CASE STUDY 8: STRATEGIC SUBSURFACE DRAINAGE

Poorly drained soil types in lower landscape positions are often subject to significant loss of soil nitrate, loss of applied fertilizer N, and high crop mortality. They cause application inefficiency (tractor ruts and overlap areas), and when crops struggle to successfully grow, these areas are at risk of salinization and further soil degradation. The case study field is located in Manitoba, Canada. Some areas (mainly SWAT zones 9-10) were consistently unproductive or too wet to be seeded, prior to subsurface drainage installation (field NDVI shown in Figure 1, SWAT MAP and soil tests shown in Figure 2).

Targeted drainage lines were installed in June 2021, with these areas showing significant improvement over time (Figure 1, right). In situations like this, it can take several years for salts to leach to the drainage lines and reduce impact on crop yields. Once crops are able to grow, they help use excess surface water and regenerate soil productivity even further.

The risk of subsurface drainage is that nitrates, or even phosphates, can leach with water and end up in surface waters further downstream. But leaching of these nutrients can be managed well with consistent soil testing and VR application to manage soil nutrient levels. In this field, phosphorus leaching is not a concern due to pH and texture, and nitrogen rates have been reduced by 45-95% in zone 10 since drainage was installed. Once productivity is restored, the crop is using available nitrates, and nutrients are managed well, risk of nutrient loss is relatively low.

