



Qualitative Water Shortage in the North of Lower Saxony: Solutions for the Antifreeze Irrigation

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Introduction



- in 2015 in Lower Saxony (Germany) approx. 18,000 ha of vegetables were cultivated
- antifreeze irrigation serves the protection of plants from freeze to death during the flowering period
- common practice in the north of Lower Saxony to avoid future crop failures
- investigation area is called Altes Land, where up to 1,000m³ water per night and ha are needed for the antifreeze irrigation
- usable fresh water must have a quality of no more than 0.2 to 0.3 ‰ salt content

Antifreeze Irrigation

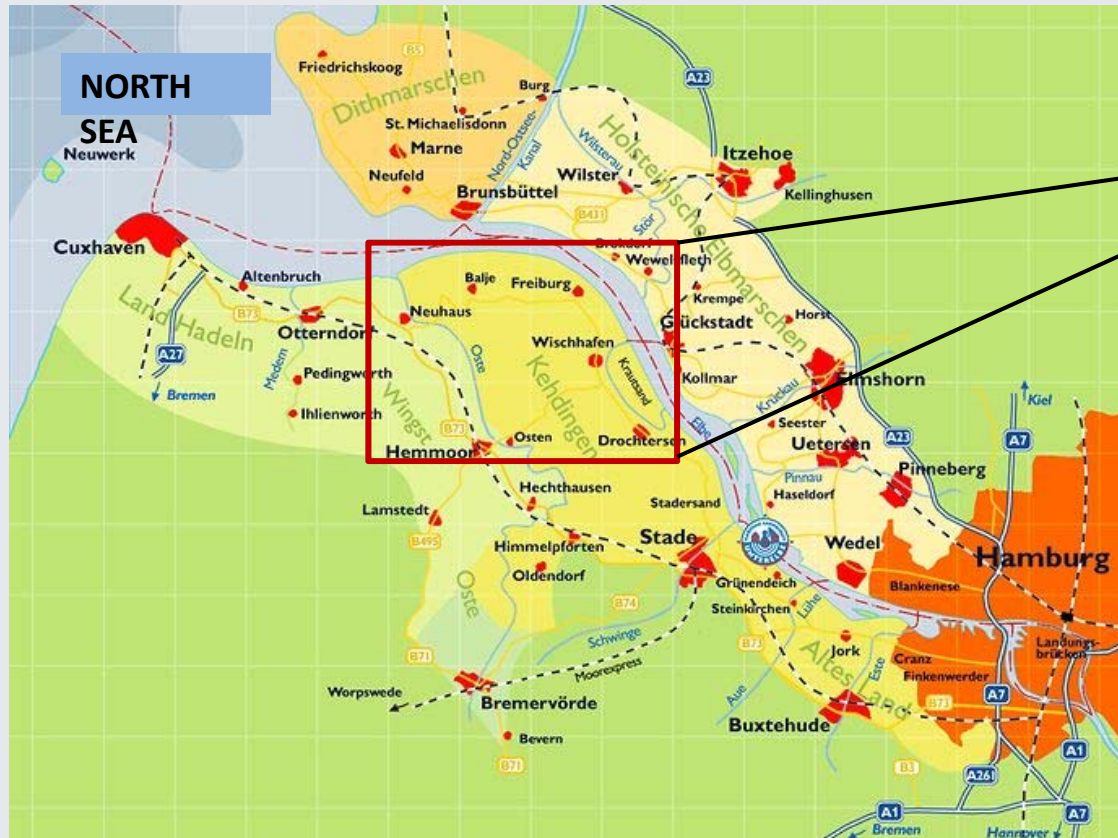


Introduction

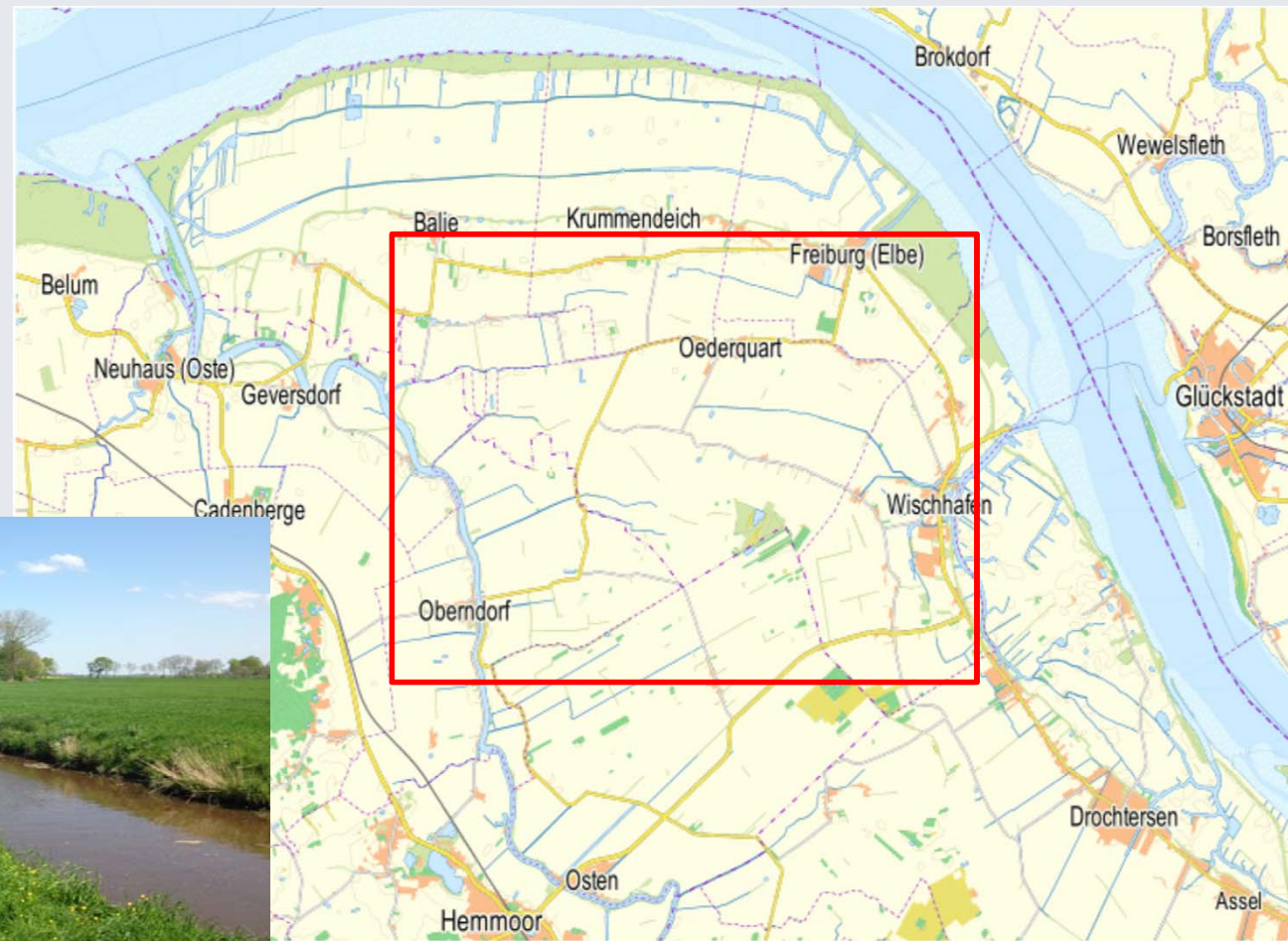


- water for the antifreeze irrigation is currently fed into the various marshes in the area via the dikes of the Elbe River
- due to the increasing Elbe depression, several rivers in the Elbe catchment of Altes Land do not contain anymore proper fresh water, and reached already a salt content of $>1 \text{ ‰}$
- brackish water zone of the Elbe River is shifting downstream causing a qualitative water scarcity
- need for an alternative fresh water supply
- need for irrigation water has steadily increased also due to recent climatic changes

