United States
Department of
Agriculture

Forest
Service

Agriculture
Handbook No. 617

National Forest Landscape Management

Ski Areas

Volume 2, Chapter 7

United States
Department of
Agriculture

Forest
Service

Agriculture
Handbook No. 617

National Forest Landscape Management

Ski Areas

Volume 2, Chapter 7

Foreword

Volume 1

National Forest Landscape Management, Volume 1, is a training document that was distributed throughout the National Forest System in April 1973. It is used as a basic text to illustrate the concept, elements, and principles of our landscape management program. This program seeks to identify the visual characteristics of the landscape and analyze, in advance, the visual effects of resource management actions. Volume 1 was prepared by landscape architects, land management specialists, and research scientists from throughout the Forest Service.

Volume 2

National Forest Landscape Management, Volume 2, consists of several chapters. Those already published are: The Visual Management System, Utilities, Range, Roads, Timber, and Fire. Additional chapters are expected in the future. The effort to produce each chapter has been spearheaded by one Forest Service Region, chosen for its experience and demonstrated expertise in the field, utilizing contributions from other Regions, research scientists, industry, and universities.

We hope you find this chapter thought provoking and useful. Comments and suggestions are always welcome.

R. Max Peterson
Chief

June 1984

Acknowledgments

Endorsed by the American Ski Federation

This handbook, which deals with the application of visual resource management principles in planning, designing, and constructing winter sports developments, would not have been possible without the work of many individuals.

The principal author is Hubertus J. Mittmann, Regional Landscape Architect, Rocky Mountain Region. Much of the information contained in "Planning Considerations for Winter Sports Resort Development" (USDA FS 1973) is incorporated in the text.

Dr. James D. Mertes, Department of Park Administration and Landscape Architecture of Texas Tech University, and Thomas A. Musiak, Department of Landscape Architecture in the College of Architecture and Design at Kansas State University, worked on the Beaver Creek project, supplied considerable information and materials, and consulted on all phases of this publication.

For their continuous cooperation, we would like to thank Vail Associates, especially Dean Kerkling, David Mott, and Jack Zehren. Beaver Creek photographs and daily reports on the project were provided by Larry Warren, the Forest Service liaison person on the Beaver Creek project, and David Roden, a landscape architecture student at Texas Tech University. Erik Martin, the Forest landscape architect on the White River National Forest, contributed many ideas and photographs.

Cover photo by H. Peter Wingle.

All Beaver Creek sketches
by Robert Armon.

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Contents

Introduction 1
Chapter Objectives 1
A Historical Perspective 1

Ski Area Developments and the USDA Forest Service 2

Landscape Management Concepts for Ski Area Planning and Design 3
Visual Quality Objectives 4
Desired Character 5
Dominance Elements 5
Landscape Design Considerations and Techniques 7

A Planning Procedure 11
Identification and Approval of the Site 11
Issuance of a Study Permit 11
Formulation and Issuance of the Prospectus 11
Development of the Master Plan 11
Preparation of the Environmental Assessment Report 12
Issuance of Special Use Permits 13
Preparation of Detailed Site Plans and Facility Designs by the Permittees 13
Approval of Plans by the Forest Service 13

Developing the Master Plan 13
Visual Resource Management Planning Considerations 13
Visual Inventory and Analysis Procedure 15
Mountain Capacity and Skiing Quality 17
Lifts 18
Structures 19
Transportation and Parking 19
Soils 20
Hydrology 22
Utilities 22
Skier Safety and Hazard Management 22
Vegetation Management 23
Air Quality 23
PERSPECTIVE PLOT Computer Graphics Program 24

Detailed Design and Construction 27
Common Areas of Concern 28
The Mountain 32
The Base Area 40

Monitoring 48

Literature Cited 51

Other Publications in the Land Management Series 51

Appendix—Beaver Creek Design Regulations 53

Introduction

Winter sports developments have a considerable impact on the land, especially from a visual standpoint.

Chapter Objectives

Ski area developments can have considerable and long-lasting impacts on large areas of land. Because these areas are used—and viewed—by thousands of visitors daily, it is important to use the techniques and procedures available for minimizing any adverse impacts associated with these resorts, while providing optimum recreation opportunities.

The objectives of this chapter are to

- Demonstrate how landscape management principles and techniques can be used in the planning, designing, and building processes to achieve and maintain desired visual quality.
- Explain and illustrate the planning and design requirements for constructing or expanding winter sports developments.

The first portion of this publication describes concepts relative to landscape management and a general planning procedure for developing or expanding winter sports complexes. This section is followed by a more indepth discussion of master planning. The remaining text deals specifically with detailed design and construction processes and describes methods for maintaining the visual integrity of these important public places.

The techniques and concepts presented in this publication are not intended to represent new policy or direction. Rather, they are suggested as a framework for stimulating new ideas and formulating better planning methods. They are presented here generally in the context of a major destination resort since such a facility best illustrates the need for coordinated planning. However, the principles apply equally well to small and/or day-use areas.

A Historical Perspective

Skis have been used for winter travel for thousands of years. Their earliest use was recorded in stone age cave drawings at Rodoy, Norway, near the Arctic Circle, and skis have been discovered that are more than 4,500 years old. In Scandinavia, their use during wartime became an important factor because they provided increased mobility. In the United States, the use of skis goes back to the first settlers. Their skis were long and

heavy, and their journeys across the country were difficult, especially in mountainous terrain.

People began using skis for recreational purposes during frontier times. After the first rope tow was developed, skiing for recreation became more widespread. Although some ski runs and lifts were built during the 1920's and 1930's, the ski industry did not really develop until after World War II. Many members of the 10th Mountain Division, headquartered at Camp Hale in the Colorado mountains, took an active part in promoting skiing and developing ski areas.

Skiing has become a major recreational activity, and participation in this sport continues to increase. As a result, existing winter sports areas will be expanded and new areas will be built to accommodate the growing demand. Most of the newer developments do not concentrate solely on winter sports, but combine facilities for summer and winter recreation activities in multimillion-dollar resort complexes featuring numerous conveniences.

In the future, expansion and rehabilitation of existing areas will be much more prevalent than the creation of new areas, but consideration of protection and enhancement of the natural scene will be an objective in all cases.

Reprinted by permission from Denver Public Library, Irwin (Gunnison County), Colo. Photograph by Mellan, March 1883.

On the National Forests, private sector concession-operated ski areas provide sophisticated winter recreation activities. In addition to their intended use, these areas are expected to emphasize the forest setting and introduce the public to the more rustic, natural resource-based recreation opportunities that are provided nearby with public funds.

Direction for providing and planning for these activities is based on the Multiple-Use Sustained Yield Act of 1960, which authorizes and directs the Forest Service to manage the National Forests under principles of multiple use, and the National Environmental Policy Act of 1969 (NEPA), which requires a systematic, interdisciplinary approach to the planning of projects associated with Federal lands. In concert, these two acts provide the direction necessary to ensure proper and prudent development or expansion of these areas.

Most major ski areas in the United States depend on National Forest System lands for ski runs and lift sites. Also, appropriate base facilities are sometimes located on these lands. As of July 1982, more than 55,500 acres, representing 167 sites, had been developed on National Forest System lands, providing a total nationwide capacity for more than 455,000 skiers at one time. The need to provide sound, responsible planning for this ever-expanding recreational activity is a major Forest Service concern.

Forest plans and environmental assessments consider not only the various uses for which the land is suited but also the feasibility of a site for a particular purpose. Numerous sites that are physically suitable for winter resort development may not be acceptable for this purpose because of conflicting social, resource, or other reasons. To determine a site's feasibility, extensive studies of such factors as terrain, soil, climatic and snow conditions, visual characteristics, hydrology, access, economics, and environmental impacts must be conducted. Sites will not be approved for use by the USDA Forest Service unless all appropriate analyses are favorable or potential adverse effects can be mitigated.

Landscape Management Concepts for Ski Area Planning and Design

Many associated social, medical, and business amenities result from the development of winter sports sites. In addition to the amenities they provide, these resorts generally improve the overall economic climate of the community they serve.

Because winter sports areas are developed for the public's enjoyment, it is important to make these areas both attractive and useful, while retaining as much of the natural character and charm as possible. Accordingly, in planning for alterations of the land and introduction of structures, potential changes and effects on the character of the landscape must be identified and considered. This emphasis must be in place at the very beginning of the process and must remain a critical and guiding force throughout the planning, detailed design, and construction phases.

Many of the winter resort areas are readily visible from major highways and other heavily used recreation areas. The amount of potential landscape modification will vary greatly with slope, aspect, vegetation color and texture, type of terrain, distance from the viewer, and character of the structures introduced to the site.

A variety of methods to lessen visual impacts should be considered in planning. Runs can be shaped and natural openings

The appearance of a winter sports area depends greatly on the consideration that was given to visual resource management during the planning, designing, and construction stages. Proper planning can result in an area with a very pleasant, natural appearance.

used to minimize straight-line effects. Feathering and scalloping of run edges, thinning or glading of timber, and creating natural-appearing openings are effective methods. Lift lines can be blended into ski runs, topography, and natural openings. Strict design regulations and guides can be developed for all structures. Roads can be minimized or designed and screened in a manner that will not detract from the site's natural character. Innovative construction methods, such as helicopter chairlift construction and pumping concrete to tower sites, can also be used to lessen the overall visual changes.

By establishing visual quality objectives—five categories of acceptable landscape alteration—for a proposed or existing area and then analyzing them from the perspective of what the desired character to be retained or created over time is going to be, the process of effectively dealing with the issue of visual quality can begin.

Visual Quality Objectives

Visual quality objectives are measured in terms of contrast with the surrounding, natural-appearing landscape. Natural-appearing landscapes are those in which historic cultural changes are accepted and which appear to have evolved to their present state through natural processes.

The process for determining VQO's and the way in which they are used is documented in Agriculture Handbook No. 462 (USDA FS 1974), which describes the visual management system in detail.

The visual quality objectives are the following:

- *Preservation* (P)—Only ecological changes permitted.
- *Retention* (R)—Management activities are not visually evident.
- *Partial Retention* (PR)—Management activities remain visually subordinate.
- *Modification* (M)—Management activities in foreground and middleground are dominant, but appear natural.
- *Maximum Modification* (MM)—Management activities are dominant, but appear natural when seen as background.

The objectives are based upon the physical characteristics of the land and the sensitivity of the landscape as viewed by people. In addition to the visual quality objectives, the Visual Management System also provides for two short-term management alternatives—enhancement and rehabilitation—that may be employed to increase landscape variety and to rehabilitate landscapes that have been excessively modified.

The rugged mountains, the climatic condition, and the well-planned configuration of the ski runs gives this winter sports area a natural appearance. The road seems to be the only artificial intrusion.

The straight lift line with associated plantings is the only indication that this is a ski area. The run design, with its natural vegetation edge, blends well with the surrounding landscape.

Enhancement

Enhancement is a short-term management alternative aimed at increasing positive visual variety where little variety exists. Enhancement may be achieved through addition, subtraction, or alteration of vegetation, water, rock, earthforms, or structures to create additional variety of forms, edges, colors, textures, patterns, or spaces.

Rehabilitation

Landscape rehabilitation is a short-term management alternative used to restore landscapes containing undesirable visual impacts to a desired visual quality. Rehabilitation may not

All features on the mountain must be considered when determining ski site designs. A dominant straight lift line can ruin the effect of ski runs that have been carefully designed to appear natural.

Enhancement can be achieved in areas that lack visual variety by adding a variety of vegetation species, colors, or age classes.

always bring about the prescribed visual quality objective immediately, but it should provide a more visually desirable landscape in the interim. Rehabilitation may be achieved through alteration, concealment, or removal of obtrusive elements.

Desired Character

The appearance of the landscape to be retained or created over time is termed its desired character. It is a combination of design attributes and opportunities, as well as biological opportunities and constraints. Once a parcel of land is allocated for winter sports use, the degree of alteration of the landscape varies considerably with the different types of activities. The greatest impact will be generated by facilities that require considerable alteration of the landscape through vegetation manipulation, soils manipulation, and the introduction of structures. Of all the winter sports facilities, downhill ski areas require the greatest landscape alteration because of the need for ski run clearings, road construction, and associated structures. Because of the time and financial commitment involved, the impact of ski areas must be considered to be permanent. For this reason, it is important to analyze what the land with its natural features has to offer and the extent of alterations needed for achieving the desired character through planning and design. Special attention must be given to long-range vegetation management because of the dynamic and constantly changing plant communities.

Once an area is allocated to ski area development, planners must take advantage of the terrain to best satisfy the winter sports and summer use needs while, at the same time, maintaining the visual integrity of the area through appropriate design.

The desired character of an area, then, should be a blending of the constructed alterations into the natural, established landscape in a way that achieves harmony during all seasons of the year.

The design of the desired character for a new or expanding ski area must recognize that the site, regardless of size, is a dynamic and constantly changing community of plants, people, and structures.

Dominance Elements

To achieve the desired character for an area, it is important first to identify and analyze its landscape features in terms of the elements of form, line, color, and texture. These are important considerations during the planning and design phases—when significant decisions are made about the mountain regarding retention of the existing landscape character.

Form

Form is the mass of an object or of a combination of objects that appear unified. In ski area developments, the strongest form is usually the mountain. Other forms are structures or tree masses. The appearance of a natural form should be complemented by landscape alterations.

Although the landscape character is dominated by the natural form of the mountains, the desired character along the road can be controlled through proper visual resource management.

Line

Line is a point that has been extended; it is anything that is arranged in a row or sequence. Line can describe the silhouette of form or it can be considered separately. Line is also defined as the intersection of two planes: obvious examples are ridgelines, timberlines, and powerlines. Line is also evident in tree trunks, avalanche paths, and vegetative boundaries.

In winter sports developments, many manmade lines are introduced in the form of ski runs, vegetation edges, ski lifts, utilities, and roads.

Color

Color enables us to differentiate objects that may have identical form, line, and texture. Color dominance often depends on the observer's position. Colors viewed at a distance are usually muted by a bluish haze caused by dust and moisture. Foreground colors are stronger and more dominant. This is especially important to consider when speaking of the same color from various viewing distances.

How well ski area developments fit into the naturally established landscape will depend greatly on how the colors of the area's components harmonize with the surrounding landscape.

Texture

Texture dominance varies with distance. When a tree is viewed at close range, the texture of the leaf patterns is dominant; when the tree is viewed from a few hundred feet, major boughs form the dominant texture; when the tree is viewed at a distance of several miles, entire groups or stands of trees become the dominant texture.

In addition to introducing new textures with constructed facilities, like lifts and buildings, winter sports developments also

The natural form of the mountain dominates this scene. Any winter sports development should coordinate the forms or shapes of the introduced structures with the existing form configuration.

Because of the contrast with natural surroundings, straight lift lines visually dominate the scene. Careful planning and designing can minimize this effect.

From this perspective, the lift line is immediately obvious in an otherwise natural-appearing area.

can alter the natural texture of the landscape by removing vegetation for these sites and the ski runs. Careful planning and design should be used to achieve a visually acceptable blending.

Landscape Design Considerations and Techniques

For the most part, three kinds of activities that directly affect visual character can occur on a mountain during ski area development: vegetation modification, soils manipulation, and introduction of structures. By considering the basic design techniques of manipulating the edge, the shape, and the scale of these activities in the planning and design phases, it is quite possible to achieve an esthetically pleasing development.

Vegetation Modification

Vegetation can be removed, modified, or added. The visual impact depends on the form and scale of this change in relation to the surrounding landscape. After the suitability of the terrain for skiing is determined, the ski runs, roads, and lift clearings have to be designed. The initial clearing should be the minimum acceptable for skiing, as well as for road and lift construction. Should it become necessary in the future to clear additional trees, it can be done easily and is less costly than adding trees or building snow fences. The tree edge of all clearings needs to be carefully designed for the best natural blending

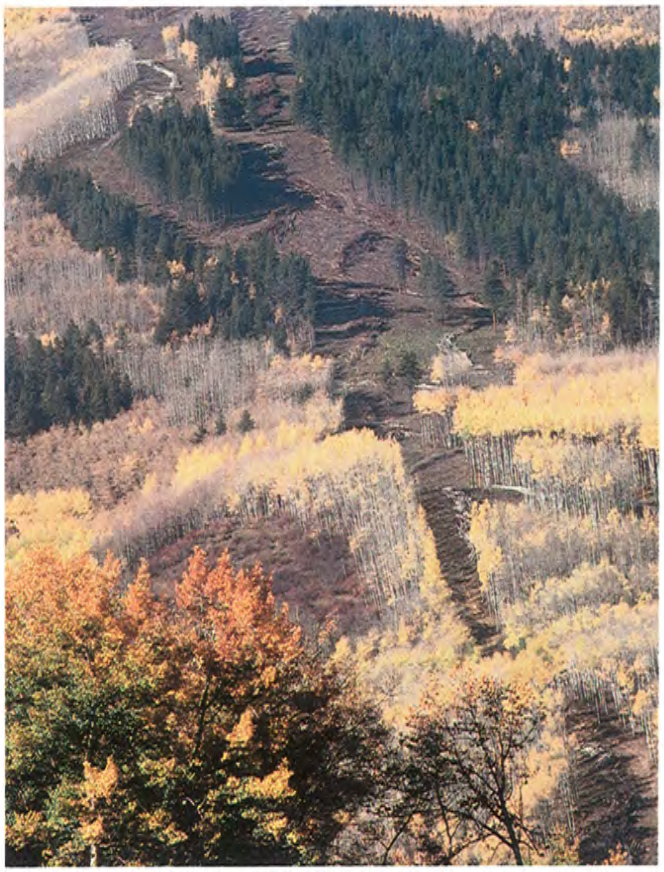
During winter, landscape colors are primarily gray and green, contrasted against the white snow. Texture provided by vegetation and open areas will help developments appear more natural.

Straight lift line clearings like this should be avoided.

with windfirm trees. Because a natural-appearing edge is perceived mainly in terms of texture, it should be located where a variety of tree sizes, age classes, and species can be incorporated. The line of the edge should not be straight but, rather, flow with the topography and vegetation pattern.

Soils Manipulation

Any soils manipulation must ensure blending, erosion control,



Because the colors and texture of vegetation in an area can vary considerably during spring, summer, and fall, their pattern should be used to the best advantage when designing ski areas.

and revegetation. From the visual standpoint, improper soils manipulation can have a long-lasting, negative effect. Only roads that are absolutely necessary should be planned, because on steep ski mountains, cuts and fills can create a visual pattern that will not meet the visual quality objectives or allow a safe ski run pattern.

Wherever soils manipulation is planned, soils properties, the hydrologic regime, and the possible visual impacts need to be known. The design should ensure a smooth blending with existing topography, allowing for a natural-appearing edge. All cut and fill slopes should be designed to prevent moisture loading and slippage. Roads crossing ski runs should have smooth transitions to allow for good skiability. Because of the quick runoff in spring, grading of shallow ditches into established natural drainage patterns is necessary, but should reflect the natural configuration of the land on the ski run.

Introduction of Structures

Structures are as important from the appearance standpoint as

Initially, ski trail clearing should be held to the minimum acceptable for skiing. Additional clearing can be done later, if necessary.

When the edge of a ski trail is located, windfirm trees should be carefully selected to avoid wind-damage.

This slope grading project was blended well with the existing topography.

vegetation and soils manipulation. Architectural style, building materials, size, and color can be used very effectively to reach the desired character and meet the adopted visual quality objectives.

The colors should be neutral and dark on lift facilities. Buildings should be designed to create a pleasant, relaxing atmosphere within a developed and controlled architectural theme. Strong and bright colors should be used only as accents. Natural-appearing materials and colors can usually help establish the desired character throughout an area.

