TORO® SENTINEL®
APPLICATION NOTE

AN05: SCHEDULER / OPTIMIZER

Version: 1-20-2011

SCHEDULER / OPTIMIZER IN SENTINEL

Scheduler / Optimizer Overview
The **Scheduler** button in The Sentinel Main Toolbar opens the Flow Optimizer/Scheduler window which is used to optimize Program starts based on demand and flow limit without changing station order within the Program.
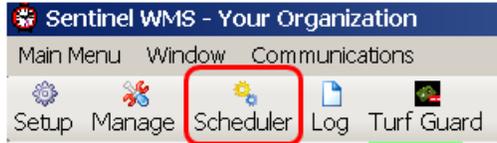
The Scheduler/Optimizer allows Sentinel WMS to assign start times for programs with the Auto Schedule Start option selected. The Scheduler/Optimizer will attempt to schedule irrigation to occur in one continuous block, or as close to a continuous block as possible within the defined constraints (Water Window and Total Flow). The Auto Schedule Start option is selected in Automatic Operations and must be selected for each program that will be managed by the Scheduler/Optimizer. To work properly, programs using Auto Schedule Start must have a valid Water Window defined and no Start Time defined. This will allow Sentinel WMS to determine when the program should start in order to finish on time (before end of Water Window). Programs that need to water at a specific time can be given a start time and the Scheduler/Optimizer will leave them alone; these programs cannot have the Auto Schedule Start option selected.

Scheduler / Optimizer Setup
For Programs to be Optimized:
1. No Start Times should be set.
2. A Water Window in which the Program should run must be defined.
3. Auto Schedule Start must be selected (checked)
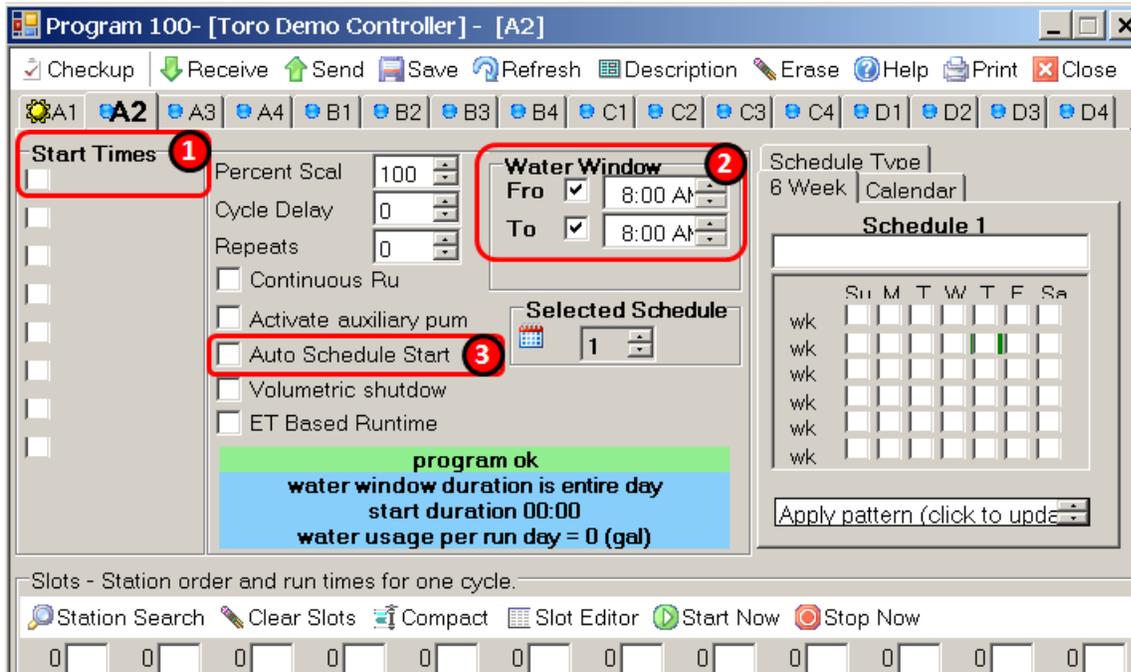
For Any Zone/Station in the "Program to be Scheduled/Optimized":

