VERMONT ENVIRONMENTAL BOARD
10 V.S.A. §§ 6001-6092

Re: Killington Ltd.,
Farm and Wilderness Foundation, and
Vermont Department of Forests, Parks, and Recreation
#1R0813-5-EB

FINDINGS OF FACT, CONCLUSIONS OF LAW, AND ORDER

This decision pertains to the appeal of Land Use Permit # 1 R08 13-5 issued by the District #1 Environmental Commission on November 24, 1997. As explained below, the Environmental Board ("Board") concludes that the project at issue complies with 10 V.S.A. § 6086(a)(l)(C), (E), and (F). Accordingly, the Board hereby orders the issuance of Land Use Permit #1R0813-5-EB.

I. BACKGROUND

On November 24, 1997, the District #1 Environmental Commission ("Commission") issued Land Use Permit #1R0813-5 ("Permit") and Findings of Fact, Conclusions of Law, and Order ("Commission Decision") to Killington Ltd. ("Killington"), Farm and Wilderness Foundation ("Farm and Wilderness"), and the Agency of Natural Resources' Department of Forests, Parks, and Recreation ("ANR") (collectively, the "Applicants").

The Permit authorizes the installation of a 10,000 foot long, 24 inch wide pipe within the Route 100 right-of-way between Woodward Reservoir in Plymouth and the Killington Ltd. Sunrise Base Area; a fire hydrant at the Reservoir and along the pipeline; a primary pumphouse near the Sunrise lodge; a secondary pumphouse and water withdrawal adjacent to Reservoir Brook near the Sunrise parking lot; 10,000 feet of upgraded pipeline along ski trails to convey water to Bear Mountain and Killington Basin; and improvements to the existing water intakes on Falls and Roaring Brooks and the Ottauquechee River (collectively the "Project"). The Project is located in the towns of Plymouth, Bridgewater, and Sherburne.

The Project requires an Act 250 permit since it constitutes development pursuant to 10 V.S.A. § 6001(3), and a substantial change to Land Use Permits #1R0813 pursuant to Environmental Board Rule ("EBR") 34(A) and (B). and 2(G).

On December 18, 1997, Farm and Wilderness filed a motion to alter the Permit with the Commission.

On December 24, 1997, Nicholas J. Lenge ("Appellant"), appealed from the Permit. The Appellant contends that the Project does not comply with 10 V.S.A. § 6086(a)(1)(C)(water conservation) and (l)(F)(shorelines). The Appellant also appeals from the Commission's denial of his request for party status under Criterion l(C)

On January 13, 1998, the Commission issued Re: Killington Ltd.. Farm and Wilderness Foundation. Vermont Dept. of Forests. Parks. & Recreation, #1R0813-5, Memorandum of Decision, and Land Use Permit #1R08 13-5 Altered.

On January 15, 1998, Killington filed a cross-appeal with respect to the Appellant's party status under Criterion l(F), a motion for a full Board hearing, and a motion for recusal of certain Board members.

On January 22, 1998. the Appellant filed a party status petition with respect to Criteria l(C) and l(F).

On January 22, 1998, Marcy Harding, Chair oft he Environmental Board. convened a prehearing conference.

On February 4. 1998, Farm and Wilderness and Killington. respectively. tiled a response to the Appellant's party status and statement of the issues.

On February 6, 1998. the Chair issued a Prehearing Conference Report and Order ("Prehearing Order").

On February 10, 1998, ANR and Farm and Wilderness filed a cross appeal from the Commission's January 13, 1998 Memorandum of Decision with respect to 10 V.S.A. § 6086(a)(l)(E), but limited to condition #l 1 of the Permit.

On February 17, 1998. ANR tiled a Reply Memorandum Concerning the Scope of Review Under Criterion (l)(F).

On February 18, 1998, Killington filed a letter stating that it had not provided a copy of its February 4, 1998 response to the Appellant's party status request to the Appellant.

On February 18, 1998, Farm and Wilderness filed a waiver of its right to a prehearing conference with respect to its cross-appeal.

On February 25, 1998. the Environmental Board deliberated with respect to this matter.

On February 27, 1998, the Environmental Board issued Re: Killington Ltd., Farm and Wilderness Foundation, and Vermont Department of Forests, Parks, and Recreation, Application #1R0813-5-E, Memorandum of Decision (Feb. 27. 1998) ("Memorandum Decision").

On April 6, 1998, the Board denied Killington's March 10, 1998 Request for Clarification of the Decision.

During April and June, 1998, the parties tiled prefiled evidence and objections, and proposed findings of fact and conclusions of law.

On July 6, 1998, Chair Harding convened a second prehearing conference which all the parties attended.

On July 7, 1998, the Board conducted a site visit and convened a hearing in this appeal with the following parties participating:

Killington, Ltd. by Edward V. Schwiebert, Esq. and James A. Caffry, Esq.
Farm and Wilderness Foundation by Robert Wooimington, Esq.
Agency of Natural Resources by Andrew Raubvogel, Esq.
Nicholas J. Lenge by Stephanie J. Kaplan, Esq. and Paul Gillies, Esq.

Upon the completion of cross examination by the Appellant of the Applicants' witnesses, and after the admission of the parties prefiled evidence subject to rulings on evidentiary objections, the Board recessed the hearing to deliberate. The Board reconvened the hearing and announced that the Applicants had met their burden of proof with respect to all criteria on appeal such that the Board recessed this proceeding pending the issuance of this decision.

On August. 19, 1998, the Board deliberated regarding this appeal and, on that day. declared the record complete and adjourned the hearing. This matter is now ready for decision. To the extent any proposed findings of fact and conclusions of law are included below, they are granted; otherwise. they have been considered and are denied. See Secretary, Agency of Natural Resources v. Upper Valley Regional Landfill Corporation, Docket No. 96-369, slip op. at 13 (1998); Petition of Village of Hardwick Electric Department, 143 Vt. 437,445 (1983).

II. ISSUES ON APPEAL

As stated in the Memorandum Decision. the issues are as follows:

1. Whether. pursuant to 10 V.S.A. § 6086(a)(1)(C), the Project's design has considered water conservation, incorporates multiple use or recycling where technically and economically practical, utilizes the best available technology for such applications, and provides for continued efficient operation of these systems.

2. Whether, pursuant to 10 V.S.A. § 6086(a)(l)(F), the Project must of necessity be located on a shoreline in order to fulfill the Project's purpose, and the Project will, insofar as possible and reasonable in light of its purpose: (i) retain the shoreline and the waters in their natural condition, (ii) allow continued access to the waters and the recreational opportunities provided by the waters, (iii) retain or provide vegetation which will screen the development or subdivision from the waters, and (iv) stabilize the bank from erosion, as necessary, with vegetation cover.

3. Whether, pursuant to 10 V.S.A. § 6086(a)(l)(E), condition #11 of the Permit should be superseded and, instead. with respect to flow over the dam during periods when Killington is not drawing down Woodward Reservoir, provide as follows:

> The permittees shall ensure that a minimum conservation flow of 0.8 csm occurs at all times during the winter draw down for snowmaking in Reservoir Brook below the dam on Woodward Reservoir. Killington Ltd. shall be responsible for maintaining this minimum flow from the start-up of withdrawal through the refill of the Reservoir. During the rest of the year, Woodward Reservoir shall be kept full and pass natural flow over the spillway at all times. except in connection with imited draw downs for maintenance, which may occur at any time provided that such draw down plans with provisions for appropriate conservation flows are approved in advance by the Agency of Natural Resources.

III. FINDINGS OF FACT

1. The Project consists of the installation of a 10,000 foot long, 24 inch wide pipe within the Route 100 right-of-way between Wocdward Reservoir ("Woodward Reservoir" or "the Reservoir") in Plymouth and the Killington Ltd. Sunrise Base Area; a tire hydrant at the Reservoir and along the pipeline: a primary pumphouse near the Sunrise lodge: a secondary pumphouse and water withdrawal adjacent to

Reservoir Brook near the Sunrise parking lot; 10,000 feet of upgraded pipeline along ski trails to convey water to Bear Mountain and Kiilington Basin; and improvements to the existing water intakes on Falls and Roaring Brooks and the Ottauquechee River. The Project is located in the towns of Plymouth, Bridgewater, and Sherburne.

2. Woodward Reservoir is retained by a dam reconstructed by Farm and Wilderness in the early 1980's. This dam replaced an older dam that had become structurally unsound. The older dam was constructed in the middle of the 1800's to provide a reservoir for augmenting stream flows at the Mallory Woolen Company downstream in Bridgewater.

3. Prior to the construction of the original dam a pond existed at what is now the Reservoir. The dam raised the pond's water level about 15 feet, increased the flooded area by about 56 percent, and thereby increased the total water surface area by about 40 acres.

4. From the time that the original dam was put into operation and through the 1950's, the Reservoir was operated to provide water for downstream mechanical or electrical power. The operation entailed refilling the Reservoir in the spring and fall with the seasonal increase of stream flow and then subsequently drawing it down during the summer or late winter as the downstream needs for power required the release of water.

5. In the 1960's, downstream power production ceased, and Farm and Wilderness obtained control of the Reservoir. Ever since, Farm and Wilderness has maintained the Reservoir at a stable water level during the summer time, and drawn down the water level in the winter time. This was done to protect docks and is no longer necessary as floating docks are now used.

6. Under the current and historical management of the Reservoir by Farm and Wilderness, the Reservoir is drawn down 12 feet on average, typically beginning around November 1.

7. The Reservoir is stocked annually with brown and rainbow trout by ANR to provide a put and take fishery. In the early 1970's, ANR introduced rainbow smelt to provide a forage base for the trout and other fish in the Reservoir. Other fish species found in the Reservoir besides the trout and smelt include yellow perch (the dominant species), largemouth and small mouth bass. northern pike. chain pickerel and several non-game species.