Before grading the slope, the topsoil should be removed and saved. Steep banks should be avoided, and proper blending with the existing topography should be achieved.

To avoid surface erosion and to insure good revegetation, the topsoil should be mulched after seeding and fertilizing, and the mulch should be held in place by netting.

Utility installments for water and gas require large ditching operations. The lines should be located in open or cleared areas or beneath the ski runs. As in grading operations, topsoil can be saved from these projects for rehabilitation.

Many types of structures are used in winter sports areas. Architectural style, building materials, color, and siting must be considered for creating visually acceptable designs. These structures have been well designed using design elements of form, line, color, and texture.

A Planning Procedure

The steps for developing a new or expanding an existing ski area on or associated with National Forest land can vary from one location to the next depending upon environmental, social, and financial considerations. In addition, it is feasible that two or more steps might occur simultaneously. Although not a formal agency process, the steps normally considered in the planning procedure generally are as follows:

1. Identification and approval of the site.
2. Issuance of a study permit.
3. Formulation and issuance of the prospectus.
4. Development of the master plan.
5. Preparation of the environmental assessment report.
6. Issuance of special use permits.
7. Preparation of detailed site plans and facility designs by the permittees.
8. Approval of plans by the Forest Service.

Identification and Approval of the Site

Potential sites are first identified and some eventually approved for possible development through the forest land management planning process. Selection and approval is based upon the suitability, capability, and the availability of sites. Intensive State and local government participation is important to ensure proper coordination with their own land management objectives and resources.

Issuance of a Study Permit

If analysis work on a site involves removing trees or making other changes in the forest condition, a study permit will be required. Permission to collect data and perform studies does not guarantee that a development permit will eventually be issued, even if a particular project proves to be technically and economically feasible in an area.

At this point, proponents will normally begin a close review of the various physical characteristics of the area to determine its real potential as a ski area. They will examine the slope, aspect, and snow conditions and make preliminary estimates of skier capacity. In addition, they may review possible lift locations and begin considering potential locations for base facilities and mountain amenities.

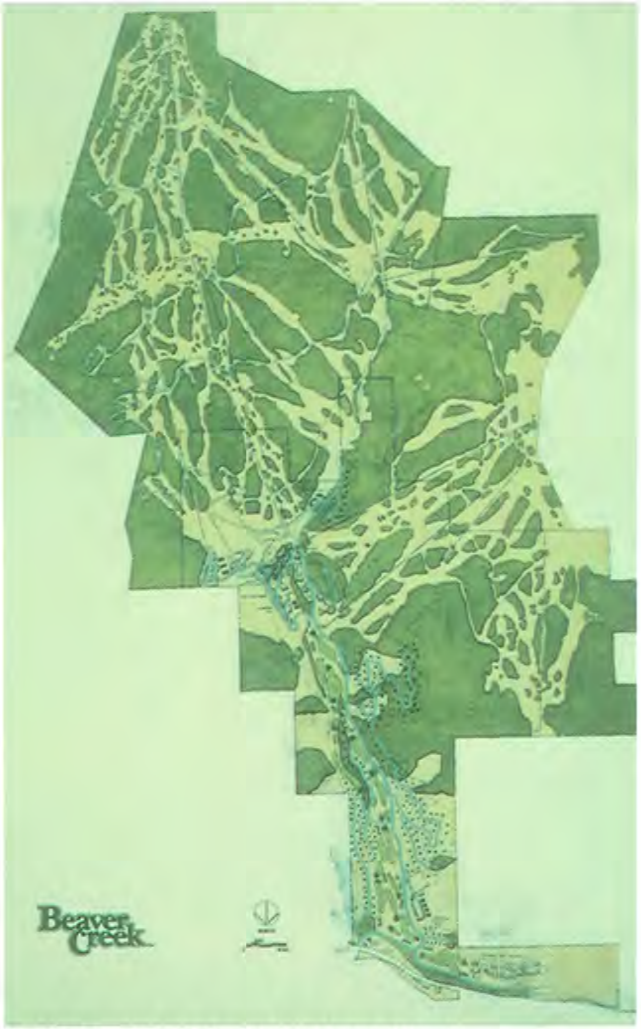
Formulation and Issuance of the Prospectus

When studies show that it may be feasible to develop certain National Forest System lands for a winter ski resort, open competition for development rights through a prospectus may be required, regardless of who undertakes the initial studies.

Bidders are required to prepare a conceptual development proposal and to present their financial and managerial capabilities. Once selected, the successful bidder will be asked to prepare a master development plan, which will be reviewed and approved by the Forest Service prior to issuing the special use permits.

Development of the Master Plan

Perhaps the most time-consuming and rigorous step in the ski area planning process is development of the comprehensive master plan. The Forest Service monitors planning progress during this effort to verify the data reported by a proponent



Plans for resort areas should show the total development, including the proposed recreation areas and the transportation system.

In this situation, two separate ski area permits were granted to meet the need for increased skier capacity; however, the topographic situation was not suitable for expanding the existing area.

and plays an instrumental role in determining the optimum level of development to meet long-term public needs.

In most cases, an interdisciplinary team helps formulate the master development scheme describing the ultimate plan for the site. Specialists in ecological sciences, skiing, soils, hydrology, community planning, forestry, and landscape architecture, for example, provide expertise to the team leaders, who, in turn, coordinate the inventory, analysis, and synthesis of information that culminates in a final master development plan.

A more detailed discussion of ski area master planning considerations is presented in the next section.

Preparation of the Environmental Assessment Report

Proponents of new or expanded ski areas are responsible for preparing and/or providing information needed for the environmental assessment report. The requirements may vary slightly from one Region to the next; however, all reports review the master plan and examine alternatives to the proposed development scheme. The report analyzes the environ-

mental consequences of each alternative, surfaces areas of potential resource damage, and recommends mitigating measures.

Issuance of Special Use Permits

The Forest Service issues two types of special use permits: term permits and annual permits. These permits are the contract and operating agreements between the Forest Service and the permittee. The term permit, which is normally issued for 20 years with a statutory maximum of 30, can include an area of up to 80 acres and usually covers that part of the site where the major capital investments are located. A companion annual special use permit is issued for the additional area needed for ski runs and other needs such as avalanche control and access. The Forest Service may not terminate the special use permit except upon breach of the permit terms by the permittee. The permits may be reissued or amended to provide for additional development or to update the permit provisions, if agreeable to both parties. When a commitment is made by the permittee to provide improved or additional services and capital investments, the term permit may be extended, but never beyond the maximum of 30 years. Normally, when permits are issued for new resort developments, a period of a few years may be necessary to allow for completion of development plans, financial arrangements, and other matters. However, if these requirements cannot be met within a reasonable time, the permits may be subject to termination.

Preparation of Detailed Site Plans and Facility Designs by the Permittees

Once given final approval for development, based on an accepted comprehensive master development plan and environmental assessment, the permittee is responsible for preparing all site plans and facility designs that will be used within the boundary of the winter sports site. These are reviewed by the agency to ensure compliance with the master plan and to ensure that all environmental concerns are being carefully considered.

Approval of Plans by the Forest Service

Following review and completion of any requested changes, plans are approved by the Forest Service and construction may begin. Often, several separate approvals are necessary at this stage, extending over a period of time, to provide for an orderly, sequential construction process.

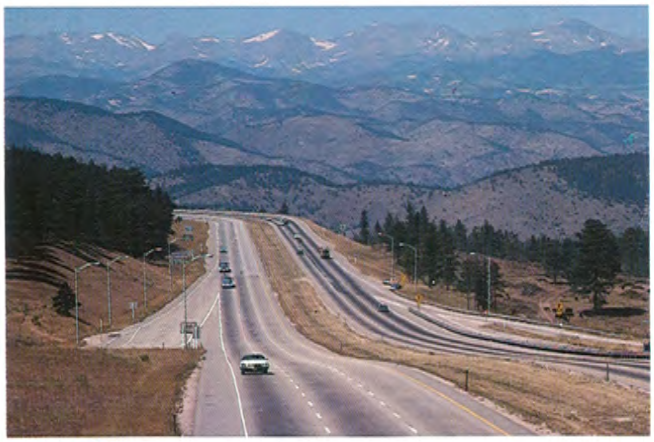
The winter resort industry has been the major catalyst for the accelerated growth of mountain resort communities during the past decade. Development plans can no longer be limited to such items as skiing facilities, lodges, and runs. While winter sports—especially downhill skiing—may constitute the initial phase of development, support facilities and services from local government and the private sector must be considered in planning. Land suitable for these purposes is limited; therefore, the optimum development of each site must be carefully analyzed and considered in the master planning stage. Plans must reflect the proposed master scheme for the entire area under consideration—both private and National Forest System lands—and should include a schedule for phase development.

The actual approach and requirements for this level of planning may vary from area to area, but the ultimate goal is always to form a responsible and feasible long-range framework for developing the ski area. The following discussions present some of the issues and concerns that normally should be addressed in the master planning process for major ski areas.

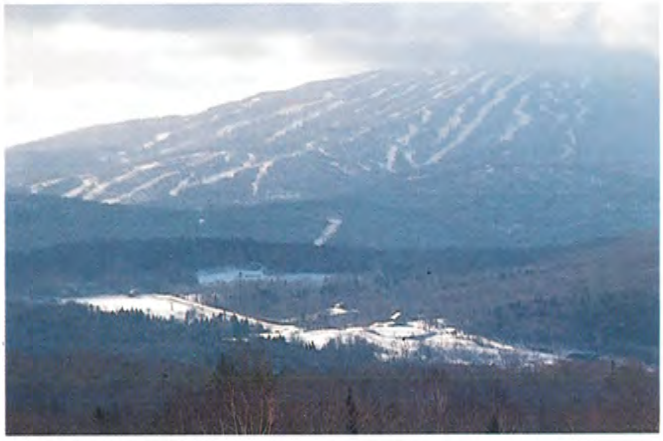
Visual Resource Management Planning Considerations

Of utmost concern in the contemporary planning for any mountain resort community is the visual linkage between the development components (such as buildings, lifts, roads, ski runs, and utilities) and the existing visual character of the area. In fact, recent use surveys have shown that the highest priority of the majority of skiers is experiencing outstanding scenic quality. To respond accordingly, master planning must develop a framework that allows for retaining or enhancing as much of the visual quality of the area as possible.

Ski areas usually contribute to the expansion of existing communities or the formation of new communities. Long-range planning will ensure proper growth.



Providing good travel routes to winter sports areas is a primary planning consideration, particularly when ordinary use from nearby metropolitan areas is expected to be considerable.



The contrast created by ski runs is visible from a considerable distance. The configuration of the developments of the ski mountain will determine whether the impact is positive or negative.

A vegetation pattern like this is conducive to the kind of vegetation manipulation necessary for developing ski areas. An inventory of the entire site is necessary to determine its existing visual condition and its visual absorption capability.

Visual quality objectives should be established not only for the ski area itself but also for the land that can be seen from the ski area.

By using basic visual management concepts and principles from the start, it is possible to provide information regarding the best locations for development components that will result in minimum disturbance of the visual quality. This is based on the physical attributes of the landscape, people's sensitivity regarding change in the landscape, and the ability of the landscape to accept alteration without losing its inherent visual character.

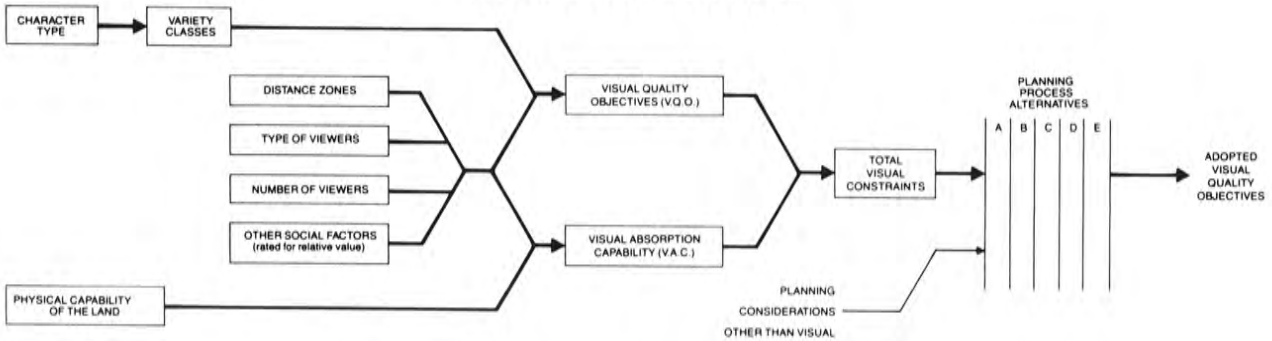
Of course, during the master plan development process, other issues—like providing feasible access routes, adequate and varied skiing terrain that works well with a system of lifts, and other economic and social factors—must be considered and occasionally tradeoffs must be made. If, however, visual considerations are analyzed and surfaced early in the process and taken into account at each decision level, the resulting plan will reflect a sensitivity for retaining and maintaining the site's scenic characteristics.

Visual Inventory and Analysis Procedure

By combining the visual quality objectives and the visual absorption capability of a site, it is possible to identify the total visual constraints of an area and thus what precautions must be taken into account in the planning, design, and construction phases.

The following example graphically illustrates this technique.

THE VISUAL MANAGEMENT SYSTEM



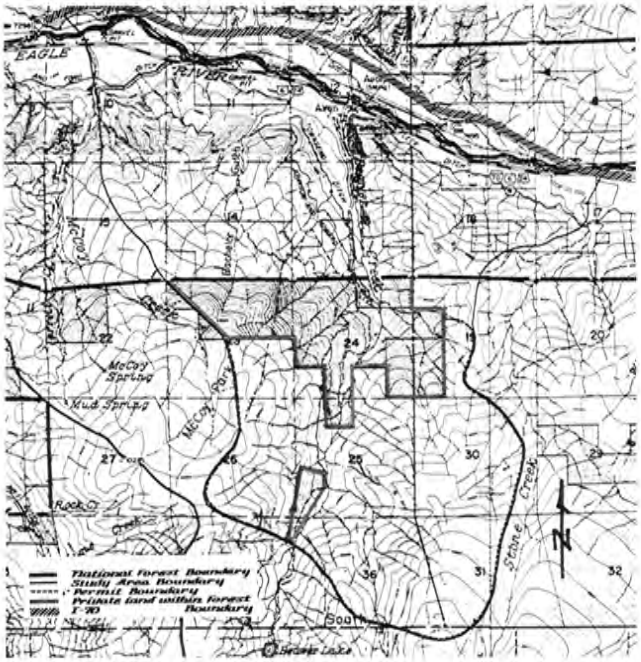
Visual Quality Objectives (VQO's)
The VQO's for the area were based on "The Visual Management System," which is Volume 2, Chapter 1, of the National Forest Landscape Management series (USDA FS 1974). In the planning stage, the VQO's were primarily determined as seen from the Interstate Highway and the road that was constructed into the area. It was recommended that new, more detailed VQO's be established for the area as soon as new roads, trails, pedestrian circulation patterns, and other viewpoints were established that reflected new viewer sensitivity levels. At this time, it was recognized that the inventoried retention and partial retention VQO's could not be met with the landscape alteration necessary to build this resort but that, through proper design, the alteration would blend well into the naturally established landscape.

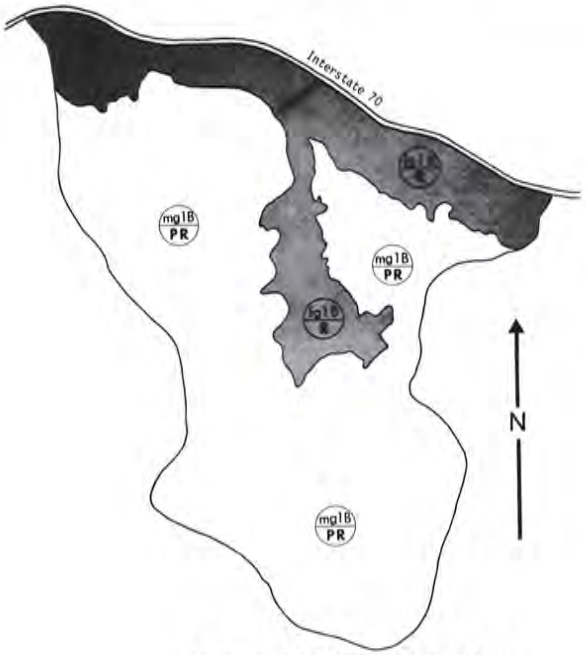
Visual Absorption Capability (VAC)
The VAC of a landscape is based on physical factors inherent in that landscape. As there are different types of landscape alterations, the VAC will depend on different physical factors. The following matrix shows the VAC factors pertinent to this example.

The VAC information is used to determine how the facilities planned for an area can best be located with the least impact on the landscape. This information also can be used in the preparation of cost estimates as they relate to the visual resource requirements of the area. For example, if facilities must be placed in an area with a low VAC, it will usually be more expensive to meet adopted visual quality objectives than in an area with a high VAC. All these factors were mapped separately on clear acetate combined in an overlay. The combination of different factors determined the score for the VAC and was then mapped for application in the planning and design process. The map clearly identifies the areas with a high, medium, or low VAC.

Total Visual Constraints and Recommendations
By combining the visual quality objective map with the visual absorption capability map, the relative total visual constraints for the area can be displayed graphically.

Because the degree of visual impact of the area depends on, and is in direct proportion to, the amount of contrast with the natural character of the landscape, the map indicating the total visual constraints is essential for predicting visual impacts. Areas of low and moderately low ability to withstand modification from the visual standpoint are graphically shown on the map and serve as "red flag" areas to the land manager. The "red flag" areas shown on the map are not areas where modification should not take place; rather, they are areas where it would be more difficult and possibly more expensive to retain





VISUAL QUALITY OBJECTIVES
(AS PER NATIONAL FOREST LANDSCAPE MANAGEMENT, VOLUME 2, CHAPTER 1)

R Retention
PR Partial Retention
fg foreground distance zone
mg middleground distance zone
1 highest viewer sensitivity
B variety class common to the character type

the natural character of the landscape. In the design phase of the proposed development, the designer must be aware of the locations of these visually sensitive areas and the reasons they are sensitive. By referring to the VAC and VQO maps, planners and designers can clearly see why some areas are more sensitive than others.

Mountain Capacity and Skiing Quality

The number of people that should be accommodated varies widely because of topography, snowfall, esthetic criteria, limitations of either the base or the mountain, and many other factors. Whatever the optimum number of people, space must be reserved at the base to provide parking and the service facilities that ultimately will be needed.

The acreage suitable for base facilities varies greatly among areas. To a large degree, the amount of available acreage determines if an area can be developed sufficiently to be a self-contained community or if the area's success is dependent upon people living within commuting distance. The Forest Service recognizes the expense of developing a resort area and that land sales or leases are often needed to recover initial development costs within a reasonable period of time. There must be a balance between the development opportunities on the mountain and at the base area.

VISUAL ABSORPTION CAPABILITY

Score of 10 through 16 = Low
Score of 17 through 23 = Medium
Score of 24 through 30 = High

EXISTING VEGETATIVE AND LANDFORM SCREENING ABILITY	ASPECT RELATIVE TO VIEWER	80°-100° 1	60°-80° 100°-120° 2	Less than 60° More than 120° 3
	SLOPE	60% + 1	25-60% 2	0-25% 3
	VEGETATIVE HEIGHT	0-6 ft. 1	6-30 ft. 2	30 ft. + 3
	VEGETATIVE DENSITY (Summer Months)	0-20% 1	20-80% 2	80%-100% 3
LANDSCAPE DIVERSITY	LANDFORM DIVERSITY	Low 1	Medium 2	High 3
VEGETATION REGENERATION POTENTIAL	SOIL PRODUCTIVITY	Low 1	Medium 2	High 3
	ASPECT	180°-270° 1	90-180° 270-360° 2	0-90° 3
POTENTIAL MAGNITUDE OF SOIL CONTRAST	POTENTIAL SOIL COLOR CONTRAST	White to Yellow 1	Medium 2	Brown to Black 3
	EROSION HAZARD RATINGS	High 1	Medium 2	Low 3
	SOIL STABILITY (Mass Movement)	Low 1	Medium 2	High 3
	Point Value Each	1	2	3

VISUAL ABSORPTION CAPABILITY (V.A.C.)

