

DEVELOPMENT OF OPERATIONAL MANUALS



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ABSTRACT

This paper highlights the process employed by Goulburn Valley Water (GVW) in the development of its electronic, web-based, operations and maintenance manuals. To date manuals have been developed for 40 water and 26 wastewater treatment plants along with over 200 sewer pump stations.

This paper will outline the history dictating the need for the Manuals, as well as the key processes undertaken during the development of the manuals including:

- GVW's requirements.
- Developing a manual template and data management structure.
- Staff ownership.
- Data collection process from the facilities including operator input.
- Review process by operators and technical staff
- Ongoing review/update process including further development to allow users to access GVW's Operational System.

1.0 INTRODUCTION

Goulburn Valley Water was formed in 1994 as part of the Statewide water business amalgamation process. The Authority now administers an area of approximately 20,000 sq. kms stretching from the edge of Great Divide in the south (Wallan, Woods Point) to the Murray River in the north. It provides water and wastewater services to a population of over 105,000 in 56 towns and cities throughout the region.

The Authority's water and wastewater systems incorporate 1450 kilometers of water mains, tanks and reservoirs, 42 water treatment facilities, 27 wastewater management facilities, 253 sewer pump stations and 900 kilometers of pressure and gravity sewers.

2.0 OPERATIONS REVIEW AND OUTCOME

In April 2000, Goulburn Valley Water undertook an operations review with the aim of identifying the key issues facing its Operations Group. The review followed a period of significant investment in new infrastructure and technology, requiring the Authority to increase its focus on the operation and maintenance of these assets.

The operations review identified several factors that could impact on GVW's ability to continually deliver high quality water services to customers. One of the main factors identified was the lack of concise operations and maintenance (O&M) documentation.

An evaluation of the library of O&M manuals and all available O&M documentation from the various water and wastewater systems existing at the time was undertaken. In summary, there was a myriad of documentation varying in quality from poor to reasonably good, however few systems were comprehensively documented. In the worst case there were a significant number of systems with no manuals at all. This made operating the systems very difficult and often led to inconsistencies in operational practices between staff.

Reviewing the existing manuals and their varying quality and content reinforced the need for generic manuals to be developed allowing easy reference for operators and technicians. The lack of O&M documentation placed a heavy reliance on the collective knowledge of the key operational personnel. This translated into more problems as experienced people retired and were replaced with inexperienced personnel. Newer operators were unfamiliar with individual facilities and were forced to *reinvent the wheel* when it came to particular plant idiosyncrasies and fault finding. This lack of experience and available reference material increased the risk of sub-optimal system operation. With the Authority increasing its focus on the effective operation and maintenance of its assets, the importance of documenting the collective experience of all personnel in detailed O&M Manuals was highlighted.

From this point, manuals were to be developed for all water treatment and wastewater treatment plants, pumping facilities, and collection and distribution systems. A number of alternatives to deliver a concise and comprehensive library of manuals were considered.

The preferred alternative involved a partnering approach between in-house operational and technical staff and technical consultants to produce Intranet based manuals. The tendering of the project ensured Goulburn Valley Water would receive a diverse range of submissions from consultants eager to showcase their latest wares. The use of specialist external consultants ensured that the manuals developed would be user friendly and state of the art.

3.0 GVW'S REQUIREMENTS

GVW recognised early in the concept stage that for the O&M Manuals to be an acceptable and usable reference guide, the information should be presented in non-technical and simple terms to ensure the document can be easily read and understood. There also needed to be a high level of “ownership” by those involved in developing and using them particularly technical personnel and operators. GVW also needed to determine what specific inclusions they wanted the manuals to contain.

