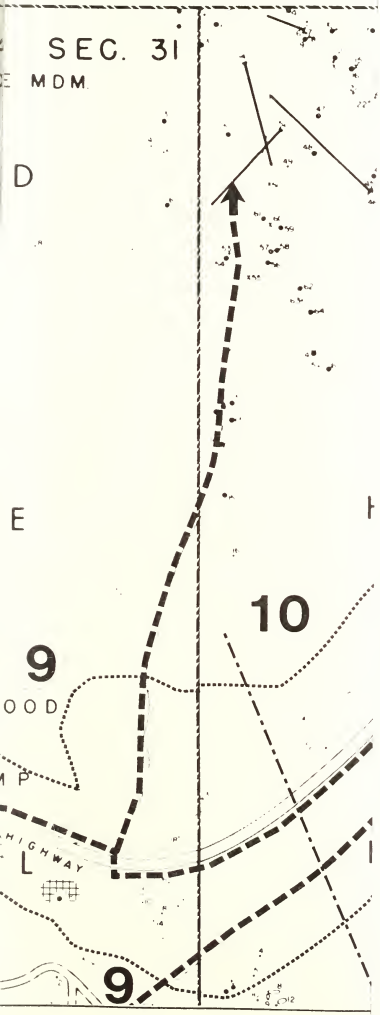
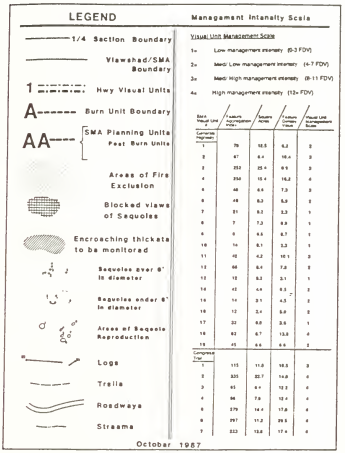
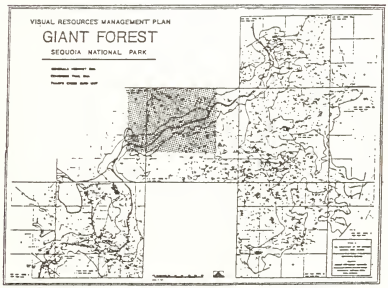
VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA







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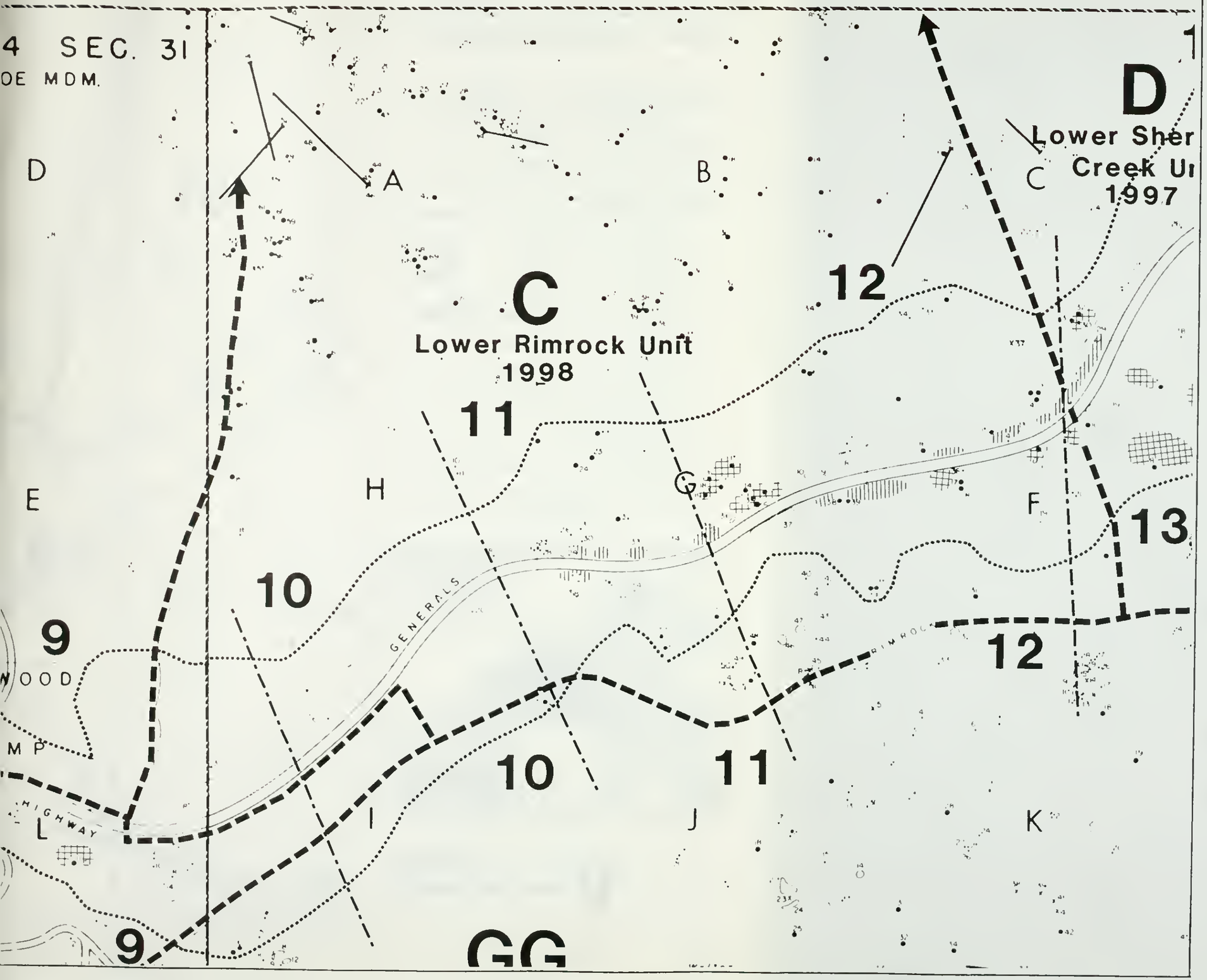
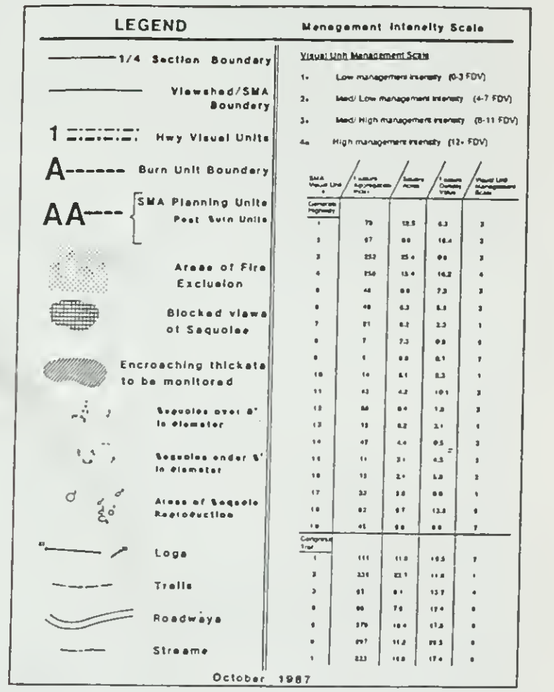
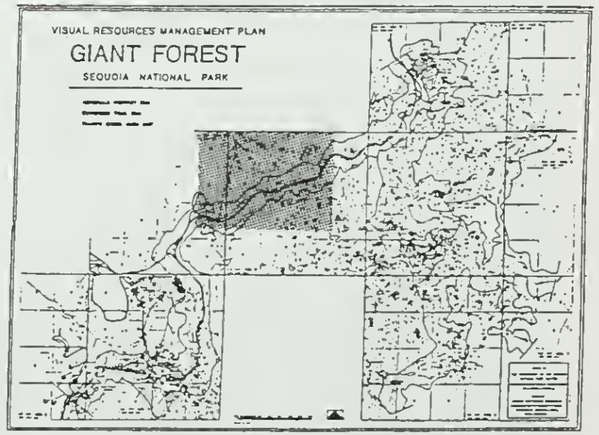
STUDY SECTION- f

VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA







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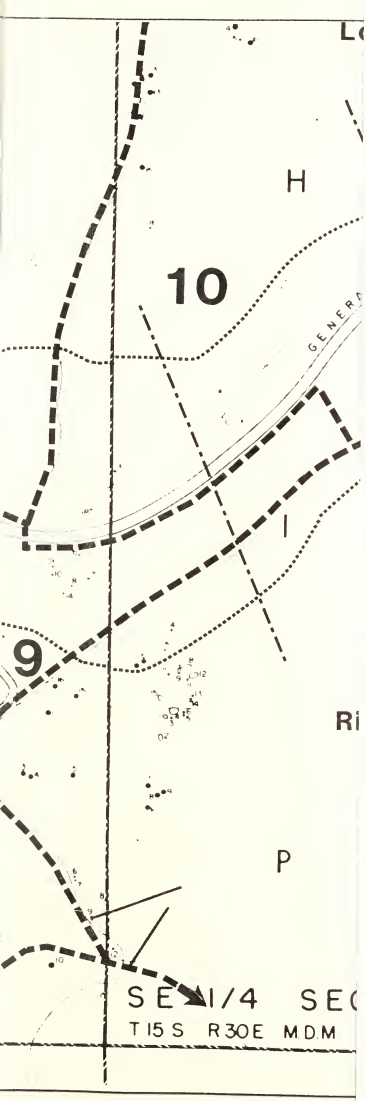
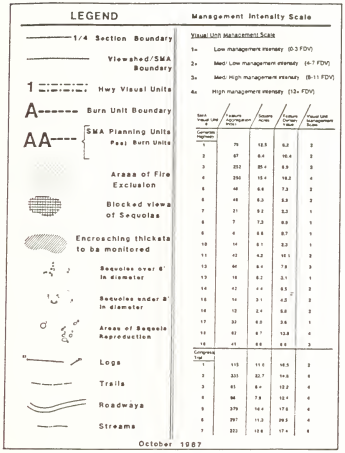
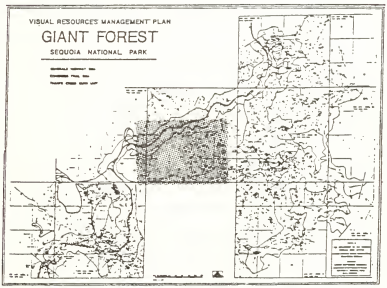
STUDY SECTION- f

VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA







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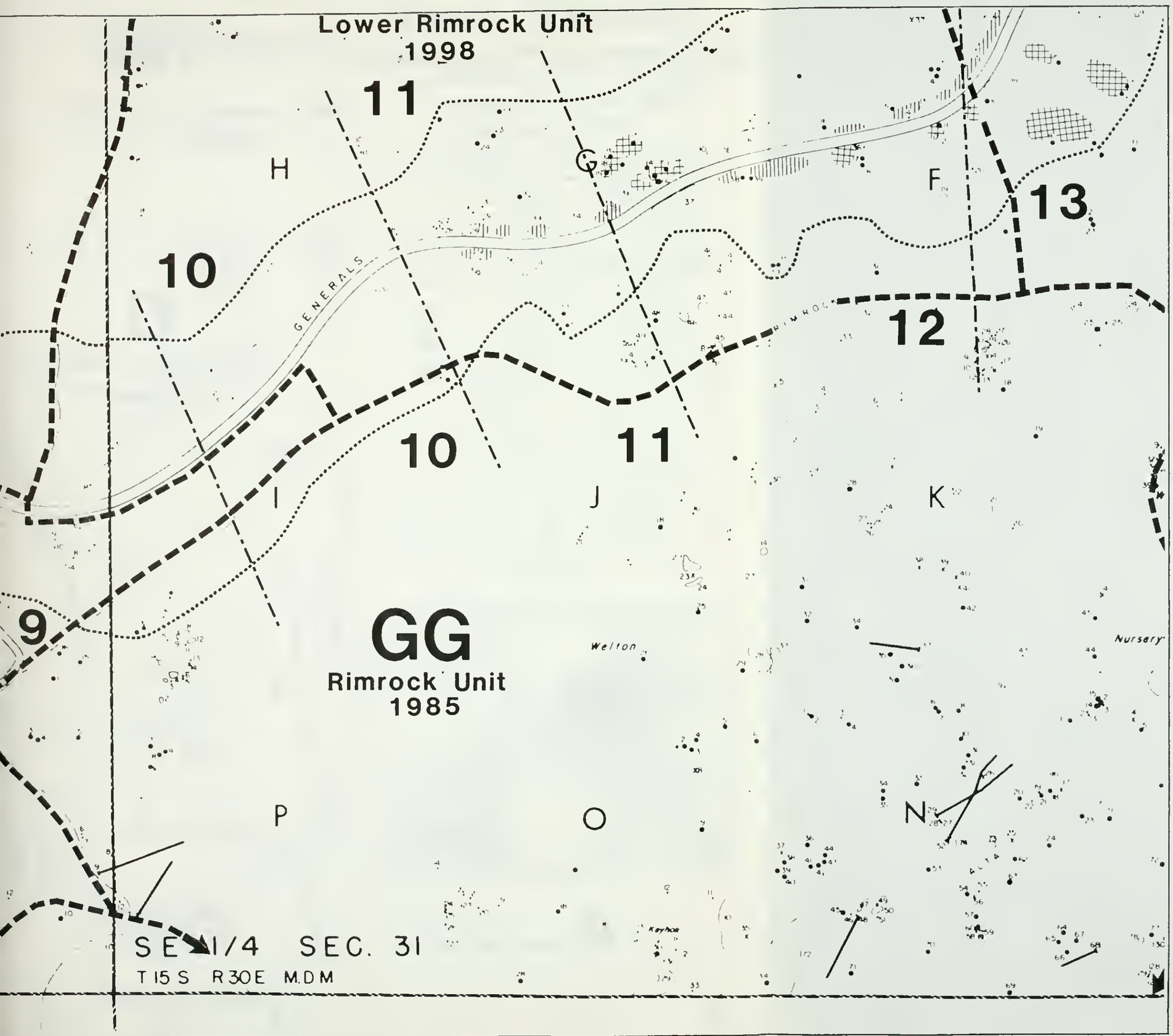
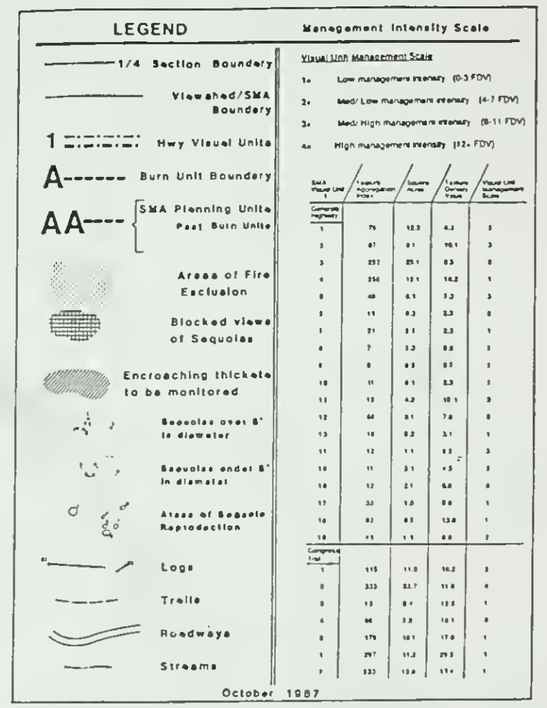
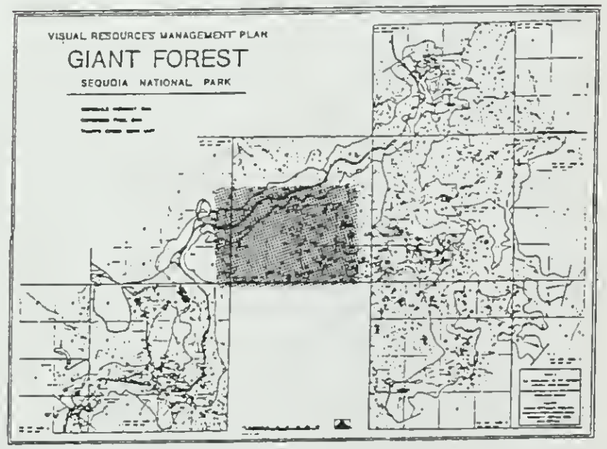
STUDY SECTION- **g**

VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA







map key:
STUDY SECTION- **g**

HH Gateway U

Upper Congress Unit
2000

13 14

D

Lower Sherman
Creek Unit
1997

C

1

F

13

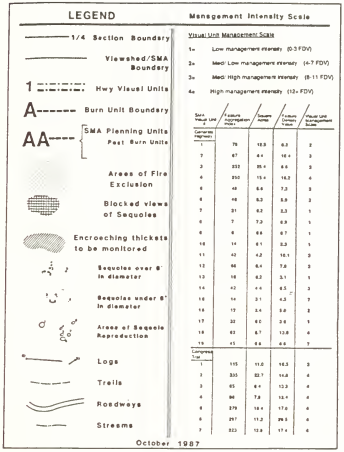
12

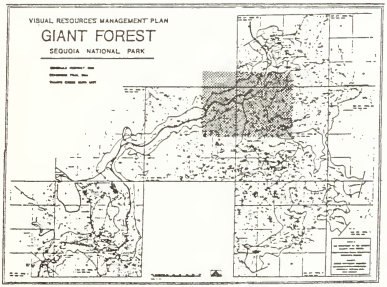
GG

Rimrock Unit
1985

V

Generals Highway SMA
Congress Trail SMA





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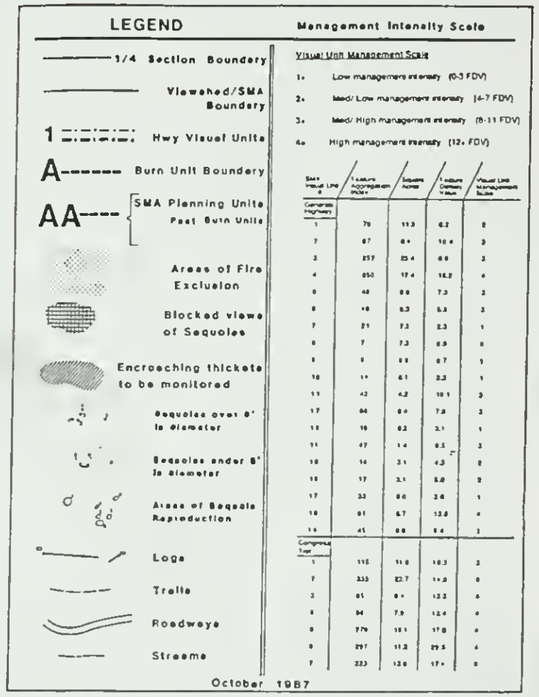
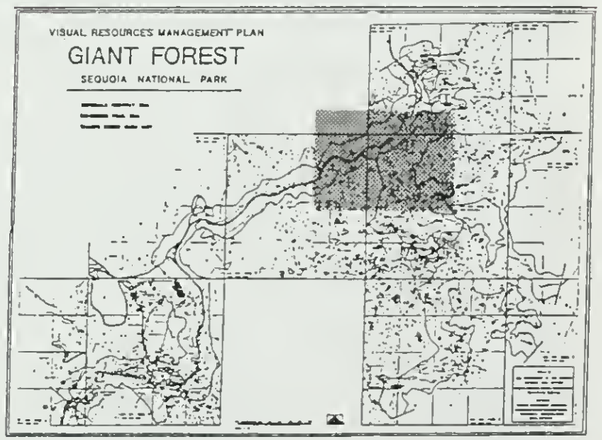
STUDY SECTION- h

VISUAL RESOURCES
Landscape Management Plan

Generals Highway SMA
Congress Trail SMA





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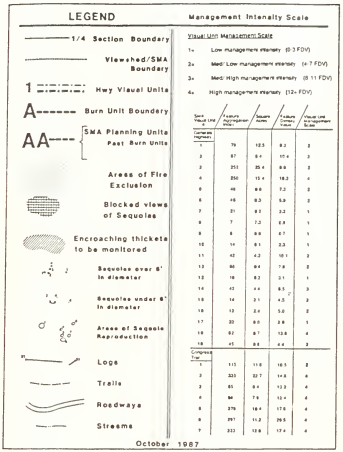
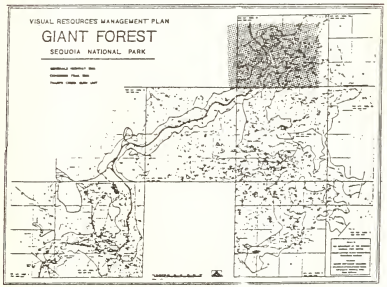
STUDY SECTION- **h**