(RELATIVE TO THIS STUDY AREA)

High V.A.C.
Medium Low V.A.C.
Low V.A.C.

An area's visual absorption capability should be inventoried carefully. Different tree species, color combinations, and a good revegetation potential contribute to a high-rated visual absorption capability.

Planners must carefully consider skiing quality because skiers do not like crowding or congestion, poor snow conditions, or poorly designed runs. If the skiing difficulty of a run changes, it will hinder skiers who cannot easily negotiate the most difficult sections. It may be necessary to manipulate run locations to create an ideal proportion of beginner, intermediate, and advanced or expert runs. Such manipulation may lower the capacity of an area but increase its popularity and viability.

Heavy skier use can wear out snow, particularly in congested areas. Snowmaking, dispersal of skiers, and distribution of lifts, runs, and other facilities can be used to increase an area's capacity. Wind, unstable soil conditions, uncontrolled flowing water, esthetic quality, and existing or potential snow conditions, such as an avalanche, can reduce capacity if not considered in the planning stages.

Determining an area's capacity involves many technical, economic, and social disciplines. It is both a subjective art and a quantitative science. Making this determination is time consuming and expensive, but it is an essential element in area planning and should be disclosed in appropriate NEPA documents.

TOTAL VISUAL CONSTRAINTS
(RELATIVE TO THIS STUDY AREA)

0 Least able to withstand modification from the visual standpoint
1 Low ability to withstand modification
2 Moderately low ability to withstand modification
3 Moderately able to withstand modification

V.Q.O. - V.A.C. MATRIX

VISUAL QUALITY OBJECTIVE	VISUAL ABSORPTION CAPABILITY: LOW	MED.	HIGH
R	0	1	2
PR	1	2	3
M	2	3	4
MM	2	3	4

TOTAL VISUAL CONSTRAINT

When planning a winter resort area, the Forest Service is interested primarily in obtaining optimum recreation development to serve the general public. Although private land values are affected by the location of resort areas, maximizing the value of individual tracts of private land must be a secondary consideration of the Forest Service. Development plans for an area must show the placement of skiing terrain in relationship to private lands and the base area. To determine this, approximate locations and general specifications of lifts and runs are needed. A legal commitment to use certain private lands between the base areas and National Forest land for parking, ski runs, hiker access, and similar purposes will be needed.

As year-round resort communities develop near ski areas, the ski slopes become important hiking and summer recreation areas. When an area is being developed, seasonally changing uses should be considered because the beauty of the mountain itself during the summer will affect the attractiveness of the area as a resort and is an important element in meeting the National Forest recreation goal.

Lifts

Lifts should be located to serve the best skiing terrain. Ski runs and slopes should be planned to provide the best skiing opportunities without wasting terrain. Lifts should then be located to best serve these ski runs.

Lifts are merely a means of access, and the type of lift may vary depending on the terrain that it must cross. Seldom should the type of lift dictate the location of ski runs. A lift intended to provide ski run access and scenic views for summer tourists is one exception to this principle.

There are various means available for constructing lifts and they should not be located only where good upper and lower

This type of trail development with multiple bases ensures good dispersal with little congestion, and wear-out problems are minimized.

terminal sites have been selected to minimize construction costs. Of course, costs are important concerns and must be considered equally with the issues of skiing quality, esthetics, and other environmental factors.

Structures

Adjacent private lands that are required for adequate public service must be addressed in the master planning stage. Public service and maintenance buildings, ski runs, lift and terminal structure locations, parking lots, utility systems, and all other buildings should be designed to take advantage of the full potential of the area to minimize visual conflicts, to allow for grading and drainage needs, and to protect and enhance the area's environmental resources. From a functional as well as a visual standpoint, the design criteria identified in the master plan should be sufficiently detailed to allow for evaluation of it as it relates to the mountain.

If there is only one major lift from the base area, lift lines will be long and trails near the base will be congested.

Besides considering shops, restaurants, and accommodations for residents and visitors, the impact analysis for the resort complex needs to concern itself with water supply, interpretive services, medical facilities, sewage treatment, community services, service stations, fire protection, law enforcement, and public transportation.

Transportation and Parking

Planning for transportation is an integral part of the planning process and must reflect the future needs for goods and services from the area and its surroundings, as well as the demands created by the resort. The Forest Service will perform the transportation planning necessary for the multiple-use management of the extensive forest areas that include and surround a ski resort. In some cases, planning for development or management of resources adjacent to a ski resort may not be complete at the time a permittee wishes to develop a ski area. Development of road systems, inside or outside the permit area, may have to be deferred if a permittee wishes to accelerate the development. In such cases, alternative methods of facility construction that do not require roads may have to be used.

A well-planned road system is usually needed to ensure an efficient resort operation. Before construction is begun on any road, its long-range location and use in the overall development should be determined. Certain roads may be needed to provide for future area construction or for transporting supplies and personnel during the winter. Unneeded roads, on the other hand, may be a liability. Unneeded construction roads to tower locations can be backfilled and revegetated after they have fulfilled their purpose. However, serious consideration should be given to alternate methods of construction if roads will have no subsequent use.

The main road system should be located so it will not interfere with the long-term operation of the area. Roads should be located, designed, and constructed to serve the purpose for which they are needed and with consideration for their long-term maintenance. Roads can be narrow where they cross ski runs. Culverts can direct water away from ski runs and help control water runoff problems. Switchbacks can be located on flat benches where they will not damage skiing quality, or they can be confined to areas where ski runs will never be needed.

The quality of skiing is what draws skiers to a particular area, and it is therefore essential that the slopes be well groomed. Ski runs should be designed so that snow maintenance equipment can operate efficiently without sacrificing skiing quality.

Snowpacking equipment cannot maintain runs that have abrupt road crossings, nor can skiers cross them easily or safely. Runs of intermediate difficulty become more difficult to ski if they are crossed by roads at steep locations. Snowpacking machines should not cross ski runs at steep locations as they work their way up the hill because these routes become flat "benches" and downgrade skiing quality.

Soils

After the most appropriate alternatives have been selected for installing facilities and locating ski runs, roads, and other improvements, a detailed site analysis of the soils is usually needed. These studies provide detailed information regarding specific sections of the construction site so that the design can overcome unavoidable limitations or hazards. The expertise of hydrologists, landscape architects, geologists, and engineers is needed to design a system for fragile soils and hazardous sites. Deep borings, laboratory tests, and detailed studies are often necessary. Specific prescriptions may also be necessary to ensure revegetation and stabilization of the site to prevent erosion or other soil problems during winter or spring.

Before a site is approved for resort development, a preliminary soils report must be prepared as part of the environmental

While parking lots like this are easy to construct and the simple, uncomplicated design makes snow removal easy, the addition of surrounding vegetation or islands of vegetation could have made this lot more attractive.

Instead of building roads to each tower site for transporting concrete, concrete was pumped to the sites.

Helicopters can be used for lift tower installation to obviate the need for expensive road construction.

analysis. It is through this analysis that the basic land use decisions are made. The preliminary soils report is general, and it estimates the suitability, hazards, and limitations of the area for various impacts.

More comprehensive soil studies are needed during the conceptual development planning process carried out by the interdisciplinary team. These studies are based on soil examinations of the upper 5 feet of the earth's crust and identify areas where problems exist. Where deep soil situations are significant, or where mass land instability is involved, the services of engineering geologists are required.

Soil maps showing the extent and distribution of different soils in the area may be needed to show soil descriptions, which are the recorded information of the physical and chemical soil characteristics of each soil body. Soil interpretations are derived from soil characteristics and the environmental influence of climate, geology, topography, and vegetation.

Soil properties must be carefully analyzed. When the loose topsoil on this steep slope was saturated with water, massive soil slippage resulted.

If at all possible, ski runs should not be located over major drainage channels because they can cause severe melting problems in the fall or spring.

Hydrology

Ski runs in water courses may cause problems for a ski area operator if flowing water melts the snow. This is a common problem in areas where the effects of water runoff have not been considered before ski runs were planned. The problem can be especially critical early in winter when snow depth is minimal. Water should follow a natural course and be directed off the ski slopes. Culverts to carry water are expensive and must be designed to carry the peak load.

Utilities

Utilities are planned to serve the ultimate development. These plans should include power, potable water, waste water treatment and disposal, telephone, television, and gas. Onsite impacts should be minimized to protect the visual resources. Utilities should generally be underground.

Domestic Water

Water needs for new resort communities must be anticipated. Maintaining water quality is important not only to the community but to the downstream user as well. Because of prior claims, sufficient water rights may not be available for new resort or community development. Rights must be acquired for both domestic use and snowmaking needs.

Sewage Treatment

Sewage treatment is closely scrutinized. Such agencies as the Federal Water Quality Administration, State and county health departments, and the USDA Forest Service must review and approve plans before construction of treatment facilities is authorized. This may be a time-consuming process, but it cannot be shortened at the expense of public health. Many areas suitable for future development of winter resort areas lie high in the headwaters of domestic watersheds. In such situations, wastewater must receive complete treatment before being released.

Power Transmission and Telephones

Power lines or telephone cables that are visible from the base or from areas served by lifts should be buried. Consequently, the locations of future lifts and runs must be known before any proposals are made to install lines to lifts and buildings. If the approximate location of all distribution lines can be determined during the planning stage, future burying costs can be avoided.

Utility companies may require considerable lead time to provide new transmission line services to an area. Therefore, basic needs should be estimated several years in advance. Utility consultants often can save both time and money for developers. Independent contractors, bidding on specifications provided by the consultants, frequently can be very cost-competitive with utility company proposals.

Skier Safety and Hazard Management

Planners must identify hazard areas throughout the site and must design control procedures, especially for avalanche areas. The cost of effective snow-safety programs almost invariably is underestimated by area planners and developers, perhaps because of a misunderstanding of the problem. Consequently, many large, modern ski areas in the United States face continuing problems and annual expenses that greatly exceed the amount that the areas' planners originally spent to evaluate the situation. Such an evaluation is an investment. If done care-

fully, it may pay for itself many times over in decreased costs and reduced danger to skiers and facilities.

Small, inconspicuous slide paths are a major concern. The large paths are usually well identified. Another problem often results when skiers who are unaware of hazards look for powder snow in the trees adjacent to the cleared slope or when they ski out of bounds into hazardous areas.

In addition, roads, parking lots, buildings, lift terminals, and towers are still being proposed by developers for construction in slide paths. Planners often spend insufficient time in the field immediately after storms, or during hazard conditions, to recognize these problems. Identifying them during the summer is often difficult, so historical data should be obtained.

Ski area operations are often complicated or disrupted by avalanche problems. Where avalanche hazards exist, preliminary safety and operating plans, along with cost analyses, should be part of the development plan.

The need for artillery or recoilless rifle control measures should be avoided because the equipment will not be available indefinitely and because ammunition and control crews are becoming a great expense to permittees. An area should be planned in such a way that control teams can get above the hazards using ski lifts. Teams should be able to ski down to control areas and control avalanches by protective skiing or by using hand charges.

Maintaining avalanche weather forecasting instruments and collecting and analyzing data is time consuming, expensive, but essential in high-hazard areas. Permittees are expected to own, operate, and use this forecasting equipment.

Major utilities that service winter sports areas do not necessarily have to make a negative visual impact; power lines can be blended into the landscape.

In complex situations, a large number of snow safety technicians are needed to ensure public safety. Area layout should be such that segments of the area can always be operated while control is being carried out in the more hazardous areas.

Vegetation Management

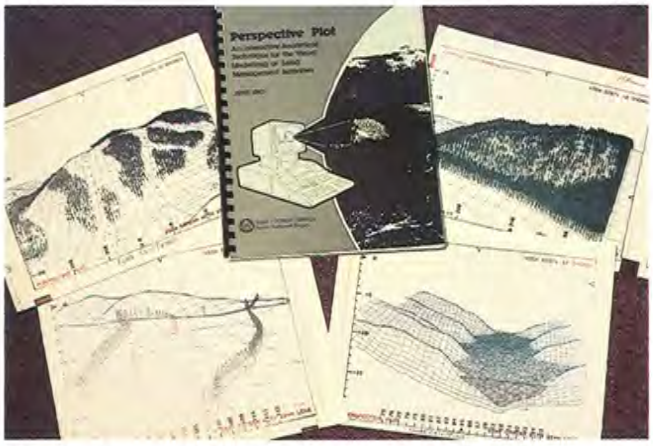
To ensure attainment and continuance of the identified desired character of the site, a long-range vegetation management plan should be prepared and implemented in close coordination with the visual management plan. The inventory for this plan should consist of species, age class, disease and insect infestations and resistance, wind firmness, reproduction potential, and location of species. This should be done for trees, shrubs, and ground covers.

If not managed properly, the forest area remaining between ski runs may deteriorate significantly over time. Exposing trees to wind and sun often accelerates problems. Over time, the viability of the ski resort, as well as scenic quality, may suffer.

The timber values on an area may be high enough to warrant commercial sales, and the economic and social benefits of placing this material on the market should not be overlooked. Timber management planning and area development planning should be performed concurrently because additional time may be needed for the sale and removal of merchantable timber. In addition, timber contractors have a responsibility to perform logging operations in a manner consistent with the long-term use of the land. The practices necessary for integrated land use should be spelled out in contracts and permits.

Air Quality

Concern for the environment has led to regulations such as the procedures that were established to govern the burning of wood product waste and other materials in the State of Colorado. Alternatives to burning must be investigated and used where advisable before burning will be recommended.



The visual impact of different types of landscape alterations can be checked for all design alternatives through a true perspective representation viewed from any location.

The actual plotted image of the Hewlett Packard 9845.

During the actual construction process, a Forest Service permit is required for burning slash. This is coordinated with favorable weather conditions and low onsite fire indexes.

Planning for fireplaces in living units and commercial buildings is an important aspect of the overall master plan. Increases in numbers of wood burning fireplaces has resulted in many situations where local mountain communities have found it necessary to either severely restrict or closely monitor and control their use because of seriously degraded air quality.

PERSPECTIVE PLOT Computer Graphics Program

PERSPECTIVE PLOT (Nickerson 1980), a computer graphics program developed by the USDA Forest Service, can visually model land management activities before they are implemented. In so doing, this program is fast becoming a powerful tool that allows for proposed designs and impacts (such as ski runs, lift locations, and structures) to be studied from selected viewing positions and adjusted, relocated, or redesigned to meet certain visual objectives. Although originally designed as a tool for modeling timber harvest proposals to determine the degree of visual modification that would result, the program is being adapted to model utility corridor proposals, dams, roads, and surface-mining activities.

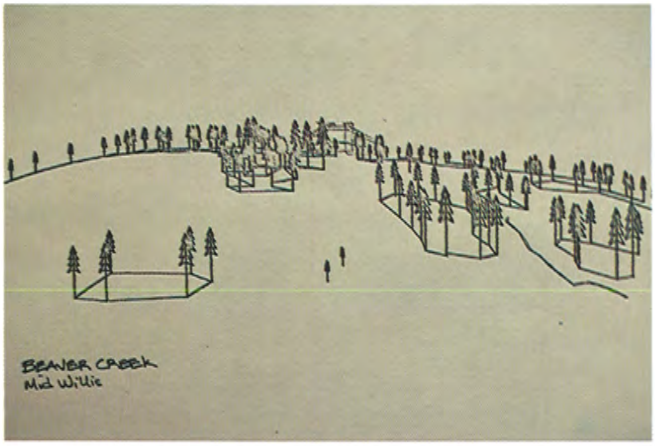
The program is used to visualize the proposed solution, allowing immediate design changes if the proposed solution is unacceptable. The designer and decisionmaker can make these design changes and immediately see the changed appearance of the proposed solution. Because of the way the program is designed, the resource manager and designer who use the program need not be computer specialists. Although originally written for one brand of desktop computer, the program is adaptable to other brands of desktop computers.

In the case of ski area planning and design, the PERSPECTIVE PLOT program can be used at the master planning level to help indicate possible visual conflicts that might develop because of the general configuration of runs as they are proposed for the mountain. The program also can be an aid at this level of planning in generally evaluating placement of the major features of the base area, roads, lifts, and other mountain structures.

At the detailed, site-planning stage, the program serves as an excellent guide in the final placement and design of the runs, structures, and roads and will accurately simulate them from critical viewpoints. Specifically, the PERSPECTIVE PLOT program will do the following:

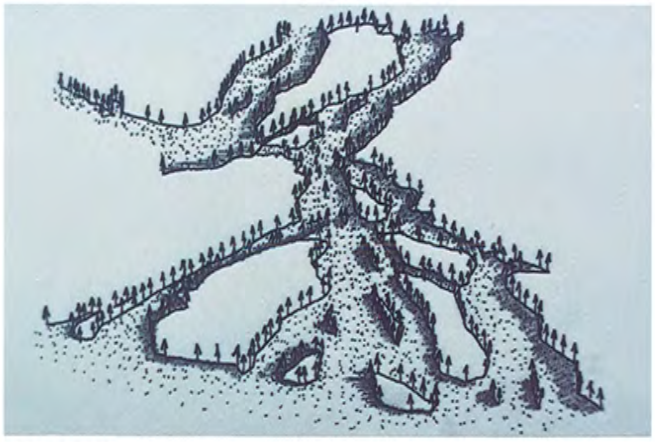
- Display proposed run locations as perceived in oblique views.
- Show the scale of proposed activities relative to surrounding features and land forms.
- Quickly provide comparative differences between various alternative proposals.
- Display textural modification in partial-removal timber harvest activities, such as feathering of the edge of ski runs.
- Visually display features associated with ski area developments (for example, lift line corridors, storage tanks, roads, and mountain structures).
- Display screening of planned activities by intervening topography, vegetation, or structures.

This actual clearing of ski runs shows how closely the final PERSPECTIVE PLOT simulation depicted the area.

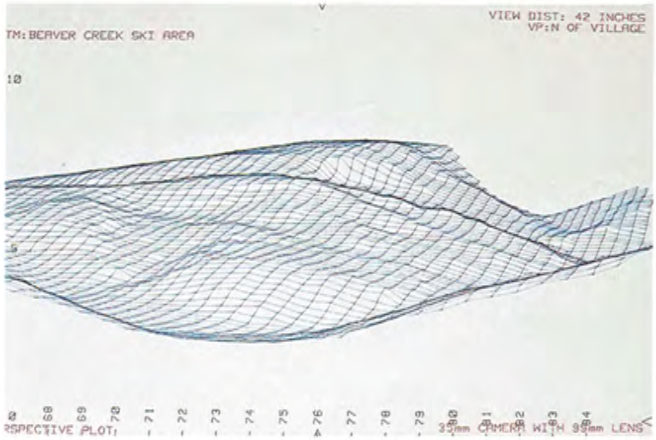


Tree shapes can be adjusted to represent the actual appearance of trees.

The runs were digitized from the topographic map of the area.