4. Expected Flow should be set in Zone Data (if flow constraints are to be used)
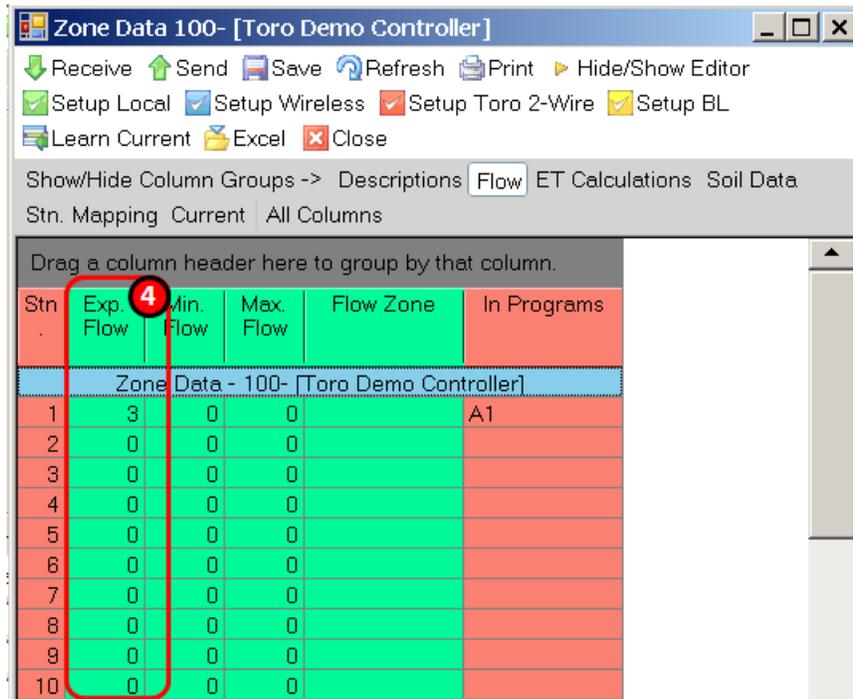
For any Satellite with Programs to be Scheduled/Optimized:

5. The Satellite must be Assigned to a System (via **Manage** on the Main Toolbar).
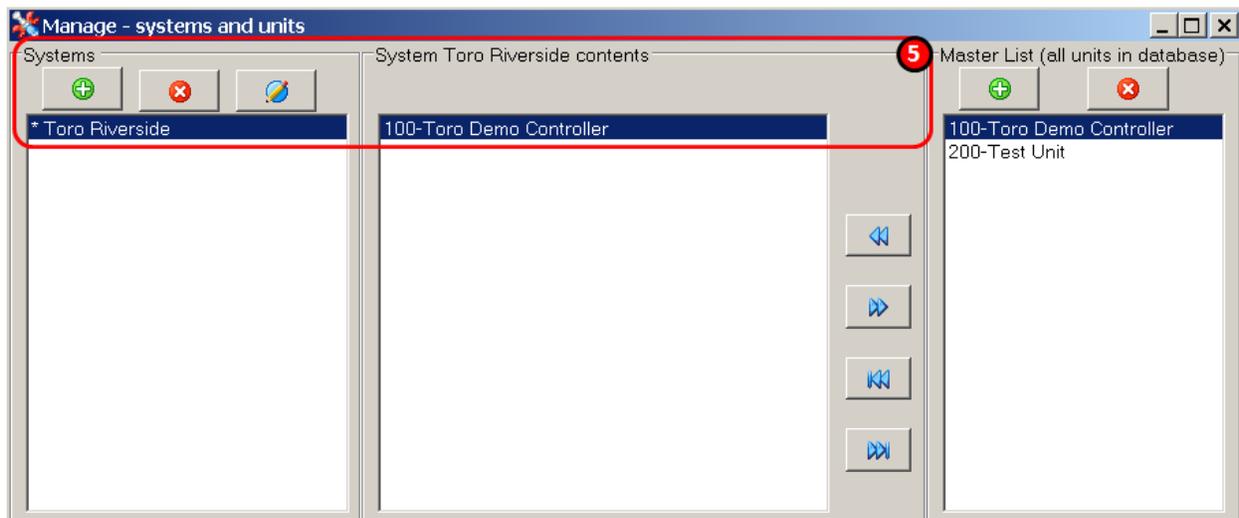
To use Scheduler / Optimizer