VISUAL RESOURCES
Landscape Management Plan

Congress Trail SMA





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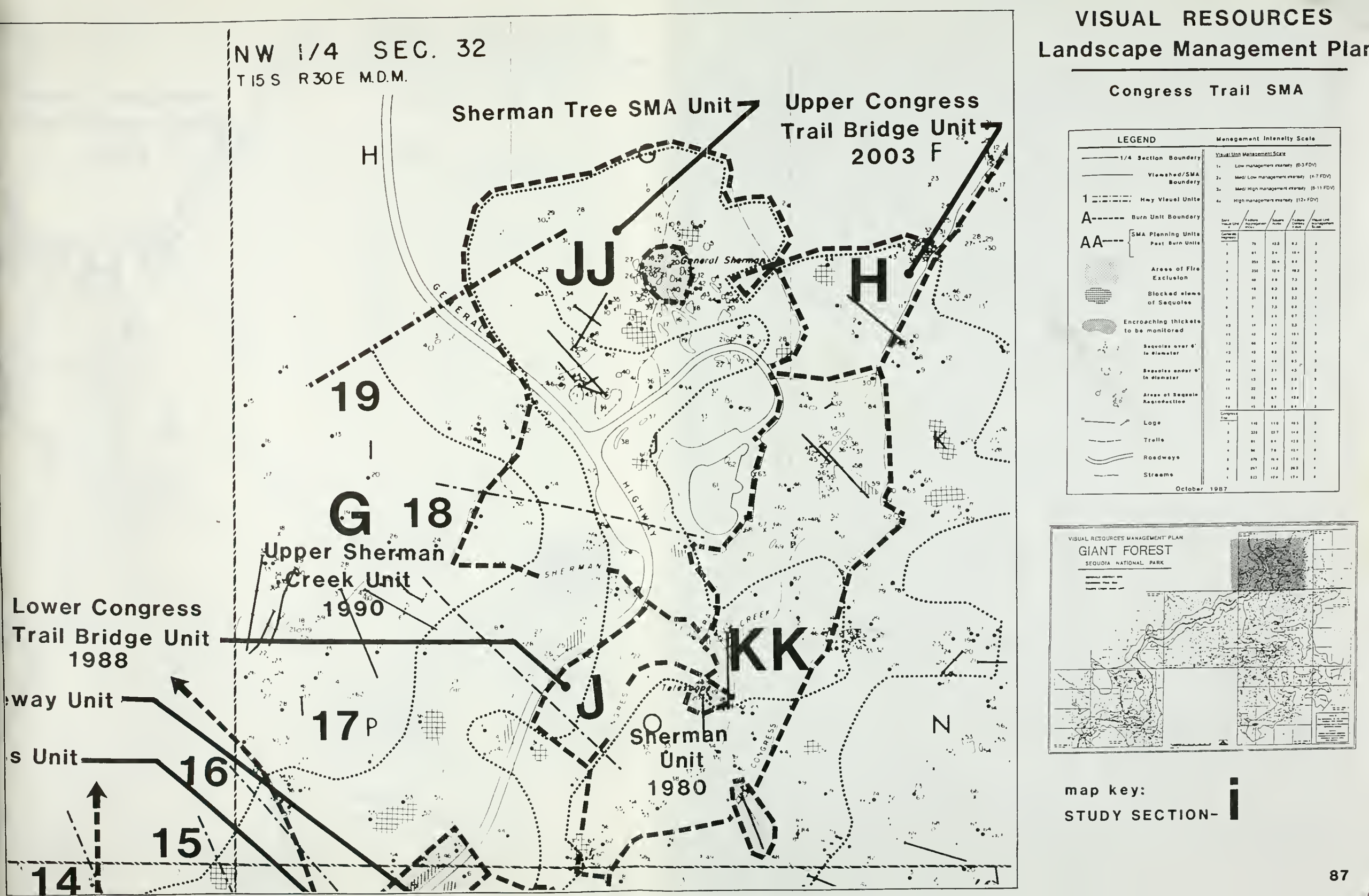
STUDY SECTION-