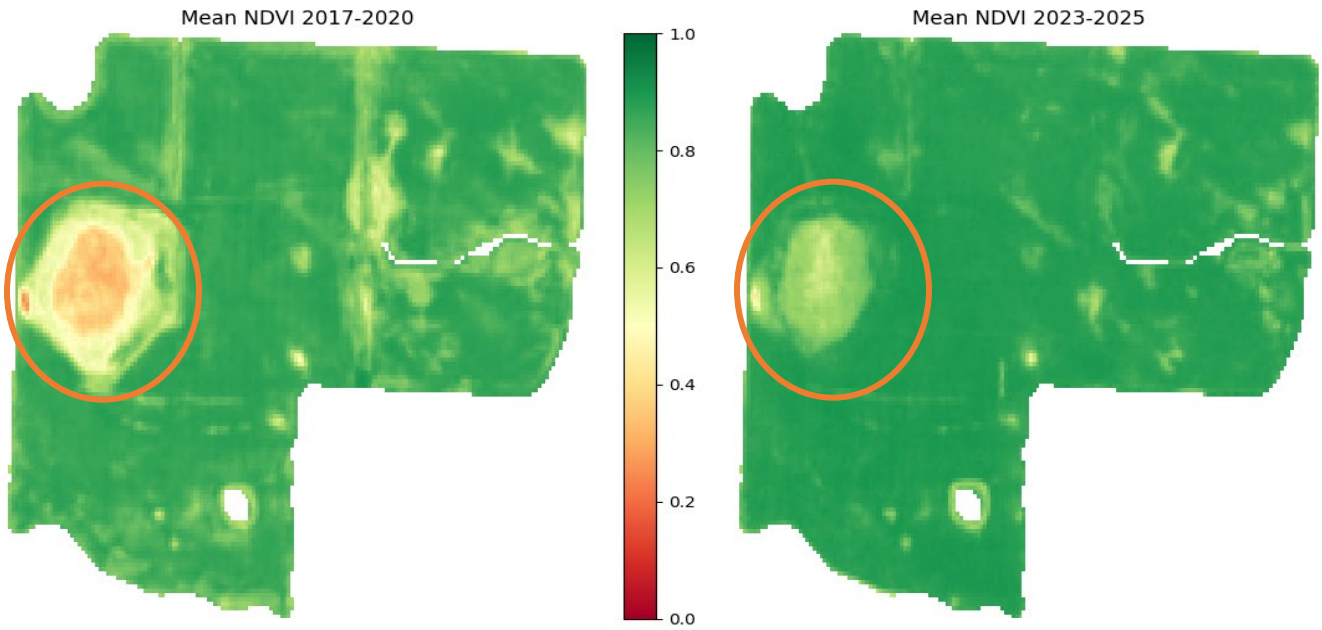
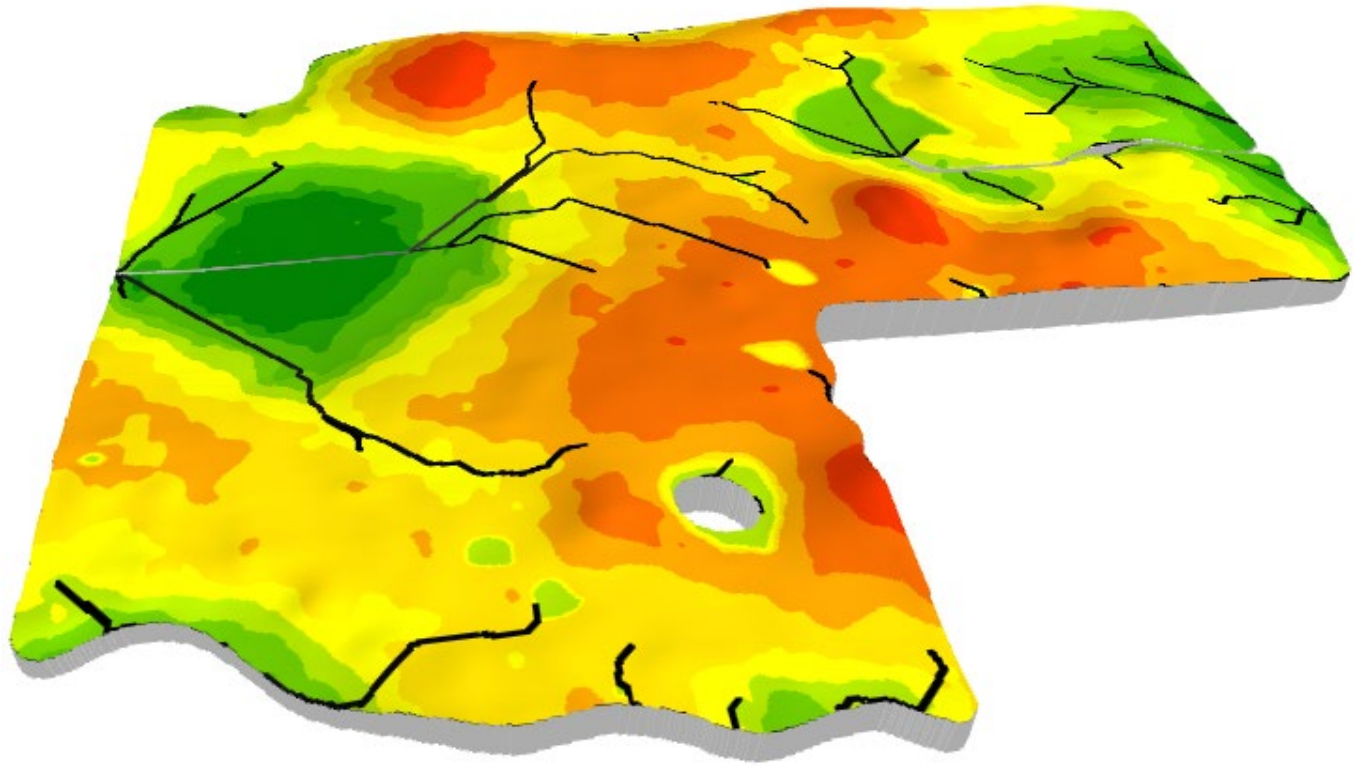


***Figure 1**. Mean Normalized Difference Vegetation Index (NDVI) before (left) and after (right) drainage installation. Key impact area circled.*



Field Area	Depth	N Year	OM (%)	pH (H2O)	NO3 (lbs)	P Olsen (ppm)	K (ppm)	S (lbs)	Cl (lbs)	Na (%)	EC (dS/m)
zone 1,2	0-8 in	2021	8.5	6	63	28	486	27	7	0.2	0.34
zone 3,4	0-8 in	2021	9.9	6.1	63	26	682	40	5	0.2	0.4
zone 5,6	0-8 in	2021	8.4	5.8	49	26	488	37	4	0.2	0.34
zone 7,8	0-8 in	2021	9.3	6.4	60	50	614	160	9	0.5	0.97
zone 9,10	0-8 in	2021	13.8	7.9	61	36	951	160	135	7.0	5.4

***Figure 2**. 3D SWAT MAP and soil tests taken shortly after drainage installation showing Na, S, and Cl based salts contributing to high EC that limited productivity in zones 9-10.*