Initial in-house workshops with the Operations Group managers and field staff were undertaken and the following preferences for manual content were identified:

- The creation of an Intranet based system.
- Restrict the information in the manual to an individual facility, rather than encompassing an entire system.
- Plant overview flow schematics depicting process elements in order of sequence.
- Structured layouts to access information relating to a facilities process elements. (For example the operational elements – (Raw Water, Alum Dosing, Treated Water etc) require information on - Purpose and Targets, Safety, Design Criteria and Components, Maintenance, Monitoring, Normal Operation, Process Control, Trouble Shooting and Emergency Operation.
- Access to Standard Operating Instructions, Manufacturers Literature and complete sets of drawings. (Electrical, Civil, P&ID etc)

4.0 DEVELOPMENT STRATEGY

GVW's preferred strategy for developing the O&M Manuals was one that involved the contribution of the operators, internal technical personnel and external consultants.

It was seen that GVW staff would have the greatest knowledge of their system operations but one of the crucial components of the project was the significant role the selected consultant would have in providing an independent view to identify issues overlooked through GVW familiarity.

4.1 Appointing a Consultant

After a tender review and interview process, GVW contracted PPK as the external consultant. Using their specialist knowledge and experience, PPK were to develop a user friendly interface for navigation and develop an O&M Manual design template that would allow ease of documenting the field information collected from site. The template assisted in documenting the process in the logical order of plant operation. PPK also produced a standard directory structure and naming convention for the management / maintenance of the collected data.

Further to the specific information inclusions sought by the Operations Group, PPK were able to incorporate many of their own features of Web based technology they had developed through previous projects, including:

- User friendly colored graphical interfaces for selecting process elements.
- The ability to allow users to access material in several ways.
- The availability of the information to the entire organisation via Intranet.
- Accessing reference information, such as supplier information etc through hotlinks directly from web documents.
- Enhanced Quality Control. Only one document is maintained on the system.
- Links from the O&M Manual system directly to corporate systems.
- Layered access to information where the most used information is at the top.
- Provide both text and visual links.
- The use of digital photos as a photo is worth a thousand words.

These features were introduced to operators and technical staff through workshops conducted by PPK.

4.2 Developing the Initial Manuals

The project proposed using the O&M template developed by PPK, to produce complete web-based operations and maintenance manuals for three of GVW's facilities. The initial facilities were the Seymour and Numurkah WTP's and associated systems and the Tatura WMF and associated systems. PPK began to collect the operating information from one facility initially and in the process continued to establish the standard template for all future manuals. After the construction of the standard template and the first manual, the next two facilities were documented.

A facility's operation is able to be broken into two specific lines of information.

- The Operations Section incorporating such elements as Safety, Maintenance, Monitoring, Normal Operation, Emergency etc. and;
- The Process Element Section such as Raw Water, Alum Dosing, Filtration, Treated Water etc.

To access information from a facility in the method desired, PPK developed the behind the scenes file structure and HTML (programming code) that would allow the user to access information from more than one path.

The user would be able to access information relating to a plant across an entire process element (e.g. Raw Water – Safety, Maintenance, Monitoring, Normal Operation, Emergency etc) or operation section (e.g. Monitoring – Raw Water, Alum Dosing, Filtration, Treated Water etc).

The matrix depicts the structure of a facility's operation information. The matrix shows how a user is able to access the information vertically as a particular process element, or horizontally as an operation section across the process elements.

Figure 1: Facility information matrix.

Operations Section	Process Element	General	Raw Water Supply	Alum Dosing	Clarification	Filters	pH Correction	Chlorination	Clear Water Storage	Generic or Attached Items	Other Business Areas
		Purpose & Targets	KPI's, objective settings of elements, general description of process elements								EPA License & WQ requirements
Safety	OH&S issues, 'Hazard Rating', training and protective equipment requirements								MSDS and Dangerous Goods OH&S SOP	Safety Plans	
Management	Levels of authority and notification, required training to operate								GVW authority hierarchy		
Design Criteria & Components	Size, capacity and design assumptions, component description								Equipment list & supplier data including scanned supplier information and electronic information such as CDs of pump manufacturers' specifications	Asset Management, Supplier Register	
Maintenance	Table of frequency (less frequently than monthly), type and location.								Suppliers Register and contacts, standard work order forms, spare parts list	Asset Management	
Monitoring	Table of frequency (monthly or more frequently), type and location								Testing SOP, EMS requirements	EMS, Techbase	
Normal Operation	Start up, operation and shut down procedures, chemical purchasing procedures, PLC / Citec / SCADA controls								Quality Management System Operation SOPs and log sheets, chemical suppliers		
Manual Operation	Manual start up, operation and shut down procedures								Operation SOP		
Process Control	Available process adjustments and likely impact, adjustment steps										
Trouble Shooting	Potential problems such as failure of PLC, possible cause and remedial action										
Emergency	Potential system failure and emergency responses								Emergency Response Procedures, Notification of Key Customers	Emergency Response Plans, Priority Customer List, AquaRate (database of all customers)	
Other	Supply quality requirements, irrigator conditions, major customers								Service Suppliers list		
Drawings	Plant Drawings								Electronic Plan room		