VISUAL RESOURCES
Landscape Management Plan

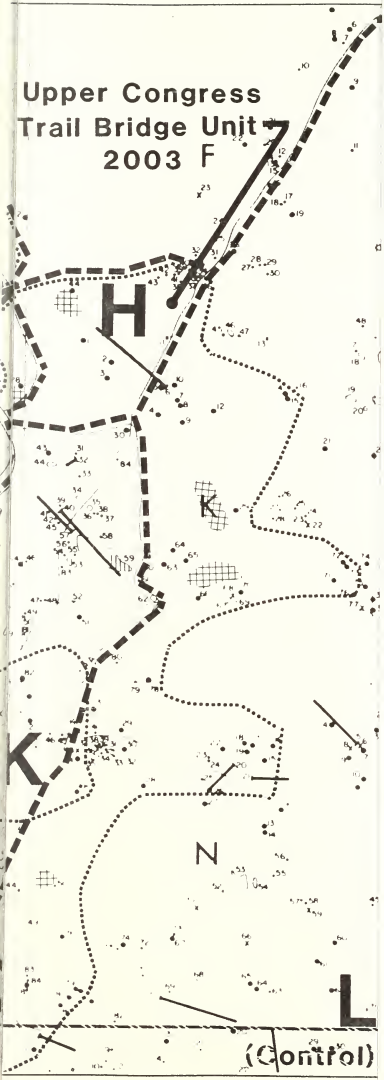
Congress Trail SMA

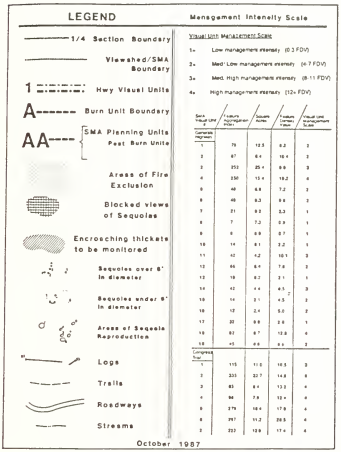


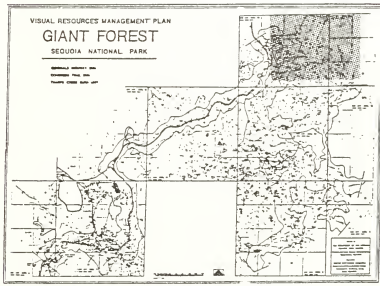
map key:
STUDY SECTION- **i**

VISUAL RESOURCES
Landscape Management Pla

Congress Trail SMA



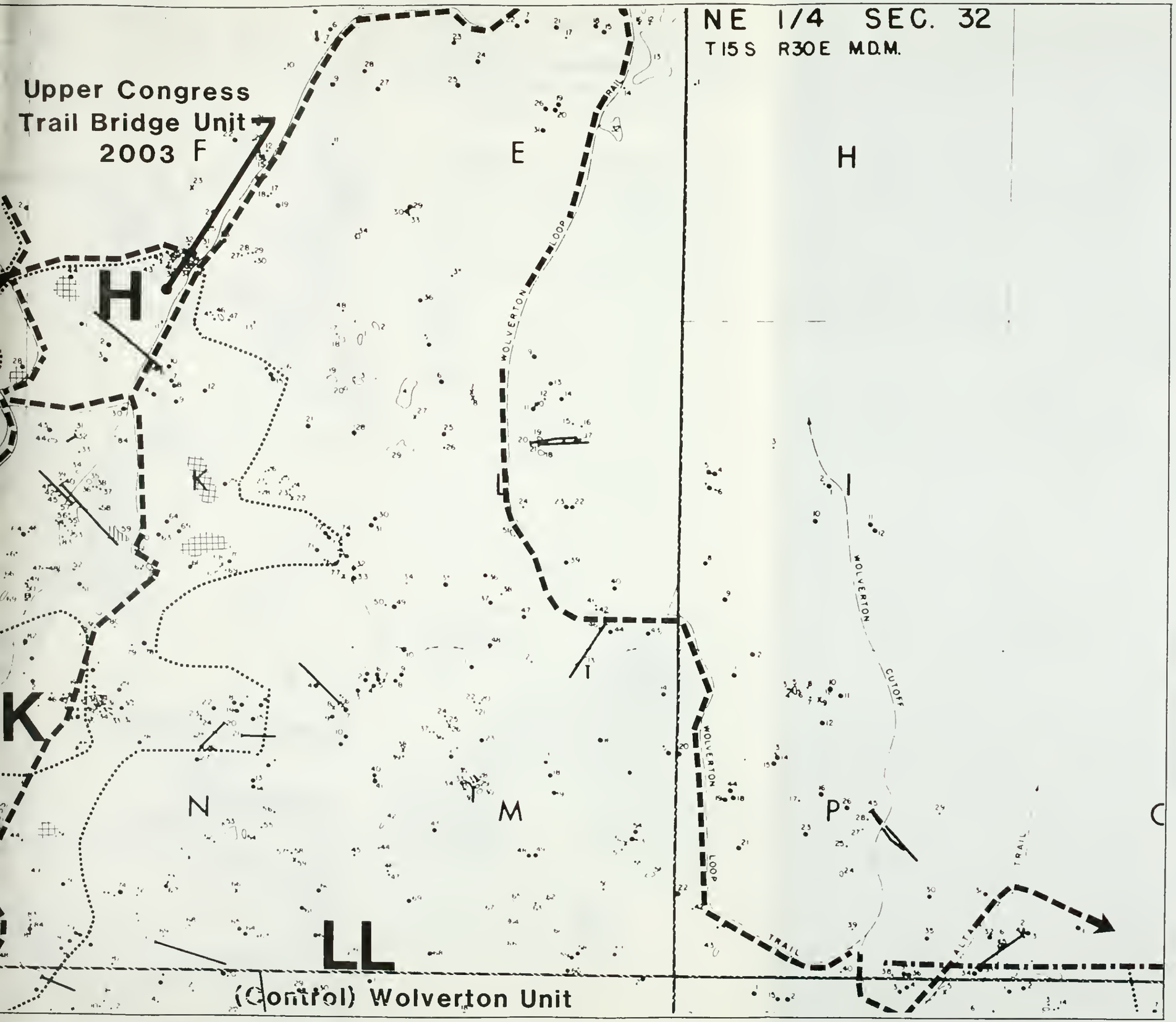


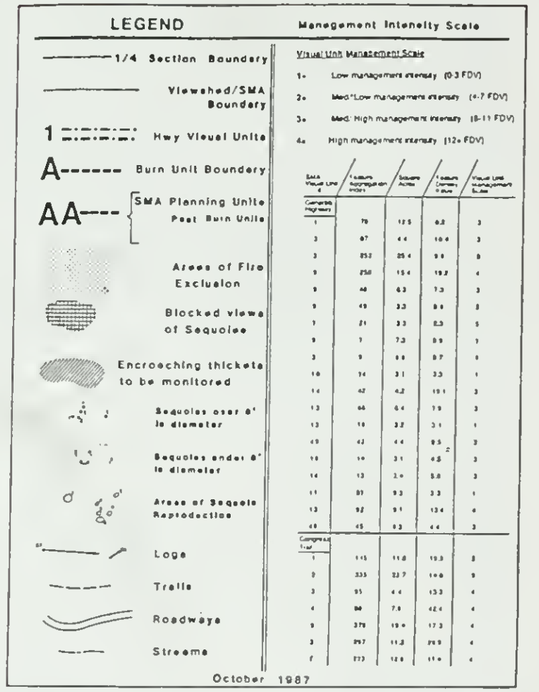


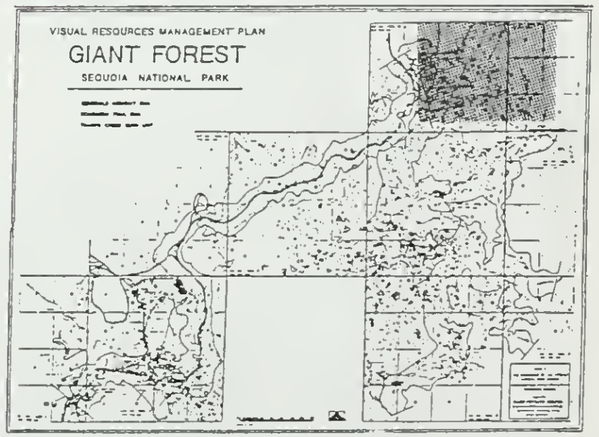
map key:
STUDY SECTION- j

VISUAL RESOURCES
Landscape Management Plan

Congress Trail SMA







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STUDY SECTION- **j**

VISUAL RESOURCES

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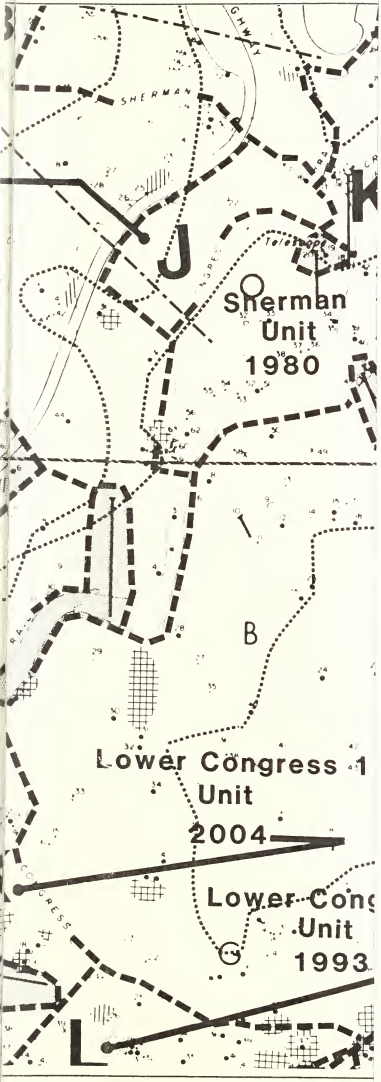
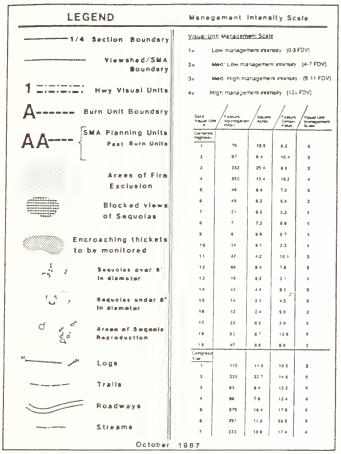
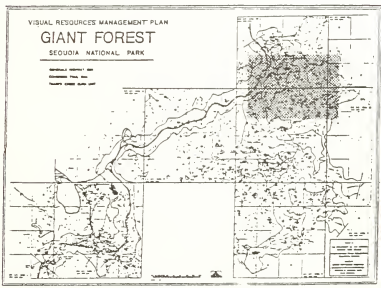
Congress Trail SMA







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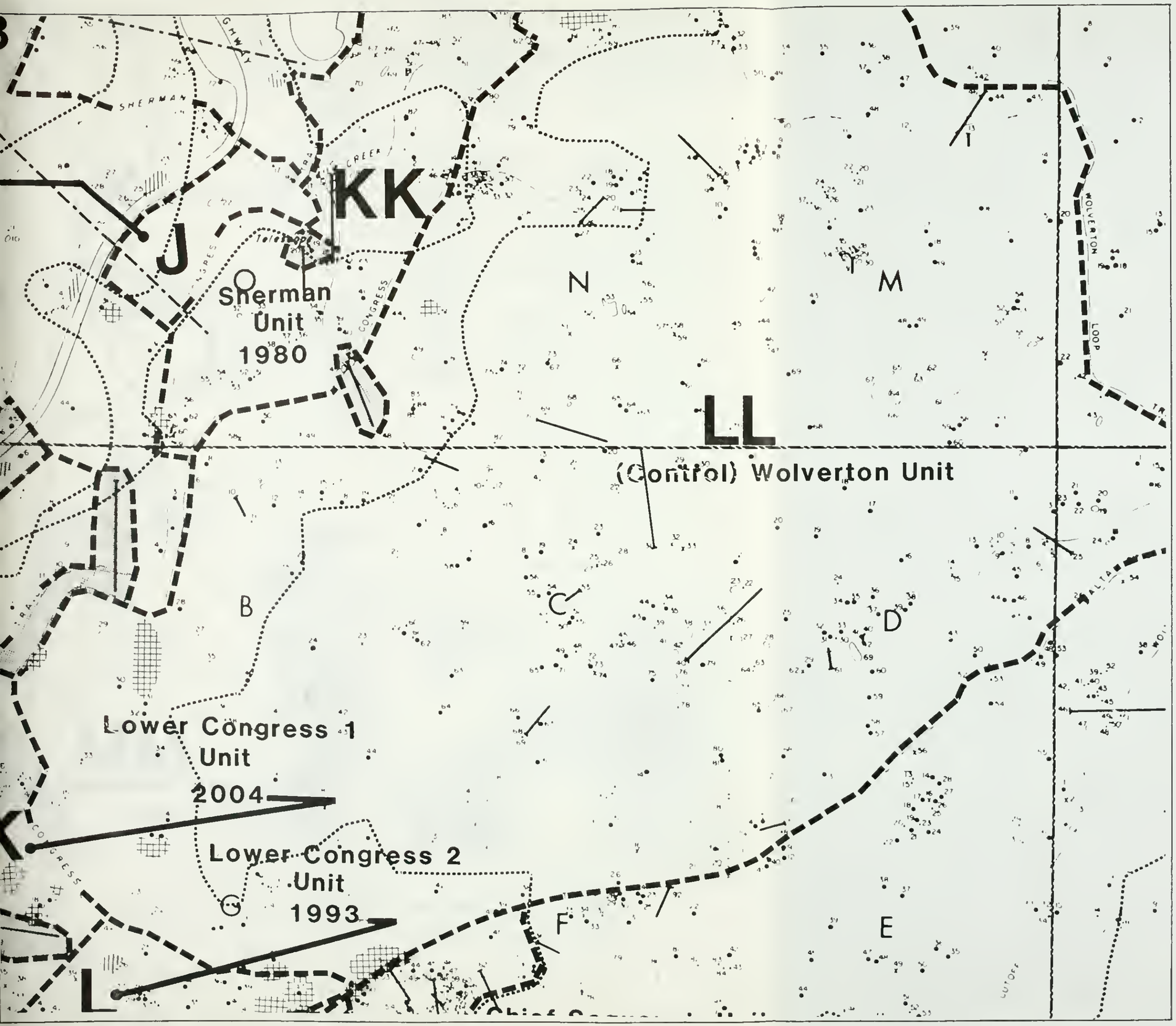
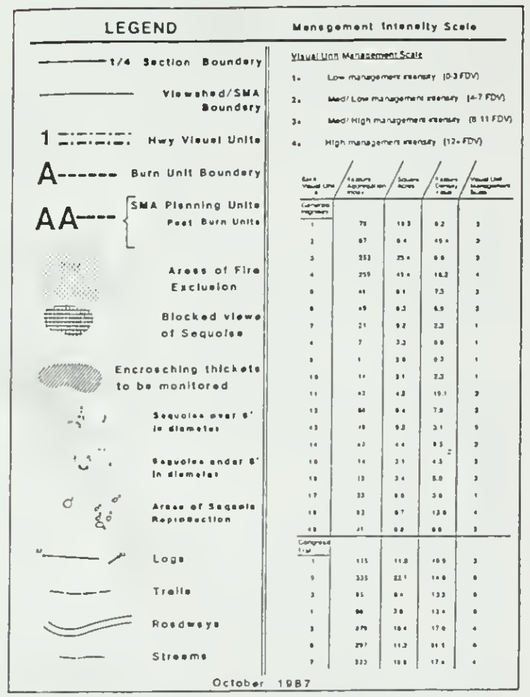
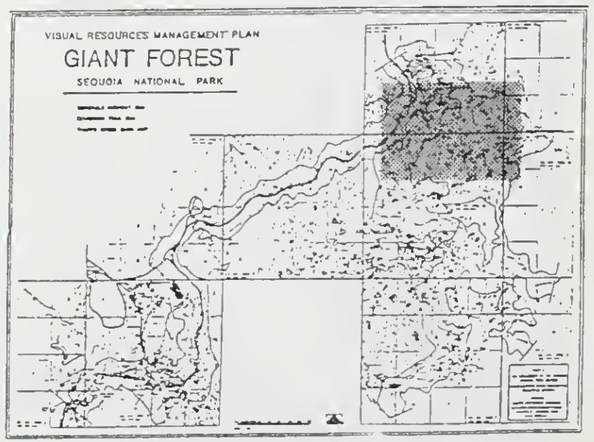
STUDY SECTION- **k**

VISUAL RESOURCES
Landscape Management Plan

Congress Trail SMA







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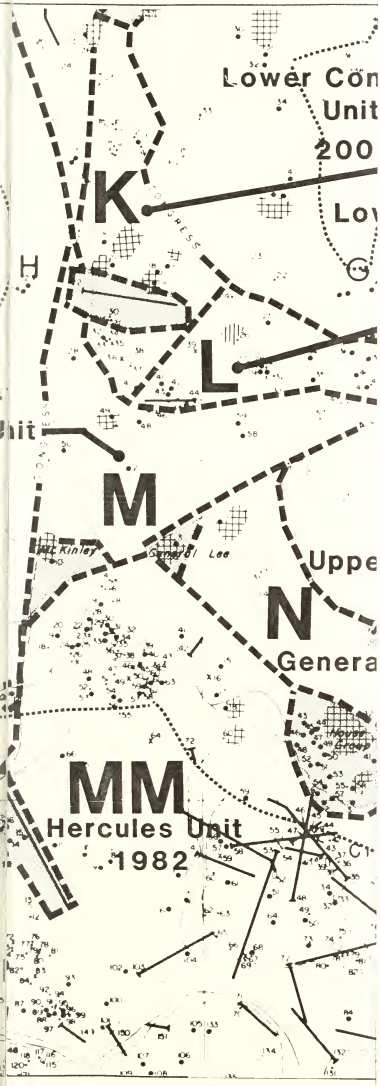

VISUAL RESOURCES

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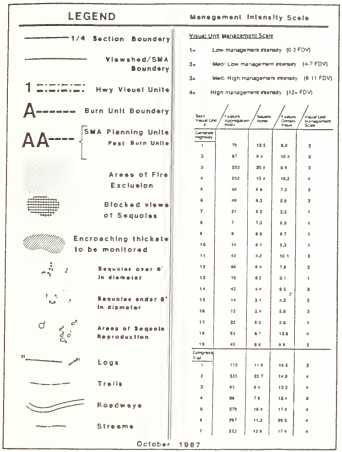