8. The shoreline around the Reservoir is steep and gravelly with abundant cobbles. There are a few locations where the soil has more sand and there has been some erosion created by minor wave action.

9. The existing Reservoir shoreline where the intake will be located consists of grassed banks sloping slightly to the water line where the bottom consists of sands and gravel. Directly to the north, within four feet of the proposed intake and along the dam to the north. the shoreline and side slope of the Reservoir are stone rip-rap down to elevation 133 1'. The location of the proposed siphon house currently is grassed with small trees.

10. The Project will be constructed in accordance with the engineering plans prepared by Sno.matic Controls and Engineering.

I1. The Reservoir will be drawn down starring in early winter, to a depth of 12' below normal high water. The deepest excavation for :he intake pipes will be to 17.5' below high water. The short term construction draw down will allow the installation of the intake pipe to be performed with no adverse effect to the Reservoir. Once the Reservoir is drawn down, a floating silt screen will be installed from the surface of the water to the bottom. This screen will contain any sediment that may result from the installation work. The water intake pipes will be fabricated on-shore and welded to the intake filter system. The intake pipes will include the 24" steel snowmaking line, the 12" steel tire line, the 2" steel priming line and a 1" PVC conduit for control wires. The intake filter will consist of a 3' by 4' by 8' steel box screen with 1" square openings on five sides. The back plate of the box screen will be ¼" steel plate to which the steel intake pipes will be welded. The PVC conduit will pass through the back plate via a drilled hole. The intake pipe trench will be excavated from the bottom up the slope. When the excavation is complete. the entire intake pipe and box screen assembly will be lowered into place with a crane. The pipe trench will be backfilled from the top down with bankrun gravel bedding (at least 6" over pipe), native till. and 2'6" of stone rip rap.

12. The use of stone rip-rap for backfill on the disturbed slopes of the Reservoir. as is in place on the adjacent banks. will prevent both any short term. construction related, and long term, operational. erosion of the banks and will restore the shoreline to its pre-construction slope. The post-construction condition will be the same as the adjacent rip-rap slope.

13. The intakes pipes will be buried to prevent freezing and damage from ice or vandalism. The intake pipes will not interfere with winter or summer recreational uses of the Reservoir. The burying of the pipes will also mean that they are not visible.

14. The construction of the intake will require only two to three days and will be performed in 6' of water with the silt screen in place. There will not be any discharges of sediment to the Reservoir.

15. At the completion of construction, after the sediment has settled behind the screen, the floating silt screen will be removed and the Reservoir will be allowed to fill to the winter depth maintained by Farm & Wilderness. The disturbed area above the stone rip-rap will be stabilized temporarily with an erosion control blanket and hay mulch until spring construction. A silt fence will be placed parallel to the shoreline at the top of the stone rip-rap to control any sediment from the disturbed soils above the bank. During the winter in which the intake structure and pipes to the siphon house are installed, no water will be withdrawn from the Reservoir for snowmaking use.

16. In the following spring, after the siphon house has been constructed, the intake pipes will be extended the last few feet from the top of the bank to the siphon house and the fire line will be extended to the hydrant. The 13' by 15' siphon house will be mostly underground with only a 4' by 6' wood shingled access hatch protruding 3' above the ground.

17. As soon as the pipes are placed, the disturbed area will be final graded and stabilized. Conservation mix seed, fertilizer, lime, and an erosion blanket will be placed over all disturbed areas outside the limits of the stone rip-rap, in accordance with Killington's erosion control plan. The disturbed area will be kept to the minimum required to do the work. The existing trees will be replaced with 4' to 6' trees of the same species. The trees and the additional shrubs to be planted will screen the view of the siphon house access hatch from the Reservoir.

18. All disturbed areas will be restored to the existing grade and replanted with existing or duplicate replacement vegetation.

19. Because Killington's existing upland water sources of Roaring Brook and Falls Brook are proximate to the existing on-mountain snowmaking infrastructure, those sources will be used preferentially as streamflow conditions allow. As

natural flows recede below 0.8 csm. the statewide average February Median Flow ("FMF"), or as demand for snowmaking water exceeds the volume of water available from those sources. water will be pumped from the Ottauquechee River, using the existing Bear Mountain and Snowshed Ponds as transfer points to which water can be pumped when available from the river.

20. When natural streamflows and the volume of water available at the three existing withdrawal points is insufficient to meet Killington's snowmaking demand, water will be used from Reservoir Brook, if available. and then from the Reservoir. The Reservoir will be the last source to be tapped to provide water for snowmaking, It is less expensive for Killington to use its other snowmaking water supplies as compared to the Reservoir.

21. The 10,000 gallons per minute design flow for the Project is provided by creating a siphon rather than by pumping. The siphon must be created by first priming a section of the line. A 5 horsepower priming pump in the siphon house will be used to create the siphon. Once this section of the line is tilled, the in-line valve is opened and the siphon created by the water in the line flowing, by gravity, down the line toward the Sunrise pump station will draw water from the Reservoir. Once the line is completely filled, there is no further need for pumping at the Reservoir siphon house. This system allows for water withdrawal from the Reservoir with minimal energy use.

22. Killington's water withdrawal from the Reservoir will not begin prior to November 1 Usually the drawdown will begin in December and progress through the winter at a rate depending on actual streamflow conditions during the winter months and the resultant availability of water from the other stream sources. The maximum drawdown will occur no earlier than February and no later than mid-March. No withdrawal of water will occur following March 15.

23. Killington used a mass hydrograph simulation technique with 23 years of hydrological data to assess the expected changes in the Reservoir's water levels. This technique is applied in the course of evaluating various alternative source and storage options for snowmaking water supplies. The simulation utilizes the projected daily water demand for snowmaking, daily streamflow rates based on past U.S. Geological Survey ("USGS") stream gauge data, proposed conservation flows. and proposed withdrawal rates.

24. The output of the model includes predicted water availability, reservoir drawdown

magnitude, date of maximum drawdown, and refill date. The simulation results show a range of maximum projected drawdown values from 0 feet (if the Project had been operating under the flow regime that existed in 1973) to 12 feet (on the basis of the flow regime in 1971 and 1987). The average maximum drawdown would be 4.8 feet, computed as the mean of individual projected daily water level values for the 23 years simulated.

25. During the Project's operation, the actual rate of drawdown will not exceed 6 inches per day, based on the maximum rate of withdrawal and the size of the Reservoir. Once withdrawal by Killington begins each winter, there will be a slow, steady decline in water levels, interrupted only by major thaw/melt events. Once the maximum drawdown level is achieved, there will be only relatively minor water level fluctuations.

26. This pattern of fluctuation is of lesser magnitude than that which has occurred historically, in that the Reservoir level. as managed by Farm and Wilderness, has fluctuated by 4 feet in response to changes in inflow. The hydrographs and tabulated data show that the water level will stabilize at different levels each year, thereby not resulting in one single elevation on the shoreline of the Reservoir that could be subject to erosion effects.

27. The Project will comply with the following operating conditions:

Drawdown Range (feet)	Percentage of Years Modeled
-0.0 to -2.0	17
-2.1 to -4.0	17
-4.1 to -6.0	4
-6.1 to -8.0	22
-8.1 to -10.0	22
-10.1 to -12.0	17

28. Under maximum drawdown conditions (12 feet below full pool), the only volume of water that could be withdrawn would be that volume of inflow which exceeds the guaranteed outflow rate of 0.8 csm. During the late winter period when such maximum drawdown conditions could be extant at the Reservoir, the highest non-storm inflow expected would be 1 .4 cfs per square mile (csm), based on typical hydrologic conditions during that time of year. Higher flow rates would occur only in association with thaw and rainfall events that would cause a rising water level as described previously. Since the drainage area at Woodward

Reservoir is 2.9 square miles, the available volume of water would be 1.74 cfs or 780 gpm or about 8% of the siphon pipe withdrawal capacity. This figure is computed as the difference between inflow (1.4 csm) and outflow (0.8 csm), or 0.6 csm multiplied by the drainage area (2.9 square miles). Thus. 1.74 cfs is the maximum withdrawal rate for the late winter time period when the Reservoir is drawn down to the maximum allowable depth.

29. The results of the simulated refill analysis of the Reservoir following the cessation of annual withdrawals by Killington indicate an average date to achieve complete refill of April 5, with the latest refill date projected to be April 30 (based upon 1971 data).

30. In the past, the Reservoir has been allowed to refill later in the Spring, and in some years, it has not refilled completely until mid-May.

32. The modeling results indicate refill completion dates, as shown below:

Refill Completion Date	Percentage of Years Modeled
Before April 1	39
April 1 - 7	22
April 8 - 14	17
April 15 - 21	13
April 22 - 28	4
April 29 - April 30	4

31. Refill of the Reservoir by April 23 is necessary to ensure that there will be no adverse effect on smelt spawning.

32. Killington will meet the April 23 target date pursuant to its refill management plan. As part of the plan, Killington will make intensive data collection in the Woodward Reservoir watershed during the late winter, including measurement of snowpack water equivalent using snow cores and rainfall monitoring, to assess the volume of water available for refill. Refill of the Reservoir will occur by April 23 in all years, either through the natural course of spring runoff or through the implementation of the refill management plan.

33. Subsequently, if needed, adjustment of the outflow rate from the Reservoir will be made to prevent the release of too much water from the Reservoir, thereby resulting in a refill date that would be too late to avoid damage to the Reservoir's

fisheries habitat. With the implementation of this plan, refill will occur in all years prior to the target date of April 23.

34. Like all Vermont ski areas subject to ANR's Snowmaking Rule set forth in Chapter 16 of the Environmental Protection Rules, Section 16-05(2) requires Killington to complete an alternatives analysis ("Needs and Alternatives Analysis" or "NAA"), which contains an evaluation of the following: the need for water; potential water source and storage options; water conservation and efficiency; and *general* management practices.

35. The objective of Killington's NAA was to identify a reasonable and feasible alternative that would meet the Project's purpose and enable conformance with the general conservation flow standard, thereby lessening the impact on the natural condition of the subject stream as a result of the withdrawal of water.