6. Click on Scheduler in the Sentinel Main Toolbar.
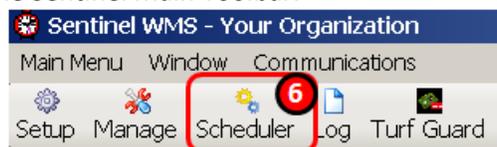
Scheduler / Optimizer Settings & Options
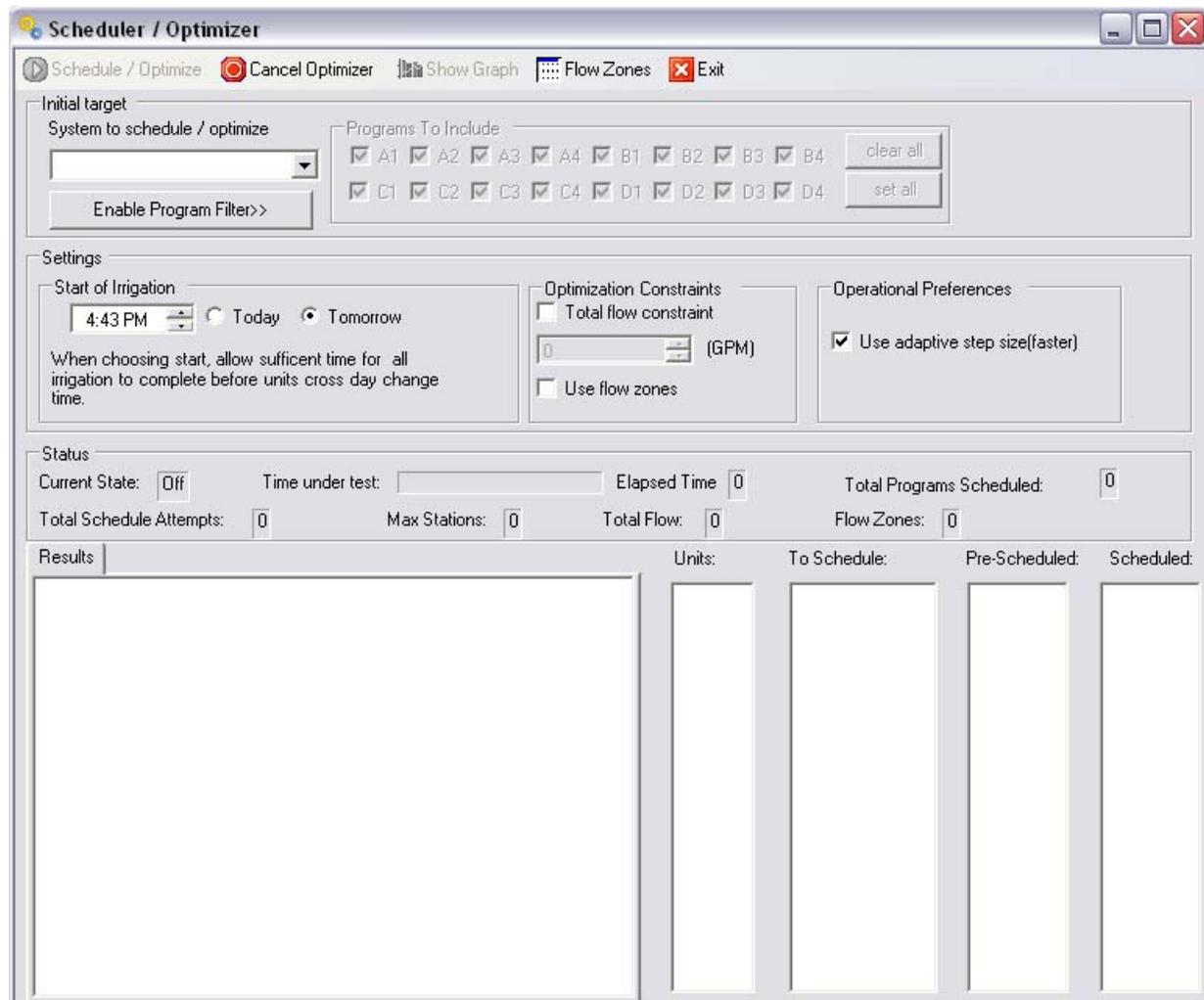
Initial Target