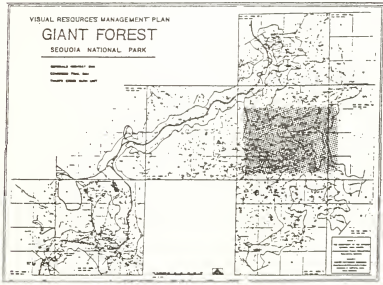

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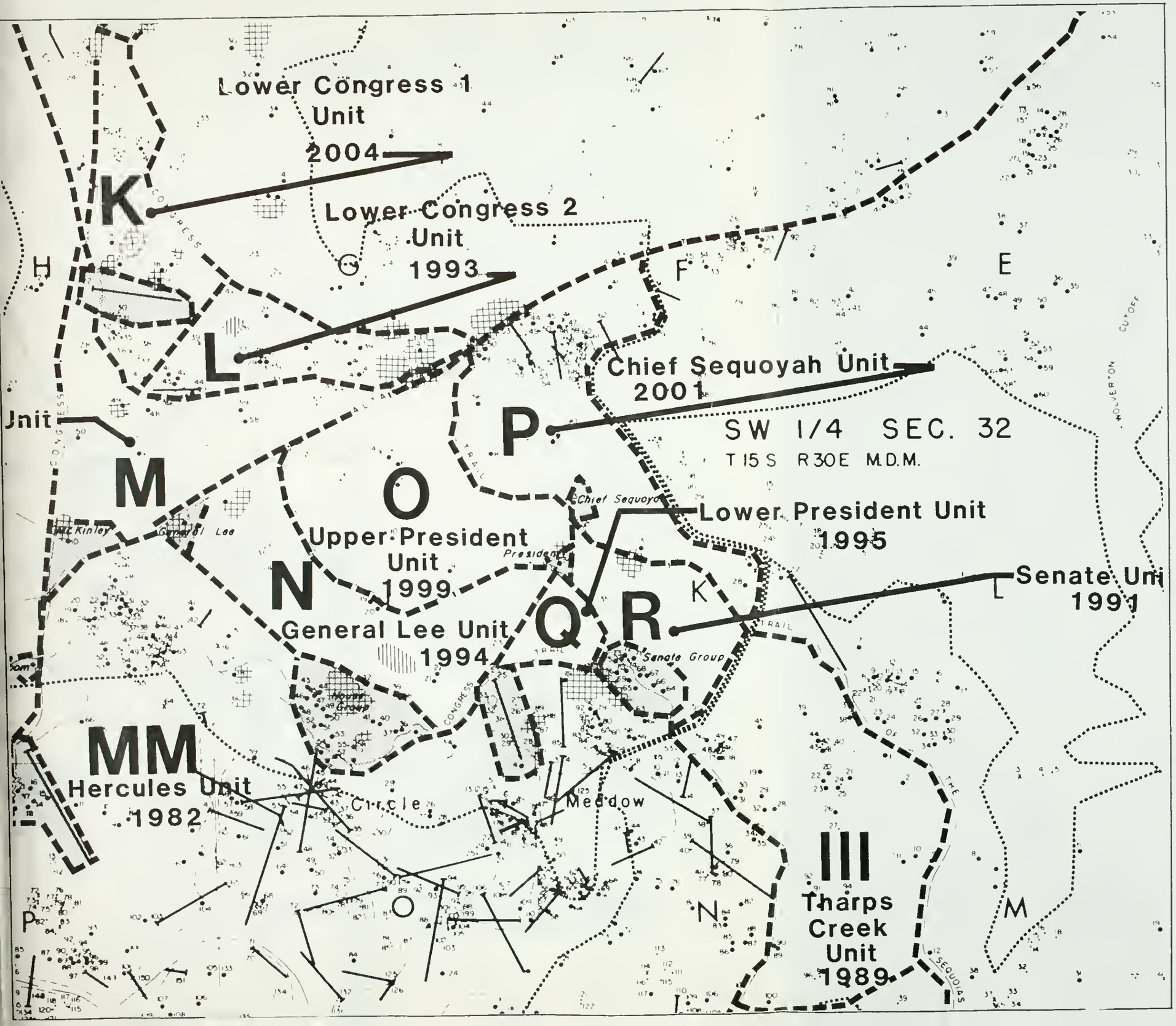
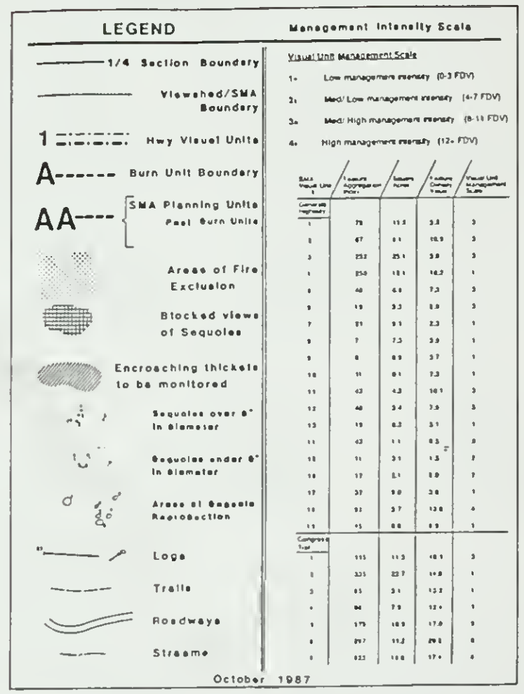
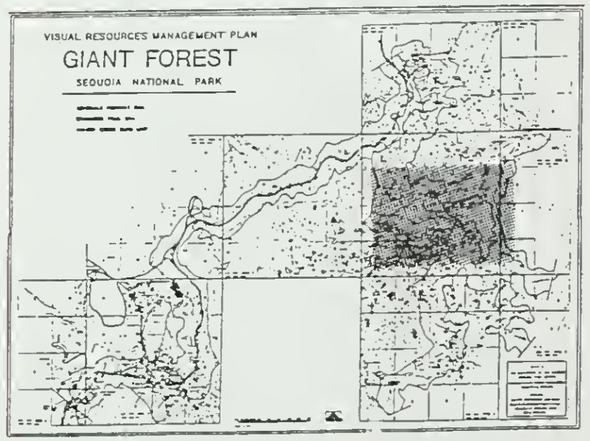
STUDY SECTION-

VISUAL RESOURCES
Landscape Management Plan

Congress Trail SMA







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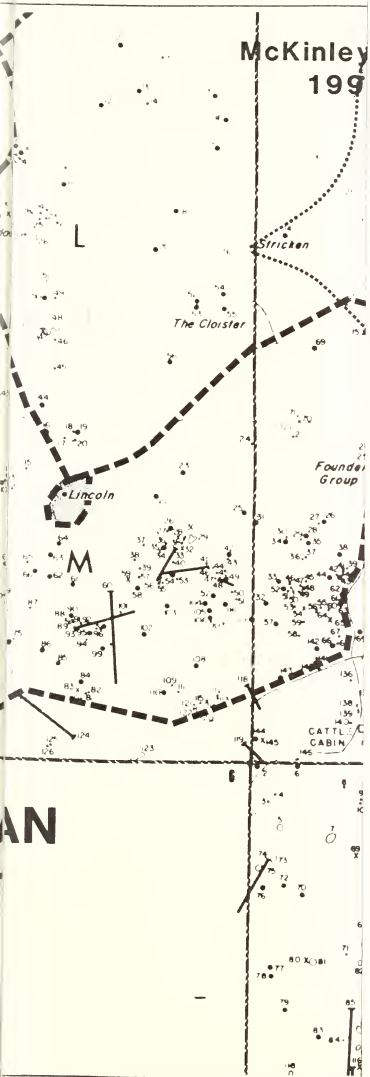
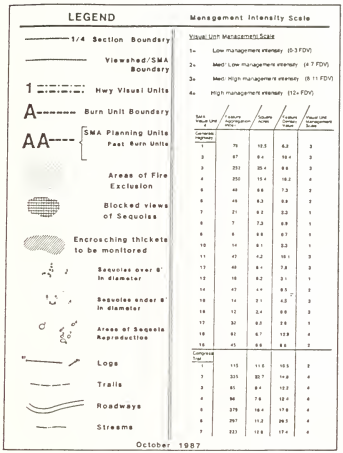
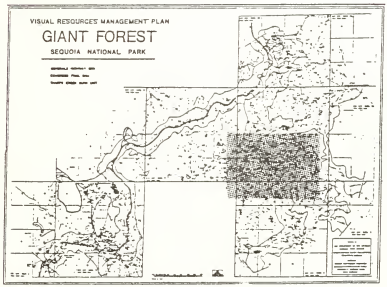
STUDY SECTION- I

Congress Trail SMA







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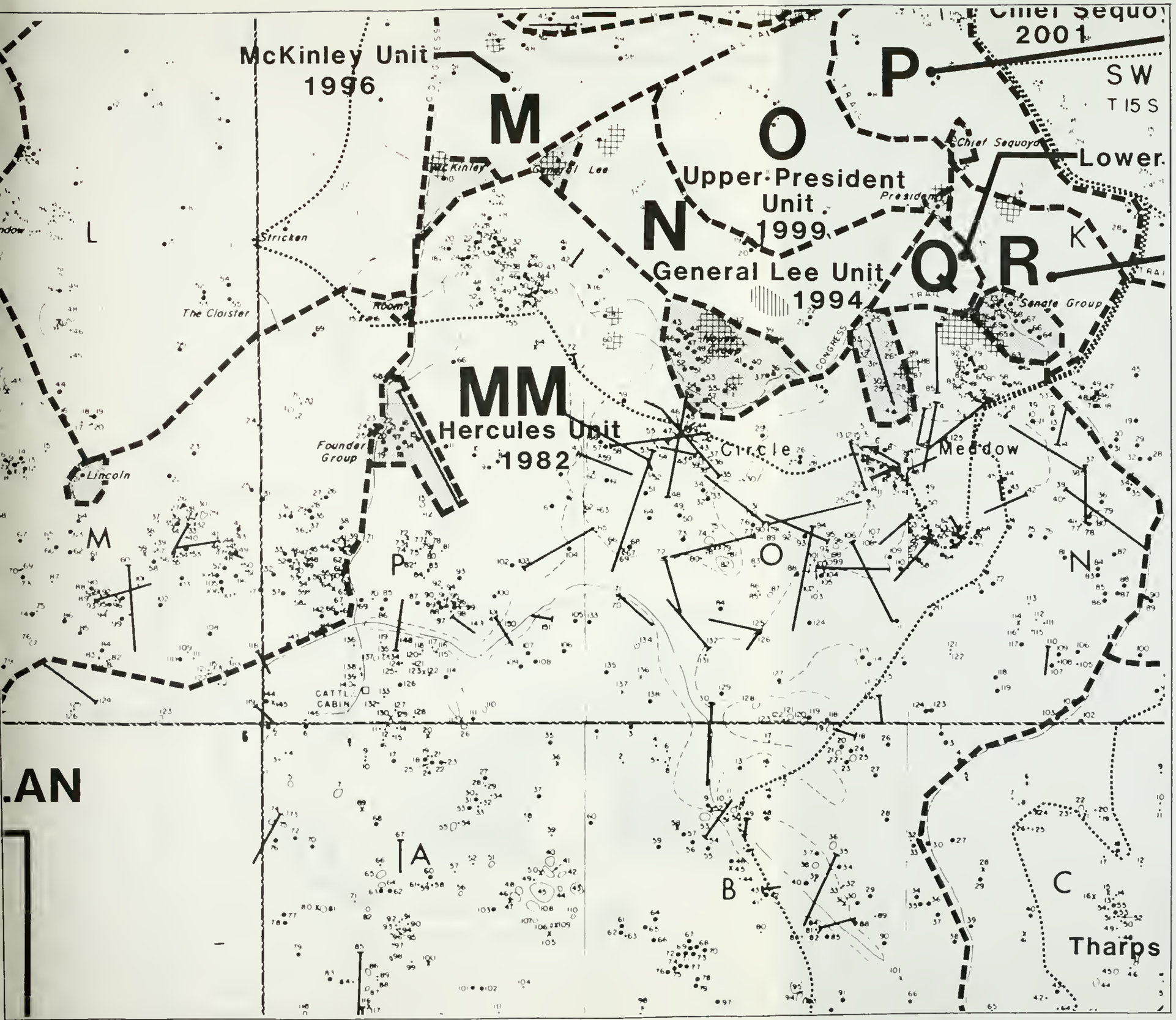
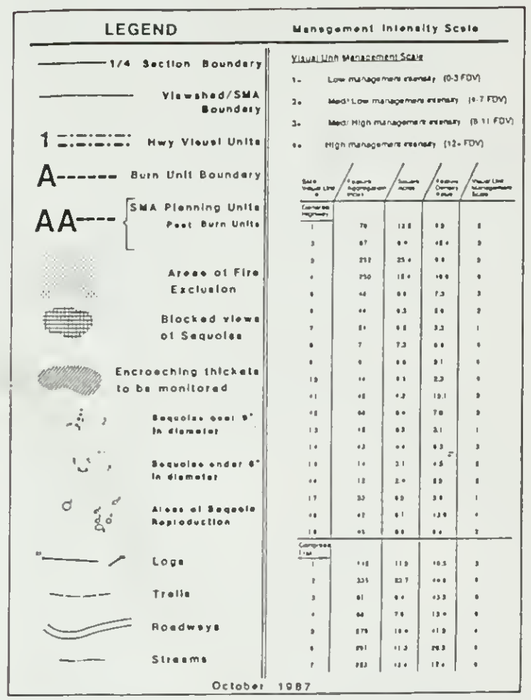
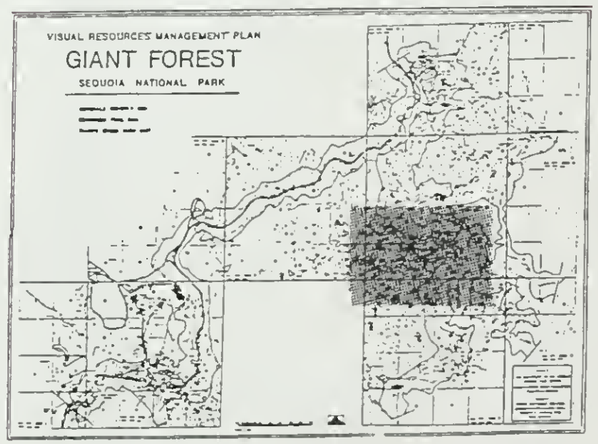
STUDY SECTION- **m**