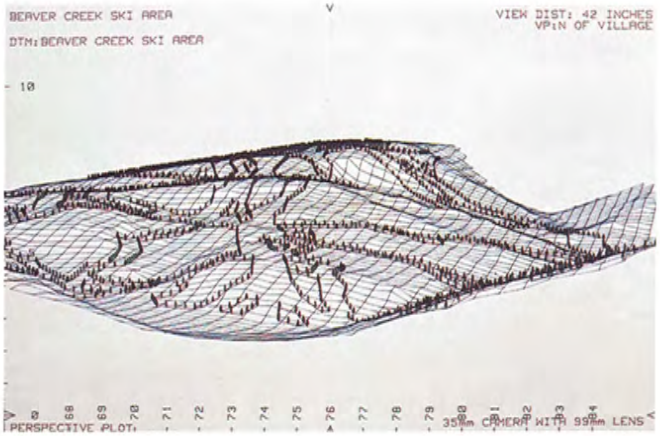


The computer printouts can be enhanced by color.

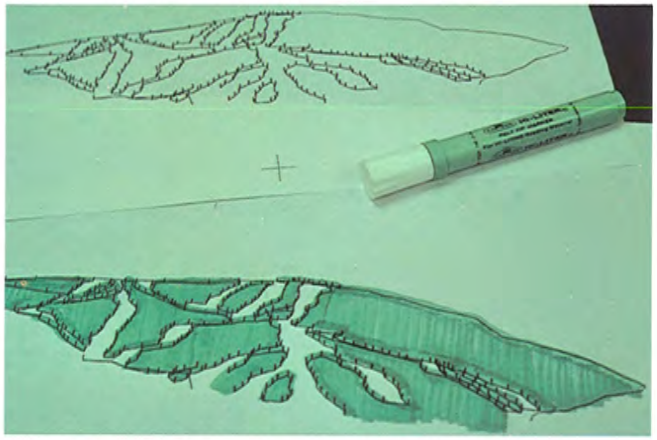


The distorted-square terrain depiction in perspective.

An enhanced version of the computer printout of the PERSPECTIVE PLOT depiction.



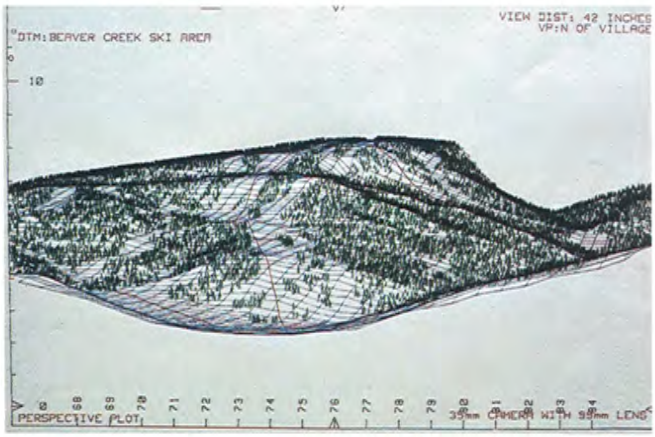
Tree edges added to the terrain depiction.



A quick dri-mark sketch enhances the presentation.

Tree massing only, without the terrain model.

Detailed Design and Construction



Tree massing and lift lines applied to the terrain depiction. Trees can be shown as a combination of hardwoods and softwoods.

Detailed site plans and facility designs for the project are prepared by the permittee, based on the master plan concepts. The Forest Service must approve plans for any project that will affect National Forest System resources; any other authorizations that may be needed will be subject to local requirements. Construction may begin only after all plans have been approved.

Visual resource management principles must be applied to all phases of the design process, with emphasis on using the design elements discussed earlier. The effects of the project must be analyzed not only from the standpoint of its specific design features but also from the standpoint of the project's overall design theme. The use of the PERSPECTIVE PLOT computer graphics program, discussed on page 24, can be of great assistance during this phase of making final design decisions.

The Beaver Creek area prior to any construction. The highway in the foreground is Interstate 70.

Two years later, the effects of the ski area are visible everywhere. The major contrast of the ski runs resulted from the straw mulching.

Common Areas of Concern

Roads

Roads are needed for transporting people and supplies to mountain facilities and for moving heavy machinery to construction sites. Roads also provide access to vegetation treatment areas, as called for in the vegetation management plan. The visual impact of a road depends largely on its size, where it is located, and how it is molded to the natural terrain. With modern construction equipment and techniques, most of the facility installation on the mountain can be done by air or with equipment designed for overland travel.

This is a properly graded road with a shallow drainage ditch. Immediate seeding and mulching will insure a natural appearance in a short period of time.

Roads should be constructed so they will last, but visually they should be as unobtrusive as possible. Since traffic ordinarily will be light, roads should be narrow with strategically located turnouts. The visual absorption capability data, described on page 16, will help considerably in determining the best road locations from the visual standpoint.

After being designed, roads should be carefully constructed. Tree clearing should be minimized, and cut and fill sections should be blended into the natural terrain. This is especially true where ski runs cross roads, though ski runs should be crossed by roads only when absolutely necessary. All debris, including large rocks, should be used or removed—not simply pushed downhill to the toe of the fill. As soon as possible, all cut and fill slopes should be topsoiled, revegetated, and mulched to prevent erosion. Where excavation exposes light-colored soils that create an undesirable contrast with the surrounding area, efforts should be made immediately to subdue the contrast. Where cut and fill sections would create large scars that cannot be rehabilitated, retaining walls may provide a satisfactory visual solution.

The width of this mountain access road is adequate. The cut and fill sections will be fine graded, seeded, fertilized, and mulched.

Because roads cut across the slope, they will collect runoff water. Consequently, a shallow, lined drainage ditch must be provided on the uphill side. Wherever necessary, culverts must be installed under the road to disperse the water into naturally established drainage areas. Where no natural drainage area is available, the force of the water below the culvert must be dissipated by a rock bed or a similar surface to prevent erosion around the culvert outlet.

The access road to the base area is most important because it offers visitors their first impression of the ski area. The access road should be located to take advantage of the natural terrain, thereby requiring the least amount of landscape modification. In choosing the road's location, planners should consider the most pleasant approach to the area. When designing the entrance road, they should consider the users' safety, snow removal problems, and the area's appearance during summer and winter. See Volume 2, Chapter 4, "Roads," of the National Forest Landscape Management series (USDA FS 1977) for more details on visual considerations for road construction.

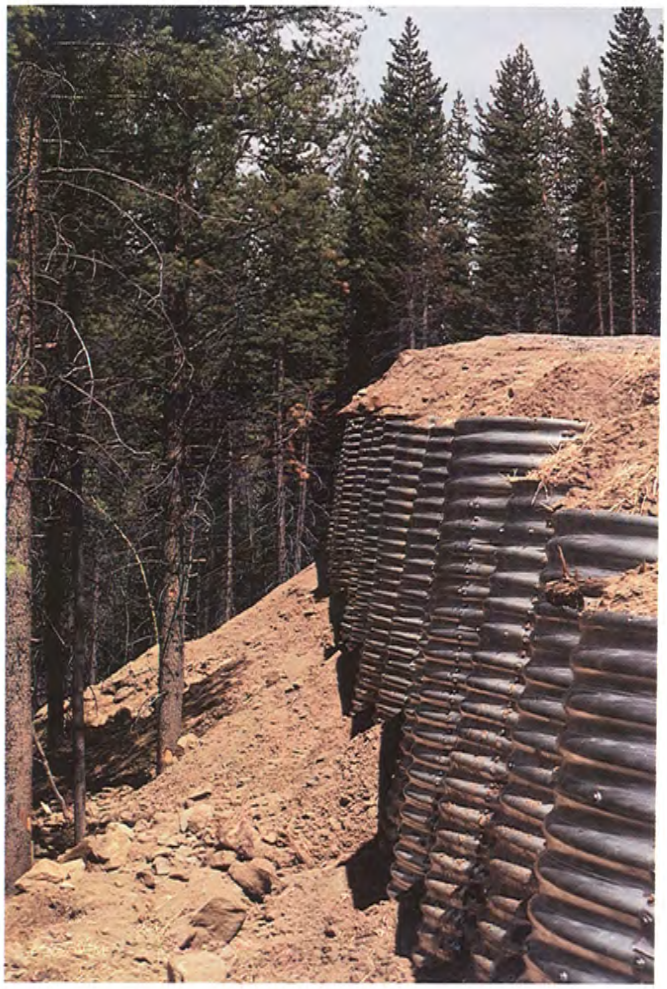
Utilities

All facilities in the area are served by at least one utility, such as power, water, sewer, gas, and telephone. To avoid climatic hazards and to improve visual appearance, all utilities should be buried. In addition, they should be located so they can be accessed easily for repair. Burying lines along the main road

This is an example of an improperly designed road. Steep cut and fill sections should be avoided, and the road should not be constructed on unstable soils.

The cut and fill slopes along this road were well constructed and immediately revegetated to prevent erosion.

This road crosses a ski slope, but because of good engineering, it will not interfere with winter use. The cut and fill sections are smooth, and the ditch provides adequate drainage.



Electric lines to all mountain facilities were plowed in with minimal disturbance of the ground surface. This job was accomplished in record time with new equipment capable of maneuvering over the mountain's steep slopes.

would provide an easy solution. Certain utility lines could be buried along the edge of the ski runs if the expected incidence of repair is low. Burial of utility lines must be coordinated with all other construction activities to prevent disturbance of areas after they have been graded and seeded. If the lines are buried, the only other impact of utilities will be the switching and metering boxes that are installed above ground. However, visibility of these boxes can be minimized by locating them where they will blend with vegetation or buildings and by painting them to blend with the natural surroundings.

Where blending is critical from a visual standpoint, the use of architectural screens may be appropriate. Planning utility installations for the total capacity of the area is critical. Plans showing locations of underground lines and aboveground structures will ensure proper blending, will ease access for repairs, and will help prevent damage from other excavations.

Water storage tanks can be buried, but they are usually installed above ground. Because of their large size, they should be located where they are not visible. Using vegetation screening and dark neutral colors and restoring the excavated area will minimize their visual impact. Microwave reflectors, repeaters, and substations can also be conspicuous, but if properly located and designed, they can blend into the landscape with little visual contrast.

Sewage treatment facilities should be located away from the main use areas. The design and exterior colors of the treatment facilities should blend with the architectural theme of the area and its natural surroundings. To achieve a natural blending with the surrounding area, a landscape plan should be developed using natural plant materials found in the area.

Because many utility lines are now buried, the visual impact in most instances is negligible. The utility equipment that must be above ground should be designed carefully to fit the desired character of the area. Close coordination with the utility companies during the planning and design stages can eliminate objectionable visual impacts and the need for expensive screening structures or plantings for aboveground utility installations.

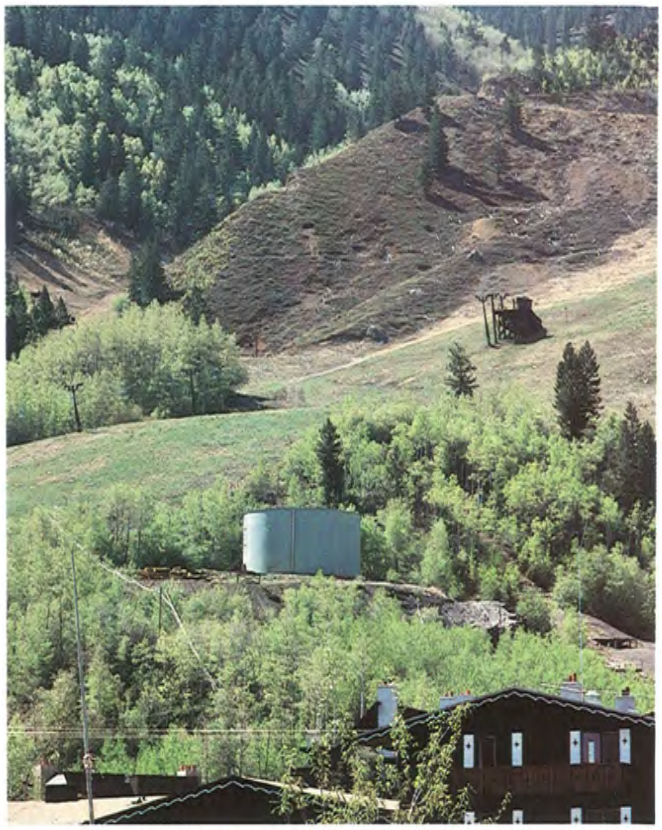
More detailed information about utilities is available in Volume 2, Chapter 2, "Utilities," of the National Forest Landscape Management series (USDA FS 1975).

Signs

Signs serve four basic purposes: they provide direction to different facilities; identify facilities, features, and hazards; convey rules and regulations; and give information and provide interpretation.

Water and sewer pipes usually require extensive excavation. It is important to complete this type of work before the ski runs are revegetated.

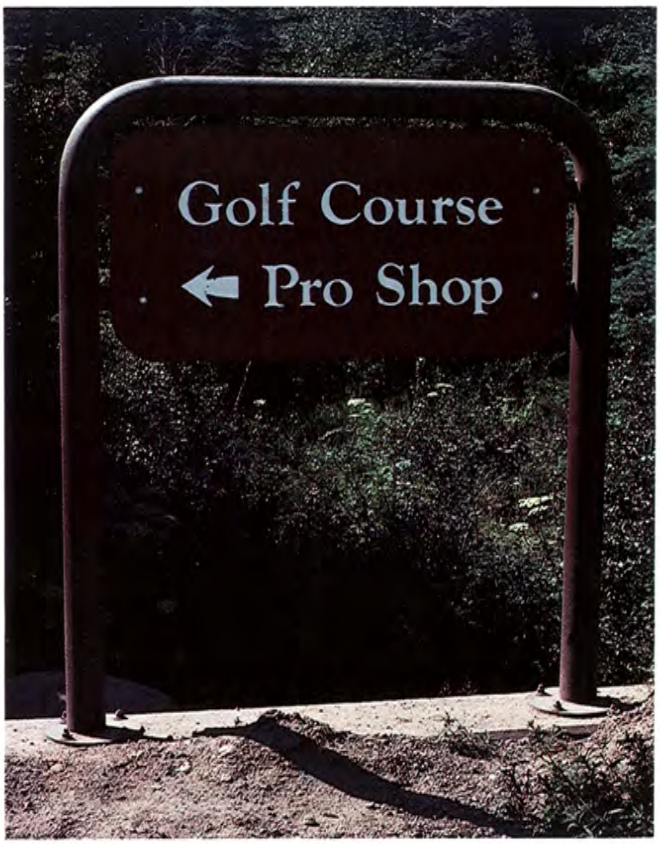
Dark green was chosen as the color for this water tank because it is surrounded by spruce trees. The reflectivity of the paint will be dulled over time.



The appearance of this water tank can be softened with proper landscaping and a color that blends better with the background.

Sign designs, supports, and materials must be chosen carefully to create the desired effects.

Sign design should be simple and the message should be clear.



A design theme used on signs throughout an area will contribute to a pleasant cohesiveness.

Signs on the mountain are particularly important from a safety standpoint. For example, signs are used to identify trails by name and the level of difficulty of ski runs so people can negotiate their way down the mountain safely using runs that are compatible with their level of skiing competence. They should be located so they are easy to see, but not a danger to the skier.

A sign plan for the entire area must be developed to ensure that people receive all the information necessary for the orderly operation of the area. Size of signs, colors, and mountings should be controlled through a master sign plan. An attractive common design theme should be chosen to lend an appealing cohesiveness to the area.

The Mountain

The mountain itself is the most prominent feature of the ski area because it can be seen from many different vantage points. The steepness of the slopes and their aspect to the viewer contribute greatly to the visual impression; the design of ski runs, lifts, and other facilities influence whether the visual effect will be positive or negative.

In some areas, the existing visual condition is well suited to winter sports use and requires only minor landscape alteration.

Successful treatment of the ski trails will be a year-round asset to the area. This area achieved the results shown in this picture within 3 years after the ski trails were cleared.

Ski Runs

When designing ski runs, function is the first priority. However, runs can be made acceptable from the visual standpoint as well. The following are some basic considerations for ensuring visually acceptable ski runs:

Fall Line

The topographic configuration of the slopes usually will dictate the best location for the runs. When the ski run is located on the natural fall line, the run itself usually has a better chance to appear natural, as well as provide the best skiing.

Grading

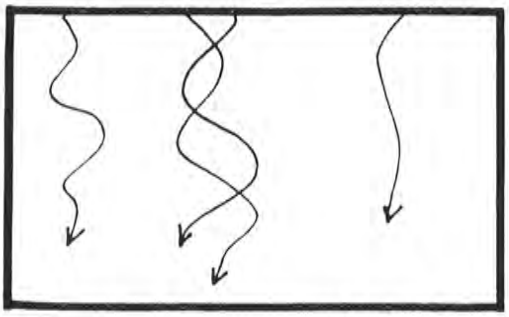
Before modifying the topography to fit a run into a specific site, the soil, water, and vegetation conditions must be carefully analyzed. In general, cut and fill operations should be held to a minimum. Sucessful grading will imitate the existing slopes and blend smoothly with the surrounding natural topography. Surface runoff must be calculated, and provisions must be made to avoid erosion. Revegetation with ground covers and grasses should be started as soon as the grading is completed.

Vegetation

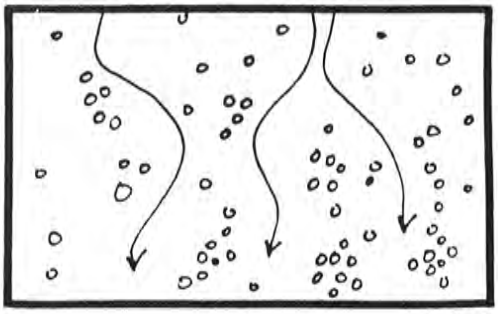
Because trees and shrubs must be removed for ski runs, the configuration of the resulting openings must be carefully planned. Wind patterns are studied first to determine where the snow is and where ski runs could be scoured by the wind. At the same time, this study indicates which areas have the least windthrow potential and the best snow accumulation potential.

