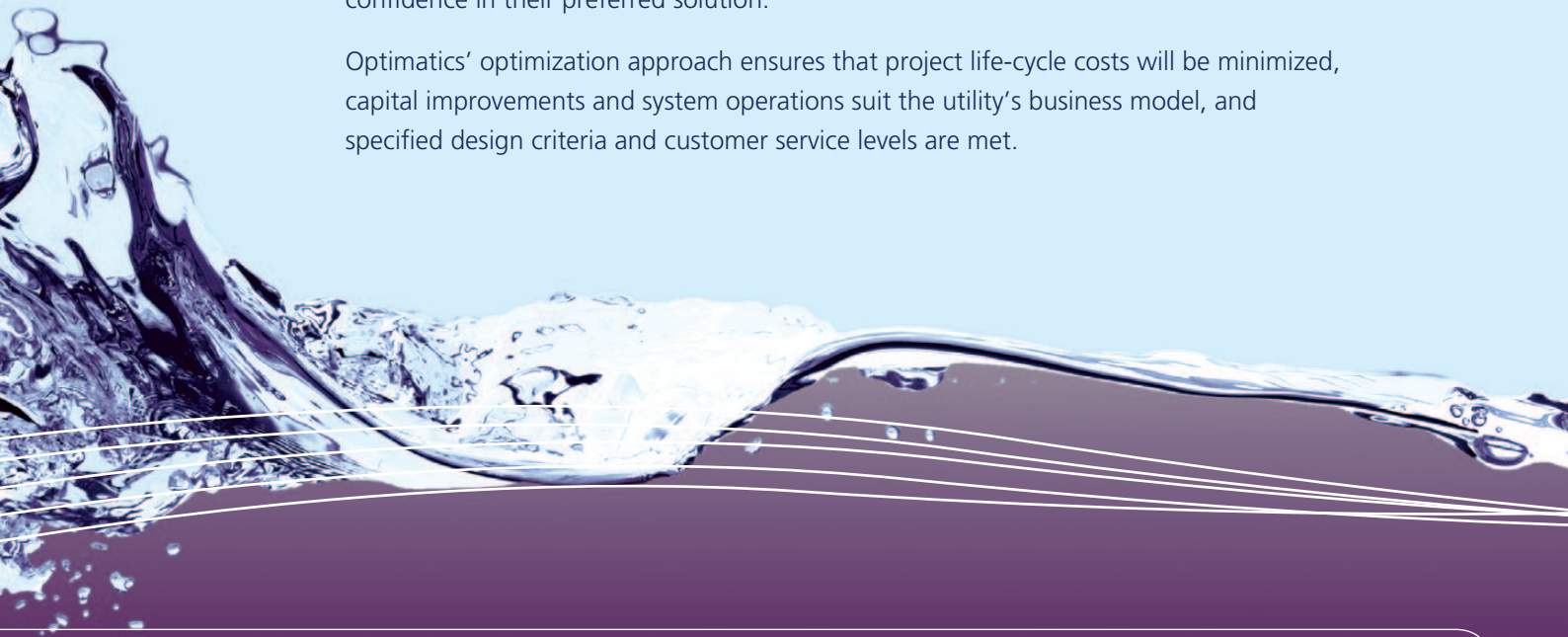




Optimatics

optimizing wastewater
collection systems





Wastewater optimization is one of Optimatics' specialized decision-support services. We combine engineering skill and experience with our powerful software tools to identify a range of near-optimal wastewater system configurations.

Optimatics works closely with wastewater utility managers to perform comprehensive analyses of improvement alternatives thus ensuring the utility and its stakeholders great confidence in their preferred solution.

Optimatics' optimization approach ensures that project life-cycle costs will be minimized, capital improvements and system operations suit the utility's business model, and specified design criteria and customer service levels are met.

Optimatics Wastewater Solutions

WHAT WE CAN DO FOR YOU...

- Perform exhaustive options analyses for conveyance, inflow and infiltration (I/I) reduction, storage and treatment facility improvements
- Save money by finding one or more near-optimal wastewater system configurations
- Develop an optimized Capital Improvement Plan (CIP)
- Develop a targeted and cost-effective I/I reduction plan
- Prioritize capital improvements to meet affordability constraints
- Provide wastewater optimization software and/or specialist engineering services.

VALUE TO YOUR ORGANIZATION...