System to schedule / optimize - Select the System that contains the units that will be Scheduled/Optimized. Units must be added to a system in order to be considered by the Scheduler/Optimizer.

Clicking **Enable Program Filter** will allow for selection of only programs that need to be scheduled. Unchecked programs will not be evaluated during the scheduling process.

Settings

Start of Irrigation - The Start of Irrigation time should be set for at least one minute before the earliest Water Window begins. Today or Tomorrow should be selected based on when the irrigation will run based on the defined Change of Day. For example, if the change of day has not yet occurred, and the irrigation is going to run after the change of day takes place, Tomorrow should be selected. If the change of day has already occurred, and the irrigation is scheduled to run before the next change of day, Today should be selected.

Optimization Constraints - The Scheduler/Optimizer can schedule watering that doesn't exceed a total flow, or that doesn't exceed the defined flow of hydraulic tree. Zone Data must be populated with an Expected Flow value for this function to work. Flow Zones must be defined (accessible through the Flow Zones button in Scheduler/Optimizer) if Use flow zones is selected.

Operational Preferences - By default, Use adaptive step size (faster) will be selected. If scheduling fails with this option selected, try running the Scheduler again with the option turned off.

Status
Current State - If the Scheduler/Optimizer successfully completes the Current State will show Finished with a green background. If it fails to schedule the Current State will show Finished with a red background.

Statistics about the Schedule/Optimization process are displayed under Status, such as how long the Scheduler took to complete (or how long is has been running if it has not completed), the number of attempts it has made, and constraints that were supplied for the process.

Results
Scheduling results are displayed, such as what times were assigned to each program and which units and programs were scheduled, and any programs that were pre-scheduled (a start time was defined in the program, so the Scheduler did not change it).

Example of a successfully completed Scheduler/Optimizer using a 25gpm flow constraint:
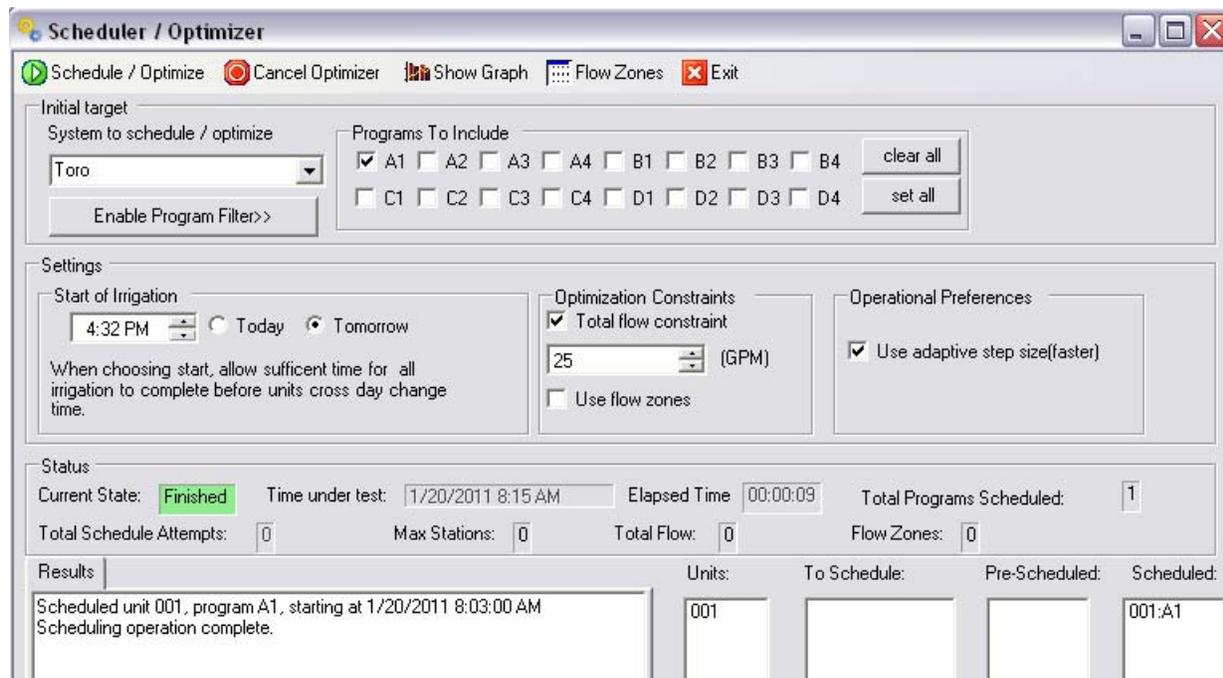
The updated schedule must be sent to all affected satellites in the system after successfully running the Scheduler/Optimizer.
1. Click **Exit** to apply the changes to the database.
2. Open **Unsent Changes** for the **System** that was scheduled.
3. Click **Send**.

