Construction of the Cascades Golf Course

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The Cascades Golf Course at Hot Springs, Va., was opened to play October 11, 1924, exactly thirteen months after ground was broken. Since that time it has won wide renown and approval of some of the foremost devotees of the game. Selection of the site, however, was not merely a matter of choice; it was foreordained as the only available one within a reasonable radius of the Virginia Hot Springs.

Few places could have been found to combine more natural and artificial obstacles to construction. A timid administration would have shied at the prospect; for as the seas cover three-quarters of the globe so the rocks covered the site of this course. And beside rocks there were forests and streams, hills and houses at inopportune places, awaiting reduction, diversion or removal. Compared to the advantages of the site, however, these difficulties were of minor importance and the wisdom of those whose vision foresaw the result is sufficiently attested today. A brief exposition of the nature and diversity of the elements of this work may be of interest to readers of THE BULLETIN.

The course is located at the northern end of the Falling Springs Valley near the headwaters of the picturesque Cascades, conceded by many the loveliest small stream in America. On three sides the wooded hills, notched with vistaed gaps, hover in protecting beauty a thousand feet or more above the general level of the links.

Preliminary to a definite consideration of the site a golf architect was retained. A tentative layout, based on reconnaisance, was submitted, followed by a complete topographic survey from which a 100-foot scale base map was prepared, using a 5-foot contour interval in general and a 1-foot interval in detail. The field control from which this map was prepared was used as the basis of all later construction. Contrary to lay opinion, the value of such a survey and map so far exceeds their cost as to be inestimable. This is more readily understood when it is known that the cost was less than half of 1 percent of the cost of construction. Furthermore, survey and map were completed in eleven days and a tentative estimate of the probable construction cost was prepared from the data thus supplied.

When a decision on the final layout was reached the whole scheme was quickly transferred from field to map, checked over carefully for errors of alignment and distance and approved for construction. With this map as a base the water system was now designed. The height and location of the reservoir determined, the site of the pumping station fixed, the sizes of the mains calculated and their disposi-

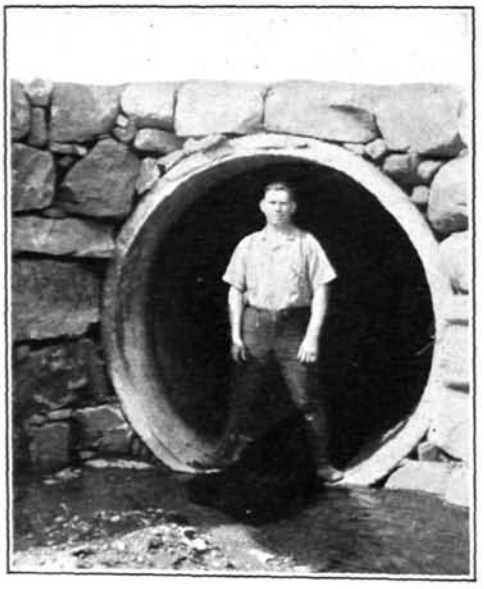
tion laid down on the map, the whole layout was transferred to the field as required by using the control and reference points of the basic survey. Keycock hose connections were provided at 100-foot intervals over the entire course, and at greens and tees, with a capacity of 300 gallons per minute. The pumping units consisted of two 10 H. P. semi-Diesel oil engines and chain driven triplex heavy duty pumps. The reservoir was of reinforced concrete with a capacity of 150,000 gallons. While this water was not intended for drinking purposes, and special fountains on a separate system were provided, automatic chlorination was installed as a safeguard.

Actual work was begun September 12, 1923, and construction was pushed with such vigor as the man power and weather of that period permitted. The organization of personnel and equipment was made as simple, complete and compact as possible. The men were divided into timber, clearing and dynamite crews, grading and trenching gangs, team and tractor units, and a steam shovel and truck unit. A filling station, garage and blacksmith shop were established in buildings on the site and the teams were cared for in an excellent stable, also a part of the property. Tools and equipment were assembled and repaired as required on the job.