4.3 Adopted Screen Layout

To reduce user confusion, no matter what information was being accessed nor from where in the manual it was being accessed, all screens throughout the manuals were designed to be of a similar layout. The screens are split typically into 3 areas as follows:

Title

- Top strip across the screen showing header of current location.
- Site wide and system navigation buttons and Logo's.
- Remains the same between levels to allow constant access to corporate and generic documentation.

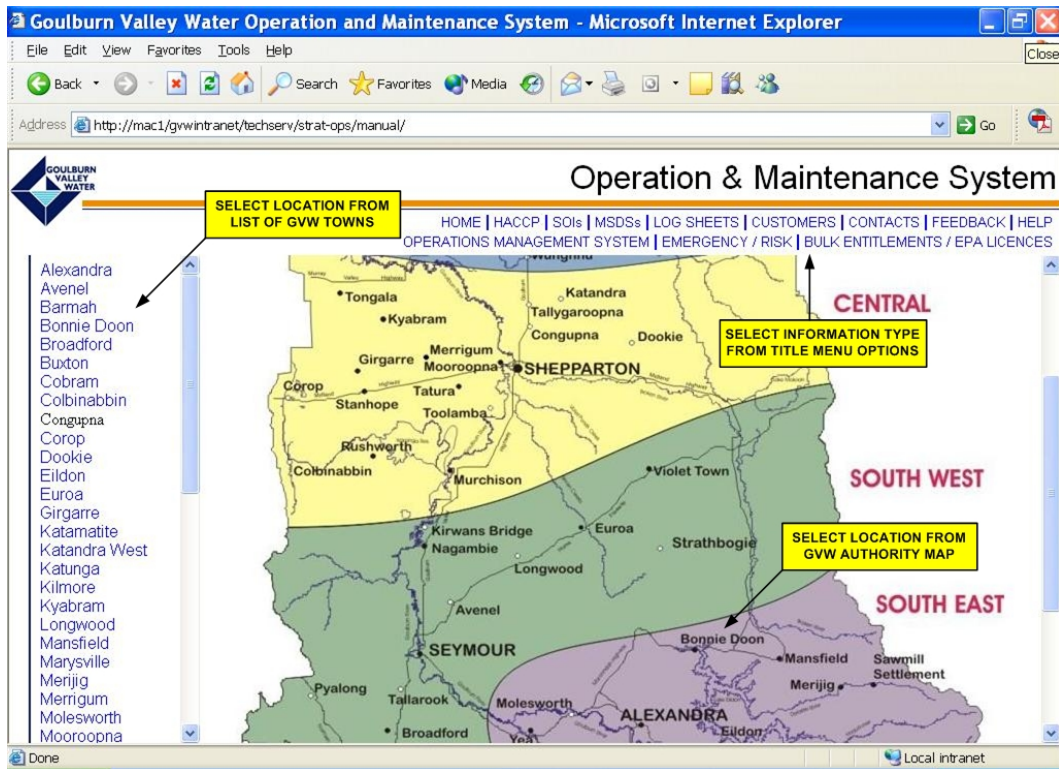
Side Bar

- Text index for specific navigation system i.e. text options of main screen graphics.
- Changes specifically when moving from one level to another to coincide with main screen graphic.

Main Screen

- Graphical menu selection
- Data Presentation and changes with each action.