Setting and Location



Setting and Location

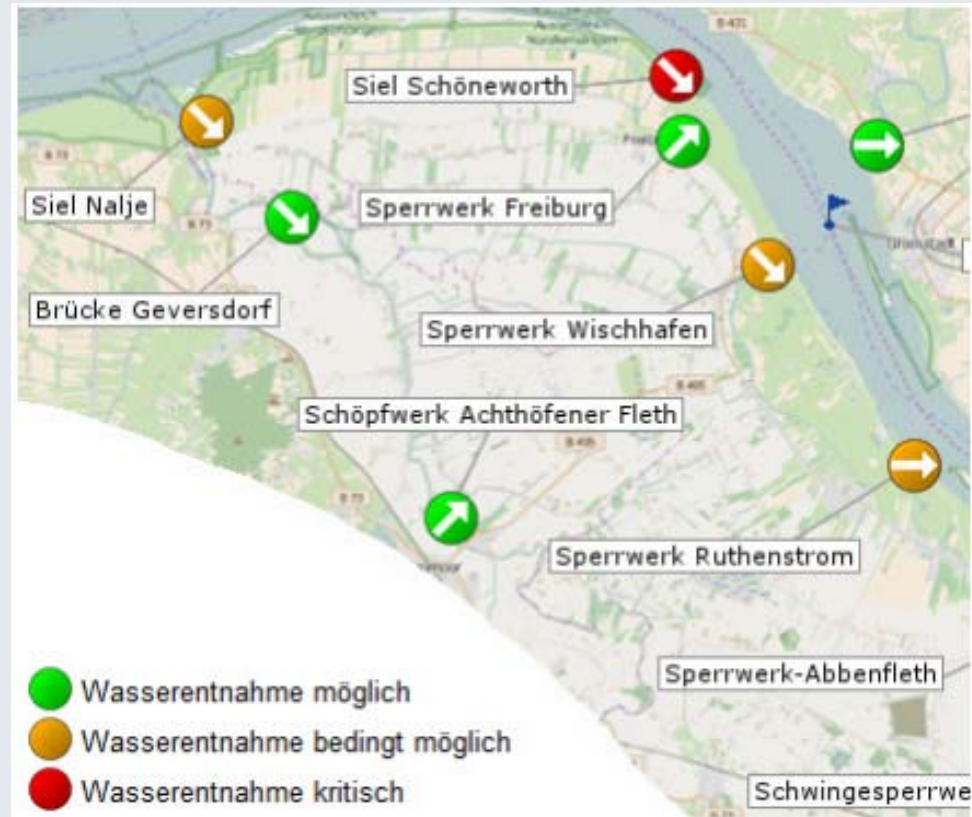


Setting and Situation



Salinity

- Antifreeze irrigation before flowering: ≤ 1.0 g NaCl/L
(≈ 3600 mS / cm)
- Moisturizing irrigation: ≤ 0.5 g NaCl/L
(≈ 1900 mS / cm)



(www.portal-tideelbe.de)

Scope and Approach



- to determine alternative fresh water supply options outside the Elbe River, especially for the Freiburg-Schleusenfleth water system
- a connection to the Oste River was examined as a preferred variant
- the water demand was determined, and inventoried in terms of the current water availability
- further was conducted a deficit analysis of the current water supply and an option analysis

