UTILIZING NATURAL WATER, SOIL AND TERRAIN FEATURES FOR OPTIMAL IRRIGATION POND ALLOCATION

INTRODUCTION

In Viskan Valley close to Horred lies the farm Kyrkebacka where my brother is growing organic vegetables. To protect his crops from dry summers in the coming years, he is planning to create an irrigation pond to store water for later use.

The farmland belonging to the farm extends in both directions from the farm. The northern field is situated fairly high, making the southern field more appropriate for creating a wetland as rain water is accumulated here.

What additional natural factors could influence the placement of the pond and how could it be designed to make effective use of these?

METHOD

On order to find the most suitable placement, following parameters has been identified on the site and taken into account when making a multi criteria evaluation (MCE):

- Soil type most suitable for retaining water
- Flow accumulation (rainfall)
- Existing depressions
- Soil moisture

The flow accumulation was calculated from a digital elevation model and explained in the flowchart. As for the soil types, a pond bed of post-glacial clay would be better at retaining water than the courser glacio-fluvial sand and is therefore included in the MCE (see constituent sub-maps). Depressions and soil moisture were added to give a clue of existing water accumulation tendencies, topographically and hydrologically.

In addition, one should also take in consideration the shape and size of the pond in regards to land use efficiency, i.e. can the pond be located on a part of the field which otherwise would be difficult to cultivate?

All analyses and map productions were carried out in ArcGIS Pro. On site knowledge was obtained through a field visit and dialogue with my brother.

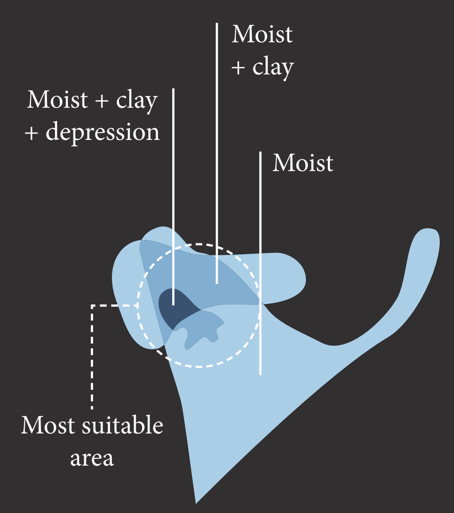
SITE EVALUATION

Four possible placements for the irrigation pond are marked out on the map. Pros and cons for the sites are discussed under each proposal-map respectively (*a–d*).

RESULTS

From the MCE the centre area is what stands out as the most interesting site for an irrigation pond, due to the soil being the most moist, the soil type clay and an already existing depression makes it more likely to flood. It is also in direct contact with the accumulated flow from north-east.

On the upper half and in the west corner two marl pits has been identified. Enlarging these, either one or both, could be an option which also reconnects to the cultural heritage of the site. Due to its higher pH, marl pits often makes for good environments for flora and fauna sensitive to acidic environments[1]. This makes it a good place for an irrigation pond when considering ecological values, but a poor choice since both marl pits are situated on relatively dry ground. However, marl pits are relatively deep, which lowers their evaporation.



DISCUSSION

The four different pond designs all capture different site qualities, each having their pros and cons. Due to the small size of the farm my brother finds it hard to motivate the construction of a relatively large pond with flatter edges, even-though it brings with it ecological benefits. This applies to *a*, *b* and *d*.

Proposal *c* could with its potentially more alkaline water environment also bring with it positive ecological features as marl pits often serve as wildlife refuges in agricultural landscapes, however, one should bare in mind that the use of the pond for irrigation will alter the water level severely.