- Decision support - defensible solutions for decision-makers
- Capital cost savings
- Transparency and repeatability
- Leverage investment already made in hydraulic modeling.

How we are different

Optimatics' unique, world-leading technology evaluates many thousands of possible option configurations and assesses both cost and hydraulic performance simultaneously.

In a single optimization analysis thousands of complete hydraulic model simulations are performed.

Applying optimization processes in combination with sound engineering judgement expands the number of options that can be considered in a reasonable timeframe.

Optimized solutions are typically 10 - 30% lower in cost than master plan solutions developed using a trial-and-error approach.

Optimatics' wastewater engineering team, in collaboration with water industry specialists, has used its extensive experience to develop Optimizer WCS - *"Decision support software for wastewater infrastructure planning"*.

"It is nearly impossible to consider all possible combinations of storage and conveyance options along with system rehabilitation for each subcatchment without powerful optimization tools offered by Optimatics. Optimatics helped us complete a comprehensive evaluation of options for a client facing costly regulatory-driven solutions to sewer overflow problems to identify what our client feels is the most cost-effective solution. The solution was millions of dollars less than what was previously identified through traditional trial-and-error alternative evaluations completed as a part of prior master planning projects."

Tim Coleman – CH2M HILL, Global Technology Leader, Chicago, United States



Overview of wastewater collection system problem formulated and solved using Optimizer WCS

1. Select infrastructure improvements and operational settings:

- Location, size and slope for new and parallel sewer mains
- Sections of older existing sewers to be replaced or rehabilitated
- Location and size for new (or expanded) storage facilities
- Location, capacity and design head for new (or expanded) pump stations
- I/I reduction target in each sub-catchment
- Location and capacity for new (or expanded) treatment facilities
- Real-time-control (RTC) settings.

2. Minimize capital and operational costs:

- New conduit costs, including parallel conduit costs
- Conduit abandonment costs and new conduit replace in-place costs
- New storage costs
- Pump station capital costs
- Operating costs (energy)
- Maintenance costs
- Rehabilitation (I/I removal) costs
- Treatment facility costs
- Control structure costs.

3. Satisfy design criteria and system performance constraints:

- System surcharge
- Overflow volume and/or frequency
- Basement flooding
- Maximum and minimum velocity
- Minimum ground cover to top of pipe
- Redundancy or reliability constraints.

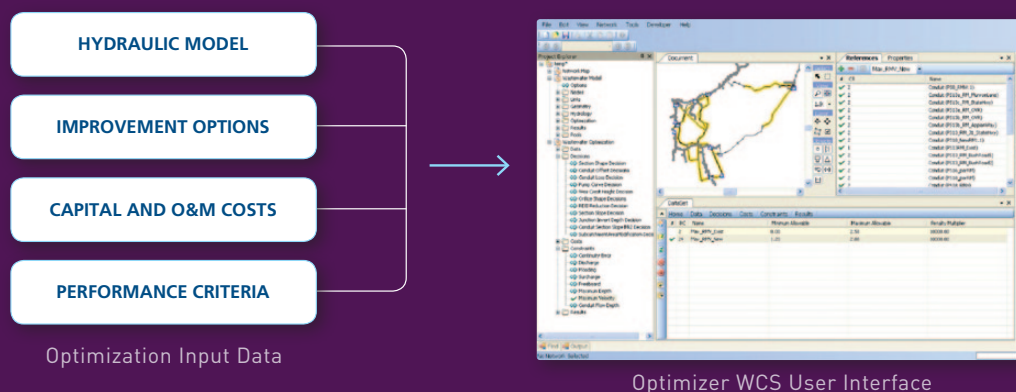
Using Optimizer WCS, equalization storage can be evaluated at every conceivable location in the system; specific I/I reduction targets can be determined for each individual sub-catchment; and conveyance capacity improvements, new flow path alternatives and treatment plant upgrades can be evaluated simultaneously.

Formulating Optimizer WCS is a straightforward process of importing the hydraulic model, importing unit cost rates and linking model elements to the relevant cost rates, option tables and design criteria.

In a single optimization run Optimizer WCS automatically generates and runs thousands of hydraulic model configurations; evaluates hydraulic performance; and determines capital and operational costs for each trial solution.