To avoid icing on the runs, all seepage areas and water courses must be identified. If at all possible, runs should not be located

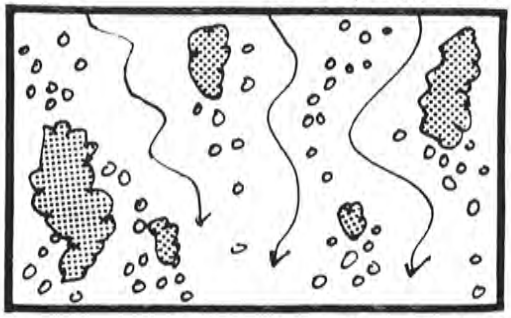
Ski Trail Layout Concepts



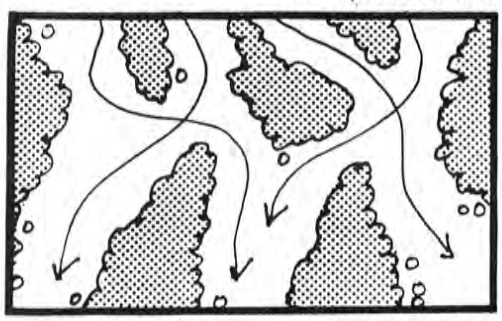
Open Parks
100% open 500 ft. wide



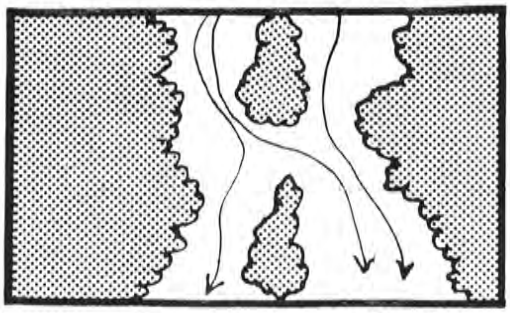
Gladed
90% open 300 ft. wide



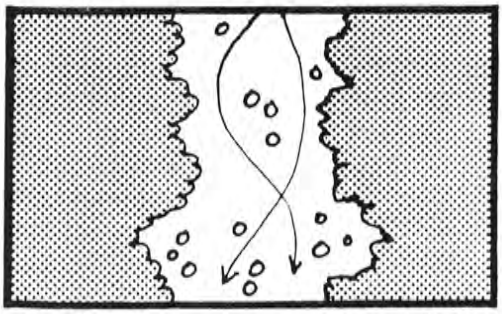
Semi-gladed
70% open 300 ft. wide



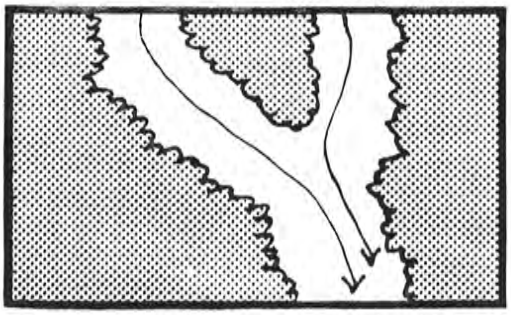
Interconnected
50% cleared 500 ft. wide



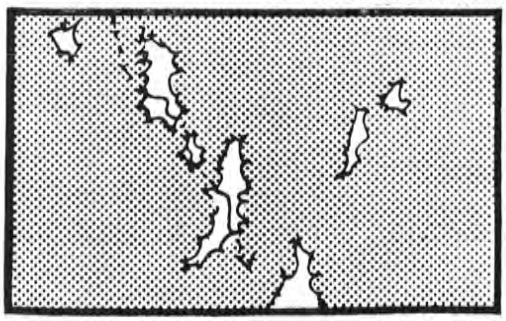
Large islands
40% cleared 180 ft. wide



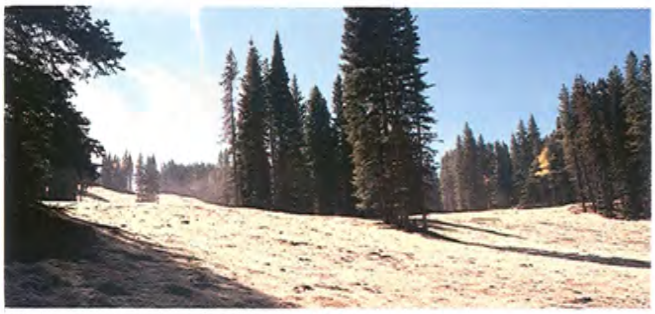
Tree Islands
30% cleared 150 ft. wide



Traditional
20% cleared 120 ft. wide



Forested
Natural Openings



These ski runs were graded to provide the best skiing possible, while retaining the natural configuration of the topography. The combination of the natural-appearing vegetation edge, the tree islands, and the topography make this landscape alteration visually attractive.

Grading and vegetation manipulation can ensure a natural-appearing ski run. The road crosses this ski run three times without affecting the run's skiability. This is possible because proper grading procedures were used.

The mulched slopes show considerable contrast in comparison to the upper slopes with the bare ground or grass. The visual impact of the ski slopes will be subdued because of the ski run configuration and low color contrast.

over these areas, but surface drainage from the runs should be diverted toward these water courses. Shallow cross drains that can be revegetated or lined to prevent erosion are preferred. The cross drains should be undulating to reflect the natural terrain as much as possible.

From the standpoint of maintenance and appearance, the vegetation edge is extremely important. A natural-appearing edge in the design of a ski run is a key to maintaining the desired character and to meeting visual quality objectives. All vegetation manipulation should be based on the vegetation management plan. Where possible, run edges should be located to coincide with existing biological edges. The tree edge should be undulating with a variety of windfirm trees and shrubs. Where it is safe to do so, leaving tree and shrub islands in the ski runs will contribute greatly to the natural appearance. When the ski run edge has to be located in an even-aged stand of trees, a vegetation management plan should be prepared for creating a natural-appearing uneven-aged vegetation edge. Small trees and shrubs can often be transplanted from areas cleared for ski runs.

If there is any doubt about the width of a ski run, the narrowest width should be cleared first. This leaves the option open for additional clearing at a later date.

During the design process, the PERSPECTIVE PLOT program (Nickerson 1980) should be used to determine whether the apearance of the area as seen from the prominent observation areas is acceptable.

Merchantable timber that has been cleared is usually sold. Smaller timber can be chipped, burned with the slash, or used

Run clearings should have a natural-appearing edge with a variety of vegetation species, sizes, and age classes.

A variety of species and age classes provide a natural-appearing edge in this clearing.

as firewood. Wood chips can either be sold or be used as mulch or as surfacing material for foot trails. The burning of slash must be carefully planned and can be done only on days when the fire danger is low and the smoke will be dispersed. The slash has to be located far enough from live trees to avoid singeing them above ground and damaging their roots below ground. The effect of the fire on soil fertility also must be considered because intense heat may destroy many soil nutrients. After the runs have been cleared, all debris must be removed so the runs can be used for skiing with minimum snow cover.

Ski Lifts and Associated Structures

Because ski lifts and their associated structures are large, manmade, and usually located in a straight line, they can mar the visual effect of an area. The majority of lifts are chairlifts, T-bars, gondolas, rail systems, or large tramways. The lifts usually consist of lift towers, cables, chairs or gondolas, loading and unloading stations and ramps, counterweight structures, and the operator and machinery housing. The structures vary from simple to massive and complex.

The location of lifts is determined by run locations and the topographic configuration of the mountain. From the visual standpoint there are three important aspects to be considered—the color of the structure, structure design, and appearance of the lift line.

Color of Structures

The color selection for all structures should be made to achieve the best blending with the surrounding landscape during both summer and winter. Because manmade structures tend to have smooth surfaces that reflect light, any color appears much lighter than it actually is, so dark colors should be used to prevent contrast. Recommended colors for lift towers and chairs are neutral dark brown, dark olive, dark green, dark blue, or black. Other colors may be appropriate where local vegetation and soils have a distinctive coloration. Galvanized steel on towers and chairs or gondolas should be darkened to prevent glare.

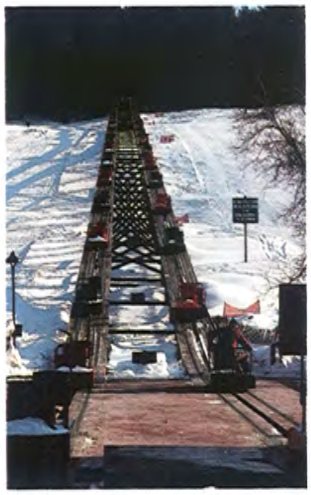
The operators' building, ramps, lift terminals, and machinery-housing structures should fit the adopted color theme for the area. Subdued colors should be used because they blend well with the natural color scheme. Using natural materials on these structures also will help them blend into the site.

Slash to be burned is piled in the center of the cleared ski run to prevent root and scorching damage to the trees along the edge of the ski run.

Although the structures are dark in color, they still create some contrast because they do not blend well with the surrounding vegetation.

This color chart has been developed as an example of colors that usually achieve the desired blending in a natural environment. It should be kept in mind that colors on smooth manmade surfaces need to be two or three shades darker than the background colors to compensate for the shade shadow patterns created by naturally textured surfaces that make colors appear darker. All colors shown are from the Munsell Soil color charts.

Although this is definitely recognizable as a ski area, its visual impact is subdued because no unnatural lines have been introduced. Lift lines have been well integrated into the overall design.



Because these lift clearings were blended with the ski runs, they are not noticeable.

Design of Structures

The various lift structures that are available usually are designed by the manufacturers and are based on the performance characteristics of the different lifts. However, the design of ski ramps and housing structures for operators and machinery is not limited by such factors and can be based on local considerations. Primary considerations for designing these structures should be maintaining the architectural theme of the area and keeping the structures in scale with the surroundings. Using natural exterior materials usually helps to achieve the desired blending, not only during winter but also during summer.

Blending of the Lift Line

The object of blending the lift line into the mountainside is to obliterate the artificial straight line, and theprimary method for achieving this blending is vegetation manipulation under and along the lift line. The clearing for the lift should have naturally scalloped edges with a variety of tree and shrub sizes and species; a clearing with straight vegetation edges should be avoided. The color of the lift structures and their proposed relation to the other facilities on the mountain also are important factors to consider. The lift line structures can be integrated into the ski runs if all necessary safety precautions are taken. This solution is usually quite satisfactory from a visual standpoint, and it is attractive because it requires no additional vegetation clearing.

The location of this lift line is good; however, the light-colored chairs create a contrast that draws attention to the chairlift.

This lift line clearing is in contrast with the natural configuration of the ski run. Integration with the ski run and the use of a natural-appearing clearing edge could have made this clearing visually acceptable.

During winter, the contrast of snow accentuates this straight lift line clearing.

Snowmaking Equipment

Snowmaking equipment is now being used in many ski areas. The four basic components of a snowmaking system are the compressor building, water storage facilities, the pipes that carry water and air, and the nozzles that mix water and air to form the mist that becomes snow.

Although the building that houses the compressors can easily be blended with the architectural style of the area, its location will have to be planned carefully because of the noise associated with the compressors. The water storage facility, which can be a pond, a water tank, or a structure built directly on a stream, will affect the area's appearance. Water tanks should be colored and located to create as little visual contrast as possible. Ponds and stream water collectors can be attractive features of the area if properly designed. They can serve dual purposes in summer and winter. The pipes carrying water and air are usually buried with valve connectors above ground. Because there will be no appreciable visual impact if they are buried properly, pipes should be buried wherever possible. If the pipes are installed above ground, the visual appearance of the area is marred by the straight line effect and the color and reflectivity of the pipes. Color can be applied to eliminate the color contrast of pipes, but it is difficult to eliminate the straight line effect. Using shrubs to hide the pipe is probably the best solution. The nozzles that mix the water and air for snowmaking are usually portable, and their visual impact is minor because they are removed when not in use. However, noise from the snowmaking equipment is a factor that should be considered thoroughly during the design phase of ski areas.

Mountain Buildings

The location and design of mountain buildings—usually restaurants and ski patrol buildings—determine their visual impact. The architectural style and exterior color of the buildings should harmonize with the natural surroundings, and the structures should be located to take advantage of natural vistas for people's enjoyment. Existing natural vegetation around the

Because considerable soil disturbance is necessary for installing snowmaking equipment, the equipment should be installed before the ski runs are revegetated.

Good architecture and colors, natural materials, and excellent siting among the natural vegetation help blend this structure into the landscape.

Grading around this restaurant was done carefully to blend it with the surrounding landscape. The topsoil that was saved was reapplied after grading to establish a good seedbed and also to provide natural vegetation from the seeds contained in the topsoil.

buildings will improve their appearance. Soil manipulation should be minimized, and final grading around the buildings should simulate the natural topography and blend with the undisturbed areas.

Summary

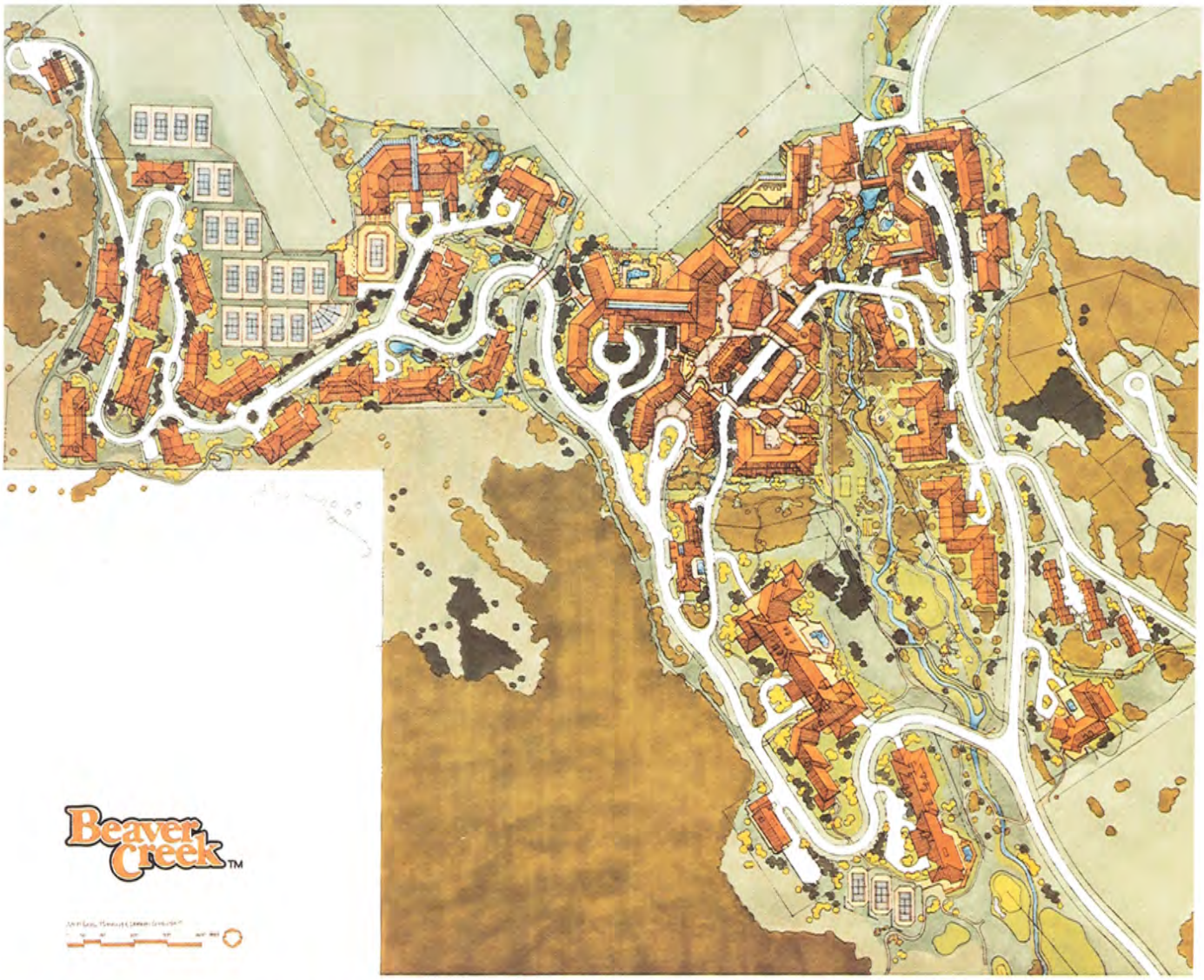
These main features of the mountain development (runs, lifts, buildings, etc.) are completely interrelated and must be considered as a unit for all planning and design phases.

The visual quality objectives adopted for the area can be achieved if the designs follow the overall planning recommendations. They also will be reflected in obtaining the desired character for the area. Results of many of the designs for improving the visual resource, such as reaching the desired edge effect along ski runs, will become apparent only after an extended period of time. Plans must reflect this, and appropriate periodic actions must be taken to reach the desired goal. Accordingly, an action plan should be developed that includes periodic updating and recording of achievements.

The Base Area

Although this area is discussed separately from the design standpoint, all features of the base area are completely interrelated with development on the mountain. Visual resource management considerations are applied at a smaller scale than on the mountain, but they involve considerably more detail to achieve the adopted visual quality objectives.

Before developing designs for separate components of the base area, an overall design theme for the area should be developed. To ensure consistent design throughout the area, design guidelines should be developed and a design review process initiated. An excellent example of this can be found in the Beaver Creek



design regulations (Beaver Creek 1979 a, b), which are reprinted in the appendix. These have been instrumental in establishing an orderly development program on the private lands at the Beaver Creek Resort and in ensuring the best visual results as they were planned.

The base area facilities that have the greatest influence on the appearance of the base area are discussed on the following pages. Particular attention must be given to ensuring that the appearance of these facilities will enhance the year-round appearance of the area.

Parking

The location and size of parking areas usually have considerable visual impact on a base area. These parking areas also influence the total circulation pattern for vehicles and pedestri-

If there is adequate room, parking lots can be located within an area. Otherwise, parking garages should be provided, or the parking lot should be located away from the core of the ski area.

If parking lots are located away from the core area, good mass transportation system should be provided.

ans. Therefore, their location must be planned and integrated carefully for a well-designed facility.

Although a flat, large parking lot without plantings or other features may be the best from the standpoint of snow removal, its appearance, especially during summer, will not be the best from the visual standpoint. By taking advantage of the natural topography and established vegetation, a design solution usually can be found that will satisfy the requirements for both snow removal and appearance.

When space for parking at a site is limited, other solutions should be considered. One alternative is to locate parking some distance from the ski area and use shuttles to the base. A more expensive solution is to use parking garages, which already are being used in many areas. A vegetation management plan should be developed for the entrance road and parking area to ensure a long-lasting and attractively landscaped area.

The Village

The base area is perceived not only from outside the area but also from within the area. Much detailed planning and design is necessary for achieving a solution that protects the visual integrity of the landscape and presents the user of the area with a pleasant atmosphere. Since most of our perception is visual, the designs concentrate on appearance in addition to function.

If the base area is to include a village (as is the case with most private land base areas), the village will usually contain shops, restaurants, plazas, entertainment facilities, condominiums, and overnight accommodations. Because many pedestrians use the area, traffic should be limited to vehicles that service business establishments. Access to the village area should be by foot, by mass transportation from parking lots located away from the village, and by bus.

To control the orderly visual development of such a village, a total village plan should be developed and development regulations formulated. As part of this plan, design guidelines should cover such aspects as the total design theme, architectural design theme, relation of buildings to open spaces, sign plans and theme, landscape plans within the village, and the transition of the village into the naturally established landscape.

Planning, design, and construction must satisfy established codes and regulations. To ensure appropriate design for the area, a design review and development process should be established that clearly shows what is expected.

Buildings

The lodge, restaurant, shops, ticket offices, and all other buildings required at the base area determine the area's character. An architectural theme that is applied throughout the base area and the mountain (see appendix) will be a great advantage from the visual standpoint. The architectural integrity should be planned for with specific design suggestions regarding building size, materials, colors, spacing, and other architectural details. When different owners and builders are involved, design approvals and construction inspections should be coordinated to ensure the desired results.

The orientation and placement of buildings should be based on a logical plan that anticipates people's needs during the ski season as well as during the summer. The appearance of the base area, which is sometimes combined with a village area, can develop its own charm, attracting people into the area.

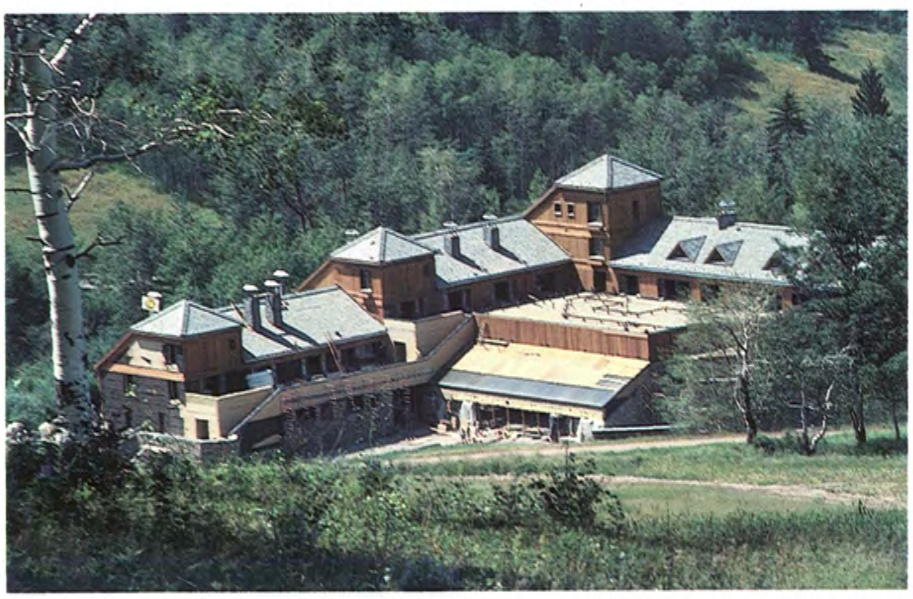
Lower Lift Terminals

These terminals usually consist of the lift structure, operator's building, machinery cover, loading area, and the maze area where orderly waiting lines form. The base area should be

The environment created by shop displays, signs, and the mall area in general can significantly affect whether people will enjoy an area.

