MOTOROLA

MOSCAD APPLICATION NOTE

WASTEWATER SYSTEMS

APPLICATION OVERVIEW

Wastewater (or sewage) systems, which are found in every community, are responsible for the collection of wastewater from homes, commercial sites and industry, and for its treatment and ultimate discharge to the environment. All wastewater utilities use some type of remote monitoring and/or control system to aid in proper and efficient operation.

Older systems may rely primarily upon local control and merely a remote indication of a single, non-specific station alarm. Newer installations make more information available both for local and remote control. Dynamic processes like wastewater collection and treatment require continuous process monitoring and control to achieve minimum standards of cost and treatment regulations.

Proper monitoring of equipment can maintain operations at a optimal level by identifying and correcting problems before they turn into significant system failures. Avoiding major problems has become more important, as both Federal and State regulatory agencies increase the economic consequences of improper discharges.

Motorola provides a wide range of Supervisory Control and Data Acquisition (SCADA) products that are especially well suited to wastewater systems. This has been shown by hundreds of installations worldwide, involving thousands of Remote Terminal Units (RTUs). System installations vary from simple site alarming to complex distributed control systems with redundant central computer stations.

This experience has helped develop a new and improved generation of products, higher quality field engineering, and greater customer satisfaction. The product line has recently been strengthened with the new **MOSCAD - the most innovative and powerful SCADA system on the market today.**