36. The Rule requires, upon expansion of a snowmaking system, that all "reasonable and feasible" alternatives be examined that would allow for increased conservation flows to the FMF at existing withdrawal sites. The FMF is that flow rate which, over the long term, is exceeded 50% of the days during the month of February, which is the lowest flow month during the winter season. The FMF standard is a conservative and protective limit which ensures protection and restoration of aquatic habitat, aquatic biota, and fish. By maintaining FMF, a water user would have to curtail withdrawals from a stream or river as natural streamflows receded to FMF. No withdrawals whatsoever are allowed when natural flows fall below FMF.

37. Killington's NAA includes a comprehensive evaluation of source and storage alternatives including potential sites for reservoir or tank construction, alternate stream and river sources, existing reservoirs, and lakes and ponds.

38. Several options were evaluated with respect to each of those alternatives. The various alternatives were compared on the basis of the ability of each to meet the basic Project purpose of providing the necessary water for snowmaking on existing and proposed terrain, the opportunity for streamflow restoration consistent with the Rule and other regulatory requirements, and the economic feasibility of each alternative to Killington.

39. Historic annual water use from 1988-89 through 1996-97 has averaged 508 million gallons ("Mgal"). The current snowmaking system serves 552 of 823

acres of ski trails. The range of seasonal water use over this time period has been from 400 Mgal to nearly 600 Mgal. Consistent with general design practices for such analyses, a total seasonal volume of 570 Mgal per season has been projected for the existing ski trails with snowmaking. The total projected value is somewhat greater than the average usage over the past several years since it represents a design condition used for planning: purposes which has occurred and will continue to occur only during certain years, as a result of the absence of natural snowfall and/or occurrence of thaw events. The design demand volume is less than the maximum usage that has occurred in the past. The projected typical total usage volume has been broken down by month, as follows:

a.	November:	100 Mgal
b.	December:	165 Mgal
c.	January:	150 Mgal
d.	February:	95 Mgal
e.	March:	60 Meal
	Total:	570 Mgal

40. The total volume represents a usage of 1.03 Mgal of water per acre of ski trail per season, which is consistent with the demand volume modeled at other Vermont resorts that have completed Needs and Alternatives Analyses.

41. Killington's NAA quantified Killington's future snowmaking water demands for full buildout at 923 Mgal. under which 902 acres of ski terrain would be served with snowmaking.

42. The total future water demand equates to 1.02 Mgal per acre per season, which is a water demand volume that is consistent with past experience at other Vermont ski resorts.

43. The projected demand volume of 923 Mgal will not be available in every winter season. Instead, 80% of the total demand (80% x 923 Mgal = 738 Mgal) will be available in at least four out of five years, or 80% of the years evaluated. This means that in four out of five years, on average. more than 738 Mgal would be available from an alternative that meets the "80/80" guideline, and in fact during an average to above average winter with respect to streamflow, 100% of the total demand would be expected to be available. During one year out of five, on average, water availability would fall to 80% of the total demand volume or less.

44. Due to the high cost of snowmaking operations (pumping costs, equipment, labor), snowmaking will be undertaken only as needed to ensure a reliable and safe skiing surface on trails served by the snowmaking system. Total seasonal snowmaking water demand fluctuates considerably as a result of weather conditions.

45. Based on target depths of snow for reliable and safe coverage of ski trails with snow of 2.0 feet for beginner trails, 3.5 feet for intermediate trails and 5.0 feet for expert trails, a single coverage event on all 902 acres of proposed ski terrain to be served by the snowmaking system would require a total volume of 337 Mgal. The projected total seasonal volume represents somewhat less than three complete coverage events. The actual demand will vary from year to year, depending on the number of times that resurfacing of the skiing surface, and how much restoration of that surface, is needed following thaw events.

46. Killington's NAA considered all surface waters within the general vicinity of Killington that potentially could provide a sufficient volume of water to meet the demand target either alone or in combination with other sources. The streams and rivers considered were Roaring Brook, Falls Brook, Reservoir Brook at Woodward Reservoir, Reservoir Brook at West Bridgewater, and the Ottauquechee River at two locations.

47. Killington's NAA also considered a number of storage alternatives, including the expansion of two constructed water storage facilities that are part of the existing Killington snowmaking system, Bear Mountain Pond and Snowshed Pond. Due to site geometric constraints, public safety issues, and downstream flooding conditions, significant expansion of either of those facilities is not a feasible alternative.

48. Killington's NAA evaluated a total of ten sites for the construction of new storage facilities, five of which were considered for the placement of large above ground holding tanks, and the remaining five for the construction of new storage reservoirs. The tank options are costly to construct, at about $0.15 per gallon, and limited to a practical volume of 10 to 20 Mgal. Sites which could theoretically contain tanks with a total storage volume of 90 Mgal were identified but were rejected due to aesthetic concerns resulting from a "tank farm" appearance. The cost of construction of 90 Mgal of above-ground tankage would be $13,500,000 and would only deliver about 25% of the needed water. If sites could be located to accommodate the full 300 Mgal required, then the cost would be $45,000,000.

All of the water tank options are unacceptable due to the high cost, visual appearance, and limited volume in relation to the required storage volume.

49. The remaining five sites were locations at which offstream reservoirs could be constructed, ranging in size from 10 Mgal to 35 Mgal, at an estimated cost of SO.08 to $0.10 per gallon. The costs associated with these on-mountain sites are considerably higher than conventional pond sites, due to small size, relatively large depths, and the need for bedrock excavation. Dam construction at these locations would require innovative techniques and designs, including rock fill dams and membranes. Like the above ground tanks, these sites would provide relatively small volumes of storage in relation to the storage needed. The cost of constructing 300 Mgal of new storage would be $24,000,000 to $30,000,000.

50. The use of multiple sites would further increase costs due to the need for duplicate infrastructure such as pump stations and control equipment. as well as additional pipelines to access all of these locations.

51. There are several issues associated with the construction of underground tanks that render this approach technically and economically infeasible.

52. To obtain the requisite storage volume of at least 300 Mgal, if subsurface tankage were 10 feet deep, a site or combination of sites totaling 92 acres would be required. Site conditions such as soil type, depth to bedrock, groundwater conditions and other environmental factors would preclude such construction.

53. The construction of this volume of tankage would require the location of enough suitable sites for the disposal of removed material. The material removed for the excavation for 300 Mgal in tankage would result in 1,485,000 cubic yards of removed material. An estimated 125,000 truck trips would be needed to move that amount. of material.

54. The cost of construction of underground tankage is estimated to be $0.20 to $0.50 per gallon. Given that estimate, the total cost of this option would be $60.000.000 to $150,000,000. That range is almost 100 times as costly as the Project.

55. Killington's NAA considered the use of groundwater as a potential alternative water source. However, the use of groundwater to supply the Killington snowmaking system is not a reasonable and feasible alternative. The instantaneous need for water from ail sources equals or exceeds 10.000 gpm. The

yield of bedrock wells in the vicinity is on the order of 50 gpm or less. Therefore. 200 or more drilled bedrock wells would be needed to meet the demand. Such a massive use of groundwater would have serious adverse consequences to the bedrock aquifer such that future groundwater use by others would be precluded.

56. Killington's NAA also considered the use of two existing water bodies: Kent Pond, located adjacent to Gifford Woods State Park, with a potential storage volume of 165 Mgal if the dam were raised by 5 feet, and Woodward Reservoir, a constructed facility with an existing usable storage volume of 344 Mgal in the upper 12 feet of the Reservoir.

57. Two alternatives, each predicated on continued use of existing withdrawals, raised to a FMF streamflow limit, ultimately were selected for further analysis being: (i) two mountain reservoirs providing a total of 65 Mgal of storage combined with Kent Pond (165 Mgal storage), resulting in a total storage volume of 230 Mgal; and (ii) Woodward Reservoir (greater than 300 Mgal).

58. The first alternative involved the construction of two storage reservoirs to obtain 65 Mgal of storage, and modification of Kent Pond, which would involve increasing the height of the existing earth till dam to raise the current water level by five feet to allow for an additional 165 Mgal of storage at that location. The total resulting combined storage volume is only 230 Mgal. That volume would be inadequate to enable the restoration of flows at the existing withdrawals to FMF and also provide the volume of water necessary for snowmaking.

59. For the Woodward Reservoir alternative, there is a total storage volume of 293 Mgal based on a ten foot drawdown, and a total storage volume of 344 Mgal based on a twelve foot drawdown.

60. The cost of the Woodward Reservoir intake, pipeline to Sunrise, and Reservoir Brook intake is $2.1 Million, which includes the intake and 10,000 foot pipeline segment from Woodward Reservoir to the Sunrise Base Lodge. In comparison, the Kent Pond and new storage alternative would cost $7.35 Million, or more than three times the cost for the proposed use of the Reservoir, and the Kent Pond alternative would not provide the-necessary volume of water.

61. In addition to Kent Pond, to obtain additional storage capacity to achieve an amount comparable to that of the Reservoir, Killington would have to build 70 Mgal capacity of storage at a cost of $0.08 to $0.10 per gallon, that is, $5.6

Million to $7 Million. The total cost to obtain the requisite storage would be between $12.95 Million and $14.35 Million. a factor of approximately seven times the Project's cost.

62. The Project at the Reservoir is the preferred option. The requisite volume of water already is in storage in the Reservoir. The water has been released annually in the fall of the year such that no new reservoir would have to be built. Because there is no need to build new reservoirs or holding tanks, there will be far less environmental impact as compared to all the other alternatives. The use of the Reservoir will cost substantially less than other alternatives considered. The use of the Reservoir will allow for full restoration of streamflows at all of Killington's existing withdrawal points to current standards. The use of the Reservoir will enable the restoration of consistent streamflow rates in Reservoir Brook, which has not been the case historically.

