

## GEPS - Collaboration between EXLTERRA and Aa Saint-Omer Golf Club

### Comparative Empirical Observation Study - N+1 and N+2 Observation Report

#### Installation

At the beginning of September 2020, the GEPS system was installed on our course, on 2 areas identified by my team as having stagnant water problems: the part near the green of our Fairway n°5 and a practice bunker.

At the time of your visit, the installation site was completed in 4 days for the 2 zones thanks to your professional team, which was concerned with respecting our quality constraints. The installation was done locally, without the need to be connected to a network. The stigmata were almost invisible to the players and we were able to reopen the game as soon as your drill rig left the affected areas. This is a very positive point of your system.



*September 2020*

*GEPS installation: preparation and condition of the area for reopening to play*



#### Observation – N+1

After 1 year of observation and use of the system we were able to see the technical performance of GEPS:

- On our fairway, the system acclimatized very quickly since it was already quite effective from a water infiltration point of view after 4 weeks and we were able for the first time to mow the entire fairway all year long.
- We note a stabilization and a greater firmness of the ground in wet periods in this zone in direct comparison with the beginning of the same fairway which is not equipped with GEPS.

- The passage of machines no longer poses real problems and the traces in very wet periods are now minimal and the impact on the game is considerably reduced.
- All these benefits are the effects of GEPS since to demonstrate its performance we did not perform any mechanical operation on this area (1 fertilization in April). Thus, we did not need to decompact, sand or lime this area to obtain these improvements in terms of infiltration, bearing capacity and drainage.
- We had a "winter green" positioned far upstream of the 5th green and thanks to the improvement of the fairway area equipped with GEPS, we would be able to move this "winter green" in the next few weeks to allow a longer playing distance for the pleasure of our players.

***Illustrations of the GEPS-equipped fairway improvement:***



*March 2020*

*Before installation of  
GEPS*



*4 November 2020*

*8 weeks after installation*

*81 mm of rain in September*

*217 mm of rain in October*



*28 January 2021  
After 209 mm of  
rain in 3 weeks*



*28 June 2021  
After 100mm of rain in  
3 weeks*



*3 October 2021*

*After 70 mm of rain during the week: the blue line shows the limit of GEPS installation.  
No trace 2 days later*

- In our bunker, the effects were slower but after a particularly rainy winter we are now very satisfied with the improvements made by GEPS.
- We still notice the presence of stagnant water at the low point of the bunker during heavy rains, but the excess water is evacuated much faster than before. When it could stagnate for several days, it is now completely evacuated in less than half a day for the heaviest rainfall (+30mm/day).

- This bunker is also used much more than before since rainfall hardly disturbs this playing area. Our pro is particularly pleased to be able to teach in this area in all seasons.
- We are still seeing improvements in the rate of water infiltration into this bunker and are excited to be able to continue to observe the effects of this system as part of the natural water cycle and which promote groundwater recharge.

This first year of observation was particularly rainy and therefore allowed us to quickly put the GEPS in conditions of excess water to infiltrate. The effects observed were convincing and the feedback from the players was very positive.

### Observation – N+2

For this second year of observation, we were confronted with unprecedented drought conditions. Temperatures exceeded 40°C [Note: 104°F] during the peak of the heat wave and rainfall was almost nil during the months of July and August.

However, these weather conditions allowed us to observe the effects of GEPS in a completely different climatological context than the first year and until now rather exceptional for our region.

### Seasons: Fall/Winter

- On our fairway, the system has allowed us to keep the area "dry" all winter long and thanks to this improvement in water infiltration, the bearing capacity of the course is much better. Vehicle traffic (grounds crew and players) is no longer a problem.
- We still note a stabilization and a greater firmness of the ground in wet periods in this area in direct comparison with the beginning of the same fairway which is not equipped with GEPS.
- We had a "winter green" positioned far upstream from the 5th green and thanks to the improvement of the fairway area equipped with GEPS, this "winter green" has been moved closer to the green to lengthen the game a little, to the delight of our members.
- In our bunker, we unfortunately still notice the presence of stagnant water at the low point of the bunker during heavy rains. The quantities are less compared to the same conditions before the installation of the system but it would seem that the shaping of the bunker and the general shape of the area require a more important system. It may be worthwhile to extend the installation of GEPS around this bunker and particularly in the lower area to help finish "emptying" the bowl area that limits natural runoff during rainfall.
- However, this installation remains a real success since we are still seeing improvements in the speed of water infiltration in this bunker.