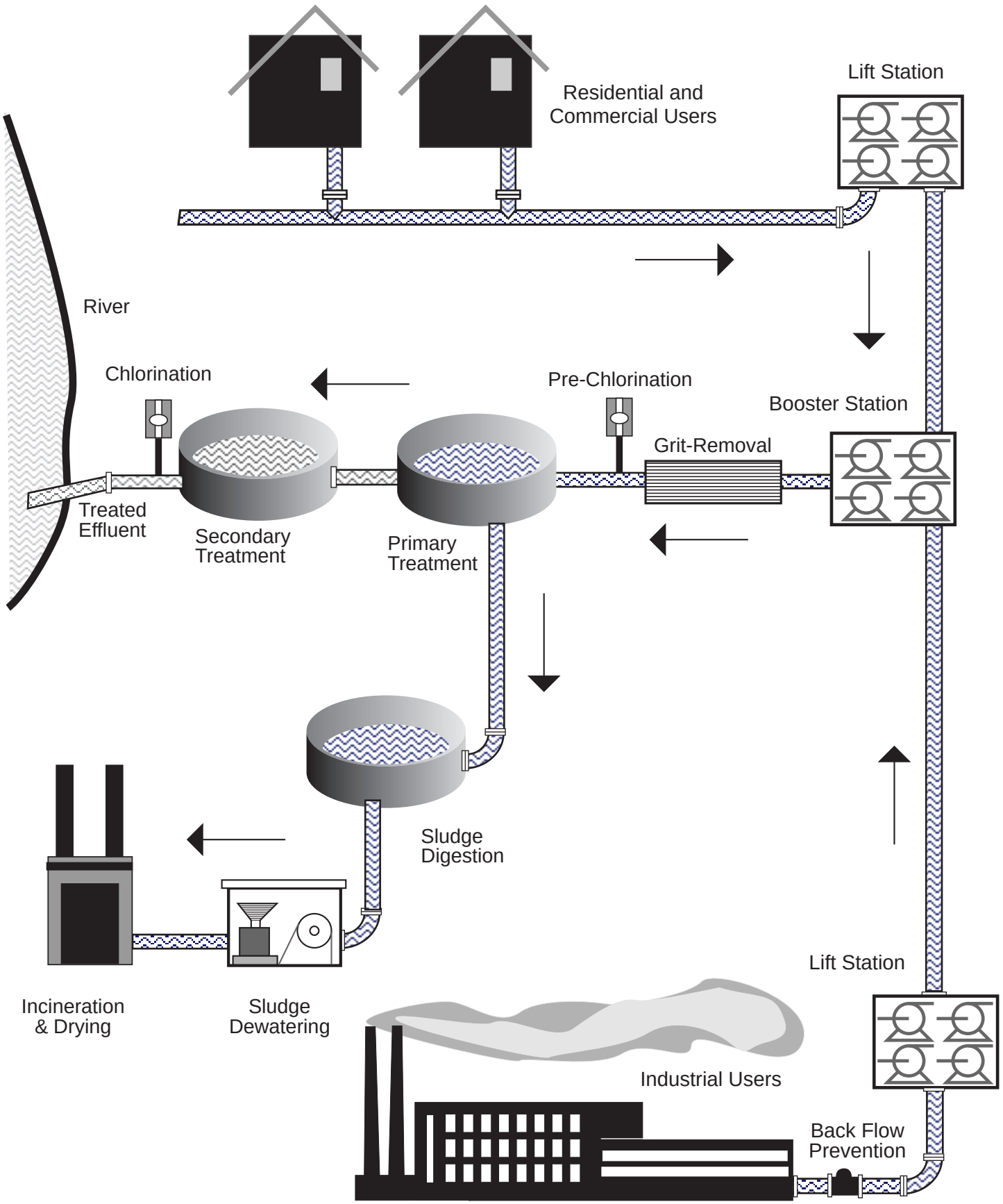

Fig. 1. **WASTEWATER COLLECTION & TREATMENT**

BASIC ELEMENTS OF A WASTEWATER SYSTEM

A typical wastewater system, graphically illustrated in Figure 1, consists of:

- Transmission lines, both atmospheric and pressurized
- Pumping stations and sewer lift stations that aid in the transfer of wastewater
- Treatment plants

These components and others need to be constantly monitored to ensure that the collection and treatment of sewage is done efficiently and safely. Many municipalities, even today, rely heavily on expensive periodic visits by maintenance people to check on the status of equipment at lift-stations and treatment plants.

A remote monitoring and control system can reduce the frequency of these visits substantially. From the comfort of an office, or out at a distant location, personnel can monitor and control virtually any aspect of the operations. A SCADA system can provide information in a real-time environment that identifies problems as they occur and can take corrective action when assistance is needed.

SCADA SYSTEM REQUIREMENTS

A typical wastewater SCADA system contains the following elements:

- Primary Sensors and Control Devices
- Remote Terminal Units (RTUs)
- Communication Subsystem
- In-plant Control Station
- Central Computer

PRIMARY SENSORS AND CONTROL ELEMENTS

These will be determined by the specific installation and operational requirements. At a remote lift station for example, older systems had just a few status/alarm inputs, with pump control left to a local controller. Modern installations tend to make more information available, such as:

Wet well (dry well) - High/Low Alarms

Level/Flow - Bubbler (measures water level), Float, Pressure measurements

Pump Status - Run, Fail, Number of starts, Run-time, Temperature, Vibration

Power monitoring - Current, Phase, Stand-by Generator

Station Conditioning - Security, Temperature, Gas

MOSCAD input/output (I/O) capability has been designed to interface directly with common elements used in these applications. In addition to isolated digital inputs and outputs, as well as all types of analog inputs, MOSCAD also offers direct (without the need for external transducers) input of three-phase AC current and voltage. Power factor, real power (kW) and reactive power (KQ) are calculated and may be used to implement a sophisticated energy savings program.

INTELLIGENT vs. "DUMB" RTUS

Dumb RTUs do not have the ability to perform any local tasks, however simple they may be. These units merely report digital or analog input information to the central computer. All decision-making and logical functions are performed at that central location.

Intelligent RTUs, such as the MOSCAD, can be programmed to meet the requirements of the specific application. The RTU program may vary from simple set-point control of a lift-station, including pump sequencing and interlocks, to more complex

multiple Proportional Integral Derivative (P.I.D.) loops. MOSCAD offers a powerful control language (accessible via a Programming Toolbox on a PC) which is flexible and easy to use.

The intelligence of the RTU allows much of the control system's decision making to be transferred from the central computer to the local site. This distribution of capability allows functions such as data storage, high speed calculations and complex decisions to be made locally, improving the overall system response time. MOSCAD can be programmed to calculate wastewater volume/flow through a lift station, determine pump efficiency and operate the most complex process without the need for a separate pump controller.