63. Based on cost and environmental impact, the Project is the most reasonable alternative to those alternatives investigated as part of Killington's NAA.

64. Because snowmaking operations are a significant component of the cost of operating a ski resort, there is a built-in incentive for a ski area to maximize efficiency in reaching the final goal, which is ensuring a reliable and safe skiing surface on the trails.

65. Killington uses water conservation measures which include, but are not limited to the following: use of state-of-the-art snowmaking equipment; optimization of the snow density; configuration of return lines to recover excess flows; use of non-toxic, EPA approved additives (Snow-max) to improve production; and snow conservation techniques such as improved trail design and drainage, snow positioning through grooming, and measuring/monitoring snow production. Each of these measures maximizes the effectiveness of all snowmaking activities. which in turn ensures that water conservation is achieved.

66. These measures have resulted in less water being used at Killington in comparison to the average seasonal water consumption volumes for four other central/southern Vermont resorts. The demand model for existing snowmaking trails at Killington is based on 1.03 Mgal per acre. The model for future expansion is based on 1.02 Mgal per acre. The existing and future projected water use rates are lower by approximately 15 percent than those for the four other ski resorts in the same geographic area.

67. The operation of a water distribution system for a snowmaking system relies on a continuous flow of water to protect pipes from freezing. As water is pumped through individual distribution loops within the snowmaking system, the bulk of the pumped water is utilized to make snow in the areas targeted for snowmaking activity at the time. However, some water remains at the end of the distribution loop. To maximize system efficiency, Killington has configured its pumping system to recapture much of this "return water" at Snowshed Pond and Bear Mountain Pond. By so doing, Killington is implementing a "multiple use" or "recycling" system to make the most complete use of water that is withdrawn for snowmaking purposes.

68. Snowmelt resulting from midwinter thaws or rainstorms has both positive and negative effects on Killington's resort operation. The negative aspect of these events is that the costly machine-made snow that has been placed on ski trails is either lost entirely or reduced greatly in quality, such that full recovery or partial resurfacing is required. The positive aspect is that such events result in increased streamflow due to natural runoff and melt processes. Although it is unlikely that actual snowmaking activities would be occurring during such events due to high temperatures, the occurrence of such runoff allows for replenishment of existing storage volumes at Snowshed Pond and Bear Mountain Pond. These volumes of impounded water then can be used for snowmaking subsequently when colder air temperatures permit. The sequence of water use is that all of Killington's other snowmaking water sources will be used first and the Reservoir last. To the degree that these on-mountain reservoirs are replenished during thaw events, the demand for water from the Reservoir is reduced.

69. Killington has undertaken a variety of measures to achieve and maintain state-of-the-art conditions in snowmaking system efficiency thereby utilizing the best available technology for conserving water in light of the Project's purpose. Killington upgrades its system regularly as new, more efficient technologies become available. Killington's personnel have developed new techniques and technology to assure efficient operations. Killington has utilized the most efficient reasonably available snowmaking equipment and practices, coupled with the use of the least environmentally damaging water source alternatives, to supply the volume of water necessary for reliable operation of its snowmaking system.

70. Killington's NAA evaluated alternatives that would allow Killington to fulfill the project purpose in the least environmentally damaging manner. The use of the Reservoir to a drawdown less than or equal to historic winter drawdown levels.

coupled with restoration of streamflows at existing withdrawal facilities, is the best overall alternative. Given that the water demand has been established and that the snowmaking system is operated in an efficient manner, the implementation of this alternative will result in utilization of the best available technology for future snowmaking at Killington.

71. The Reservoir will be the last source that will be tapped to provide water for snowmaking. For Killington, this approach makes sense because water that can be obtained closer to the resort is less expensive to use, since it does not require costly pumping from distant locations. This manner of operation will minimize the winter drawdown that otherwise would be necessary at the Reservoir. This sequential use of water sources for snowmaking, is an efficient use of the resource and results in efficient operations of the entire water withdrawal system used by Killington.

72. The Snowmaking Rule requires periodic reviews "to determine whether it would be reasonable and feasible to revise the conservation flow requirement" (Section 16-03). This ongoing periodic review provides an opportunity for independent assessment of snowmaking system efficiency.

73. The Project's purpose is to enable the withdrawal of water from the Reservoir for snowmaking on Killington's ski trails. Of necessity, facilities must be constructed or installed in the Reservoir and leading from it to the ski area in order to fulfill its purpose.

74. In all aspects of the placement. sizing, and design of the water withdrawal facility, the potential impacts to the shoreline have been minimized. The siphon house is buried below ground, with the only above ground feature being an access hatch that is set back about 45 feet from the edge of water. This distance has been maximized insofar as possible given the narrowness of the site, and is located between the Reservoir and Vermont Route 100. These facilities must be located in that vicinity to enable water to be withdrawn from the Reservoir.

75. The Reservoir's shoreline is a hybrid of natural and human-induced conditions, because the shoreline is the result of a naturally existing pond and a human made dam and its replacements.

76. Aside from the construction of the water withdrawal facility itself, there will be no alteration of the shoreline. Any impacts during construction will be restored: the

soils will be backfilled, and disturbed vegetation will be replanted. Erosion control measures will be maintained so that the waters themselves will be protected and will not have their condition physically or chemically altered.

77. The Reservoir is maintained by a dam and gate valve at the northern end. The Reservoir provides many of the functions of a natural pond or lake, including habitat for aquatic vegetation, and wildlife such as beavers, frogs and salamanders.

78. While many basic limnological concepts apply to both reservoirs and lakes (including the large size and potential temperature stratification). there are differences between them, such as watershed size, length of shoreline, and hydraulic residence time. Coarse rocky substrates and steep shorelines are more common on reservoirs than most lakes and ponds. Reservoirs possess more variable and individual characteristics than lakes.

79. As a hybrid body of water, the Reservoir is predominantly a human made water containment system. One of the Reservoir's functions, for more than one-hundred years, has been to collect, store, and release water. The fluctuating water levels have become an aspect of the Reservoir's overall natural condition.

80. There is a wide variety of lakes in Vermont, both natural and manmade, many of which do not have well-developed "classical" littoral areas. The characteristics of these lakes' littoral areas are dependent on a number of biotic and abiotic characteristics, including geomorphology, nutrient availability, exposure, and water chemistry.

81. The littoral zone plays an important role in determining the type and vitality of ecosystem that will develop in the lake (typically, a warmwater fishery of pike/perch or bass/panfish or both would develop). On the other hand, lakes that for any number of reasons, do not support extensive macrophytes tend to develop ecosystems that are less dependent on the littoral zone and more dependent on the pelagic zone (open water areas) (often a salmonid/smelt fishery). These types of lakes are the rule in northern New England, rather than the exception.

82. Because most of the Reservoir's shoreline does not have habitat that is suitable for the growth of extensive macrophytes. elimination of winter drawdowns would not increase the amount of macrophyte growth in the littoral zone. The Reservoir is most appropriately considered the type of waterbody that should be managed as a

salmonid/smelt body of water, irrespective of water level management considerations

83. The existing Reservoir substrates within the drawdown zone arc predominantly steep-sided with a mixture of boulders, cobble and sands. In some coves and along sections of the southeastern shore, the shoreline is less steep and finer substrates dominate, including sand, silt and detritus. An exception is a small cove on the eastern shore which does not experience the full extent of the drawdown due to a natural berm across the mouth of the cove. At full pond. the water depth at the cove mouth was measured at approximately 6 feet, therefore. 6 feet is the maximum extent of draw in the cove.

84. The shoreline vegetation is predominantly wooded, with small areas of open land due to residential housing, pasture, a public boat ramp. and Route 100. Few wetlands abut the Reservoir, primarily due to the steep surrounding topography. Small forested wetlands occur at the mouths of several small drainages entering the Reservoir, and a narrow emergent marsh has formed at the toe of the Route 100 roadbed along the southwest shore. A floating peat mat occurs in the isolated cove.

85. The distribution of the aquatic plants within Farm and Wilderness' drawdown zone was influenced by the substrate type, shoreline steepness and shading from the adjacent forest. Aquatic plants are most abundant in areas of tine substrates, gradual slopes and no canopy cover. Aquatic vegetation is also present in the deeper parts of the Reservoir, which are below the existing drawdown zone. Direct observations of mammals, amphibians and reptiles include red-spotted newt and green frog, and an active beaver lodge in the peat mat cove.

86. The Reservoir's wetlands and wildlife habitats are typical of reservoirs managed with a winter drawdown and summer full pond. The composition and productivity of the littoral zone is governed by substrate type, shoreline steepness and hydrologic regime. The Reservoir's aquatic vegetation species composition is fairly diverse and its level of productivity, while moderate, is typical of a reservoir dominated by hard substrates and steep shorelines.

87. The Reservoir supports average populations of amphibians. Few mammals or reptiles are present due to the steep shorelines. hard substrates and corresponding lack of well developed wetlands.

88 The current aquatic and shoreline vegetation is adapted to a water management regime that is very comparable on an ecological scale to the Project. Important aspects of this regime include full pond levels throughout the growing season, and a winter drawdown beginning in early winter and continuing through the winter until refill in the spring. The primary changes in water regime attributable to the Project's operation will not affect the aquatic and shoreline vegetation adversely. Initiating the drawdown later in the winter (December to January with an average date of January 1) will provide the drawdown zone greater protection from freezing than currently occurs. This protection will be provided by water in warmer years or an ice sheet in colder years. With the current drawdown regime beginning in early November and continuing until early December, the drawdown zone is virtually always exposed to freezing temperatures with no water or ice cover for protection.

89. The Project will not adversely effect the existing mammals, amphibians and reptiles in the Reservoir. The Project may result in some improvements to the Reservoir's aquatic vegetation, mammals and herps, as compared to current conditions.