Pedestrian circulation in villages should be anticipated and protected by only allowing service vehicles into the area.

A reception center can serve a dual purpose of providing the necessary services to visitors and accommodating the needed administrative space.



The town hall, lodge, condominiums, and facilities are combined in this base facility.

Ski school areas should be located away from the main traffic areas to avoid interference.

designed to provide quick and easy access to the terminals from all points in the base area. Access from the lower runs should be easy and free of dangerous cross traffic.

Three aspects of visual quality should be considered: architectural style, color, and materials. If the terminals are coordinated with other base facilities and the mountain facilities, then the visual integrity of the site should be ensured.

Ski School Area

The ski school is a basic component of every ski area. It usually consists of a meeting place, a gently sloping open area, and short lifts or tows. It is an introductory area that should be easily accessible from the parking area, lodge, and restaurant. Therefore, from the visual standpoint, designers should give primary consideration to the area's natural appearance in both summer and winter.

As on the ski runs, the edge effect of the vegetation should appear natural. The edge should have a variety of species and age classes of trees and shrubs, and it should imitate natural openings within the landscape character type.

If summer use is planned, signs that apply solely to winter use should be removable. Permanent structures in the area should be colored to create as little contrast with the surroundings as possible.

Recreation Facilities

At a major destination resort, a variety of recreation facilities are usually provided for visitors and residents of the area. During winter, downhill facilities, cross-country ski trails, and ice skating facilities may be provided. In summer, the facilities usually include a golf course, tennis courts, hiking trails, and swimming pools. These facilities are usually located on private land near the village and the residential areas. If properly

designed, golf courses serve a dual purpose: they provide for an mportant recreation activity, and they provide open green space within the resort area. From the visual standpoint, this green space helps to integrate the manmade structures with the natural surroundings. It is important to develop a vegetation management plan for golf courses if the vegetation is to be retained or improved.

The tennis courts usually have a more pronounced visual impact because of the paved areas, high fences, and cloth screens, so their location is usually more critical from the visual standpoint. With proper landscape treatment, the impact of the tennis courts can be softened considerably.

The area along this slide on private property was well graded and sodded to prevent erosion. The rest of the area was seeded and mulched. Use of a darker color on the slide would eliminate the contrast that makes the slide so visible.

Hiking trails have minimal visual impact. Consistent signing and maintenance should be provided. These trails can serve a dual purpose if they are used for cross-country skiing during the winter.

In recent years, alpine slides have been installed in a few ski areas. No matter how carefully the slide is installed, its light color creates a strong contrast that dominates the surrounding landscape and can be seen from considerable distances. The only way this contrast can be reduced is by using a dark-colored material for the slide. If alpine slides are approved in the master plan (as may be the case at a private land ski area) a visual study of the area should be made to determine how to minimize the visual contrast.

Residential Developments
Residential developments consist of either condominiums or detached homes. As in the village development, regulations and guidelines are the way to ensure that the buildings satisfactorily achieve the desired character of the area. The design guidelines and codes for residential developments need to be written to ensure that the naturally established landscape is protected to the greatest extent possible.

Administrative Facilities
Once a resort complex reaches the "village" size, it usually requires its own administrative facilities, such as a clinic or small hospital, a fire station, police facilities, road construction and maintenance equipment facilities, mass transit facilities, a village hall, and employee housing which is usually a high-density apartment complex with an access road, parking, and recreation facilities. The size of these developments will depend on the number of employees needed to service the resort complex adequately and the amount and cost of private land available for such facilities. As in other areas, the design theme of the entire area should be carried through to ensure the area's visual integrity.

The visual integrity of these facilities will be achieved by following the design guidelines.

Maintenance Yard
A lot of large equipment is needed to maintain a winter sports area. Because this equipment has to be stored, maintained, and repaired, a large, out-of-the-way area with easy access to the slopes has to be planned as a maintenance yard. Unless special design precautions are taken, a maintenance yard can have a negative impact on the appearance of a base area. The equipment storage area should be screened from view with vegetation or with a constructed screen. Such screens usually have a harsh appearance and should be softened by appropriate plantings and colors that blend with the surroundings. To provide visual continuity, maintenance buildings should be designed to comply with the architectural theme of the area.

By following the established design regulations, condominiums can express their own charm in keeping with the design theme of the area.

This is one of the maintenance buildings immediately after its completion. Grading and landscaping will blend this and the other maintenance buildings with the surrounding area.

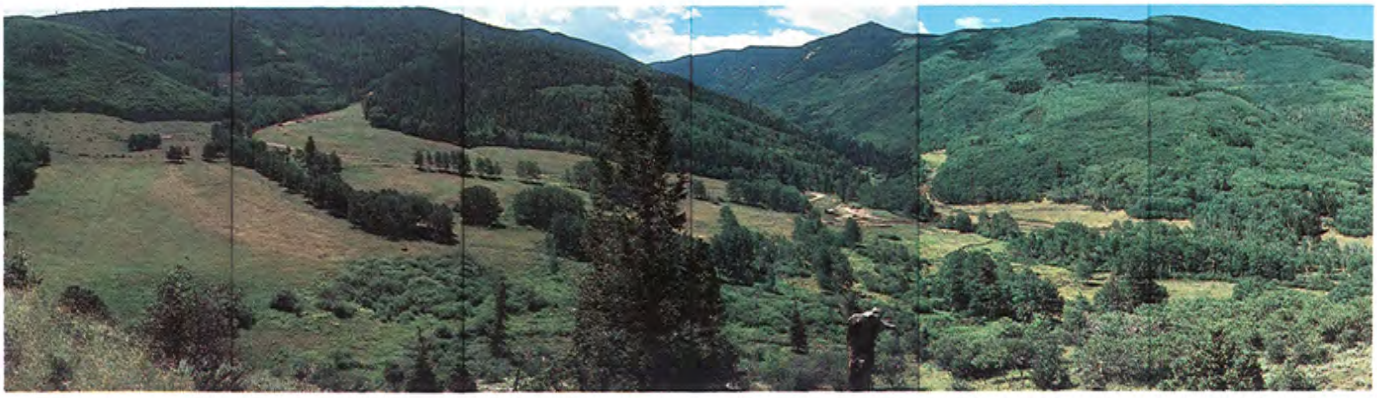
Large areas are required for storing motorized equipment, which may have strong contrasting colors.

Residential development is of major importance in resort complexes. Architectural and landscape design control throughout the development is a key to ensuring the visual integrity of the area.

Monitoring

In closing, it should be pointed out that the desired results of all the planning, design, and construction activities can be better ensured by monitoring. There are many kinds of monitoring; that which involves the appearance of ski areas is usually done photographically (still, motion picture, or time-lapse). It can be done rather easily by identifying the important viewpoints and then establishing photo points. Pictures are then taken at time intervals corresponding to initial site investigations, seasonal vegetation color and texture changes, precipitation patterns, and stages of construction.

This photographic coverage can be invaluable in the design and planning of both the initial area and its future expansion. It also assists the ski area permittee and the Forest Service in determining how well the desired results are being attained over time. These results demonstrate the application of visual resource management principles, which has been the goal of this book.



The Beaver Creek base area and lower mountain before any major construction work was done.

1978—Fall colors should definitely be considered in evaluating the visual impact of any landscape alteration.

1979—The ski runs have been cleared, seeded, and mulched, and base area construction has begun.

1980—The parking garage is now visible in the base area, and work has been started on the ski runs on the west mountain.

Literature Cited

Beaver Creek Resort Company. Beaver Creek design regulations: Single family and duplex residences. Vail, CO; 1979a. 44 p.

Beaver Creek Resort Company. Beaver Creek design regulations: The village. Vail, CO; 1979b. 74 p.

Nickerson, Devon B. Perspective Plot; An interactive analytical technique for the visual modeling of land management activities. R6-TM-031-1980. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region; 1980. 145 p.

U.S. Department of Agriculture, Forest Service. Planning considerations for winter sports resort development. Washington, DC: U.S. Department of Agriculture; 1973. 55 p.

U.S. Department of Agriculture, Forest Service. National Forest landscape management: Volume 2, chapter 1: The visual management system. Agric. Handb. 462. Washington, DC: U.S. Department of Agriculture; 1974. 47 p.

U.S. Department of Agriculture, Forest Service. National Forest landscape management: Volume 2, chapter 2: Utilities. Agric. Handb. 478. Washington, DC: U.S. Department of Agriculture; 1975. 147 p.

U.S. Department of Agriculture, Forest Service. National Forest landscape management: Volume 2, chapter 4: Roads. Agric. Handb. 483. Washington, DC: U.S. Department of Agriculture; 1977. 62 p.

Other Publications in the Landscape Management Series

U.S. Department of Agriculture, Forest Service. National Forest landscape management: Volume 1. Agric. Handb. 434. Washington, DC: U.S. Department of Agriculture; 1973. 76 p.

U.S. Department of Agriculture, Forest Service. National Forest landscape management: Volume 2, chapter 3: Range. Agric. Handb. 484. Washington, DC: U.S. Department of Agriculture; 1977. 44 p.

U.S. Department of Agriculture, Forest Service. National Forest landscape management: Volume 2, chapter 5: Timber. Agric. Handb. 559. Washington, DC: U.S. Department of Agriculture; 1980. 223 p.

U.S. Department of Agriculture, Forest Service. National Forest landscape management: Volume 2, chapter 6: Fire. Agric. Handb. 608. Washington, DC: U.S. Department of Agriculture; (in press).

Design Theme

The overriding design philosophy of Beaver Creek is to establish a remote village with its own identity, an imaginable place, complementing rather than competing with the natural landscape.

The architectural theme for Beaver Creek has been directed at establishing a compatibility between buildings and the natural environment, fulfilling the expectations of visitors as a retreat to the mountains, respecting the historic precedent of mountain buildings in both Colorado and Europe, and utilizing energy conservation and solar energy applications.

As seen from a distance, the Village should be understated and uncomplicated, made up of simple forms and consistent roof lines. In contrast to this, the central pedestrian area of the Village should have an exciting vitality and broad individual expression.

In order to more clearly interpret the design theme for Beaver Creek architecture, three levels of perception, e.g., ways in which the community will be observed, have been identified, each with its own set of considerations.

©1979 Beaver Creek Resort Company—reproduced with permission from Vail Associates, Inc.

Perception Level I—The Village Within the Landscape
At a distance the Village is seen either from the mountain looking down, or from the entry road upon arrival. Due to vegetation masses, as well as site lines created by the terrain of the area, the roofs will become the dominant element at this level of perception. At this scale, the Village should be composed of simple understated forms with an overall consistency of materials and color. Roofs shall be simple hip and gable forms. Variety should be a response to changes in topography and exterior spaces.

Materials and colors shall be relatively subdued with nonreflective surfaces. The golf course from below and the ski slopes from above will tend to set the Village in the natural and open landscape. Aspen and spruce forests on the east and west will have the effect of fusing the edges of the Village into the landscape.

The buildings from the south should open to the sun and from the north be closed to cold exposures. This contrast is similar to the extreme variation of the natural landscape between north and south facing mountain slope environments.

Residential areas should blend structures and landscape, respecting natural landforms and existing vegetation. The primary focus should be the Village with an intensity of structures contrasting with the low density and undeveloped areas surrounding it.

Perception Level II—Building and Public Spaces
The second level of perception of the Beaver Creek Village will occur within the streets and public spaces of the project. At this level of perception, the exterior walls become the dominant element, establishing the overall scale, and defining the public spaces and pedestrian circulation routes within the Village. It is important that the sequence of public streets, walls, and plazas be continuous within the Village, enhanced by minor angular changes and avoiding rigid 90° patterns. Subtle changes within wall and street alignments will create interesting streets and walls with constantly changing frontages and points of focus.

The visual expression of the wall shall be predominantly mass at the pedestrial scale, punctuated by window and door openings. On upper levels, openings shall be not more than 20% of the exposed wall area on the north, west, and east, with unlimited opening to the south responding to sun exposure and mountain views. Window and door openings should be placed in a casual or random pattern avoiding rigid symmetry, repetition, and formal patterns.

In order to achieve continuity within the landscape and within the Village itself, it is important to have building-to-building and building-to-public open space connections. These can take the form of overhead bridges, retaining walls, terraces, and private courtyards leading to public plazas and malls.

Buildings should express the structure in a rational manner with elements such as massive bearing walls and timber framing. Design should avoid visually contradicting structural relationships.

The use of materials becomes increasingly important at this level of perception, and materials should respond to the following uses:

- Framing—Heavy timber, wood trusses, and connection details are encouraged as exposed framing elements. These become especially important in establishing interesting interiors.

- Nonstructural Surface Materials—Upper level wall surfaces which appear to be non-loadbearing can be sheathed in wood siding, which should be left naturally weathered or bleached to complement other natural materials such as native rock. Stucco shall not be used as in-fill material, but rather as an expression of mass. Roofs should be made up of unit pieces of clay tile.

- Mass—Generally, the lower levels of the buildings near the pedestrian areas should be expressive of mass and substantial structural strength. Materials such as rock or plaster shall have irregular surfaces without modular patterns, precision lines, or perfectly flat surfaces. The massive portions of buildings shall have an expression of depth, substance and strength, not mere surface coverings. Windows and door reveals should have substantial depths, allowing room for interior nooks and recesses within the walls. Masonry wall colors should be generally warm off-white tones, complementing naturally weathered wood and rock colors.

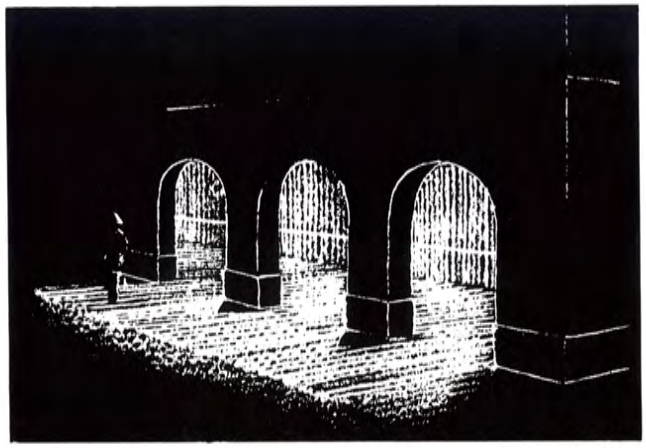
Perception Level III—Building and Landscape Details

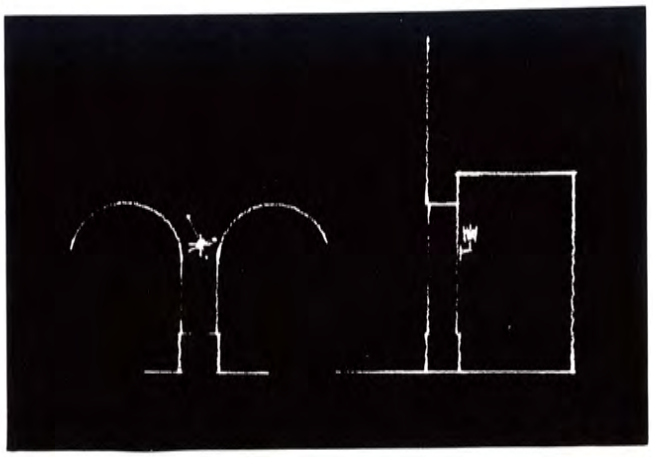
- Details—Elements such as window and door openings, balconies, trim, graphics, signs, street furniture, water, paving patterns, surface textures and color provide the third level of perception within the Village and offer the opportunity for maximum interest and individual expression. It is intended that maximum individual expression be allowed in these details to achieve a richness and vitality within the Village. Details and trim should avoid refined, highly technical finishes and, where possible, should represent handcrafted quality, especially where they are prominently visible to pedestrians.

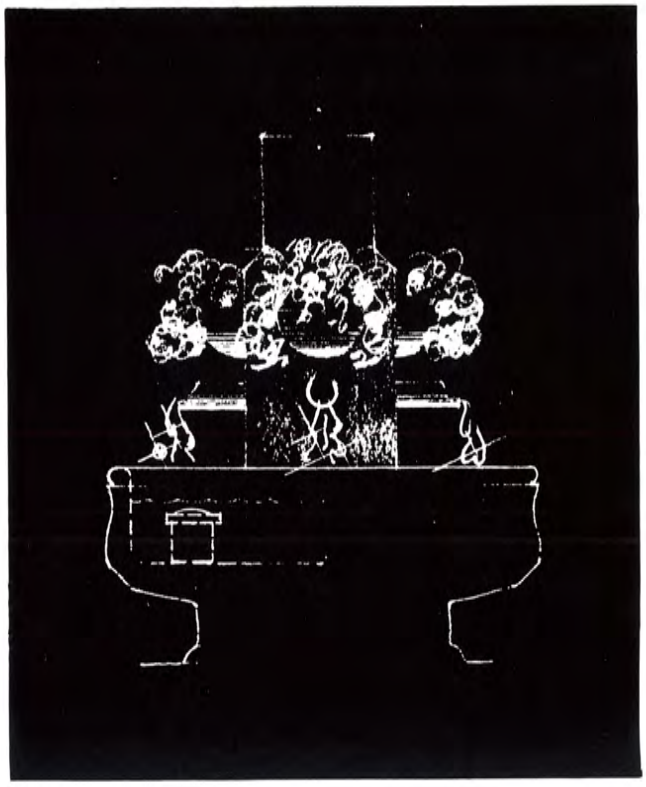
- Color—The use of color is very important to the visual richness of the Village. While major wall surfaces should be a neutral backdrop of off-white tones, smaller scale elements such as doors, window trim, signs, soffits, and recessed wall areas should introduce a strong palette of color to the Village.

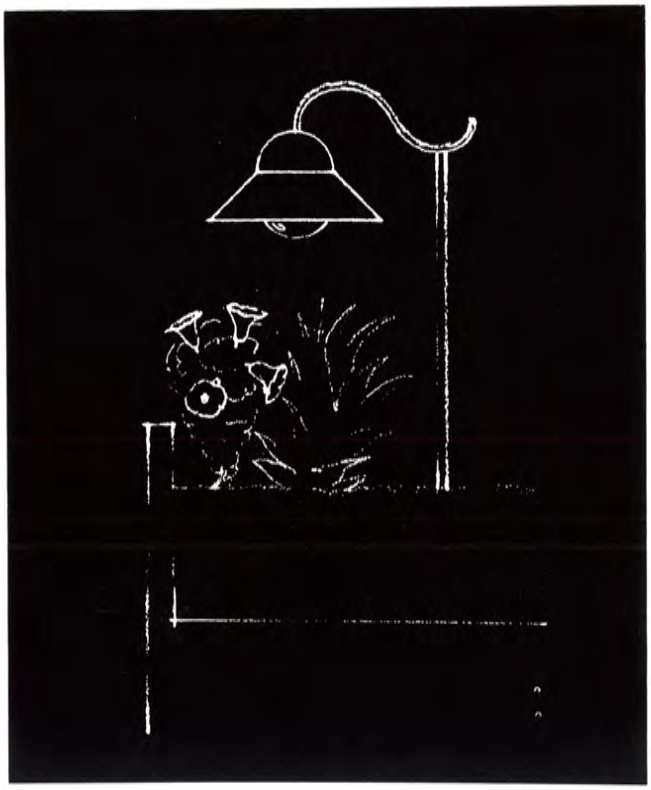
- Artwork—The cultural vitality of the area should be expressed through artwork within the Village buildings, streets, and promenades. Sculpture, fountains, ironwork, and wood carving should become integral to the design of buildings and public spaces.