Graphing

The Show Graph button will show a water usage graph using theoretical flow based on the expected flow values provided in Zone Data. Each day is shown in alternating white/blue blocks. Theoretical flow is displayed using a blue line. Actual flow data will be displayed using a green line, if it is available (water meter required).
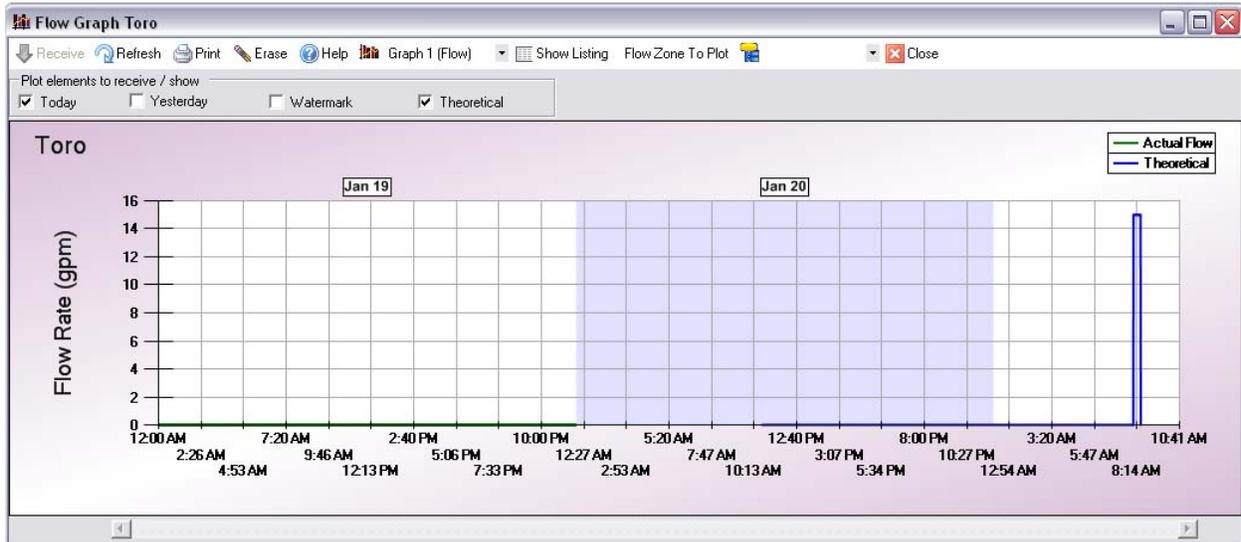
Utilizing Flow Zones