90. The Project will not adversely effect any of those fauna currently overwintering in the Reservoir. Species that can and may utilize the Reservoir include red-spotted newt and green frogs, leopard frogs, pickerel frogs and bullfrogs, and spring peepers. Population numbers are likely to be low due to the lack of emergent wetlands and soft substrates. Of these species, red-spotted newts and spring peepers hibernate in terrestrial settings and will be unaffected by the Project. Green, bull, leopard, and pickerel frogs hibernate in emergent and forested wetlands and soft pond bottoms. Green, bull, and leopard frogs typically enter hibernation in October and therefore will be affected by a winter drawdown under the current or proposed regime if they attempt to overwinter in the drawdown zone. Pickerel frogs are more tolerant of cold water temperatures and typically enter hibernation later than other frogs.

91. Most of the shoreline of Woodward Reservoir provides few areas suitable for overwintering. The limited areas of sand and mud, such as the cove with the Class II wetland peat mat, may provide hibernation habitat for these species. In the cove, the accumulated bottom sediments and litter, and incomplete drainage during the drawdown, provide suitable overwintering habitat under both existing and proposed water management regimes. The minor vegetated wetlands bordering the Reservoir also may provide limited but suitable hibernation habitat

because groundwater discharge appears to be significant in these areas and will prevent substrates from freezing in most years.

92. Reptiles potentially overwintering in the Reservoir include snapping and painted turtles. Both of these species overwinter on muddy pond bottoms or in large emergent or shrub marshes. Similar to amphibians, the extent of overwintering habitat for these species in the drawdown zone s limited throughout the Reservoir by the hard substrates and the minor extent of bordering wetlands. Again the peat mat cove is the most suitable site. due to the soft substrates and smaller winter drawdowns.

93. No muskrat sign were observed in the Reservoir, which is consistent with the very limited extent of emergent marsh, their preferred habitat. Some individuals could inhabit large ranges along the sparse emergent marsh areas of the west shore. Because muskrats build their huts throughout the fall, winter drawdowns will affect overwintering sites by dewatering access routes to food and potentially exposing the animals to increased risks from exposure and predation. Delaying the winter draw until December or January, as Killington proposes, would have the positive effect of reducing the risk period.

94. There is a beaver lodge in the peat mat cove, along with evidence of cutting on the peat mat and shore. These animals have adapted to the existing winter drawdown experienced in the cove, and have a tunnel system that extends to the approximate 5-6 foot drawdown experienced in this cove. Beavers occasionally may colonize the shoreline and therefore would be exposed to the full drawdown regime. Changing the drawdown regime from that done by Farm and Wilderness to that proposed by Killington will benefit beavers by decreasing the time of exposure.

95 The proposed drawdown regime will benefit the littoral zone in ways other than just decreasing the average magnitude of the draw. The proposed draw will occur later in the year and refill will begin earlier than the existing Farm and Wilderness regime. This will result in several benefits: the littoral zone will be exposed for a much shorter period of time (about a month compared to three months); and it will be protected from desiccation and freezing by a layer of ice and snow which will form prior to onset of the draw. These factors. in combination with the reduced frequency of large drawdowns. will enhance the habitat potential of the drawdown zone, not harm it or be equal to existing conditions,

96. While peat mat communities typically occur under stable saturated conditions and

are not typically adapted to water level fluctuations. the peat mat on Woodward Reservoir has developed on a water body that has fluctuated since it was created, The hydrology experienced by the floating mat is one of permanent saturation, and it rises and falls with the water level in the cove without experiencing a substantive change in hydrology. The Project will not have an adverse effect on the peat mat.

97. A wide range of littoral zone conditions occurs on lakes and reservoirs, and is dependent on a number of biotic and abiotic characteristics, including geomorphology, nutrient availability, exposure, and water chemistry. Many natural ponds and lakes do not have extensive structural and community diversity but still offer high quality habitat, and conversely, lakes and reservoirs with highly productive littoral zones may be eutrophic and not provide high quality habitat for many desirable species. The link between macrophyte productivity and lacustrine habitat quality is very complex.

98. Based on historical data, complete refill of the Reservoir would have occurred prior to the occurrence of two consecutive days with above freezing minimum temperatures, with the exception of two years. Once the Project goes into operation, complete refill is projected to occur, on average, by April 5. The average date of "warm up" is April 18. Therefore, on average. complete refill would occur 13 days before this "warm up". Furthermore, the analysis shows in those years when refill is delayed until later in April, there was a late occurrence of a warm up in these same years. For the two years that complete refill was projected to occur later than warm up (1987, 1988). the difference between these events is only one day, and in both cases the refill would have been complete in early April.

99. The Project's operation will not adversely affect the aquatic biota of the Reservoir's waters. The Project will help to improve the fish populations in both Woodward Reservoir and Reservoir Brook. Refill of the Reservoir no later than April 23 each year will ensure that smelt spawning in the Reservoir's tributary stream will be protected each spring. Since smelt in Woodward Reservoir spawn in late April-early May, having the Reservoir refilled by April 23 will allow them total access to their spawning site. In some past years, the Reservoir was not refilled in time and the smelt spawned in the lower reaches of the tributary brook, where they were not as successful (high egg mortalities). An increase in smelt abundance will benefit trout and other fish species in the Reservoir by providing a stable forage base.

100. The rapid drawdown characteristic of Farm and Wilderness' operation of the Reservoir effectively removed a substantial part of the Reservoir's volume. thus giving the fish and other aquatic organisms significantly less habitat during the winter months. This crowding of fish over the long term has been a significant factor in determining how many fish are able to over winter in the Reservoir. The Project will be more beneficial to the fish because the drawdowns will begin in January instead of early November, and the future average drawdown will be much less than in the past. Also, the withdrawals will occur more gradually, over a longer time period, thereby resulting in less of a "flushing" action in the outlet stream. in most years, the Project's operation will give the fish and other mobile aquatic biota more habitat during the winter months. Also, the shoreline habitat will not be exposed as much as it was in the past because of the reduced average drawdowns.

10 1. The Project will help protect smelt spawning in the Reservoir's tributary stream each spring by having the Reservoir filled by April 23 each year, and it also will help protect the trout and their spawning reeds in Reservoir Brook during the refill period in March and April. A full Reservoir by April 23 will allow sufficient water depth to give the spawning smelt access to the tributary stream. Protection of the smelt spawning also will benefit the trout fishery in the Reservoir, which depends on the smelt for forage. Another benefit to the Reservoir, and its fisheries. will be the average reduction in the maximum winter drawdowns. This average reduction in water withdrawals will benefit not only the fish, but other mobile aquatic biota in the Reservoir by providing a greater volume of water during the winter months. These reduced drawc.owns also will benefit shoreline habitat, because not as much of the shoreline will be exposed during the winter due to reduced water withdrawals.

102. While some macroinvertebrates could be killed during a winter drawdown, experience with littoral zones in other New England lakes that have more extensive winter drawdowns demonstrates that a diverse and healthy macroinvertebrate community exists in Woodward Reservoir, despite the winter drawdown.

103. Killington's operation of the Project during the winter months in connection with snowmaking will not cause erosion because the shoreline and shore structures will be isolated from the floating ice by an active shoreline crack and interlocking or floating strips of ice, as well as by the "fortification ice" formed at the onset of cold weather. Those natural protections will protect the shoreline from erosion.

The ice strips resting on the shore will protect the shore from traffic. There will be less erosion than may have occurred in the past.

104. Refilling of the Reservoir is directly coupled to warm weather and the bonds to the stones that the ice strips are resting on will melt, leaving the stones in place as the strips are refloated. The change from the Farm & Wilderness drawdown regime to the Project will eliminate or significantly reduce the open water margin around the floating ice sheet in the spring. This will reduce shoreline damage from free floating ice.

105. When the Reservoir freezes. the peat mat will become an integral part of the ice sheet within the wetland cove and the integrated mass would respond as a system to the water level variations. Similar to the floating ice in the Reservoir, the floating peat mat will follow the receding water level as the level in the cove is decreased. Once the water level recedes to the sand bar elevation at the mouth of the cove, the water level in the wetland would be independent of the Project's operation. For the remainder of the winter, ice conditions in the cove will be similar to those extant during the Farm and Wilderness drawdown. As the water level is restored, the floating ice-bog system will be restrained by an ice system similarly to the ice sheet in the Reservoir.

106. Two types of ice will be found on Woodward Reservoir, polycrystalline, commonly called "black ice", and snow ice. Polycrystalline ice, as the name implies is composed of many single ice crystals which, like icicles are clear, hence the ice sheet appears black. Snow ice of white ice forms when saturated snow freezes. Impurities trapped at the grain boundaries of ice crystals create a weak "glue" holding the crystals of ice together.

107. When ice forms, the edge of the ice surface freezes to the shore while the majority of the ice surface floats on the surface of the water. As the water level drops, the floating end of the ice drops, causing a downward curvature of the ice which is rigidly held by the shore ice. The top of the ice is in tension and the bottom of the ice is in compression. Also, as the water recedes, the near shore ice is no longer floating and the dead weight of the ice adds another load to the grain boundaries between the ice crystals, Not only is the ice bending, its dead weight tends to displace it vertically or shear it. This loading combination exceeds the tension strength of the grain boundaries and a crack starts at the surface and propagates through the ice, breaking the ice.

108. Ice is a flexible material that floats with 90% o-the ice thickness below the water surface. Any imposed load on the ice (e.g. a vehicle. bob hut, skater, or snow) is supported by distributing the Load over an area. If the ice is thick enough to support the load, the ice sheet bends and displaces a volume of water equal in weight to the imposed load. If the load exceeds the developed buoyancy force, the ice surface will become flooded. A classic example is the load associated with deep snow. Immediately following a snow storm, if one drills a hole in the ice the water will bubble out of the hole. Given the multitude of cracks and sufficient time, even in an undisturbed lake the water will eventually get on top of the ice and saturate the snow. Given cold temperature, the saturated snow will freeze and add to the total ice thickness as snow ice.

