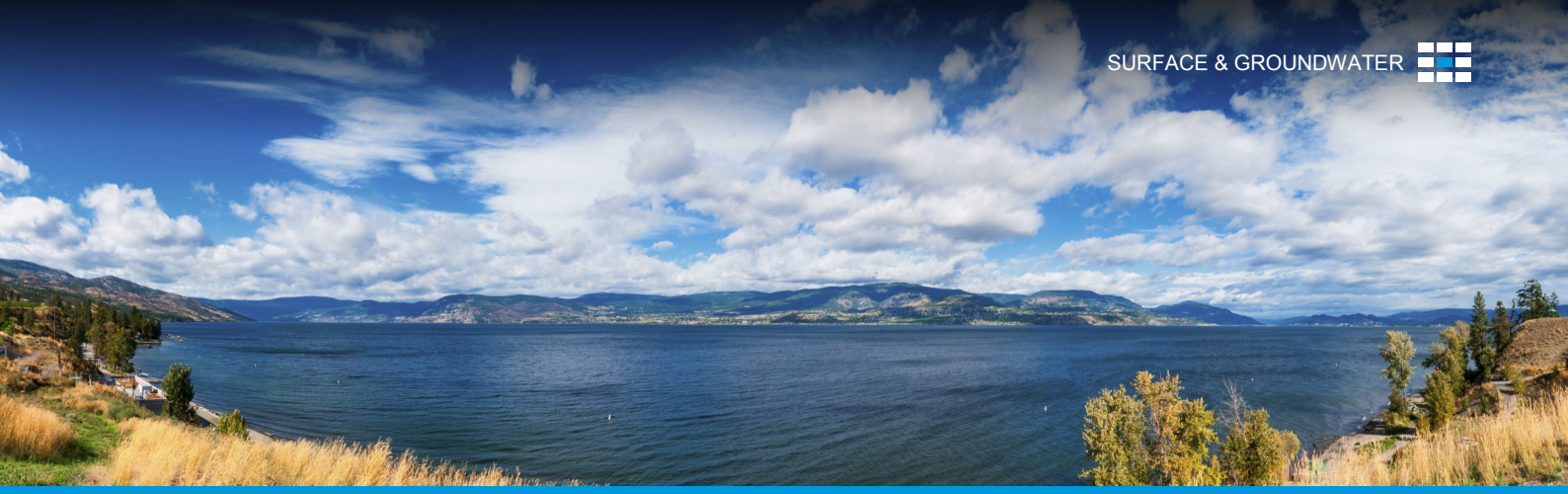

DHI CASE STORY

# DEVELOPING A HYDROLOGIC MODEL FOR THE OKANAGAN BASIN

## Enabling a better understanding of water supply and demand issues

An increasing population and competing water demands has caused concern about the long-term sustainability of the Okanagan Basin. In collaboration with Summit Environmental, we developed a hydrologic model for the Okanagan Basin Water Board (OBWB) to help authorities assess water needs and availability. The OBWB used the model to evaluate the potential impacts of climate change, land use change, and water consumption on the overall water balance in the Basin. This will assist the OBWB with shaping water resources management policies for the Okanagan Basin – now and in the future.

### COMPETING WATER DEMANDS

The 21,600 km$^2$ Okanagan Basin, located in the interior of British Columbia in Canada, spans almost 200 km, from the cities of Osoyoos in the South to Armstrong in the North. The climate in the basin is generally dry because it lies in the rain shadow of coastal mountains. Only a small fraction of the precipitation that does fall makes it to Okanagan Basin's five main lakes that connect along the valley bottom (mainstem lakes): Kalamalka, Okanagan, Skaha, Vaseux and Osoyoos. This is due to the natural environment and competing water demands from municipalities and agriculture.

Due to steady population growth in this area, the Province of British Columbia (BC) became increasingly concerned about the sustainability of water use and water management in the Okanagan Basin. As such, the Okanagan Basin Water Supply and Demand Project was initiated to evaluate current and future supply and demand for water in the Basin. The project is a partnership between the Okanagan Basin Water Board (OBWB) and the British Columbia Ministry of Environment with significant contributions from:

- the British Columbia Ministry of Agriculture
- the British Columbia Ministry of Community Services
- Environment Canada
- Agriculture and Agri-Food Canada
- Fisheries and Oceans Canada
- the Okanagan Nation Alliance

### SUMMARY

#### CLIENT

Okanagan Basin Water Board (OBWB)

#### CHALLENGE

Need to develop a basin-wide hydrologic model capable of:

- evaluating the impacts of mountain pine beetle infestation, climate change and different land use scenarios
- incorporating detailed water accounting information and data on seasonal reservoir operations

#### SOLUTION

Development of an Okanagan Basin Hydrology Model (OBHM) and an Okanagan Basin Water Accounting Model (OBWAM) in collaboration with Summit Environmental

#### VALUE

Enabled authorities to:

- evaluate the hydrologic impacts of climate change, land use change, and different water demand scenarios
- estimate present and future water needs and availability
- evaluate water management policies to plan for necessary changes or additional investments required to ensure future water security

#### LOCATION / COUNTRY

Okanagan Basin, British Columbia, Canada

The goal of the project was to provide an estimate of present and future water needs and availability, taking into account:

- population growth
- climate change
- land use change
- preservation of the environment
- other factors

The hydrologic model was used to construct a custom Water Accounting Model for the Basin. This will help make agencies and the general public more knowledgeable of water supply and demand issues in the basin.

*Map of the Okanagan Basin. Used with permission from the Okanagan Basin Water Board.*

## SHAPING WATER RESOURCES MANAGEMENT POLICIES

As part of the project, the OBWB conducted a Surface Water Hydrology and Hydrologic Modelling Study. OBWB needed to be able to model simplified hydrologic processes initially, then gradually implement more detailed and complex processes in future phases of the project once more data was collected. This included groundwater and surface water interaction. An external consultant previously selected MIKE SHE and MIKE 11 (both a part of our MIKE by DHI software) due to the flexibility and scalability they provided.

For this stage of the project, we prepared the hydrologic model. The model represented the historical hydrologic conditions and responses of the entire basin using data on:

- gridded climatic data
- spatially-distributed land-use data
- spatially- and temporally-distributed vegetation data
- spatially-distributed soils data
- groundwater aquifer characteristics
- detailed river networks

We calibrated the model against 11 years of continuous stream flow measurements and snowpack measurements at locations throughout the basin until the model provided an accurate representation of basin hydrology for a wide range of conditions.

We used the hydrologic model to calibrate a MIKE 11 hydraulic model of the five mainstem lakes in the basin. This including calibrating the model to historical dam operations and lake levels throughout the 11-year calibration period. The calibrated model was then used as a predictive tool to estimate the individual and combined impacts of:

- population growth
- water efficiency policies
- climate change
- deforestation due to mountain pine beetle infestation and clear cutting

The final results of the model were made available through the Okanagan Water Database, a central repository of water data for the basin. The results of future modelling scenarios will be used by the OBWB to help shape water resources management policies for the Okanagan Basin. These results will be made available via a web portal as a public communication tool to support the policy development process.



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