- Lighting—Lighting establishes the mood and awareness of the Village scene during the active evening hours and is therefore critical to the aesthetic and commercial success of the Village. Overall ambient lighting of public streets and spaces should be understated with minimum glare from fixtures. This subdued background light provides the context for the highlighting of architectural features, artwork, and planting. Shop fronts should include window signage lighting, which also provides indirect lighting of adjacent pedestrian areas. Light sources should generally be concealed unless used as decorative features. All major projects should engage a professional lighting consultant and their design should be coordinated with adjacent properties.









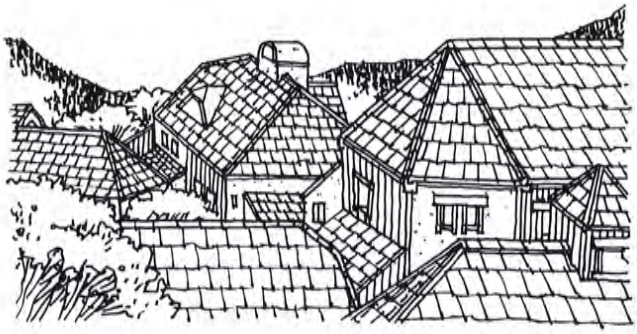
Architecture

Roofs

All major roofs shall have pitches not less than 6:12 and not greater than 12:12. Major roof forms shall be restricted to gable and hip roofs. Secondary roof forms attached to the major building form may be shed roofs with pitches not less than 4:12.

Dormers should be relatively small in proportion to the overall scale of the roof. They should be gable, hip or shed forms.

Pedestrian and vehicular areas shall be protected from roof snow shedding where roof pitches exceed 6:12. This can be accomplished through secondary roofs, snow clips and snow fences on roofs. All roof structures shall be designed to conduct rain and snow melt water in such a way as to prevent it from creating a dripping, icing or flooding menace on pedestrian or vehicular areas below.

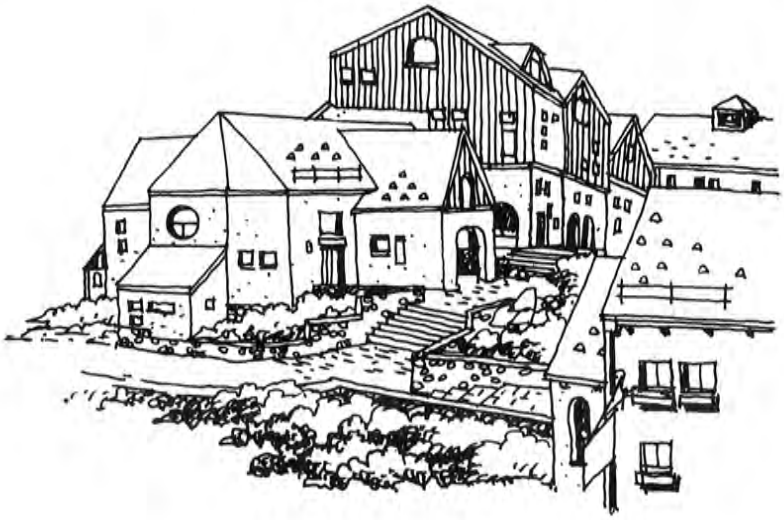


The Design Review Board shall review projects on an individual basis to assure that adequate systems and devices are installed to allow safe and effective removal of snow from roofs.

In the Village, all roof material shall be flat-profile unglazed tile as approved by the Design Review Board. Flashing, gutters, and bay window roofs should be copper.

All structures in the Village shall have a cold roof assembly or written approval from the Design Review Board for an alternative method of preventing ice build-up along the eaves.

Outside the Village, roof material shall be unit pieces such as slate, flat-profile unglazed tile, cedar shingles, or continuous vertical boards over built-up roofing. Tile colors shall be blue-gray, green-gray, or brown-gray and should have a weathered appearance. Glazed tiles, metal roofing and asphalt shingles shall not be used. It is recommended that cold roof design be used for roofs over heated interior spaces to avoid ice damage to the roofs and eaves.



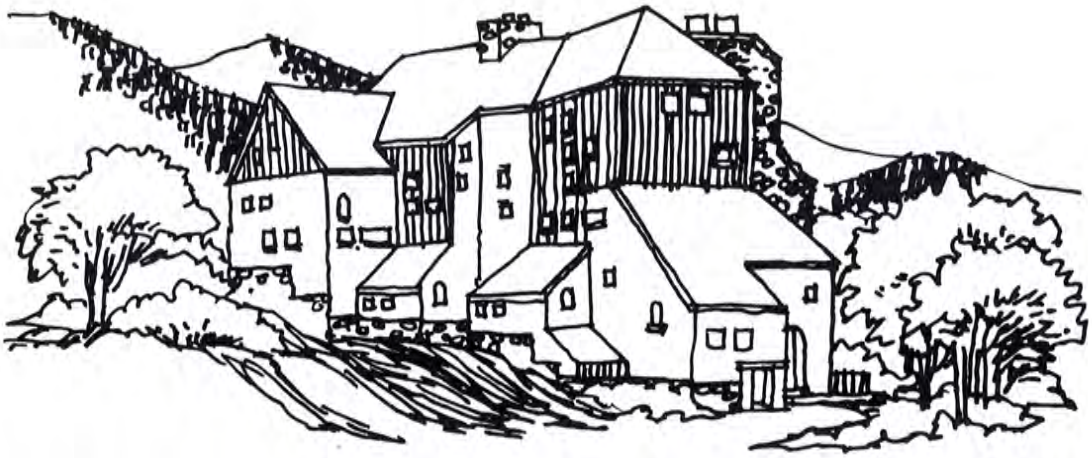
Building Height Limitations
Building height limitation within the Village (Tract A) shall be restricted to 55′ from finished grade to a point midway between eave and ridge. Building height limitation outside the Village shall be restricted to 35′ from finished grade to a point midway between eave and ridge. The building height definition for complex buildings is as follows:

Exterior Walls
Major building forms should express a simplicity and directness responsive to the heritage of mountain architecture. Complexity and contradiction of form and expression should be avoided.

Major exterior walls should convey a sense of mass through plaster or rock. Window openings in mass walls shall be relatively small in scale and be used in an informal pattern on the wall, with deep set reveals and varied proportions. Plaster shall have a soft undulating appearance similar to adobe, with an avoidance of sharp edges. Both plaster and rock shall always express mass and not be used as in-fill panels.

In contrast to the mass walls, vertical wood siding can be used as a sheathing, especially at gable ends and upper levels. Glass can also be used to contrast with the mass walls on southern exposures (see section on *Solar Design Guidelines*). Generally, the heavier rock and plaster surfaces shall be below, and visually supporting the lighter wood-sheathed elements above.

Wall materials should respond to the orientation of the building, with the north closed off (small window openings) and the south open to sun exposure (see section on *Solar Design Guidelines*).



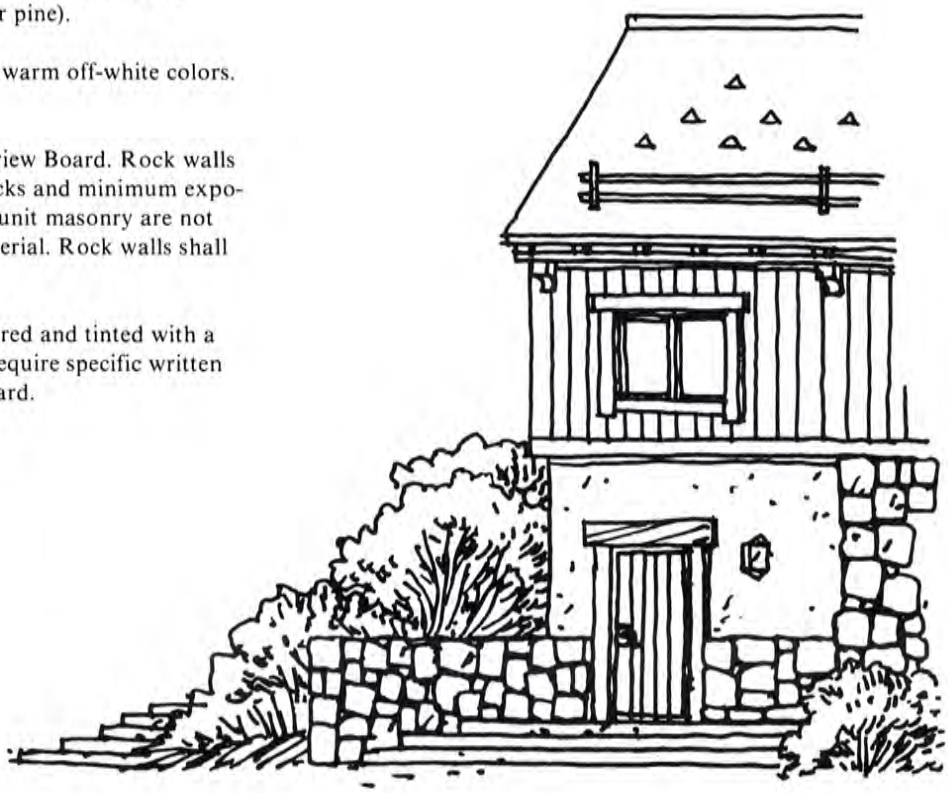
Only the following materials shall be used for exterior walls:

- Wood siding. In the Village, natural wood (western cedar or redwood) sound tight knot or better, without heavy pigment stain or paint. An Eagle County variance allows non-fire-rated wood up to a height of 50 feet above grade. Where wood is used above 50 feet only NCX-treated redwood is permitted. Outside the Village, natural wood (western cedar, redwood, spruce, or pine).

- Plaster (stucco or Drivit/Settef) in warm off-white colors. Refer to the Color Guide.

- Rock, approved by the Design Review Board. Rock walls shall have deep reveals between rocks and minimum exposure of mortar. Violcanic rock andunit masonry are not acceptable as exposed exterior material. Rock walls shall be laid in a random pattern.

- Exposed concrete, preferably textured and tinted with a warm tan or brown additive, will require specific written approval of the Design Review Board.

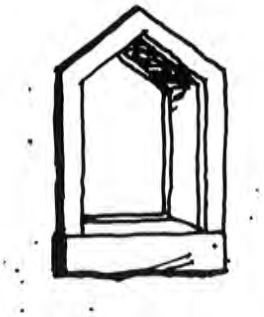


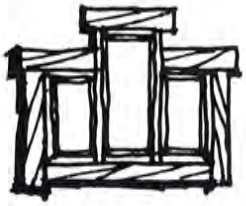
Colors
The colors of the Village should relate to the levels of perception discussed in the Design Theme. From a distance, colors should blend with the natural landscape; the predominate roof color should be the blue-gray tile. Within the streets and public spaces, the enclosing walls should be predominantly warm off-white colors tinted from beige and tan to subtle mauves and earth tones. The details such as window trim, soffits, and graphics should be accented with rich color against this subdued background.

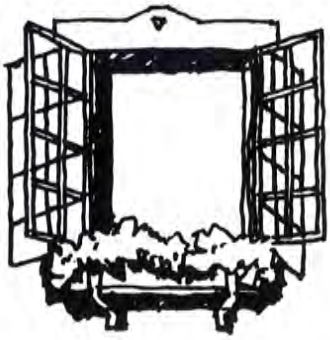
The winter climate of Beaver Creek suggests the use of warm colors—ochre, rust, yellow, orange sienna—for details to enliven the Village streets and provide a psychological and visual warmth to the area. See the Color Guide for specific color descriptions.

Windows
Window casing shall be wood. Approved finishes are natural, stained, painted or clad. Exterior window trim shall relate to other building materials, either wood or masonry. The use of headers and sills, designed integrally with the wall, is encouraged. Window locations should appear in a random pattern, rather than in a symmetrical, repetitious or formal pattern. Refer to the Color Guide for acceptable exterior window casing and rim colors.

Windows shall be used in combinations to avoid large uninterrupted glass areas. Windows shall have a double or triple glazing. No uninterrupted glass area shall exceed 20 square feet. Mirrored glass is not allowed. If shutters are used they shall be operable and not used merely as an ornament.







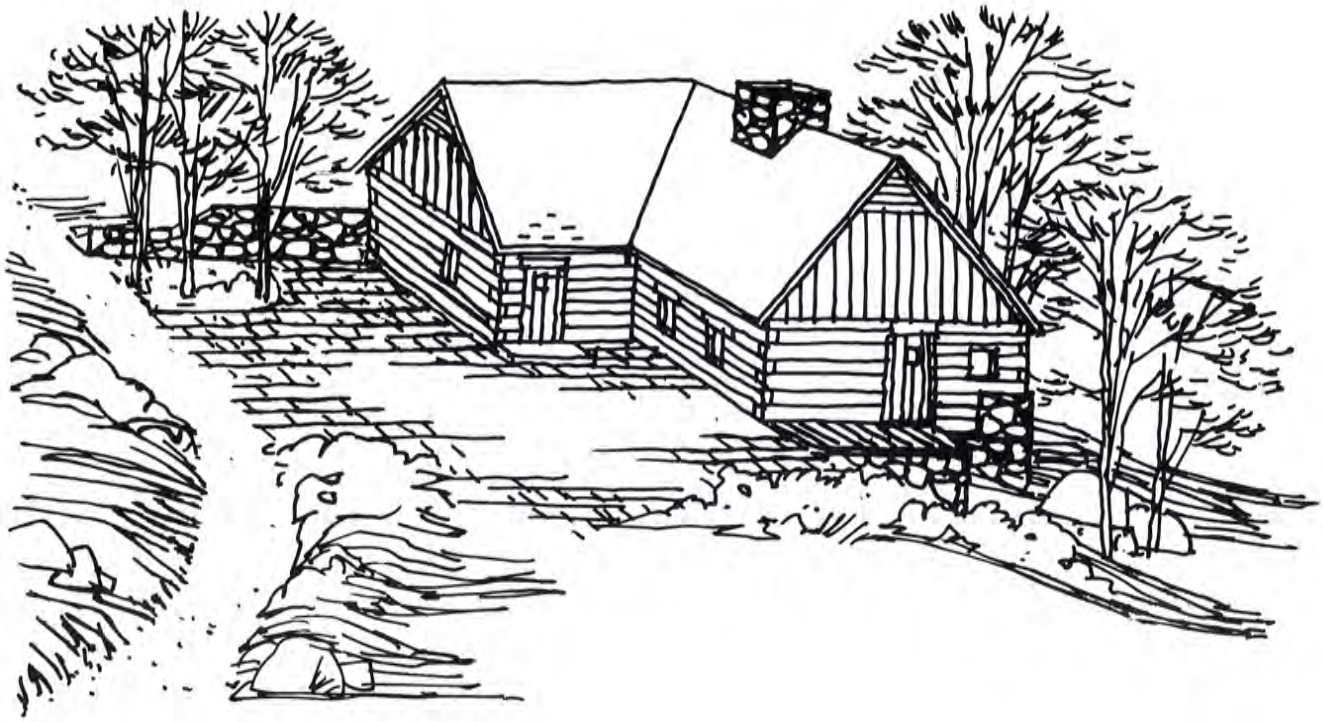
Historic Preservation

The Beaver Creek Valley has had a history typical to many high mountain valleys in Colorado. The valley has seen the passing of Ute Indians, fur trappers, adventurers, loggers, miners, and ranchers. Each has left a heritage with the valley which can and should be reflected in the architecture and artwork of the present destination resort. While the intent is not to recreate past eras, it is appropriate to respect and recall the times, structures, and people that have influenced the area.

Many of the early homestead structures of the valley will be restored as part of the recreation and trail system of Beaver Creek. In addition, there are many historic photographs and artifacts which are available through the Design Review Board for possible incorporation into new buildings and interiors. Many of the personalities, events, equipment, and folklore have been used for trail names on the Beaver Creek mountain and are equally appropriate for names within the Village.

The Beaver Creek design theme has incorporated the simple forms, pitched roofs, and native materials of early valley structures. New development should further respond to historic influences through interpretative details and artwork.

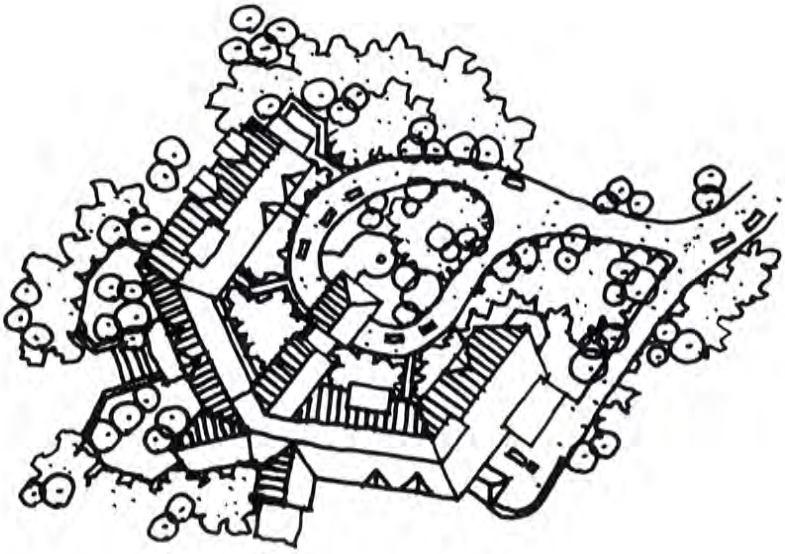
Reference: June B. Simonton, *Beaver Creek: The First One Hundred Years* (1980).