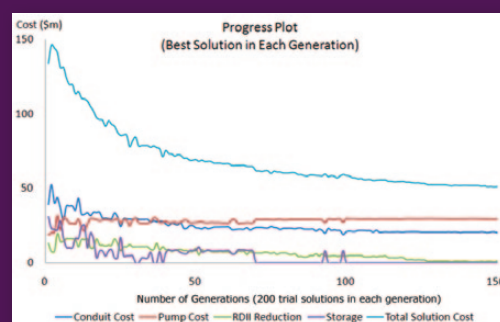
Options Analysis Process using Optimizer WCS

- 1 DATA COLLECTION (hydraulic model, options, costs and constraints) > Design Data Summary Report
- 2 FORMULATE OPTIMIZATION MODEL (import optimization input data to Optimizer WCS)
- 3 INTERIM OPTIMIZATION RUNS (produce several solutions with different characteristics) > Interim Design & Report
- 4 REVIEW INTERIM SOLUTIONS (reality check, confirm cost rates, confirm allowable improvement options, etc)
- 5 FINAL OPTIMIZATION RUNS (refine optimization model inputs and perform final runs) > Final Design & Report
- 6 SCENARIO RUNS / SENSITIVITY RUNS (optional) > "Portfolio of Solutions" for Multi-Criteria Analysis



Improvement Category	Baseline Solution Cost (\$M)	Optimized Solution Cost (\$M)
Gravity Sewer	6.7	5.2
Rising Main	19.3	13.8
Pump Station (Capital)	9.1	6.6
Pump Station (O&M)	24.0	21.5
Storage Facility	4.4	0.0
I/I Reduction	0.0	0.0
Total Project Cost	63.5	47.1

Comparison of Design



Optimization Progress

System improvement options are evaluated by coupling the fully-dynamic hydraulic model with Optimatics' unique wastewater collection system optimization process.

Optimizer WCS uses Genetic Algorithm (GA) optimization coupled with Optimatics' unique implicit refinement procedure (a combination of linear-programming optimization and automated heuristic refinement) specifically configured for collection system optimization.

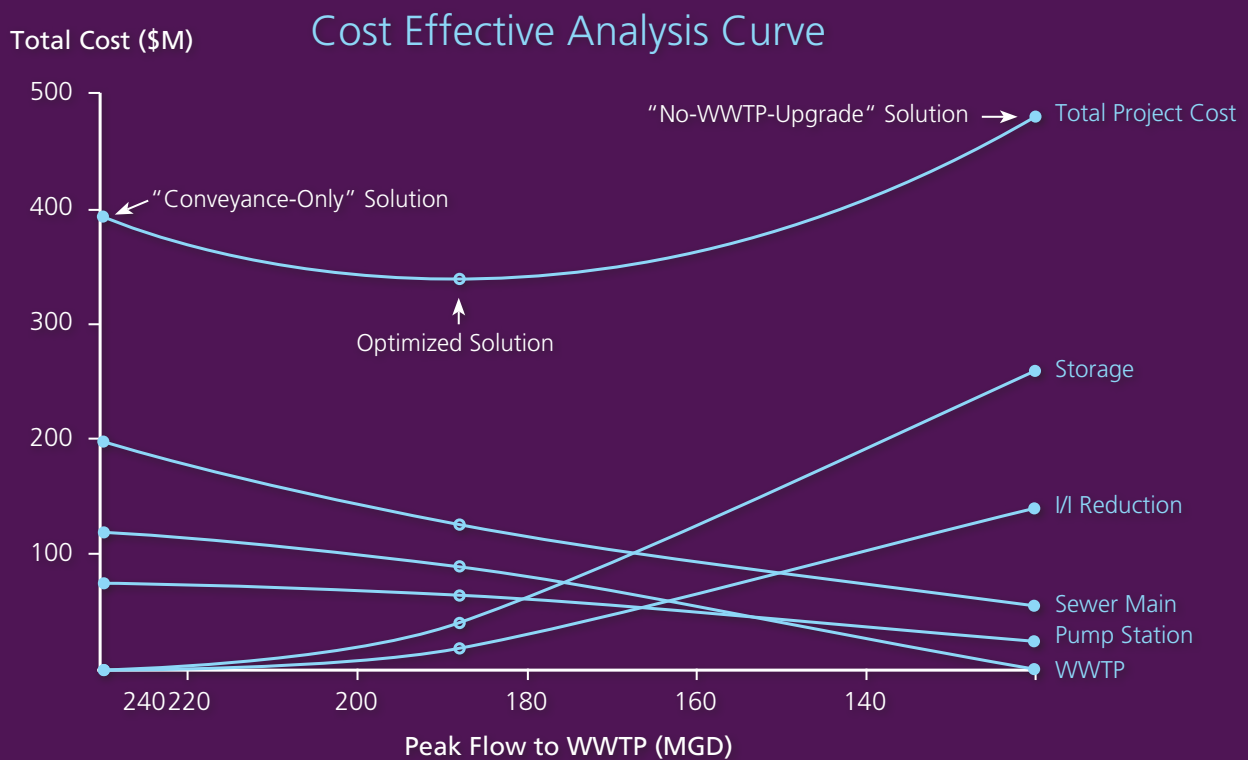
"The limitation of traditional methods is now a thing of the past as Optimizer WCS is able to analyze any number of wastewater system improvement options and select the most suitable and cost effective concept design solution."