Figure 2: Screen view of O&M System Front Page Showing Title, Side Bar and Main Screen



4.4 Review Workshops and Operating Requirements

It was as a result of initial pre-development workshops held by PPK that involved the broad range of staff from GVW that the potential in the project was seen and enthusiasm grew. Upon completion of a prototype web-based manual, further workshops with the potential users were held to obtain feedback. The workshop comments were reviewed and changes to the manual prototype were undertaken. After a further period of review and final minor modifications, the standard template web design was completed. By this stage, the staff, and in particular the operators involved in the development workshops couldn't get enough of the concept. Workshops suddenly ran overtime and an abundance of additional features were requested.

These workshops also identified the needs of users to be able to access information as quickly and easily as possible. The system therefore was designed (where practicable) to allow the most commonly used information to be available from one click (of the mouse) from the front page with all information preferably no more the three clicks from the front page. This was seen as essential, as typically any further than three clicks and a user found it too lengthy to access the information.

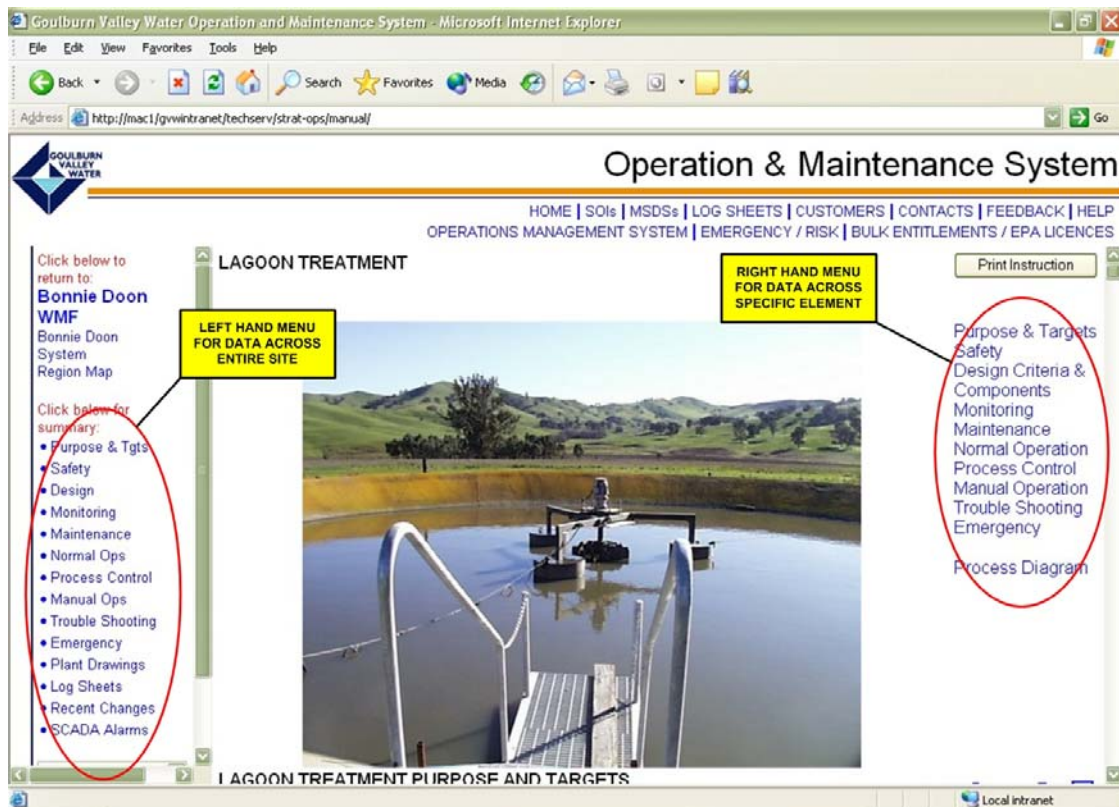
5.0 USING THE FINAL MANUALS

Access to information and sites / facilities from the main screen is by simple mouse clicks on the graphic or text. These use *Hot Spots*, *Drop Down Menus* and *Hyper Links* to move the user to the required data source. The front page is essentially a menu for site and plant selection within the system and also allows access to specific water and / or wastewater corporate documentation.