COMMUNICATION CHANNELS

Many older monitor and control systems communicate via wirelines or leased telephone lines to link the RTUs and central computer. Wirelines often prove unreliable, due to weather and physical damage. Leasing phone lines can be very expensive, with repair and permanent costs a major issue.

Motorola's MOSCAD was designed for the radio environment, with the additional flexibility to work with most any communication link, radio, leased line, dial-up lines, fiber optic, etc. All MOSCAD RTUs are equipped with a minimum of three, independent ports so that multiple and different communication channels may be used simultaneously by a single unit.

MOSCAD incorporates Motorola's MDLC protocol to ensure reliable and efficient communications over a variety of radio and line links. MDLC is an ISO (International Organization for Standardization) compliant protocol that can transfer large packets of data securely and efficiently. Using high data transmission rates, up to 9,600 bps, MDLC permits full program and diagnostic transfers from any location within the system.

TREATMENT PLANT APPLICATIONS

The combination of large I/O capacity, local control capability and flexible communications alternatives make MOSCAD an excellent choice for in-plant installations. Resembling a large frame PLC, a single MOSCAD unit can operate an entire package treatment plant or a complete phase of a large secondary installation. MOSCAD can control directly continuous processes such as Dissolved Oxygen (D.O.), Return Activated Sludge (R.A.S.), and Sludge wasting. Equipped with an optional Man-Machine Interface (MMI), operators can make changes locally, while MOSCAD still communicates archival information to a central site.

THE CONTROL CENTER COMPUTER

The role of the control center computer in most systems is to monitor and display the data reported by the RTUs. The control center also provides system-wide alarming to prompt operators when problem situations arise (major alarms can be sent automatically to alpha-numeric pagers). True supervisory control, either automatic or operator initiated, as well as other system wide activities such as maintenance planning, is best performed by the control center computer.

Motorola offers a full range of industry standard DOS or Windows-based PC software packages in either standalone or Local Area Network (LAN) configurations. This includes the MCC family of control centers which has been designed specifically to take advantage of the unique communications and control capabilities of the MOSCAD RTU.

Also available are several VMS based SCADA packages that utilize existing VAX and ALPHA based computers from DEC. Motorola can also provide a standard communication driver interface to other third party SCADA centrals including work station or UNIX based systems.

MOTOROLA'S MOSCAD - BENEFITS

Motorola's MOSCAD offers a total SCADA system solution for the needs of a wastewater utility. Intelligent RTUs provide a cost effective solution for most applications, from remote lift station monitoring to in-plant control. Motorola allows you to implement distributed control of the entire wastewater collection and treatment process.

MOSCAD offers the following features and benefits:

- **Adaptable**
  MOSCAD RTUs are more adaptable than any other RTU, and can be changed easily and remotely to reflect new configurations or program requirements.

- **Reliable**
  MOSCAD is manufactured to Motorola's exacting Six Sigma quality standards. All I/O's are isolated and meet or exceed the IEEE Surge Withstand Capability (SWC) standard.

- **Intelligent**
  MOSCAD is a powerful RTU ideal for use in wastewater systems, due to its ability to execute the wide variety of control strategies needed. In addition, many wastewater systems require some degree of backup control. Intelligent RTUs provide an alternative solution to backup control that may be more cost effective and technically sound.

- **Programmable**
  Optimal programming flexibility is offered through MOSCAD's Toolbox Software package. This powerful application generator, which runs on a PC, can be used to tailor the RTUs control program based on the customer's site requirements. New control programs can be prepared in minutes and downloaded to the RTU over the normal communication channel, from the central computer or from any site in the system.

- **Diagnostics**
  If a problem should occur at one of the RTU sites, remote diagnostics can be performed to identify the nature of the problem or make the corrections. Diagnostics can be performed by any RTU (not just at the unit reporting the problem) or from the central computer.

- **Compatible**
  In addition to supporting fast, accurate radio communications, MOSCAD works with virtually all other communication methods. This includes leased lines, data and dial-up networks, fiber optic lines and microwave interfaces. This inherent flexibility allows the integration of MOSCAD RTUs into planned or existing monitor and control systems that are designed for non-radio communications.