VISUAL RESOURCES
Landscape Management Plan

Congress Trail SMA







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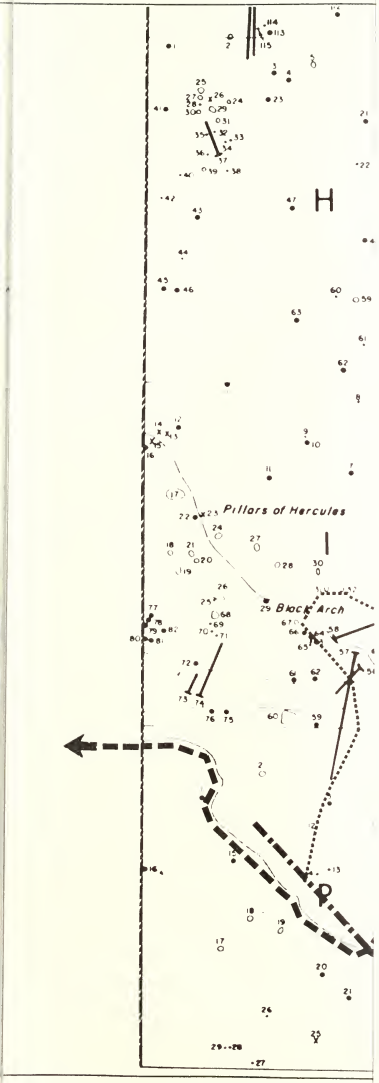
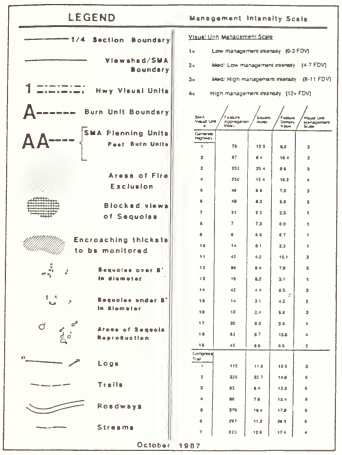
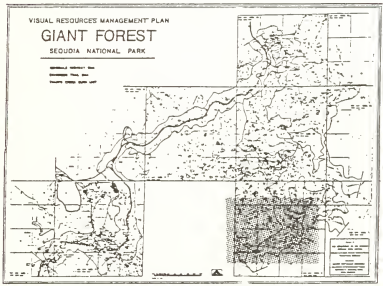
STUDY SECTION- **m**

VISUAL RESOURCES
Landscape Management Pla

Congress Trail SMA







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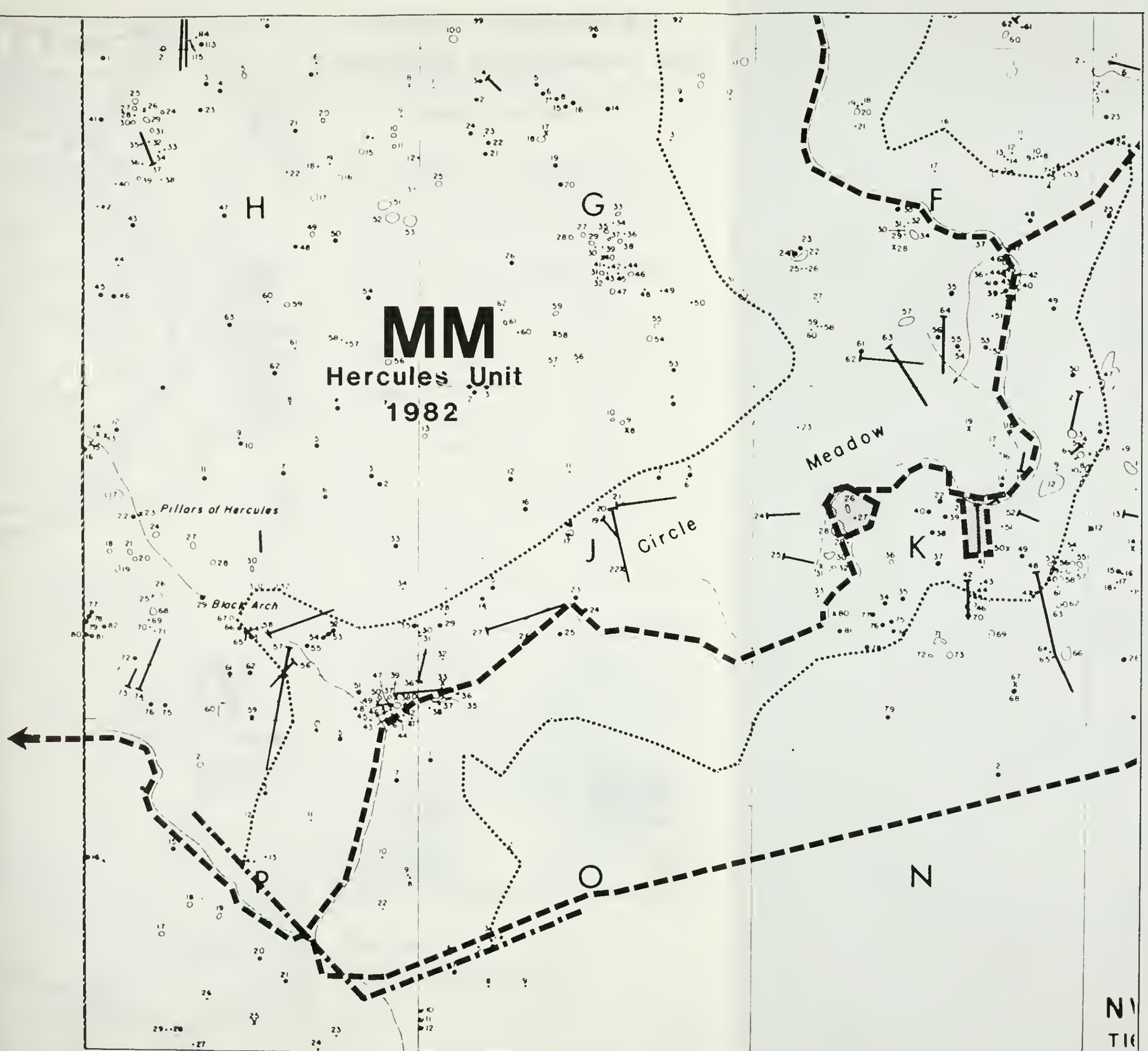
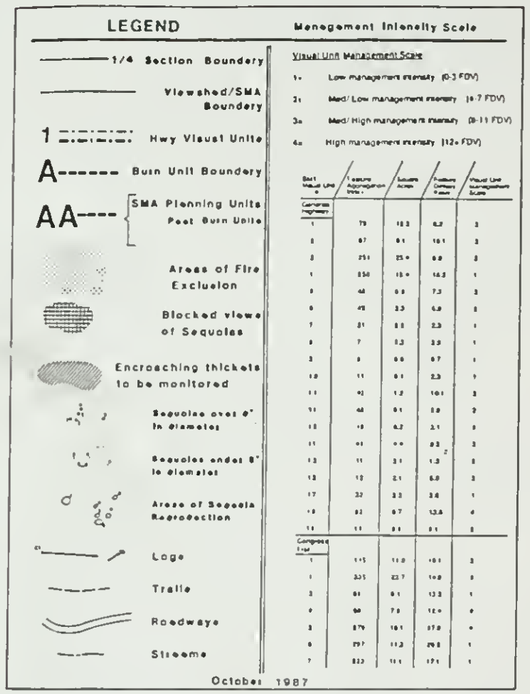
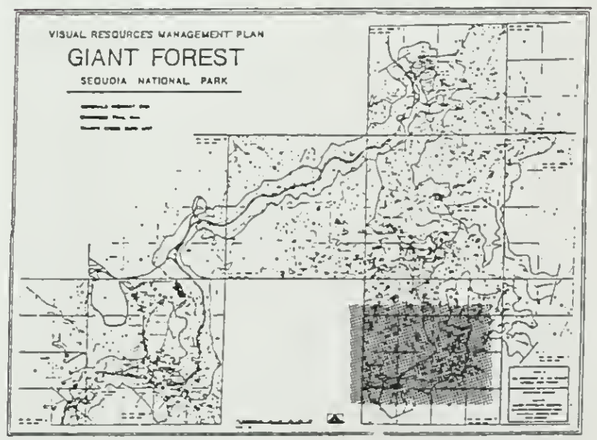
STUDY SECTION- **n**

VISUAL RESOURCES
Landscape Management Plan

Congress Trail SMA







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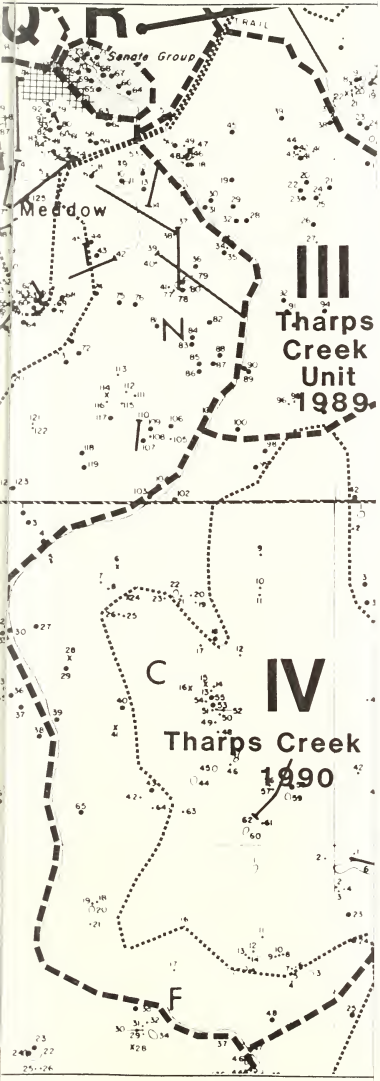
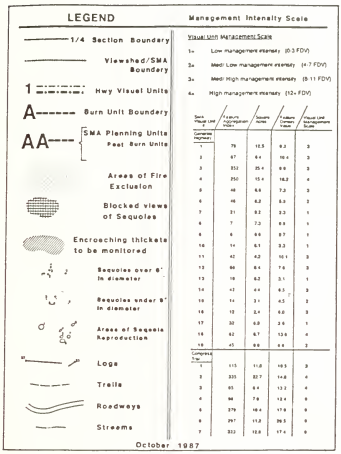
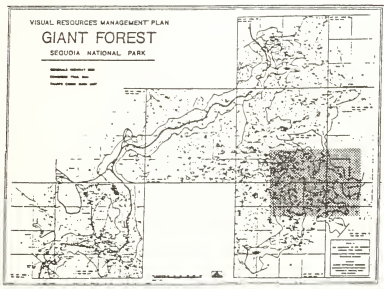
STUDY SECTION- **n**