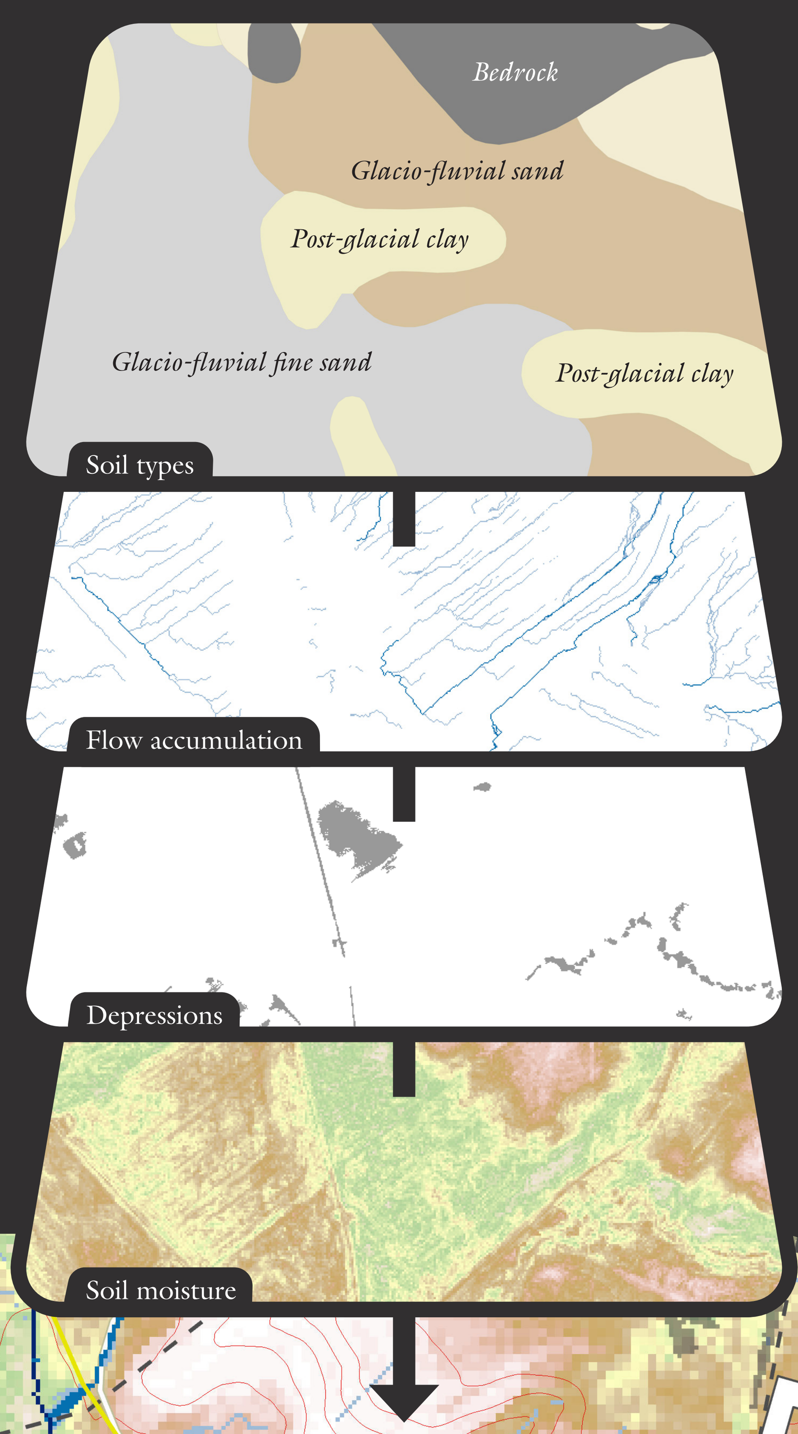
Another option which could be relevant is to redirect Kyrkebacka gutter, a relatively large amount of water from the underground reservoir further north. It flows along the east side of the road that leads up to the farm and when it reaches down the hill most of the water flows to the field south of my brothers property. By installing a pipe further up one could redirect this water, even making proposal *d*, which otherwise would be too dry, possible. Since Kyrkebacka gutter constantly flows, the absence of good water retaining soil might not be that big of a problem. Another pro for proposal *d* is its otherwise narrow and difficult shape in terms of cultivation now could find greater value as a bigger pond with more wetland-like flatter slopes. That also applies to proposal *a*, placed in the skewed angles formed by the ditch which makes plowing and sowing with the tractor more efficient thanks to its more orthagonal shape.