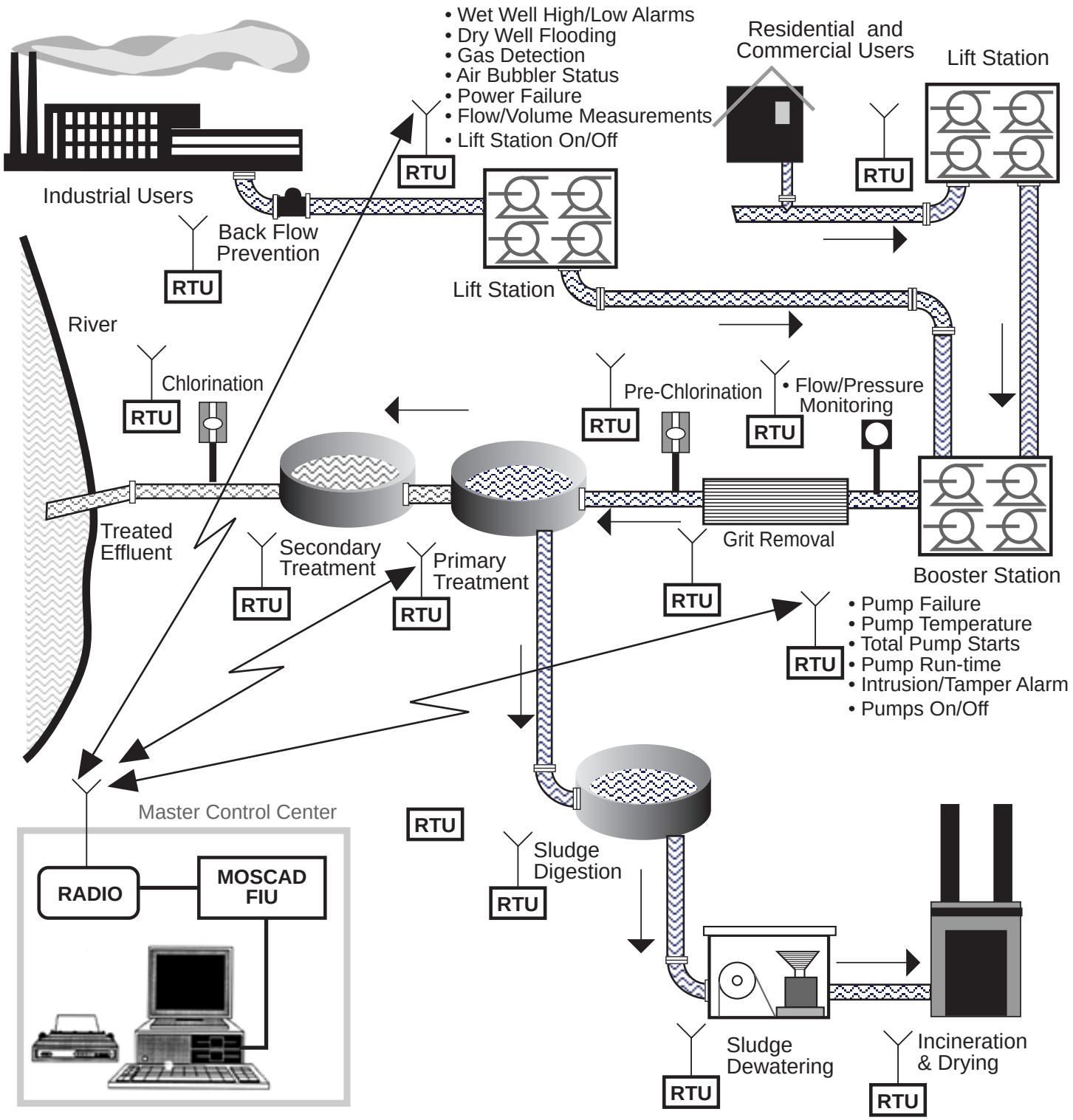

Fig. 2. **TYPICAL WASTEWATER CONTROL SYSTEM**

MOTOROLA

AN105-693

Address: