



## HELPING SAN DIEGO SUPPLY SAFE AND RELIABLE WATER

Developing a hydraulic transient model for San Diego County Water Authority

San Diego County Water Authority's (SDCWA) mission is to provide a safe and reliable water supply to its 24 member agencies in the region. Its member agencies – which include cities, districts and a military base – in turn provide this water to a USD 130 billion business economy and three million residents in San Diego County. DHI has been awarded a contract to develop a dynamic transient flow model that will be suitable for modelling SDCWA's conveyance and distribution system, including but not limited to pipelines, hydraulic facilities, reservoirs and aqueducts, as well as relevant facilities of other local agencies that have a significant hydraulic influence on the SDCWA's system.

### TOO COMPLEX FOR OFF-THE-SHELF SOFTWARE

SDCWA's water supply system consisting of 300 miles of pipelines has been developed over the last 60 years through a sequence of individual projects. The primary concerns underlying the majority of studies into hydraulic transients are in establishing a safe operating environment, analysing extreme pressures, designing system and facilities, as well as analysing their consequences.



Construction of water transmission pipelines. © SDCWA

### PARTNER

Flow Gradient Dynamics Inc.

### CLIENT

San Diego County Water Authority (SDCWA)

### CHALLENGE

Need to establish a safe operating environment, analyse extreme pressures, design of system and facilities, as well as analyse consequences of hydraulic transients.

### SOLUTION

Development of a hydraulic transient model to model the client's entire conveyance and distribution system.

### VALUE

Our client now has an all-rounded model using up-to-date data for the planning, operation and maintenance of their water supply system. This model can also be used by other consultants to SDCWA.

### LOCATION / COUNTRY

San Diego, USA

### SOFTWARE USED

MIKE URBAN FGDHT

Because of the complexity of their hydraulic system, no standard off-the-shelf software could be used. SDCWA needed an up-to-date hydraulic model of their system and required an experience consultant to develop the hydraulic engine from which the updated model could be created.

DHI worked on this project in partnership with Flow Gradient Dynamics Inc. (FGD). FGD provided their numerical engine that was further enhanced as part of this project. DHI developed the software interface so that the engine could be used for model building, modelling, and result presentations. We were leading the project, which started in 2008 with a duration of three years followed by five years of extended services and support. Most of the model building – from the geographic information system, engineering drawings, as-built drawings, schematic diagrams along with interviews of SDCWA personnel – was done by DHI. Extended services were focused on expanding the model to add new areas and training in terms of capacity building and development of training materials and videos.

### SERVICE AREA

SDCWA's boundaries extend from the international border with Mexico in the south to Orange and Riverside Counties in the north, and from the Pacific Ocean to the foothills that terminate the coastal plain in the east. With a total of 920,000 acres (1,437.5 square miles), our client's service area encompasses the western third of San Diego County. The Authority supplies 75 to 95 percent of the region's water needs, depending on the amount of annual surface runoff into local reservoirs.



Our client's service area encompasses the western third of San Diego County. © SDCWA

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### MIKE URBAN FLOW GRADIENT HYDRAULICS

We used an integrated software consisting of MIKE Powered by DHI's MIKE URBAN – the software of choice when it comes to modelling and GIS for water in the city – and FGD's hydraulic transient engine FGDHT. The product was developed by enhancing the existing hydraulic transient engine FG3D and by developing a specialised software solution MIKE URBAN FGDHT that provides the integrated tool for developing the model, running transient flow simulations, and viewing simulation results.



Flow control regulatory station and hydropower facility. © DHI

MIKE URBAN FGDHT provides the following analysis and methods:

- built-in steady-state engine
- transient force computation engine
- turbine and pump modelling
- various friction method
- rule-based control analysis
- variable-speed pumping analysis using four-quadrant pump curves

At the same time, it can simulate pressurised flows including open channel and cascading flow conditions, accurately representing SDCWA pipelines and facilities under all operating conditions.

### AN ALL-ROUNDED HYDRAULIC MODEL FOR PLANNING, OPERATION AND MAINTENANCE

The new hydraulic transient flow model has been successfully developed to model the client's conveyance and distribution system. The pilot model is compatible with the GIS used by SDCWA and it is prepared for further expansions to the entire conveyance and distribution system. The hydraulic model was verified based on previous modelling results and historical measurements available through a SCADA system, including details of dedicated monitoring under transient flow conditions. It is now used by SDCWA's personnel and consultants in the planning, operation and maintenance of their water supply system.