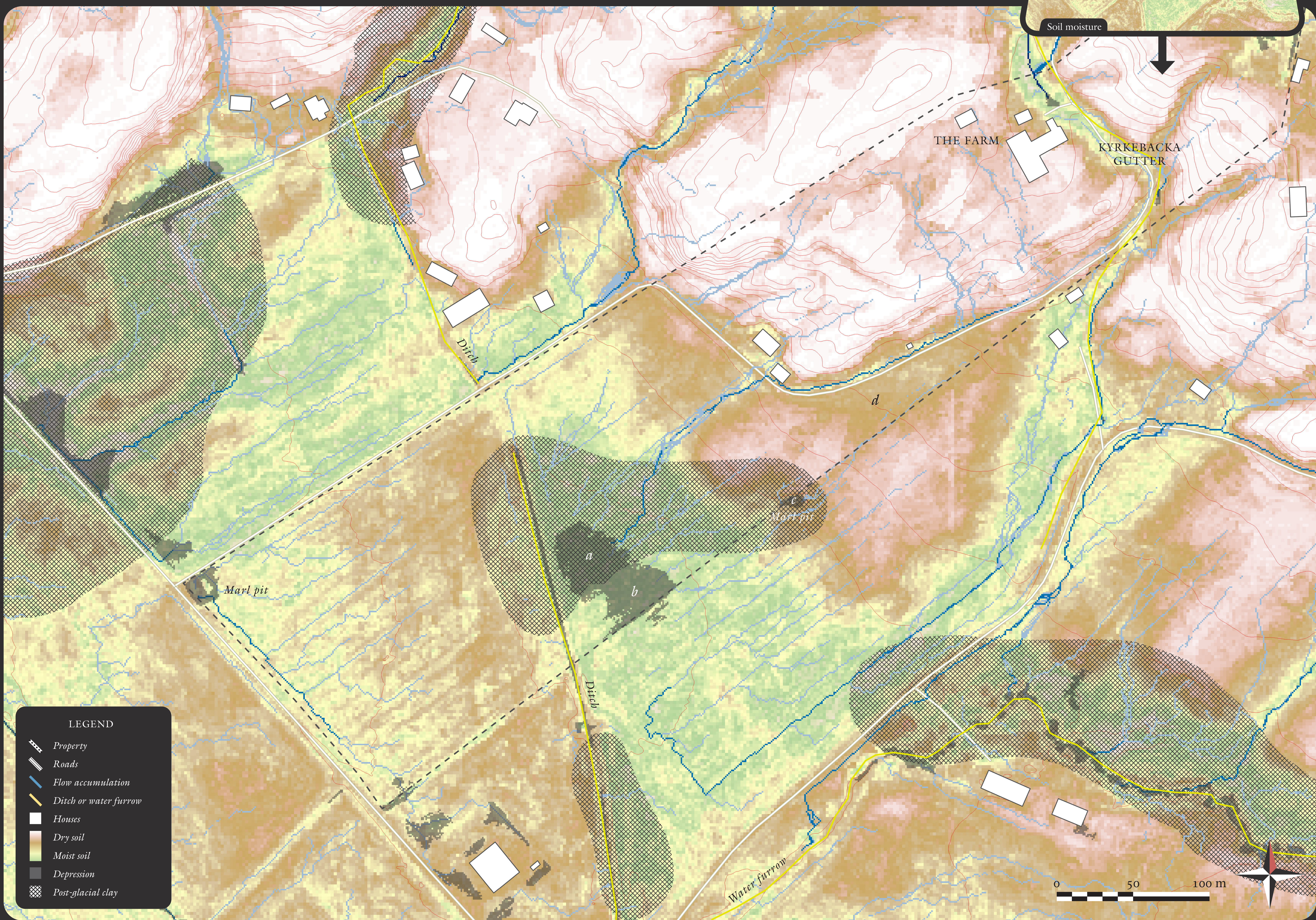
Eventhough the whole field has a french drainage, the part just north of the ditch seem wetter than what would be expected. This could indicate that the drainage does not work correctly. After plowing it was clear that this part of the soil is more on the heavy side, making it more difficult to cultivate. An irrigation pond would thus make better use of the land.