109. The formula used to calculate the load carrying capacity of the ice sheet depends on the ice thickness and the foot-print of the load. The load capacity of the ice sheet is completely independent of water level fluctuation.

110. At the onset of winter, an ice accretion process, due to waves and water level fluctuations, encases the stones, gravel, etc. along the shoreline to form a unified "fortification" for the shoreline. The width of th. s ice band along the slope is a function of the maximum cobble size, water level fluctuation, and the amplitude of wave action. As the water repeatedly wets the stones and vegetation, layers of ice are added to the objects increasing their effective diameter. This ice process is similar to candle dipping in which the diameter of the candle is built up in layers. Each successive cycle increases the diameter of the stones and vegetation and decreases the drainage voids. As the wetting-freezing cycle repeats, the drainage holes are tilled and a solid ice buffer forms at the waterline. The shoreline also may be covered by snow whose capillary action ' pulls" water above the waterline saturating the snow. Stones and vegetation are frozen into the matrix of snow-ice providing the shoreline fortification. Due to the thermal conductivity of the stones, ice, ground frost, and sub-grade, the width of the ice buffer may extend below the waterline.

111. If the water level remains relatively static, the floating ice sheet will freeze to the shore-fast ice buffer. When the water level decreases, the floating ice sheet naturally follows it. requiting a transitionzone between the floating ice sheet and the stationary shore ice. As the ice bends to accommodated the difference in elevation, tension stress develops on the top surface of the ice until a tension crack starts at the top surface and penetrates through the ice. This crack. which occurs at the transition from floating ice to the ice fastened to the shore. structurally

separates the floating ice from the stationary shore ice; in other words, the floating ice sheet is free to move vertically with respect to the shore fast ice. The location of this shore-line crack is a function of the ice thickness and distance between supports along the shoreline (e.g. docks, rocks, etc.) that may help support the weight of the ice. Due to the weak tension strength of the ice crystal boundaries, the ice will find the shortest distance between these supports when it breaks, leaving an ice collar attached to the shore line. If the water level continues to cycle, the shoreline crack remains active, allowing the floating ice to move vertically with respect to the stationary shore-fast ice.

112. As the water level continues to recede, the floating ice sheet moves relative to the stationary shore ice at the vertical face of the active crack. Eventually, the perimeter of the ice sheet will come the rest on the shore. As more water is removed, the sheet has to bend to accommodate the difference in elevation between the floating ice and the edge of the ice sheet resting on the shore. As the ice curves from the sloped beach to the floating ice, the bottom of the ice is in tension. These stresses give rise to a tension crack on the bottom of the ice, which is propagated up though the ice thickness. This second crack acts like a hinge and separates a strip of ice from the floating ice sheet. This process of breaking off strips of ice will be repeated as the water level drops. The strips or blocks of ice resting on the beach are interlocked with each other and with the floating ice sheet. That is, they can rotate with respect to each other, but cannot move laterally. In effect, the shoreline is protected by interlocking strips of ice like pieces of a giant puzzle.

113. As the water level increases, the strips of ice are refloated and keep the ice sheet in relative position. That is, the ice sheet does not move along or across the shoreline, but moves up and down in the same relative position with all the cracks between the ice strips acting like hinges.

114. One aspect of Woodward Reset-v&s operation that prevents ice damage is that re-tilling rain and snow melt run-off are accompanied by warm weather. This is significant because ice damage occurs typically when the water level is increasing and the air temperature is below freezing. The warmer temperature will make the ice more ductile, or flexible which will allow the ice to adjust itself to the increasing water level. In subsequent draw downs, the ice strips will settle back on the shore with no relative movement between the strips.

115. Because of the these ice processes, access to and from or along the Reservoir's

shoreline during the winter is not hazardous (although one always is wise to exercise caution when walking on ice, even on level ground) and people commonly enjoy different forms of recreation on and around frozen lakes, ponds, pools for hydro-electric facilities and reservoirs.

116. The only difference between prior operating procedures and those attendant to the Project is that the fortification of the shoreline will occur at full pool as compared to the historically lower freeze up elevation.

117. Generally, one will not be able to distinguish the ice floating on Woodward Reservoir from the ice on any other similar size body of water. The physics of fresh water ice formation does not vary from lake to lake. Shore ice conditions on the shore of Woodward Reservoir will be similar to any similar sized body of water where there is a net loss of water (water entering is less than the water leaving). An example would be a reservoir used as a municipal water supply.

118. As the water in the Reservoir is drawn, the ice cover will not remain suspended in air, thereby creating unforeseen hazards because ice is a flexible material that needs water or other means of support over any meaningful distance. When the water is removed, the ice will come to rest on the beach, ice can span only a short distance between supporting rocks. If the span is too long, the bending stresses will exceed the tension strength of the ice and a crack will form shortening the span length. These functions are perfectly natural and normal.

119. The Project will not impede access to the ice. Due to ice breaking mechanics, the ice strips resting on the beach will be at a shallower angle than that of the original shore slope. Basically the ice covered shore will generally reflect the slope of the beach, from steep beach/steep angle to shallow beach/shallow angle. All the blocks will be interlocked like pieces of a puzzle and will be stable enough to walk on, ski and snowmobile over. As an added benefit, the ice strips resting on the shore will protect the shore from traffic without impeding access to the ice cover.

120. For the past 20 years, traces of snow start appearing before the end of November. By the time the ice is thick enough to walk on, a thin layer of snow will be integrated into the crystal structure of the ice, giving the ice a "rough" surface. This rough surface will interlock the snow accumulation with the ice. The snow covered ice already exists on the shoreline. and the change in operations will not change the surface of the on-shore ice. In other words. if one could walk down

the snow covered beach in the past, one will be able to walk down the snow covered ice in the future after the Project has gone into operation.

121. Ice thickness is a function of the air temperature not water level fluctuation. This is a basic law of physics. Starting at full pool, the ice sheet will be larger, due to the increased water surface. The Project will not impede human or animal traffic on and off the ice.

122. After the Project goes into operation, the general ice conditions on the Reservoir will be no different from what they are now and from what occurs naturally, Ice formation and ice thickness are driven by air temperature and the change in operation will have no bearing on the ice thickness. Recreation on the Reservoir will not be impeded by the Project.

123. Ice integrity and safety is determined by temperature, not drawdown. Regardless of the withdrawal of water, ice will get thicker throughout the early winter months *on a* reservoir as it would on a natural lake.

124. The amount of water in a reservoir (or a natural water body) will fluctuate throughout the winter, and the ice surface will simply rise and fall with the water level.

125. The ice processes that will occur because of the Project will not impede or interfere with human or animal access to the ice, nor interfere with any uses of the ice surface by wildlife.

126. The pipeline and intake to be installed in connection with the Project will allow continued access and recreational opportunities because the pipeline will be buried (and therefore will not interfere with access or navigation) and the intake structure will be approximately 15 feet below the surface of the water during the warm seasons, so it too will not interfere with recreation in or on the waters of the Reservoir. No other aspects of the Project will interfere with, and the Project will allow, continued access to and use of the waters.

127. Existing Reservoir drawdowns have been far more extensive than any that will result from the Project's operation, and access to the Reservoir has not been impeded or rendered unsafe, except for the occurrence of open water in the spring as the water level is returned to full pond.

128. The Project will result in the selective or limited removal of vegetation and, upon completion of the Project's construction, the planting of trees and shrubs to screen the siphon house access hatch from the waters The pipeline will be buried. and not visible from the waters, and the exposed hatchway to the below ground siphon house will be located 45 feet back from the shore.

129. Trees and shrubs will be planted to screen the 3' high wood shingled access hatch. The intake will not be visible from the waters in any season. Once the construction is completed, the shoreline will be returned to its present condition with no visible signs of the Project other than the siphon house access hatch. which has been designed to be as small and unobtrusive as possible and which will be screened to further reduce its visual impact.

130. The intake structure (described as the "filter box") will be submerged 15 feet below the surface level of the Reservoir when full, and will be screened by the waters themselves. The natural condition of the shoreline and the waters after the Project's construction will be as they are today. before construction.

13 1. The shoreline shape and slope will not be altered by the Project's construction and will be filled with material to match existing conditions. The intake pipes will be installed with limited excavation, and the slope will be restored to the same condition as the adjoining slope. Rip-rap will protect the shoreline from erosion. After construction and the growth of vegetation where replaced, the shoreline will appear no different from the existing shoreline.

132. There are a few locations that experience some ongoing erosion. The Project will not exacerbate the existing erosion problems and the proposed water level management is expected to be an improvement over past historical practices,

133. The drawdown rate will be slower than that conducted by Farm and Wilderness, on the order of six inches or less each day. This IS slow enough so there will be no slope stability problems or "land slides" from the Reservoir's edge. Land slides have not been evident from the greater and more rapid drawdowns conducted by Farm and Wilderness. There will be variation from year to year so that the water will not be at the same level to work at cutting a bench.

134. The rip-rap banks will be stable and the planting of the disturbed areas where the construction will occur and around the siphon house, in accordance with the erosion control plan, will ensure that these areas have proper vegetative cover and that the bank and exposed soil areas will be stabi ized from erosion,

135. In Condition #11 of the Permit, Farm and Wilderness is required to maintain a guaranteed flow of 0.5 csm from the end of the refill period through the remainder of the year. The 0.5 csm flow standard would thus apply until the next season's snowmaking use commenced, which could be as early as late November, but more typically in early January.

136. ANR and Farm and Wilderness have instead recommended maintenance of natural flows downstream, i.e., the outflow of the reservoir would be equal to the inflow less evaporative losses from approximately mid-spring through late fall. The proposed revised Condition #11 is as follows:

> The permittees shall ensure that a minimum conservation flow of 0.8 csm occurs at all times during the fall/winter drawdown for snowmaking in Reservoir Brook below the dam on Woodward Reservoir. Killington, Ltd. shall be responsible for maintaining this minimum flow from November 1 through the refill of the Reservoir. During the rest of the year, Woodward Reservoir shall be kept full and pass natural flow over the spillway at all times, except 1) in connection with limited drawdowns for maintenance, which may occur at any time provided that such drawdown plans with provisions for appropriate conservation flows are approved in advance by the Agency of Natural Resources, or 2) if approved by the Agency of Natural Resources to provide a gated release to enhance downstream cold water fish habitat without significant reduction in reservoir levels.