- This bunker continues to be used much more than before as light rainfall no longer disturbs this area of play. Our pro is always very happy to be able to teach in this area in all seasons and the members are unanimous on the improvement noted.

Seasons: Spring/Summer

- The spring was marked by rather dry periods interspersed with an episode of snowfall with an accumulation of 20 cm at the beginning of April which imposed a closure of the course for 4 days. The bunker in the practice area took a little time to empty, certainly due in part to the water temperature since almost all the bunkers on the course had some standing water while the snow melted.
- The fairway area equipped with GEPS was ready for play as soon as the course reopened.
- The rest of the spring was then rather dry for the region and the lack of water was quickly felt in the un-watered areas at the beginning of the summer drought.
- The training area bunker had no stress during the summer.
- Fairway n°5, like all the fairways on the course, is not equipped with automatic sprinklers but the area equipped with GEPS behaved completely differently.

***Monthly rainfall readings on the course since 2012: (in mm/m<sup>2</sup> = liter/m<sup>2</sup>)***



MOIS	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
JANVIER	98	87	128	152	100	58	154	77	88	216	88
FEVRIER	20	77	204	43	123	52	38	75	200	47	72
MARS	104	58	68	27	91	54	88	114	123	55	17
AVRIL	151	42,5	37,5	19	84	18	93	32	27	16	70
MAI	59	29	96	47	103	71	88	25	11	78,5	35
JUIN	120	47	34	31	100	27	37	78	61	107	45
JUILLET	126	63	91	61,5	21	80	17	32	79	122	3
AOÛT	42	28	133	82	52	129	77	48	156	116	3
SEPTEMBRE	69	62	36	112	49	117	34	105	81	35	137
OCTOBRE	232	207	104	56	115	75	52	157	217	109	52
NOVEMBRE	177	188	77	150	177	130	60	163	77	190	250
DÉCEMBRE	212	133	130,5	78	21	124	155	171	153	145	209
<b>TOTAL</b>	<b>1410</b>	<b>1022</b>	<b>1139</b>	<b>859</b>	<b>1036</b>	<b>935</b>	<b>893</b>	<b>1077</b>	<b>1273</b>	<b>1237</b>	<b>981</b>

(in blue the highest monthly readings and in red the lowest monthly readings since 1997)

The rainfall records attest to the very particular climatic episode that we experienced this year. If the cumulative rainfall for the year is almost average, we notice that at the end of August we had received only 333 mm of rain per square meter, which represents only 1/3 of the annual volume in 8 months. The difference with the year 2021 is particularly noticeable in the summer period.

We can see on the following pictures that our fairway area equipped with GEPS has remained green and dense unlike the rest of the fairways and we can really see the limit of GEPS installation on this area.

***Illustrations of the maintenance of vegetation cover in periods of drought:***



*19 July 2022 – Area of Fairway n°5 equipped with GEPS*



*11 July 2022 – Fairway n°13: Area not equipped with GEPS*

- While the two photos were not taken on the same day or with the same sunlight, the difference in plant cover is striking. The GEPS system allowed for some moisture to be maintained, which is essential for turfgrass activity. Only in this area was the ground cover not under water stress.
- We do not have any automatic watering systems on the fairways. This green and rather dense aspect is therefore a result of the installation of GEPS in this area.
- The mowing time for the fairways is usually 15 hours twice a week. The drought has changed our maintenance plan as we have been mowing only 2-3 hours per week in the areas near the sprinklers to keep the course clean and limit summer grass growth.

- Only the area equipped with GEPS had a continuous growth, weaker than in spring, but we mowed it every week.

### Assessment and Outlook

During these two years of monitoring the effects of GEPS on the course, we have had the opportunity to observe the behavior of the course under all types of weather conditions.

Although our observation is only empirical, we have been able to note positive effects that have modified, facilitated and improved our maintenance of the course.

Our initial expectations were primarily to infiltrate water and improve the bearing capacity of the land, but we were also able to see the contribution of GEPS on the quality of the vegetation cover in periods of drought without watering.

With the evolution of the climate and the major importance of preserving water resources, it seems essential to us to rethink the maintenance of golf courses, within the limits of each person's capacities. Your GEPS system, which is part of the natural water cycle and favors the recharging of groundwater, appears to be a particularly suitable possibility from both a technical and an eco-sustainable point of view.

We are pleased to recommend your GEPS system, which offers real advantages in all seasons and is beneficial for the field and the players..



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