Sara Saranathan - Senior Planning Engineer, South East Water, Melbourne, Australia

The optimization model inputs are easily adjusted in Optimizer WCS, making it simple to perform sensitivity analyses and generate solutions for a range of optimization scenarios.

In less than one week, optimization runs were completed for three separate scenarios to produce the cost-effective curve shown in the figure below. The cost-effective curve provides a strong visualization of the components that comprise the different solutions developed for each optimization scenario.

- The "Conveyance-Only" solution is produced by running an optimization scenario with storage and I/I reduction options switched off.
- An optimization scenario that includes all allowable improvement options is used to develop the "Optimized Solution".
- A constraint is placed on the maximum discharge to the treatment plant in the final scenario to produce the cost-optimal solution that avoids a treatment plant upgrade.



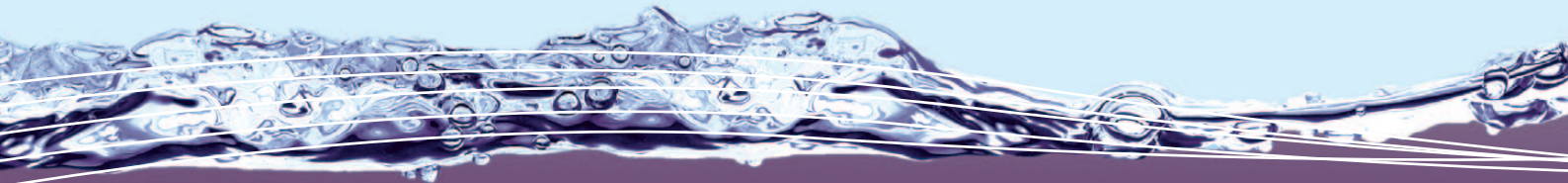
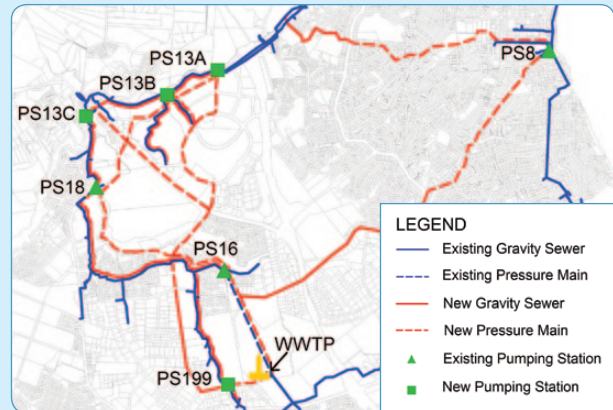
Optimizer WCS example project

Albany Wastewater Network Optimization (NZ)

New Zealand's North Shore City Council engaged Optimatics to optimize the strategic plan of the Albany wastewater catchment. The project demonstrated how optimization can be integrated with long time series (LTS) modeling to achieve least-cost planning solutions which satisfy precise overflow containment standards.

II Reduction targets were determined for eight individual sub-catchment while conveyance capacity improvements, new flow path alternatives and treatment plant upgrades were evaluated simultaneously using Optimizer WCS.