137. For setting flows related to non-snowmaking water uses, the Agency uses its *Procedure&r Determining Acceptable Minimum Stream Flows* (July 14, 1993). The procedure contains default conservation flow values of 0.5 csm, 1.O csm, and 4.0 csm for the summer, fall/winter, and spring periods, respectively. The higher fall/winter and spring values are for the purpose of protecting spawning and incubation that occurs during those periods for resident fish species. The default values are regional estimates of the median flows for August, February, and April-May, respectively, and are the same standards used by the U.S. Fish and Wildlife Service (New England Stream Flow Recommendation Policy, 198 1).

138. Under Chapter 16 of ANR's Snowmaking Rule, a value of 0.8 *csm* is used for the fall/winter period rather than the Fish and Wildlife Service regional policy value of 1 .O csm. The Snowmaking Rules apply to Killington's fall/winter snowmaking use, whereas ANR's general procedure applies to Farm and Wilderness's management from the spring through the fall.

139 If not changed, Permit Condition #11 would result in slight summer drawdowns because the 0.5 csm flow requirement must be provided from reservoir storage when natural summer flows decline below that value. The permit's 0.5 csm flow standard would apply during the critical fall spawning period for brown trout reproduction. However, under ANR's general flow procedure a flow of 1 .O csm. or inflow if less, should normally apply during the fall spawning period.

140. In Vermont, brown trout spawn during the October-November period when stream flows have increased and water temperatures have declined relative to summer conditions. A flow of 0.5 csm during the fall spawning period would essentially create a fall drought condition that would not be conducive to spawning.

141. ANR's proposed change to Permit Condition #11 protects the natural condition of Reservoir Brook by providing a natural flow regime below the dam. All flows would spill over the spillway riser with no intervention by the dam owners. except for approved maintenance drawdowns. This would essentially be equivalent to the conditions found below natural lake and ponds.

142. Historic hydrologic information is not available for Reservoir Brook and Woodward Reservoir. Without information on the hydrology of Reservoir Brook, the true extent of drawdown that may occur with a constant release of 0.5 csm cannot be determined. This presents the risk of a drawdown that could impair recreational use and possibly affect habitat.

143. The extent of drawdown that would occur during an extremely dry summer. using modeling based on summer of 1965 and data from the nearly Kent Brook gaging station, indicates that a guaranteed minimum flow of 0.3 csm would result in a drawdown of less than half a foot, assuming about four inches of evaporative loss. A guaranteed minimum flow of 0.5 csm would result in perhaps a one-foot drawdown.

144. Passing a portion of the dam discharge through the same gate to be used to provide the winter minimum flow would enhance downstream water temperatures by providing a deep cold-water release and would augment summer flows during periods when evaporative losses from the reservoir would cause unusually low flows downstream. To protect reservoir recreational use and habitat. ANR proposes limiting flow augmentation to the extent that the augmentation can be provided while maintaining the reservoir in close-to-full conditions.

IV. CONCLUSIONS OF LAW

A. Burden of Proof

The term "burden of proof' refers to two separate burdens: the burden of going forward and producing evidence, and the burden ofpersuasion. See 10 V.S.A. § 6088; In re Denio, 158 Vt. 230,236 (1992); Re: Pratt's Propane, #3R0486-EB, Findings of Fact. Conclusions of Law, and Order at 4-5 (Jan. 27, 1987). 10 V.S.A. § 6088 operates in conjunction with the requirement that before a permit can be issued, the Board (or district commissions) must make the affirmative findings required under the 10 criteria. See 10 V.S.A. § 6086(a). The Applicants have the burden of proof with respect to the three issues on appeal.

B. Criterion 1(C)

Criterion l(C) provides as follows:

> (C) Water conservation. A permit will be granted whenever it is demonstrated by the applicant that, in addition to all other applicable criteria, the design has considered water conservation, incorporates multiple use or recycling where technically and economically practical, utilizes the best available technology for such applications, and provides for continued efficient operation of these systems.

There is limited Board precedent with respect to Criterion l(C). See Re: Peter Guille, Jr., Application #2W0383-EB, Findings of Fact, Conclusions of Law, and Order (March 18, 1980); Re: Lee and Catherine Quaglia, #1R0382-1-EB, Findings of Fact, Conclusions of Law and Order (Feb. 11, 1982); and Re: Swain Development Corp., Application #3W0445-2, Findings of Fact, Conclusions of Law, and Order (Aug. 10, 1990). Nevertheless, the Guille decision offers a valuable insight into how Criterion 1(C) should be applied in this case.

In Guille, the Board denied the applicant's proposed subdivision under numerous criteria, including Criterion l(C). The Board's Criterion l(C) conclusion simply states that the applicant did not incorporate water conservation techniques into the project's design, However, the Board's rationale as to its denial under Criterion l(C) established a link between water conservation under Criterion l(C) and wastewater disposal under Criterion l(B) and water supply under Criteria 2 and 3. If the project had been designed to conserve water, then there would be less water consumption and less wastewater to be disposed.

In considering the Project, the Board believes that there is a direct relationship between water conservation under Criterion 1 (C) and the water and shoreline values protected under Criterion l(F). The less water taken out of Woodward Reservoir during the winter, the less water that is necessary to till it back up for the summer. The sooner Woodward Reservoir is replenished, the better it is for all of Woodward Reservoir's beneficiaries, be they humans, animals, or plants.

Based on the findings of fact, Killington has met its burden of proof under Criterion 1(C). Because snowmaking operations are a significant component of the cost of operating a ski resort. there is a built-in incentive fcr Killington to maximize efficiency in withdrawing water for snowmaking to reach its final goal of ensuring a reliable and safe skiing surface on its trails.

Because of the high costs associated with snowmaking, Killington uses water conservation measures which include, but are not limited to the following: use of state-of-the-art snowmaking equipment; optimization of the snow density; configuration of return lines to recover excess flows; use of non-toxic, EPA approved additives (Snow-max) to improve production; and snow conservation techniques such as improved trail design and drainage, snow positioning through grooming, and measuring/monitoring snow production. Each of these measures maximizes tile effectiveness of all snowmaking activities, which in turn ensures that water conservation is achieved.

These measures have resulted in less water being used at Killington in comparison to the average seasonal water consumption volumes for four other central/southern Vermont resorts. To maximize system efficiency, Killington has configured its pumping system to recapture return water at Snowshed Pond and Bear Mountain Pond. By so doing, Killington is implementing a "multiple use" or "recycling" system to make the most complete use of water that is withdrawn for snowmaking purposes.

The sequence of water use is that all of Killington's other snowmaking water sources will be used first and the Reservoir last. To the degree that these on-mountain reservoirs are replenished during thaw events, the demand for water from the Reservoir is reduced.

Finally. Killington has undertaken a variety of measures to achieve and maintain state-of-the-art conditions in snowmaking system efficiency thereby utilizing the best available technology for conserving water in light of the Project's purpose. Killington upgrades its system regularly as new, more efficient technologies become available. Killington's personnel have developed *new* techniques and technology to assure efficient operations. Killington has utilized the most efficient reasonably available snowmaking equipment and practices, coupled with the use of the least environmentally damaging water source alternatives, to supply the volume of water necessary for reliable operation of its snowmaking system.

Accordingly, the Board concludes that the Project complies with Criterion I(C).

C. Criterion 1(F)

Criterion 1 (F) provides as follows:

> (F) Shorelines. A permit will be granted whenever it is demonstrated by the applicant that, in addition to all other criteria, the development or subdivision of shorelines must of necessity be located on a shoreline in order to fulfill the purpose of the development or subdivision, and the development or subdivision will, insofar as possible and reasonable in light of its purpose: (i) retain the shoreline and the waters in their natural condition, (ii) allow continued access to the waters and the recreational opportunities provided by the waters, (iii) retain or provide vegetation which will screen the development or subdivision from the waters, and (iv) stabilize the bank from erosion, as necessary, with vegetation cover.

Under Criterion l(F), the Board conducts a two-step inquiry. First, the Board determines whether the Project must of necessity be located on a shoreline to fulfill the Project's purpose. If this is so, then the Board determines whether the Project will, insofar as possible and reasonable in light of its purpose, satisfy the four elements of Criterion l(F).

As defined in 10 V.S.A. § 6001(17), "shoreline" is "the land adjacent to the waters of lakes, ponds, reservoirs and rivers. Shorelines shall include the land between the high water mark and the mean low water mark of such surface waters."

1. Necessity

The question of whether the a project of necessity must be built along a shoreline is a factual question for the Board to consider. First, the Board must determine a project's purpose. Second, the Board must considered whether a project will satisfy its purpose. If a project will not satisfy its purpose, then the Board will state what it believes are reasonable alternatives to a project. See Re: Town of Barre, #SW1167-EB, Findings of Fact, Conclusions of Law, and Order at 16-18 (June 2, 1994).

Based on the findings of fact. the Project will, in part. be built along the shoreline of Woodward Reservoir. The Project's purpose is to withdraw water to meet Killington's snowmaking needs. Of necessity, the Project must be built along the shoreline of Woodward Reservoir. In contrast to the bridge at issue in Town of Barre, here the Project does fulfill its purpose, and Killington's NAA demonstrates that the Project is the best alternative of all those considered by which to fulfill that purpose.

Having determined that the Project must of necessity be located on the Reservoir's shoreline to fulfill its purpose, the Board will now consider whether the Project, insofar as possible and reasonable in light of its purpose, satisfies the four elements of Criterion l(F).