The hierarchy of information is as follows:

- From the GVW system main page:
 - Link buttons from the title block to corporate documents.
 - A listing of site locations in alphabetic order from the side bar, where a drop down menu appears for further selections when the mouse pointer is moved and clicked on a town.
 - GVW region map graphic from the main screen, where a drop down menu appears for further selections when the mouse pointer is moved and clicked on a town.
- To the Town system page:
 - Link buttons from the title block to corporate documents or back to O&M home page.
 - Listing of system plants and process elements and additional items such as major customers etc from the side bar.
 - Township System map showing layout and location of facilities with links directly to these facilities from main screen.
- To the *Plants / Facilities* page:
 - Link buttons from the title block to corporate documents or back to O&M home page.
 - Listing of the operations sections from the side bar that produces a summary of the operation section for all the plant process elements.
 - Plant process diagram from the main screen that allows selection of specific process element instructions
- To the process elements within a plant; and
- Generic or attached information, such as Standard Operating Instructions, Equipment Manuals etc.

Figure 4: *Screen View of WMF Process Element Instruction.*



6.0 REVIEW

Some of the systems managed by GVW have been in operation for almost 100 years. Due to the age of some systems, a combination of many factors such as loss of documentation and lack of concise documentation caused a large part of the project to be consumed in the sourcing of *non-existent* data or manufacturer's literature. Time was also consumed on locating information such as design details, drawings (particularly electrical) and pump curves for facilities.

The manuals are required to be technically accurate, and written in clear, simple terms to facilitate use by Authority personnel with a wide range of industry experience and technical ability. The documents are typically the first introduction for newly appointed personnel to a facility. Consequently they must concisely document the various aspects of the facilities operation in terms that will be understood by staff of this experience level. In addition they must also extend to the more complex information related to each plant that may be required by professional personnel.

Traditionally, through no fault of their own, information on plant operation was passed from operator to operator over the years, not all of which was correct. As a result, the information on plant operation and process control provided by the current operators can sometimes be "this is the way it has always been done", or "this is the way I was shown".

These factors resulted in the technical review phase of the project being a critical end component to ensure the information supplied and sourced was accurate. It also provided a significant learning opportunity for technicians and operators. One of the benefits resulting from the documenting of O&M manuals across the authority and having the process descriptions reviewed is that it will allow problems in facility operation to be identified. Site audits can be undertaken and plant optimization can be investigated. Operators and technicians then gain a greater understanding of plant processes and are able to correct or improve operating techniques. Operators and technicians will also learn from the experience offered by other more specialist technicians and operators.

7.0 THE FUTURE

Gone are the days of a bundle of hard copy manuals stuck on a shelf or hidden in a cupboard to collect dust, go out of date and never to be referenced. With the nature of technology there is always improvement and advancement. GVW is always looking to improve the way business is done and as a result are looking at new software platforms that provide flexible options such as database search functionality and quality system versioning.

It is clear that web-based technology has and will continue to have enormous benefits to GVW in improved operations and information access. The web-based O&M Manuals has allowed the consolidating of all available system knowledge and placed it at the finger tips of ALL personnel in the Authority. With access to a network computer and the push of a button or the click of a mouse a user can be taken to the information they would not normally have the opportunity to source easily.

The current phase of the project is due for completion June 2004. During the construction of the system, the integration of Authority and Operational systems has far exceeded

original plans.

From the O&M manual system a user now has the option to access a range of these systems such as:

- HANSEN – Maintenance database.
- GIS
- SCADA
- BRIDGESOFT – Operational / Environmental Information System. Database for log sheets and lab data etc.
- Authority wide documentation – EMS, Drinking Water Quality Documentation, HACCP, Emergency / Risk Plans, Bulk Entitlements / EPA Licenses, SOI's etc.

At the completion of manual production, the next step is anticipated to be a transitioning phase into a maintenance and improvement period. The project personnel will also be incorporating the backlog of new works and upgrades to current Authority facilities.

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