Improvement Options



Project Snapshot

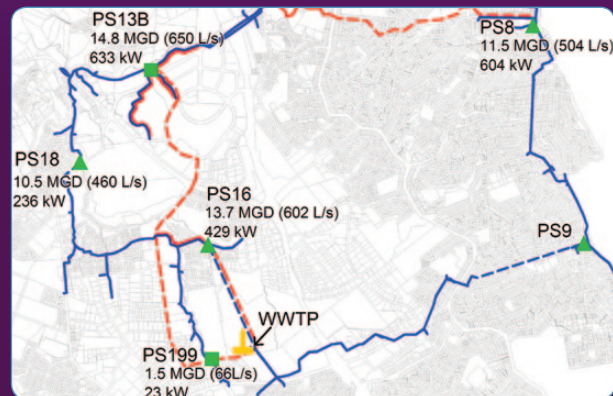
Design Criteria – Average overflow event frequency of no more than 6 months based on 17-year long time series (LTS) rainfall data.

Improvement options – Conveyance (7 pumping stations / 20 miles of sewer improvements), storage (over 50 storage site options), and II reduction (evaluated independently for 8 sub-catchments).

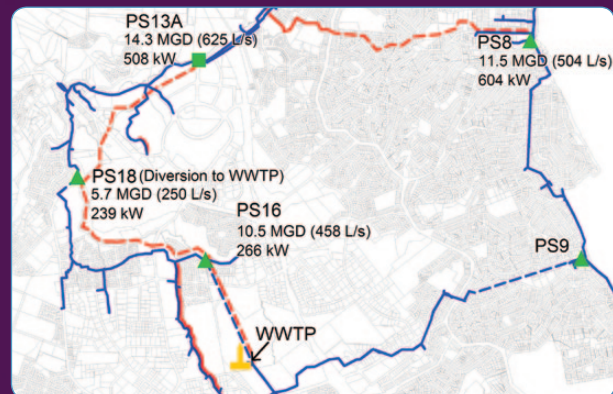
Optimization – Over 30,000 option configurations evaluated automatically using Optimizer WCS software.

Solution – Cost savings of over 25% when compared to the baseline solution (past solution from detailed options analyses completed by NSCC in 2001).

Baseline Solution - \$63.5 M



Optimatics' Solution - \$47.1 M



Cost Item	Solution Cost (\$M)		Cost Savings
	Baseline	Optimatics	
Capital	39.5	25.6	35%
O&M	24.0	21.5	10%
Total	63.5	47.1	26%

Who we are and what we do...

Optimatics was established in 1996 by a group of engineers who realized the potential of Genetic Algorithm (GA) optimization to revolutionize the design and operation of water systems. Optimatics today is a world leader in water systems optimization.

Our global team has worked with over 85 water utilities of all sizes in five countries, providing, applying and developing water engineering technology to enable our clients to best manage their assets.

Our solutions optimize the planning, operation and management of water and wastewater infrastructure. The results generated provide decision-makers with defensible solution options and empower them to make decisions on anything from daily operations to 50-year master plans.

Custom-Configured Software

Optimatics provides a range of custom-configured optimization software and technology offerings to empower our clients.



OPTIMIZER WCS – Wastewater Collection Systems
Optimally plan new infrastructure for wastewater collection systems



OPTIMIZER WDS – Water Distribution Systems
Optimally plan new infrastructure for water distribution systems



OPTIMIZER WDO – Water Daily Operations
Plan daily operations to minimize energy costs and greenhouse emissions



OPTIMIZER WRT – Water Real-Time
Implement real-time control of your pumps for automated and efficient operation



OPTIMIZER WRS – Water River Systems
Develop optimal operations and management policies for river systems



OptiCritical
Protect your customers from supply outages and assess system impacts due to main breaks



OptiRenewal
Plan optimal pipe renewal programs

To discuss your specific optimization needs
and for a product demonstration please
contact your regional representative.

www.optimatics.com



ASIA PACIFIC

Dr. Paul Smith, Regional Manager Asia Pacific
Tel: +61 8 8379 7353 Fax: +61 8 8379 7363
paul.smith@optimatics.com

NORTH AMERICA & EUROPE

Jeffery Frey, P.E., Co-founder and Technical Director
Tel: +1 773 792 2661 Fax: +1 773 792 2677
jeff.frey@optimatics.com

WASTEWATER TEAM LEADER

Joel Wilson
Tel: +61 2 6674 5723
joel.wilson@optimatics.com

HEAD OFFICE

Tim Anderson, CEO
Tel: +61 8 8379 7353 Fax: +61 8 8379 7363
tim.anderson@optimatics.com