Flow Zone Manager

To access the Flow Zone Manager, click the Flow Zones button at the top of the Scheduler/Optimizer. By default, there are no flow zones or sources defined.
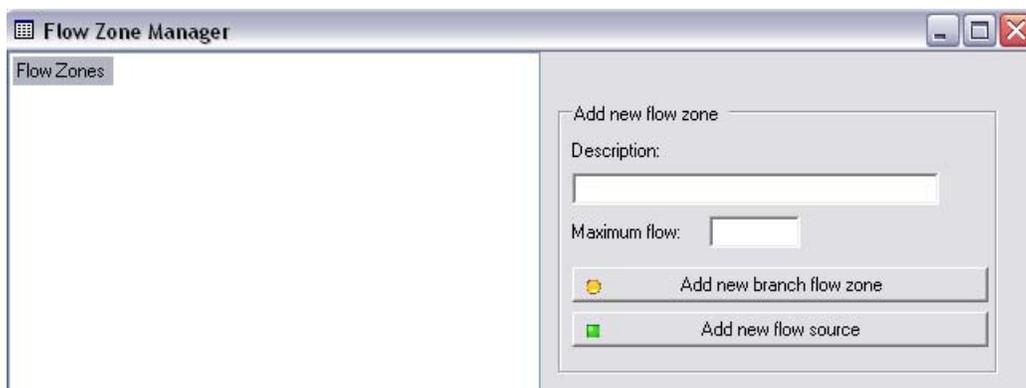
The **Add new flow source button** will add a flow source to the tree. To create a flow source, you must enter the description (name for the source) and the Maximum flow (the maximum flow capability in gallons per minute, liters per minute, or cubic meters per hour [m^3/hr] based on Units setting).