VISUAL RESOURCES
Landscape Management Pla

Tharp's Creek Burn Unit







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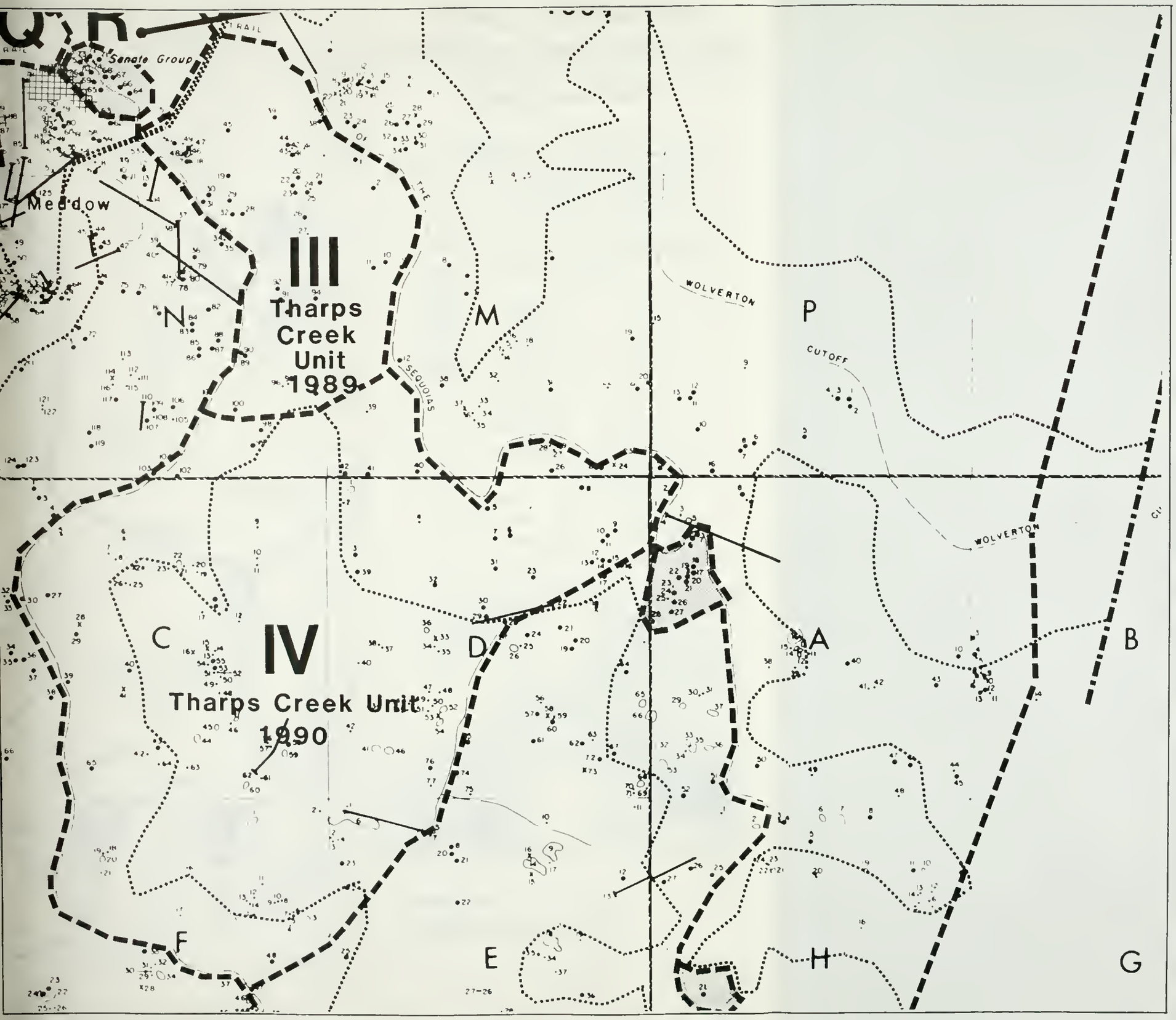
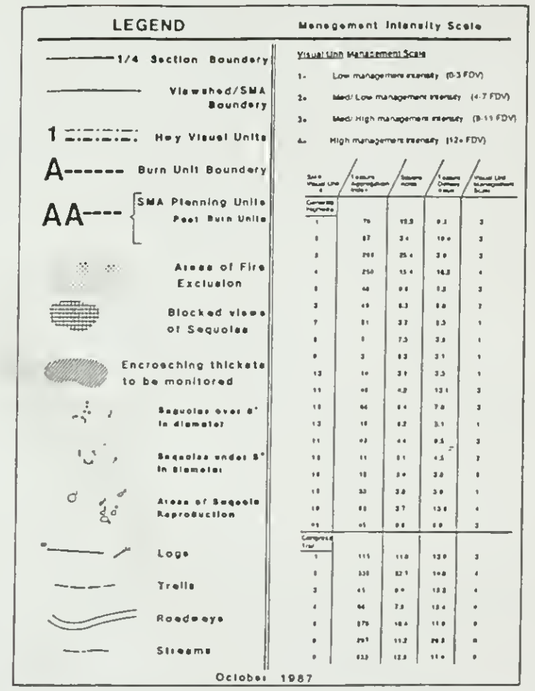
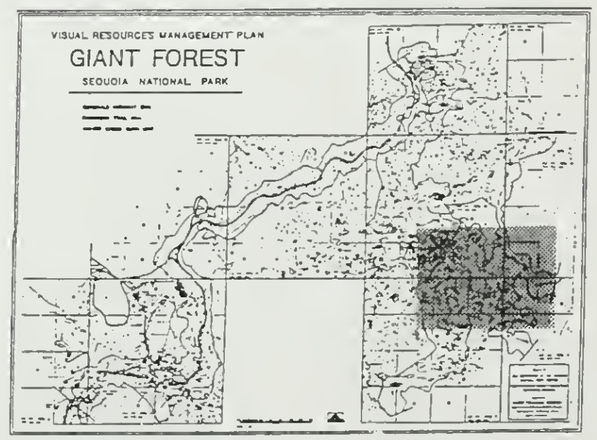
STUDY SECTION- a

VISUAL RESOURCES
Landscape Management Plan

Tharp's Creek Burn Unit







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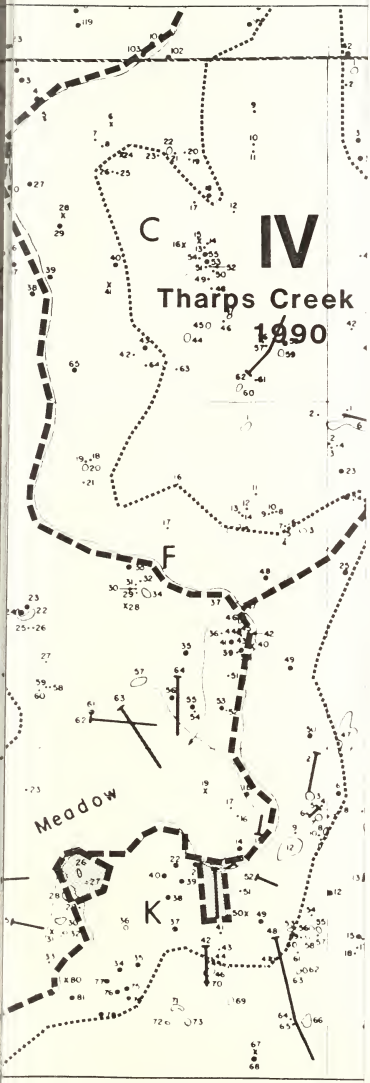
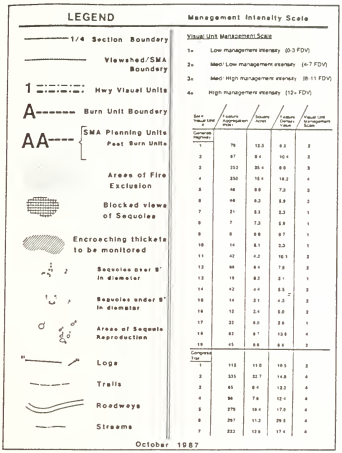
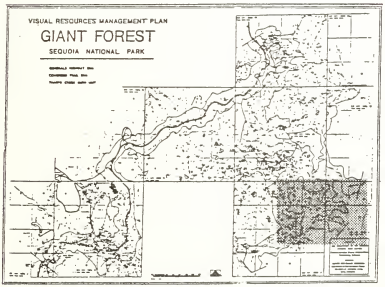
STUDY SECTION- a