POTENTIAL ERRORS

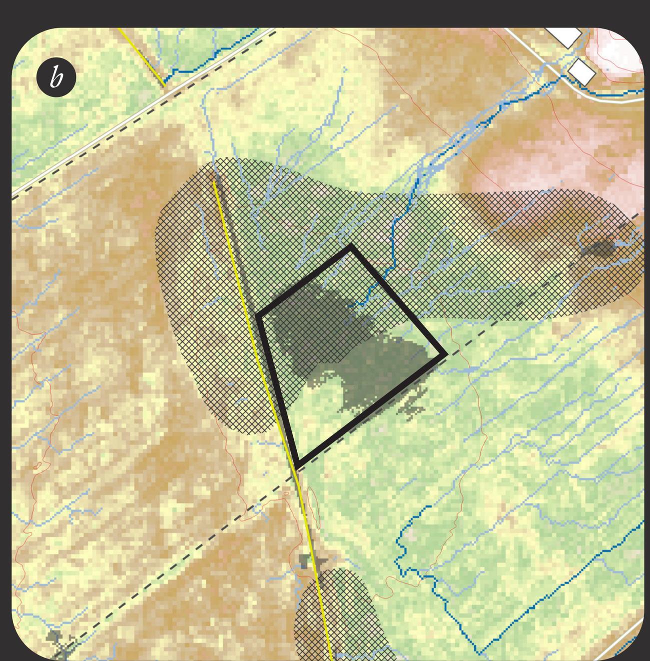
A dataset with high potential error is the soil type from SGU. On the scale 1:25 000, which is being used here, the error can be up to 25 metres. Since the work area is relatively small careful examination of the soil must be made to ensure a good result.

1 Mikael Bengtsson (2017), *Märgelgravar i Åstorps kommun: Förändringar i förekomst över tid och lokalisering i landskapet*, Högskolan Kristianstad, Kristianstad.