Steam shovel grading hill on the first hole

The work was divided into its component parts and assigned to the nine crews of from twelve to twenty men each. Cutting, clearing and burning gangs were followed by the dynamite crews, while these in turn were pressed closely by the tractor rooters, colters and gang-plows. Other tractors with spike-tooth and disk harrows followed in their wake, and then came the horse-drawn drags. At the same time still other crews were busily engaged in roughing out greens and tees, and a trenching gang was at work on the water lines. Nine of the holes were heavily timbered while five of them evidenced typical characteristics of glacial moraine, being ridged and heaped with rock from hand size to boulders of twenty tons or more. On some holes, notably numbers four and six, this condition existed to such an extent that no attempt was made to remove the rock. The steam shovel was put in a rock-free deposit near by and sufficient earth trucked to the holes to cover the rocks, the tops of the protruding ones being mud-capped and blasted off after settlement. Naturally, clearing was work of the first order. All merchantable timber was sent to the mill, being returned shortly in the form of planking for fences, lumber for bridges, blocking for the removal of houses and blanketing for dynamite shots.

Meanwhile the steam shovel and trucks were filling in the old cress lakes to form the fairway for Number Seventeen. 38,000 cubic yards were required at this point and then the shovel moved into the bed of the Swift Run, diverting it westward to the foot of Little Mountain practically the entire length of the course. This stream has a catchment area of nearly twenty square miles of steep mountain land. The run-off is extremely rapid and in a freshet Swift Run is a swirl of mad water. Cattle and horses have been drowned attempting to cross it. In dry weather it is a rocky Sahara, an impossible golf hazard. Hence its diversion. Where it crosses the fifth and tenth holes it was put in a seventy-six-inch reinforced concrete pipe and covered over. There was no compromise with Swift Run.



The 76-inch pipe under the fifth and tenth fairways.

The pipe was cast in two-foot sections in a barn on the site during the winter of 1923-24. Each section weighed one ton and was set in place in the stream bed with the aid of the steam shovel which covered it over as set. This method was used because the uncertain and torrential nature of the stream made the placing of forms and pouring of concrete in its course highly impractical.

One of the most unusual jobs encountered was the moving of a ten-room brick house from the center of Number One fairway to a point on the side of the hill below it. A steel cradle was placed under the house, the foundation removed and the house jacked along on timber cribbing until well off the fairway, where another foundation was built under it and the house lowered to its new resting place. Not a crack appeared in any of its walls.

During the fall and early winter most of the light grading, coltering, rooting and plowing was done with tractors, but as the ground froze deeply, dynamite was used more freely. Later, when the thaw came, horses supplanted tractors as the latter mired and became useless. The tractors were then moved to higher grounds and used for skidding boulders and sledding rock. Meanwhile, air drills were hard at work in the ledge rock outcrops. Water mains were laid in trenches dynamited in frozen earth. Compressed air was used for testing in place of water because of the low temperatures of this period. On the site of Number Three green the frost was forty-two inches deep and the ground had to be blasted ahead of the steam shovel. But, in spite of the cold, excellent progress was made all through the winter. It was particularly essential to have the water system complete and in operation by the time the first seed was sown. At intervals during the winter, when other activities were slowed up

by snow or heavy freezes, hundreds of yards of black dirt were loaded out of the hollows and draws in the adjacent hills and hauled to green and tee sites. A great deal of this material was obtained in the black walnut groves and was singularly free from weeds and other filth common to such soil. Before being applied it was screened through rotary power driven sieves.

Much has been said against spring seeding, but it is doubtful if better results could have been obtained had sowing been delayed until fall. Besides it would have meant the loss of a season's play. This section is the natural habitat of bluegrass, and though the fescues did not show much progress the condition of the bluegrass fairways was little short of phenomenal when the course was opened in October.