VISUAL RESOURCES
Landscape Management Pla

Tharp's Creek Burn Unit







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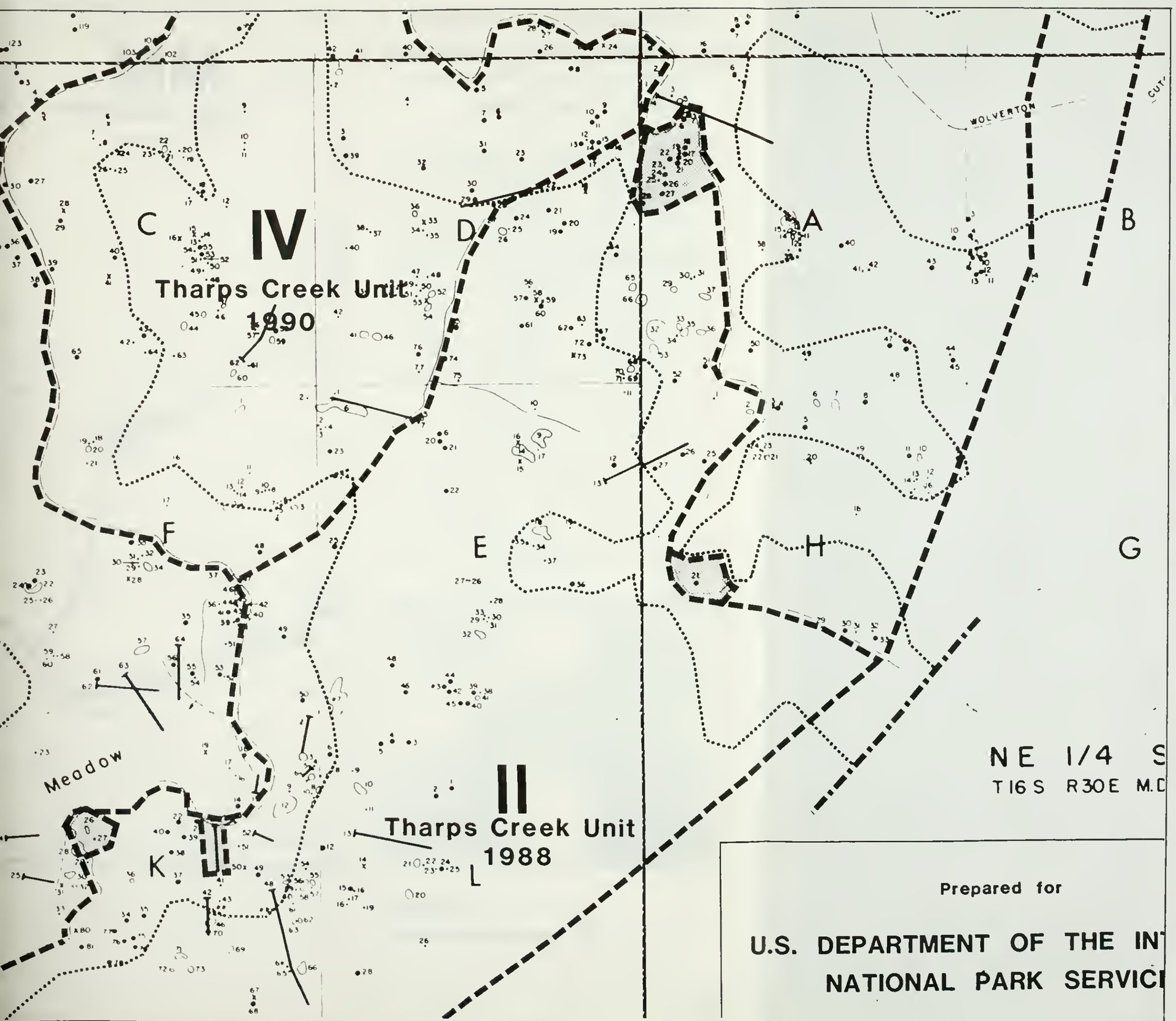
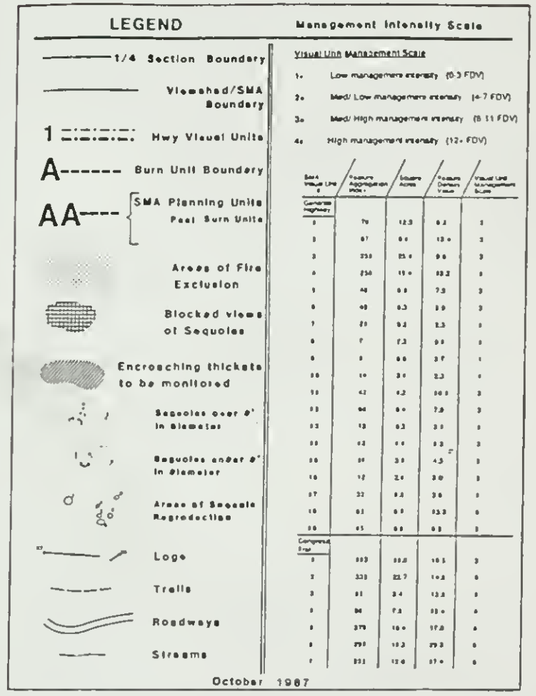
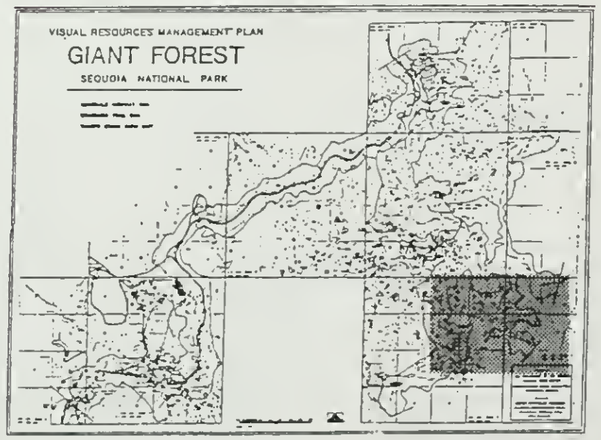
STUDY SECTION- b

VISUAL RESOURCES
Landscape Management Plan

Tharp's Creek Burn Unit







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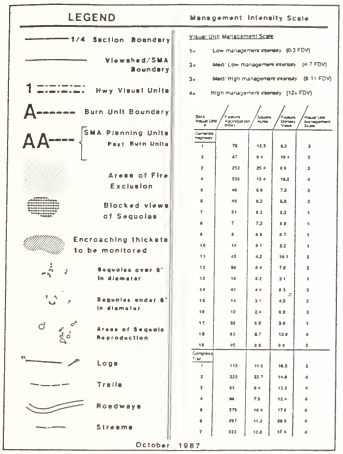
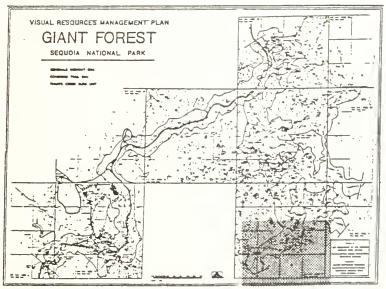
STUDY SECTION- b

VISUAL RESOURCES
Landscape Management Plan

Tharp's Creek Burn Unit





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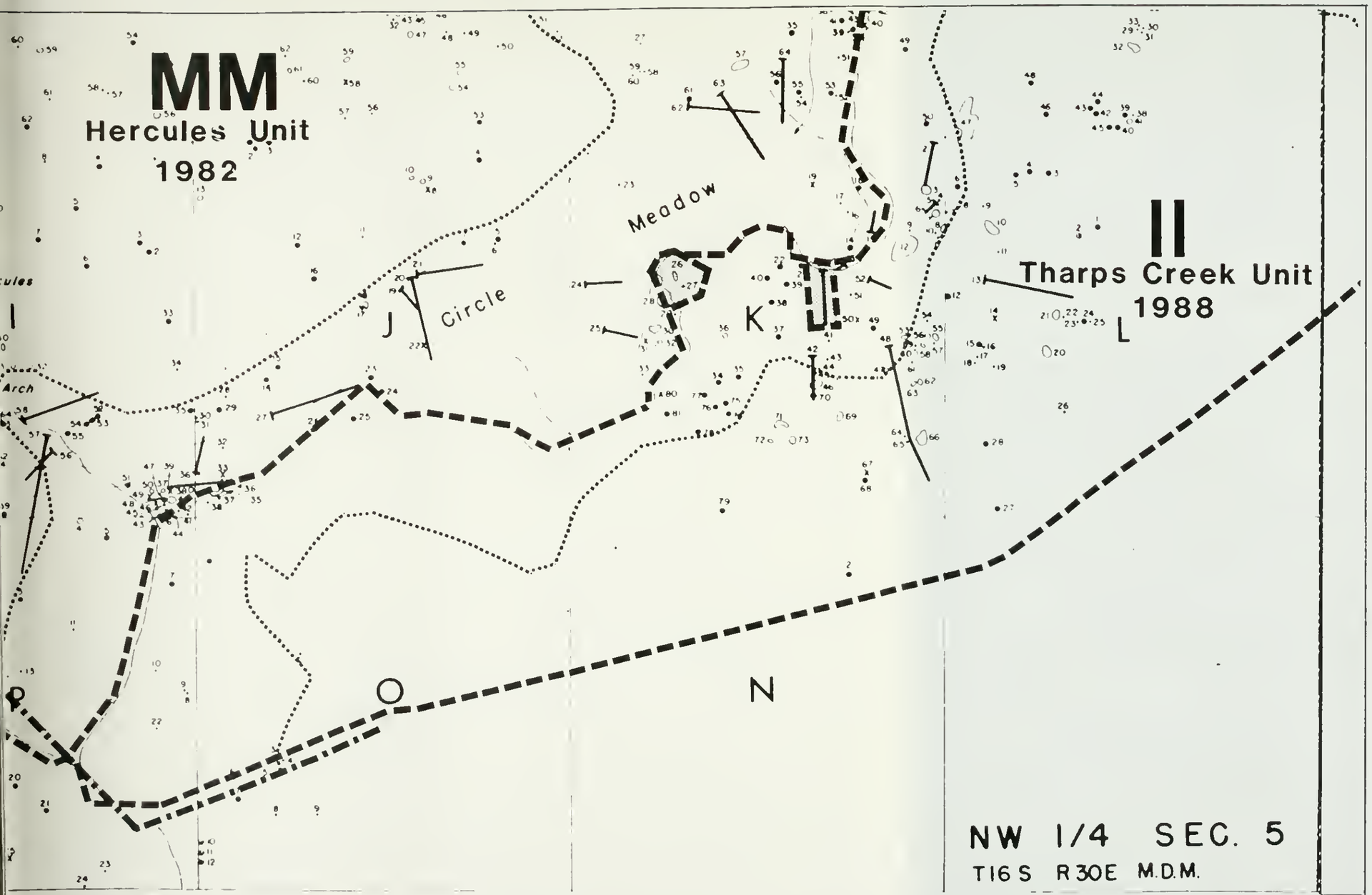
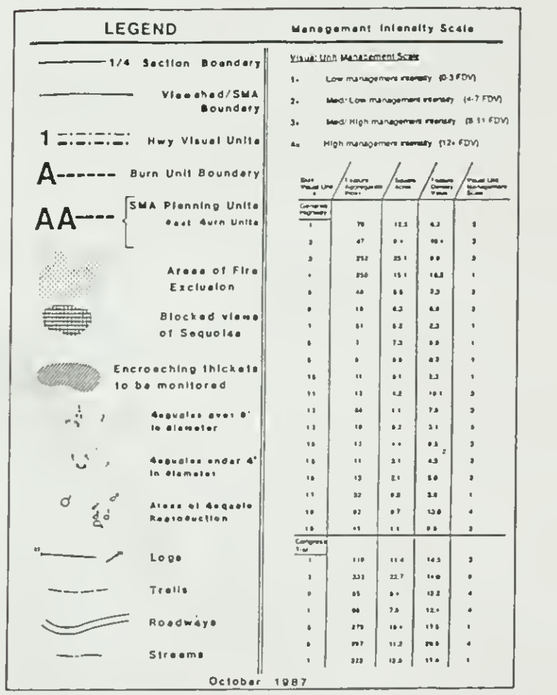
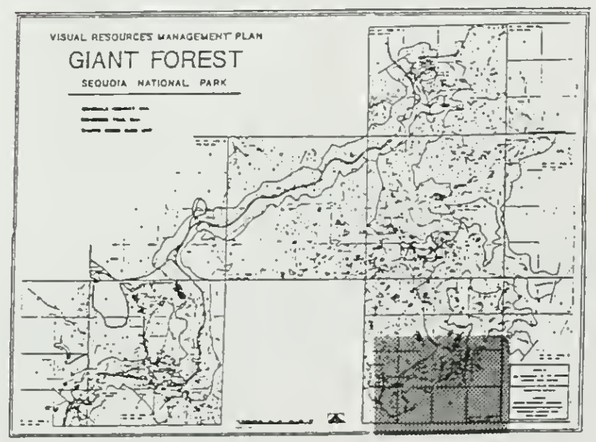
STUDY SECTION- C

VISUAL RESOURCES
Landscape Management Plan

Tharp's Creek Burn Unit







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STUDY SECTION- C