2. Four elements

a. Possible and reasonable

In In re McShinsky, 153 Vt. 586,591 (1990), the Vermont Supreme Court upheld the Board's conclusion as to the meaning of "insofar as possible and reasonable in light of its purpose." The Court stated:

> We do not believe the phrase "insofar as possible and reasonable in light of its purpose" means that the Board must accept every proposed shoreline development project, regardless of its purpose and impact on the shoreline, merely because the applicant is doing what he or she feels is possible or reasonable. See In re Southview Associates, 153 Vt. at 175, 569 A.2d at 503 (statutory language should not be construed so as to "render the legislation ineffective or irrational"). Nor must the Board design an adequate project for an applicant or issue a permit and retain

> oversight to assure that the applicant is doing all that is "reasonable and possible" to meet the relevant subcriteria. Rather, criterion I(F) requires that the Board make its own determination that a development need be located on the shoreline and that, considering the purpose of the development, "possible and reasonable" measures have been taken to protect the shoreline.

Id.

Therefore, when considering mitigation measures, the Applicants are not required to achieve the impossible or the unreasonable, but rather, only what is possible and reasonable.

(i). Natural condition.

In Re: Okemo Mountain, Inc., #2S0351-12A-EB, Findings of Fact, Conclusions of Law, and Order (Revised) (July 23, 1992), the Board considered a water-withdrawal project for snowmaking. The Board first concluded that the water-withdrawal would not maintain the stream's natural condition because it would result in the loss of spawning and incubation habitat for brown trout. Having determined that the natural condition of the stream would not be maintained, the Board applied a balancing test of the effect on the resource resulting from the water withdrawal versus Okemo's need to affect the resource in order to obtain additional water for snowmaking.

Unlike the facts in Okemo, in this case the findings are that the Project will not have an adverse effect on Woodward Reservoir's natural condition. Woodward Reservoir is a hybrid body of water. As a hybrid body of water, the Reservoir is predominantly a human made water containment system. One of the Reservoir's functions, for more than one-hundred years, has been to collect, store, and release water. The fluctuating water levels have become an aspect of the Reservoir's overall natural condition. The Project, insofar as it involves collection, storage, and release of water, will not alter the Reservoir's natural condition.

The Project's withdrawal of water will be no more dramatic than that which has been occurring under Farm and Wilderness' management regime. Rather, the Project will result in water withdrawals of lesser magnitude than that which has occurred historically.

The Project will not result in any unreasonable alteration to the Reservoir's fish and plant habitats. The current aquatic and shoreline vegetation is adapted to a water management regime that is very comparable on an ecological scale to the Project. Important aspects of this regime include full pond leve Is throughout the growing season, and a winter drawdown beginning in early winter and continuing through the winter until refill in the spring. The primary changes in water regime attributable to the Project's operation will not affect the aquatic and shoreline vegetation adversely. Moreover, as a result of the Project the drawdown will occur later in the winter such that drawdown zone will provide greater protection from freezing than currently occurs. Finally, the Project will not adversely effect the existing mammals, amphibians and reptiles in the Reservoir.

Accordingly, the Project, insofar as possible and reasonable in light of its purpose, will retain the Reservoir's shoreline and its waters in their natural condition, Having reached this conclusion, there is no need to conduct the balancing test adopted in Okemo.

(ii) Continued access.

In Re: Clearwater Realty, #4C0712-EB, Findings of Fact, Conclusions of Law, and Order (May 10, 1989), the Board concluded that continued access to Lake Champlain would be maintained at a 10 lot residential subdivision because the lot owners would all be granted an easement to obtain access to Lake Champlain.

In contrast, in Re: H.A. Manosh Corn., #5L0918-EB, Findings of Fact, Conclusions of Law, and Order (Aug. 8, 1988), the Board concluded that a sand and gravel pit would not allow for continued access to the Lamoille River and the recreational opportunities provided by the river. Because the project would generate substantial truck traffic in an area where the road was unsafe. the Board concluded that pedestrians and bicyclists would be unable to use the river out of safety concerns. In effect, the public's access to the river and all of its recreational opportunities would be cutoff by the traffic.

Based on the findings of fact, the Project will not impede access to the Reservoir and any of its uses during any point of the year.

The siphon house is relatively small and unobtrusive. The pipeline and intake will be buried and will not interfere with access or navigation. The intake structure will be approximately 15 feet below the surface of the water during the warm seasons and will not interfere with recreation in or on the water. The ice processes that will occur because of the Project will not impede or interfere with human or animal access to the ice nor interfere with any uses of the ice surface by wildlife.

Fisheries habitat will be improved since the adverse consequences from Farm and Wilderness' rapid drawdown of the Reservoir will cease. In most years, the Project's operation will give the fish and other mobile aquatic biota more habitat during the winter months. The Project will help protect smelt spawning in the Reservoir's tributary stream each spring by having the Reservoir filled by April 23 each year, and it also will help protect the trout and their spawning reeds in Reservoir Brook during the refill period in March and April. A full Reservoir by April 23 will allow sufficient water depth to give the spawning smelt access to the tributary stream. Protection of the smelt spawning also will benefit the trout fishery in the Reservoir, which depends on the smelt for forage. The Project will also benefit other mobile aquatic biota in the Reservoir by providing a greater volume of water during the winter months.

Accordingly, the Project will, insofar as possible and reasonable in light of its purpose, allow for continued access to the Reservoir's waters and the recreational opportunities provided by the waters.

(iii) Vegetation which will screen.

In Re: John and Joyce Belter, #4C0643-6R-EB, Findings of Fact, Conclusions of Law, and Order (May 28, 1991), the Board concluded that trees planted in a buffer area adjacent to the stream would screen the project such that this third element was satisfied. In contrast, in Re: Robert and Deborah McShinsky, Application #3W0530-EB, Findings of Fact, Conclusions of Law, and Order (April 21, 1988), the Board concluded that neither the existing vegetation nor the proposed additional vegetation would adequately screen a proposed campground from the adjacent river.

The Project will result in the selective or limited removal of vegetation and, upon completion of the Project's construction, the planting of trees and shrubs to screen the siphon house access hatch from the waters. The pipeline will be buried, and not visible from the waters, and the exposed hatchway to the below ground siphon house will be located 45 feet back from the shore. 'Trees and shrubs will be planted to screen the 3' high wood shingled access hatch. The intake will not be visible from the waters in any season. Once the construction is completed, the shoreline will be returned to its present condition with no visible signs of the Project other than the siphon house access hatch, which has been designed to be as small and unobtrusive as possible and which will be screened to further reduce its visual impact. The intake structure will be submerged 15 feet below the surface level of the Reservoir when full, and will be screened by the waters themselves.

Accordingly, the Project will, insofar as possible and reasonable in light of its purpose. retain or provide vegetation which will screen the Project from the water.

(iv) Vegetation which will stabilize.

In Belter, the Board concluded that the adjacent river bank would be stabilized from erosion, as necessary, with vegetative cover. In contrast, in McShinsky, the Board concluded that the adjacent river bank would not be protected from erosion due to foot traffic from campers.

In this case, the shoreline shape and slope will not be altered by the Project's construction and will be filled with material to match existing conditions. The intake pipes will be installed with limited excavation, and the slope will be restored to the same condition as the adjoining slope. Rip-rap will protect the shoreline from erosion. While there are a few locations that experience some ongoing erosion. the Project will not exacerbate the existing erosion problems and the proposed water level management is expected to be an improvement over past historical practices.

Accordingly, the Project will. insofar as possible and reasonable in light of its purpose, stabilize the Reservoir's bank from erosion, as necessary, with vegetation cover.

3. Conclusion under Criterion 1(F)

In summary. the Board concludes that the Project complies with Criterion l(F)

C. Permit Condition #11 and Criterion l(E)

ANR's cross-appeal under Criterion 1(E) is limited to the issue of flow over the Reservoir's dam during periods when Killington is not drawing down any water. The parties have all consented that the inquiry under Criterion 1(E) is limited to this issue. Therefore, the entire Project will not be reviewed for conformance under Criterion l(E). See In re Taft Corners Assoc.&es. Inc., 160 Vt. 583,590 (1993) (scope of de novo appeal limited to issues raised in the notice of appeal).

ANR proposes that Permit Condition #1 1 be modified to provide as follows:

> The permittees shall ensure that a minimum conservation flow of 0.8 csm occurs at all times during the fall/winter drawdown for snowmaking in Reservoir Brook below the

> dam on Woodward Reservoir. Killington, Ltd. shall be responsible for maintaining this minimum flow from November 1 through the refill of the Reservoir. During the rest of the year, Woodward Reservoir shall be kept full and pass natural flow over the spillway at all times, except 1) in connection with limited drawdowns for maintenance, which may occur at any time provided that such drawdown plans with provisions for appropriate conservation flows are approved in advance by the Agency of Natural Resources, or 2) if approved by the Agency of Natural Resources to provide a gated release to enhance downstream cold water fish habitat without significant reduction in reservoir levels.

Based on the findings of fact, if not changed, Permit Condition #11 would result in slight summer drawdowns that could be detrimental to the environment. The proposed condition protects the natural condition of Reservoir Brook by providing a natural flow regime below the dam. Accordingly, the Board will revise Permit Condition #11 as requested by ANR.

V. ORDER

Amended Land Use Permit #1R0813-5-EB is hereby issued. Jurisdiction is returned to the District # 1 Environmental Commission.

Dated at Montpelier, Vermont, this 25th day of August, 1998

VERMONT ENVIRONMENTAL BOARD

Marcy Harding

Marcy Harding, Chair
Rebecca Day*
John T. Ewing
Arthur Gibb
George Holland
Samuel Lloyd
Rebecca Nawrath

***Alternate Member Day reviewed a draft of this decision and informed the Board Chair of her vote in favor of its issuance as is, notwithstanding that she was unable to attend the Board's August 19, 1998 deliberation.**

J:\DATA\DECISION\EB\APPEALS\1R0813.DEC