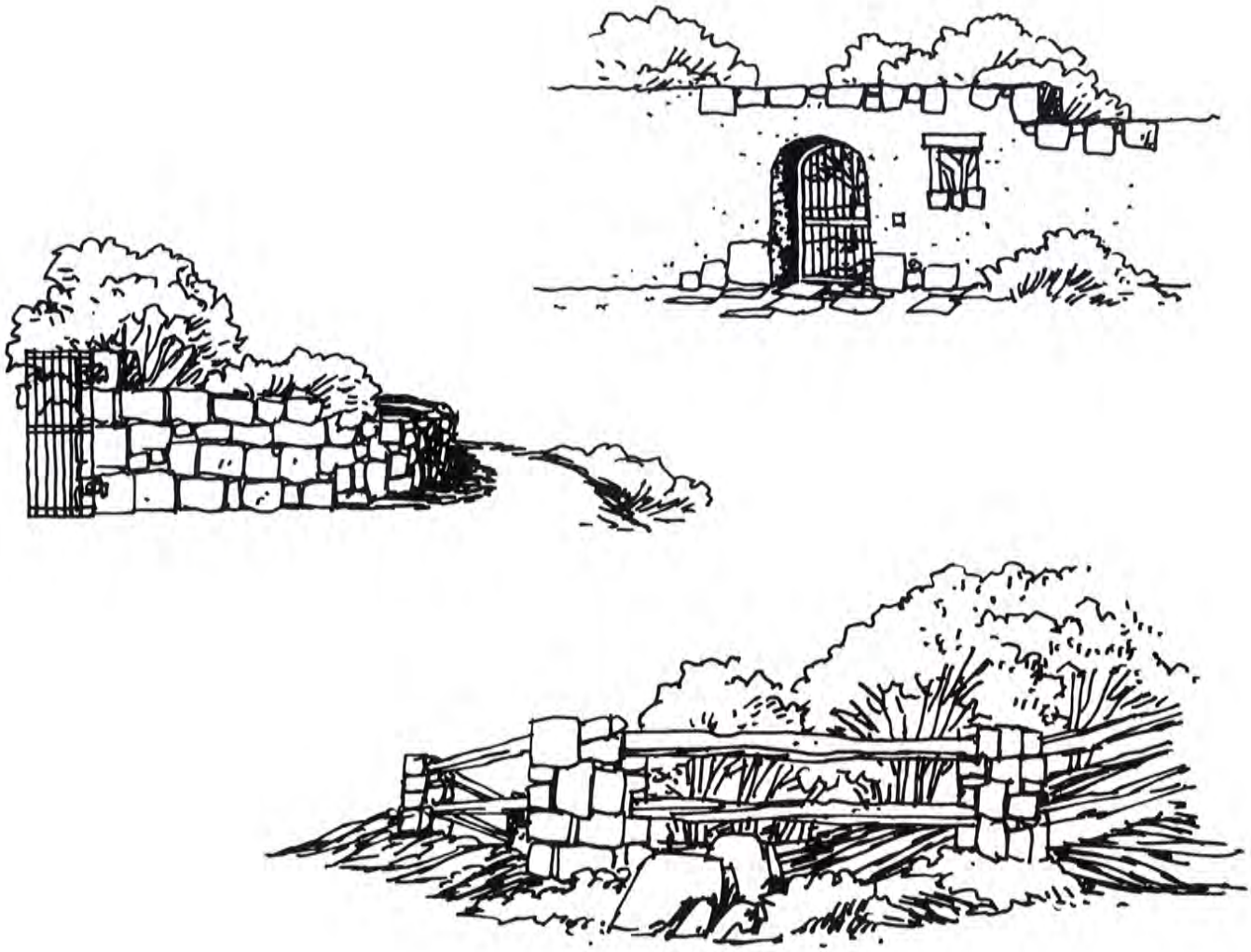


Foundations
Foundation walls shall not be exposed for more than 8" in a vertical direction, unless they are faced with wood, plaster or rock as delineated in the section on *Exterior Walls*, or unless written approval is obtained from the Design Review Board for exposed foundation walls. Such visually exposed concrete or block masonry foundations shall be stained or textured as required by the Design Review Board.

Foundations shall be designed by an architect or professional engineer to be consistent with the soils reports for the specific site.

Service Areas
Each building shall have a service and trash removal area(s) which shall be fenced, walled or bermed from public view, and provide access which does not conflict with pedestrian circulation. Trash containers shall be inaccessible to wildlife. Fencing or walls shall be compatible with the materials and forms of the building. Refer to section on *Walls and Fences*.



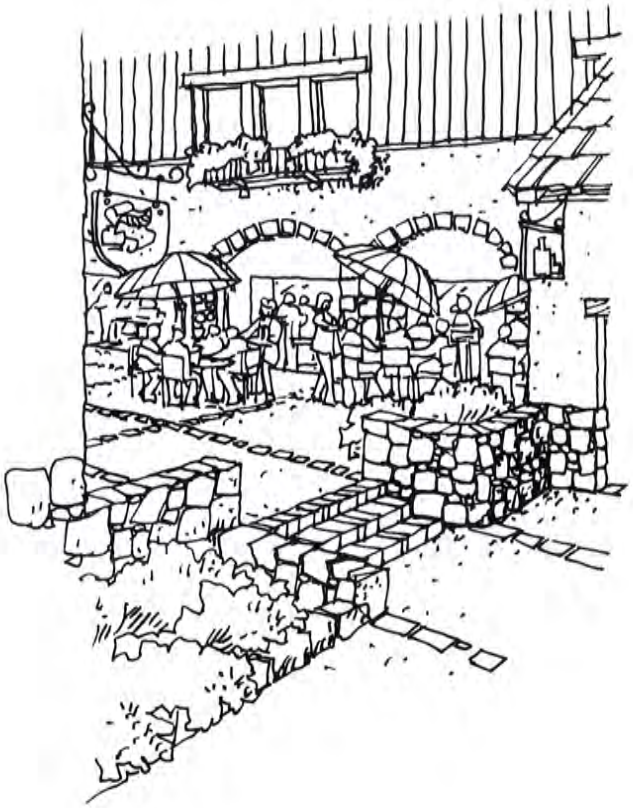


Walls and Fences
Within the Village, adjacent to the plaza and mall, walls shall conform with the colors, textures and forms of adjacent buildings and be constructed of the following materials:

- Rock approved by the Design Review Board. Rock walls shall have deep reveals between rocks and minimum exposure of mortar. Volcanic rock and unit masonry are not acceptable as exposed exterior material. Rock walls shall be laid in a random pattern.
- Plaster (stucco or Drivit/Settef) applied to a subsurface strong enough to prevent punctures or flex cracking. Plaster shall have a soft undulating appearance similar to adobe, with an avoidance of sharp edges.
- Concrete, tinted tan or light brown, and textured or board-formed. This material will be allowed only if it is designed in a manner which relates to adjacent buildings and surrounding landscape improvements.

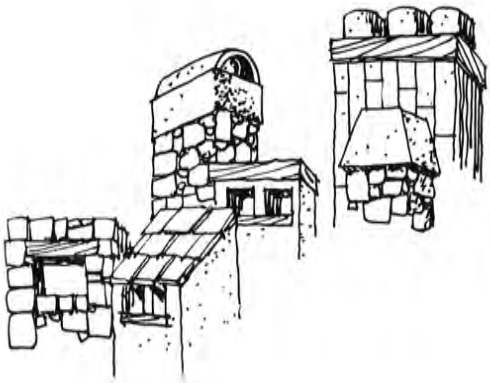
Wood fences shall not be used in the village. Outside the Village, fences shall be rock walls or a horizontal see-through wood such as split rail or buck fences, except for screening service areas, where fences shall be solid and compatible with the structure. All wood fences, if not rock wall, shall be left natural, stained or oiled, but not painted.

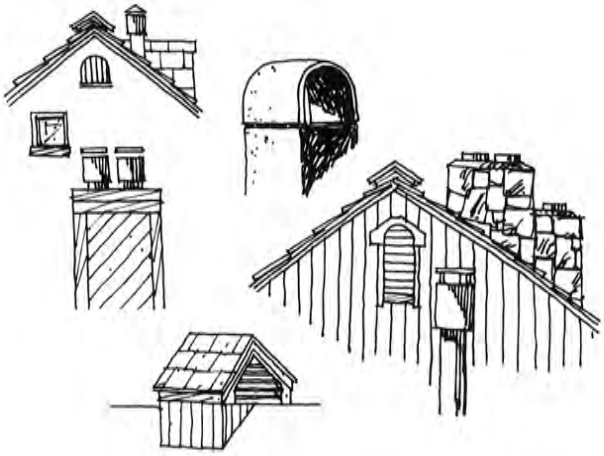
Patios and Decks
Paving material for patios and decks adjacent to the Village pedestrian street shall be similar to, and compatible with, the pedestrian street paving material in both color and size. The paving material shall be red sandstone unless an alternative material is approved by the Design Review Board.



Chimneys, Flues and Roof Vents
Chimneys and flues shall be designed in such a manner so as not to cause fumigation of ground level areas or adjacent buildings during downslope wind conditions. Chimneys should be located high on the upwind side of the building as the best means to insure adequate disbursement.

Vents and flues shall not be exposed galvanized pipe, but rather attempts shall be made to group these roof projections and conceal them from public view. This can be done by enclosing them in forms compatible with the structure.



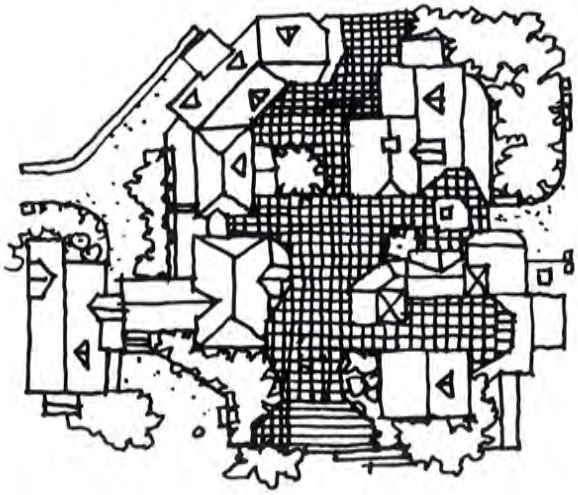


Site Plan

Building Siting

Building siting within the Village is critical due to the close integration of public spaces and adjacent buildings. This relative tightness of spaces within the commercial core area has been established to create the scale of the pedestrian village. In establishing locations and siting, buildings shall relate to adjacent and surrounding structures. It is important to consider the "void" or exterior spaces between buildings which will provide the public spaces, streets and arcades within the Village. Study of these areas should include evaluation of mass models which describe the surrounding buildings, as well as the building under consideration.

Building siting within the Village shall relate to the movement and circulation patterns of the Village. This includes a strong integration of retaining walls, walkways, patio decks, and planter areas which help establish and direct the flow of pedestrian and vehicular traffic. Pedestrian circulation should be continuous, without interruptions or barriers.



All buildings within the Village area will be required to maintain a proper setback for building code and fire regulations from their common and respective property lines. Service access and public arrival points shall be established in the initial site plan studies.

Outside the Village, building siting shall be especially responsive to features of the existing terrain, drainage patterns, rock outcroppings, vegetation, views, and sun exposure.

Landscaping and grading for any site shall interface with all adjacent properties. The developer shall indicate the means of accomplishing this interface in his landscape plan.

Grading
Grading requirements resulting from development shall be designed to blend into the natural landscape. Cuts and fills should be feathered into the existing terrain within the property boundaries. Retaining walls and cribbing should utilize natural materials such as wood timbers, logs, rocks and textured, board-formed or color tinted concrete. Slope of cut and fill banks should be determined by soil characteristics for the specific site to avoid erosion and promote revegetation opportunities, but in any case should be limited to a maximum of 2:1 slope.

Utilities
All trunk utility lines and pipes at Beaver Creek are underground. Connections from trunk lines to individual structures must also be underground. Sewage disposal systems shall be installed pursuant to the regulations of the Upper Eagle Valley Sanitation District. No individual septic and leachfield systems, nor individual wells are allowed.

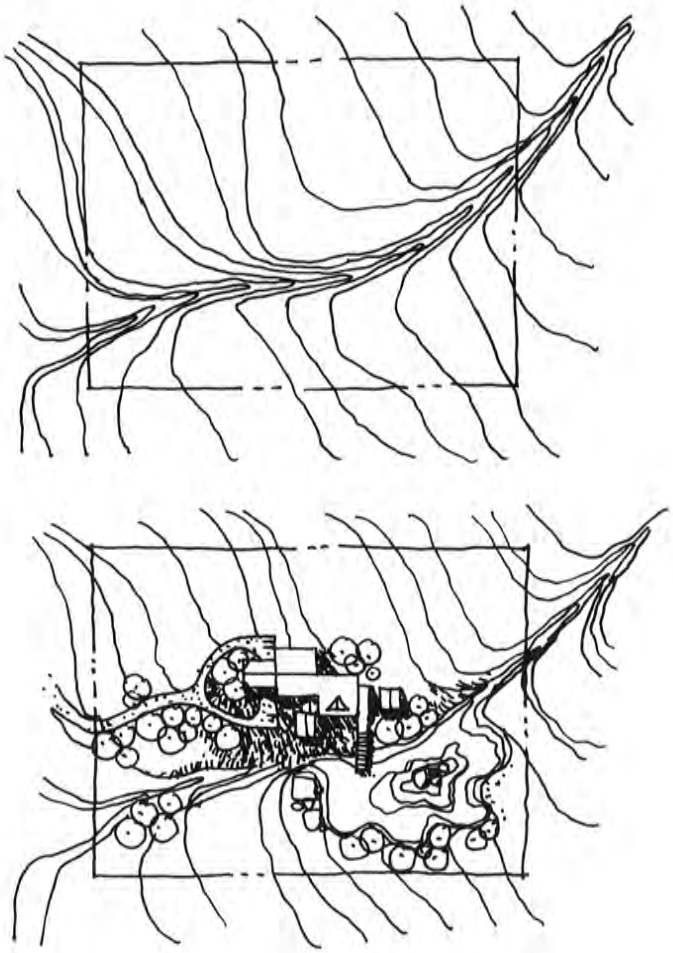
Drainage
There shall be no drainage across neighboring property lines unless written approval is obtained from the Design Review Board.

Within the Village, curbs and gutters are to be used only when severe drainage problems are present. Storm drainage shall be connected to the storm sewer mains wherever practical and shall not be connected into the sanitary sewer system.

Outside the Village, drainage patterns within the site may be modified, but the modification must be consistent with the Beaver Creek Master Drainage Plan. There shall be no curbs and gutters without written approval of the Design Review Board. Storm drainage shall not connect into the sanitary sewer systems.

In all areas, runoff from impervious surfaces, such as roofs and pavement areas, shall be directed to storm sewers, to natural or improved drainage channels, or dispersed into shallow sloping vegetated areas.

Exterior Mechanical and Electrical Equipment
All outdoor utility tanks, metering devices, transformers and other similar devices shall be concealed from the view of public spaces and neighboring properties. No exterior antenna shall be erected without specific written approval of the Design Review Board. See the section on *Walls and Fences* for means of enclosure.



Landscape

Driveways
Driveways leading to building entries or public arrival points within the site boundaries and connecting to the paved portion of any street (including the construction of any culverts, landscaping, maintenance, and snowplowing that may be necessary) are the responsibility of the owner. Maximum driveway grades shall not exceed 5 percent for the first 20 feet from the roadway, and shall not exceed 10 percent elsewhere. Driveway surfaces shall be asphalt, cobbles, or sandstone pavers. In addition, the owner shall comply with all regulations of the Beaver Creek Metropolitan District pertaining to the construction of any part of the driveway built within the District's road easement.

Paths and Walkways
Paths and walkways provide the critical pedestrian connections of the Village. Every project must include the design of convenient pedestrian routes as part of an integrated master plan system for Beaver Creek. Walkways should include points of interest, activities, and design features along their routes. Fountains, benches, sculpture, bridges, and archways should become part of the pedestrian experience. Vertical changes should be accomplished through ramps or stairs with 6 inch risers and 16 inch treads to accommodate ski boots. Surface materials should be rich and varied at focal points using cobbles and sandstone pavers. Connecting links of major routes may be surfaced with asphalt, concrete, or sandstone pavers. Minor paths may use wood chips, crushed rock, or asphalt. Major routes should be a minimum of 6 feet in width and lighted for evening use.

Erosion Control and Revegetation
An initial Erosion Control and Temporary Site Stabilization Plan is required for each project prior to Sketch Plan Approval (see section on *Design Review Process*). A detailed permanent Erosion Control and Revegetation Plan is required prior to Final Plan Approval. These plans shall explain in detail the following:

- Measures to control both ground water and surface water runoff;
- Temporary measures to retain all eroded soil material on site during construction;
- Measures to permanently stabilize all disturbed slopes and drainage features upon completion of construction.

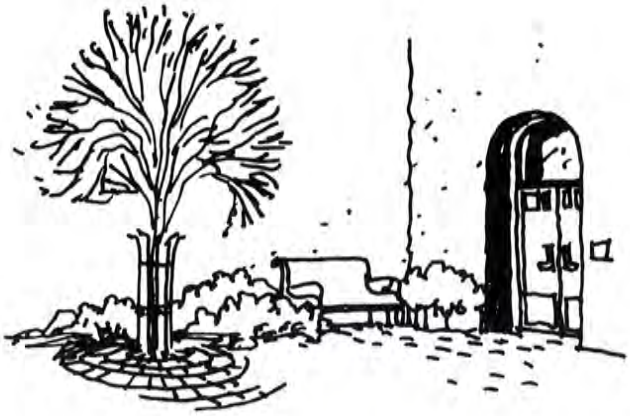
The owner/developer shall, for Sketch Plan Approval, list and describe those techniques he plans to use during excavation and construction, and indicate on his Site Plan drawings their locations, construction details, and time of installation. The owner/developer shall, for Final Plan Approval, list and describe on his Landscape and Planting Plan those techniques he plans to use upon completion of the project to permanently revegetate and stabilize all disturbed areas and drainage features.

The major concerns addressed by both plans shall be the reduction of erosive potential and control of transported sediments.

Landscaping and Plant Materials
Landscape scale and overall landscape design shall be developed so that one senses that new vegetation is integral with the natural mountain landscape and the inherent form, line, color, and texture of the local plant communities. New planting should use plants that are indigenous to the Rocky Mountain alpine and sub-alpine zones and should be located to extend existing canopy edges or planted in natural looking groups.

Ornamental plants are recommended only for locations directly adjacent to building masses or in courtyards. Manicured or groomed yards shall be within areas defined by buildings, fences, walls or other defined edge modifications so that the visibility of these yards is limited to the adjacent building. Opaque plantings at traffic intersections are not permitted.

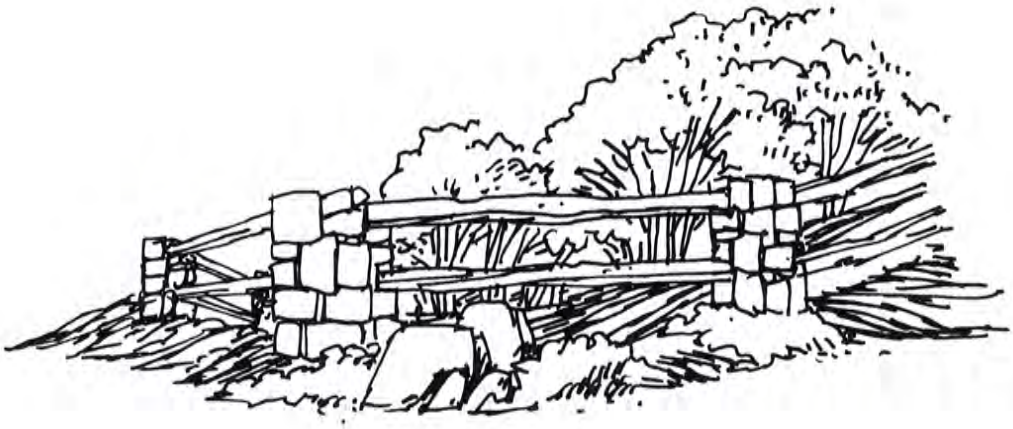
Plant materials used for erosion control shall establish immediate surface stabilization to prevent soil erosion. Diverse, self-sustaining plant species will be used to provide 80 percent surface cover within one growing season.



Building Siting
Any single family, primary/secondary structure or duplex structure built upon any lot within the affected property must be built entirely within the building envelope for such lot. However, with prior written approval of the Design Review Board, minor encroachments outside such building envelope

may be permitted for roof overhangs, balconies, service areas, porches, patios, carports, and garages. The purpose of the building envelope is to reduce uncertainty of neighbors as to which view corridors might be impacted in the future by construction and to help insure that structures blend with the surrounding landscape, rather than being a dominating feature of the neighborhood community.

Building siting shall be responsive to existing features of terrain, drainage patterns, rock outcroppings, vegetation, views, and sun exposure.

Landscaping and grading for any site shall interface with all adjacent properties. The developer shall indicate the means of accomplishing this interface in his landscaping plan.

Fences
Fences shall be rock walls or a horizontal see-through wood such as split rail or buck fences except for screening service areas where fences shall be solid and compatible with the structure. All wood fences shall be left natural, stained, or oiled, but not painted.