Overall scope: reduction of risk for qualitative water stress

General Technical Solutions

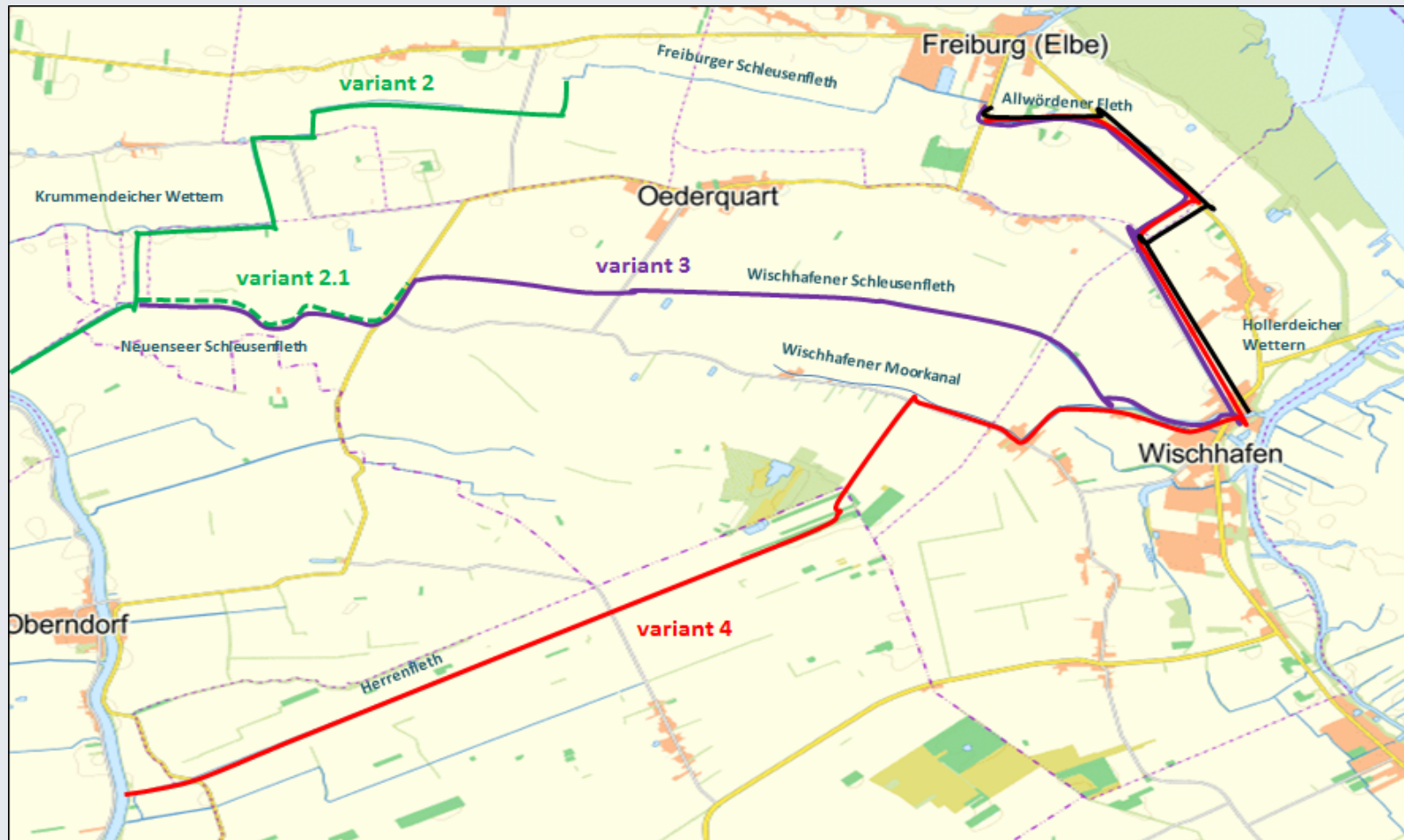


- water provision through gravity flow or by pumping from tributaries and / or adjacent areas
- increasing the storage volume by creating new irrigation ponds or reservoirs and / or river widening
- injection from the existing drinking water network or wells.

Gravity Flow Options

Variants	General location
1	Oste – Wischhafener Schleusenfleth - Hollerdeicher Wetteren - Allwördener Fleth
2	Oste – Neuenseer Schleusenfleth – Krummendeich – Freiburger Schleusenfleth
2.1	Oste - Neuenseer Schleusenfleth – Krummendeich – Freiburger Schleusenfleth (alternative location)
3	Oste – Neuenseer Schleusenfleth – Wischhafen – Freiburger Schleusenfleth
4	Oste – Herrenfleth – Wischhafen – Freiburger Schleusenfleth

Vizualisation of the Options



Options



Option 1: Length: approx. 6 km

Construction costs (estimated): approx. € 1.37 million (trench)

Construction costs (estimated): approx. € 2.87 million (tube)

Option 2: Length: approx. 9.5 km

Construction costs (estimated): approx. € 2.4 million (trench)

Construction costs (estimated): approx. € 4.5 million (tube)

Option 2.1: Length of the supply route: 20.6 km

Construction costs (estimated): approx. € 3.2 million (trench)

Construction costs (estimated): approx. € 5.26 million (tube)

Options



Option 3: approx. 20.6 km

Construction costs (estimated): approx. € 3.55 million (trench)

Construction costs (estimated): approx. € 6.15 million (tube)

Option 4: Length: approx. 20.4 km

Construction costs (estimated): approx. € 4.48 million (trench)

Construction costs (estimated): approx. € 8.86 million (tube)

Conclusions



- Concept 1 is considered a feasible variant:
 - if the depression of the Elbe does not cause a significant change to the expected salt content in the Elbe river at Wischhafen.
- Concept 2 is considered the most cost-effective variant:
 - an optimal solution with regard to the resolution of saltwater intrusion problems in the Lower Elbe at Freiburg and Wischhafen, and ***therefore preferable***.

Conclusions



- Concept 3 is not considered a preferred option:
 - not economically feasible.
- Concept 4 is also not considered a preferred option :
 - not economically feasible. The option might become relevant for an upstream shifting of the brackish water zone in the Oste river.

Conclusions



- all variants are technically feasible, the difference is made up by the cost
- beside the Elbe waterway deepening, the salt water problem will be significantly worsened in the future by climatic changes
- design might be feasible also as “flying tube” with additional cost



Outlook



- need for a regularly monitoring of the saltwater problem on the Elbe river
- further investigation needs to concern the impact of the planned navigation channel adaptation on the brackish water zone of the Lower Elbe





Thank you for listening !