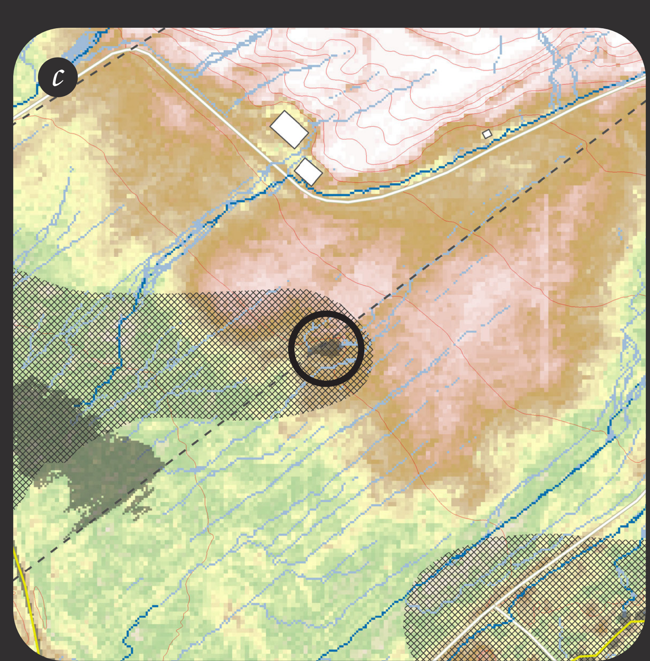




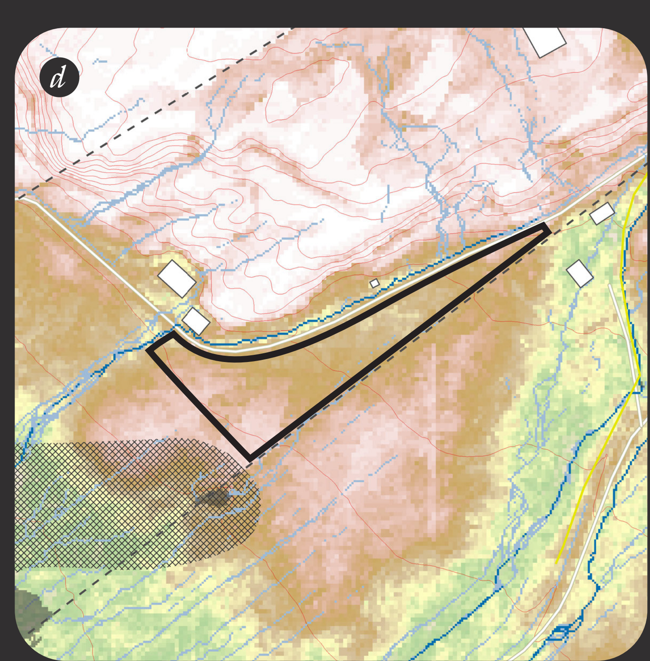
+ Good flow
+ High moisture
+ Using natural depression
+ Good water retaining capabilities
+ Very good landuse
– Could disturb flow in ditch even more



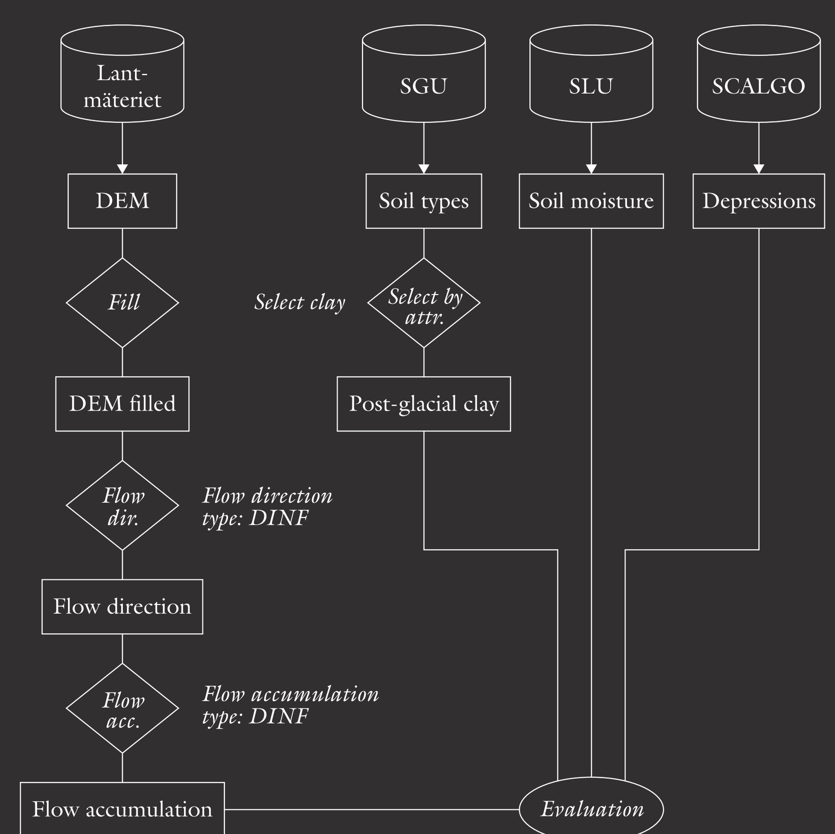
+ Good flow
+ High moisture
+ Practical shape
+ Using natural depression
+ Good water retaining capabilities
– Could disturb flow in ditch even more



+ Historical connection
+ Alkaline environment for flora/fauna
+ Using natural depression
+ Good water retaining capabilities
– Not entierly on property
– Dry area
– No natural flow



+ Very good land use
+ Close to flow
– Poor water retention capabilities
– No natural flow
– Uses good soil for farming



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Advanced digital landscape analysis with GIS