Late spring rains delayed planting of the creeping bent stolons until the middle of June and even then much difficulty was experienced in the preparation of the bed due to intermittent rainfall. Most of the greens and tees were in excellent condition, however, when opened to play, and showed continued improvement throughout a season of fairly heavy tramping. The utmost care was taken in cutting and watering and any evidence of crowning or puddling was corrected at once. Light dressings of humus, sand and ammonium sulphate were applied every two weeks. It was found that as much as seven and one-half pounds of the latter to the thousand square feet could be applied with safety if immediately watered in. This amount should seldom be used, however, except in cool, cloudy or rainy weather, or unless applied late in the afternoon. The usual dosage was but three to five pounds. What may seem in excess of the best practice was necessary at Cascades because of the comparatively high lime content of the soil and consequent need for rapidly increasing acidity. To prevent damage to the turf and avoid undue compression of the still light and springy top soil, horse-drawn mowing equipment was used for cutting the fairways and semi-rough, while the rough was cut with a tractor mowing machine. Since 1926, however, tractors have been used over the whole course with excellent results.

Practically no brown-patch was noted until late in the summer of 1925 when it appeared on Number Thirteen and Sixteen greens. Repeated treatments of Semesan eliminated it shortly and the turf made rapid recovery. Perhaps as much credit is due the early morning washing of these greens with a heavy spray of clear water which tended to break up the formation of the mycelium and prevent its spread to the unaffected turf. It should be noted in passing that both of these greens were in low lying areas surrounded by trees on three sides, so that the passage of air over their surfaces was retarded to the point of stagnation, a condition most favorable to the production of the fungus.

A brief compilation of the materials used in the construction of this course, expressed in their units of weight or measurement, together with their carload equivalents, is appended for the benefit of those interested in figures.

Materials	Tons	Carloads—50 Tons or Equivalent
Dynamite, Powder and Exploders	20.24	2
Manure	1,204.27	24
Fertilizer	16.00	1
Sand	1,287.13	26
Seed	5.61	0
Feed	208.63	12
Cement	83.46	2
Crushed Stone	330.00	7
Building Supplies	76.00	2
	Line. Ft.	
Gal. Iron Water Pipe (1" to 6")	31,765	4
3-Ply Rubber Hose (1")	11,400	0
4" T. C. Drain Tile	10,000	1
Wire Cable and Conduit	19,626	0
Fencing Wire	6,435	0
	Sq. Ft.	
Creeping Bent Stolons	181,111	3
Steel Reinforcing	23,200	1
Lumber	37,620	2
Roofing (all types)	7,911	0
	Gallons	
Gasoline and Oils	12,082	1
Paint	373	0
Tools, Equipment and Supplies	.....	1
Boilers, Radiators, Engines	.....	..
Pumps and Fittings	.....	1

This would make a train nearly three-fourths of a mile long. Compared with the actual material handled, earth, rock, timber, topsoil, etc., however, it is a small item.

The whole job was done with local labor who displayed great interest in the progress of the work from start to finish. Its timely and successful completion, in view of the many hardships of the winter of 1923-24, was a tribute to their efforts.

Seepage Water, A Menace to Good Turf Maintenance

By O. B. Fitts

One of the important drainage problems which is most frequently neglected in the construction of golf courses is that of properly taking care of seepage water from side hills. The writer has visited seven golf courses during the past season where his attention was called to poor drainage conditions on at least one green of each course, and in one instance a highly unsatisfactory fairway, resulting from seepage. Yet, in spite of the fact that all greens had been maintained in accordance with the same plan, on these courses, those which were not damaged by seepage water being in good condition, it was difficult to convince most of the greenkeepers that their trouble was due to seepage. This indicates that not only the constructor of each of these courses but also those in charge of maintenance had failed to appreciate the importance of intercepting seepage water and preventing its reaching the putting green or fairway.

Seepage problems are most frequently encountered on putting greens located on side hills, where, in order to get the desired grade, it has been necessary to cut into the slope, leaving a bank rising above the surface of the green, or on greens located on low, flat land near the base of slopes or hills. The trouble in both cases is caused by water