City Water Source added with max flow of 150gpm:
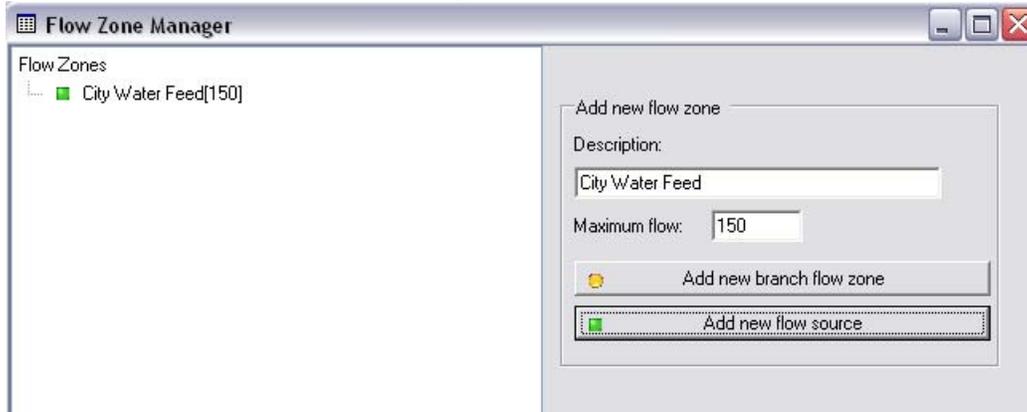
The **Add new branch flow zone** button will add pipes (children) below whatever source or flow zone (parent) is selected when the button is pressed. As with the Add new flow source button, the description and maximum flow for the pipe must be entered before the Add new branch flow zone button is pressed. Each child pipe will not exceed the flow of its parent pipe, and the total flow will never exceed the defined maximum flow for the parent flow source. This is used in the Scheduler/Optimizer to determine the maximum number of stations that can be run in any area when using Total flow constraints with flow zones.
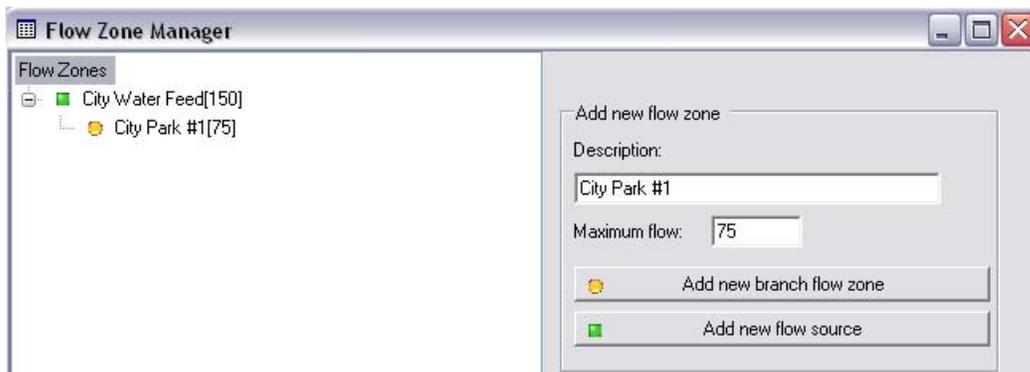
After creating the flow zones, stations must be assigned to their appropriate branches in Zone Data:
   1. In Satellite **Special Data > Scheduler Tab**, Select the **Top-most flow zone** for the Satellite (this would be the flow zone that fully encompasses the Satellite's stations.
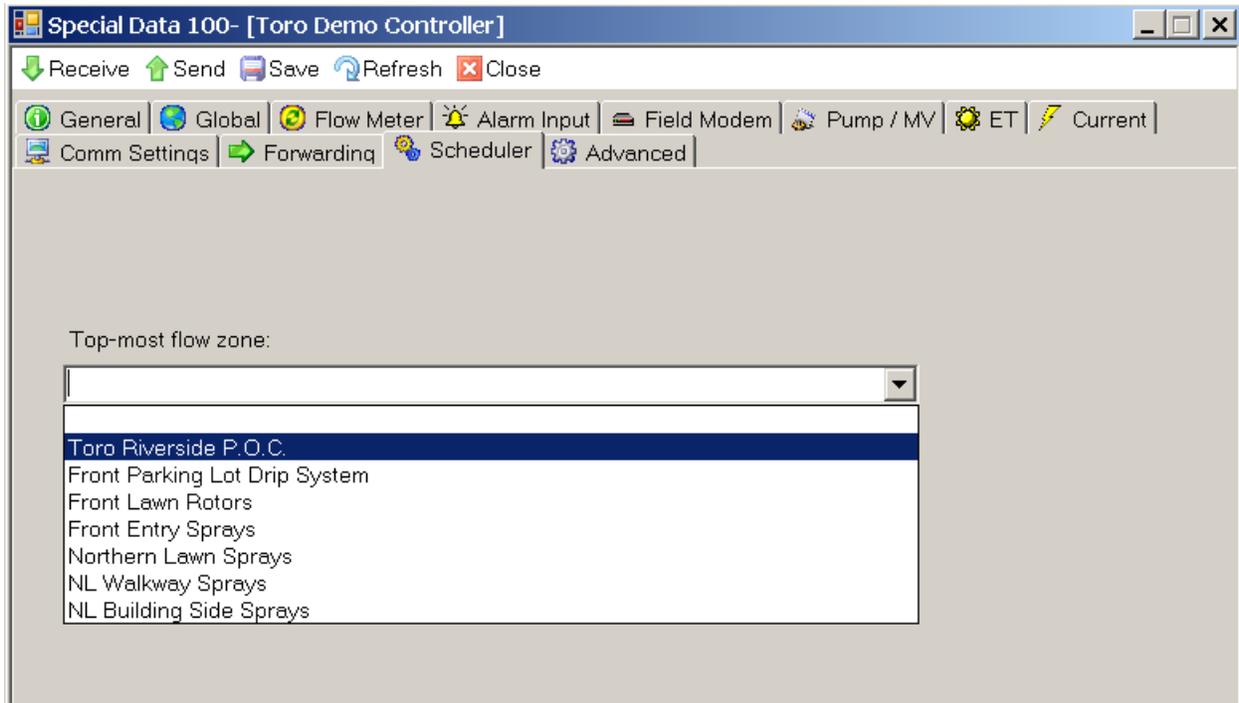
2. In **Satellite > Zone Data**, select the appropriate **Flow Zone** for each station, then **Save** and **Send** the updated data.
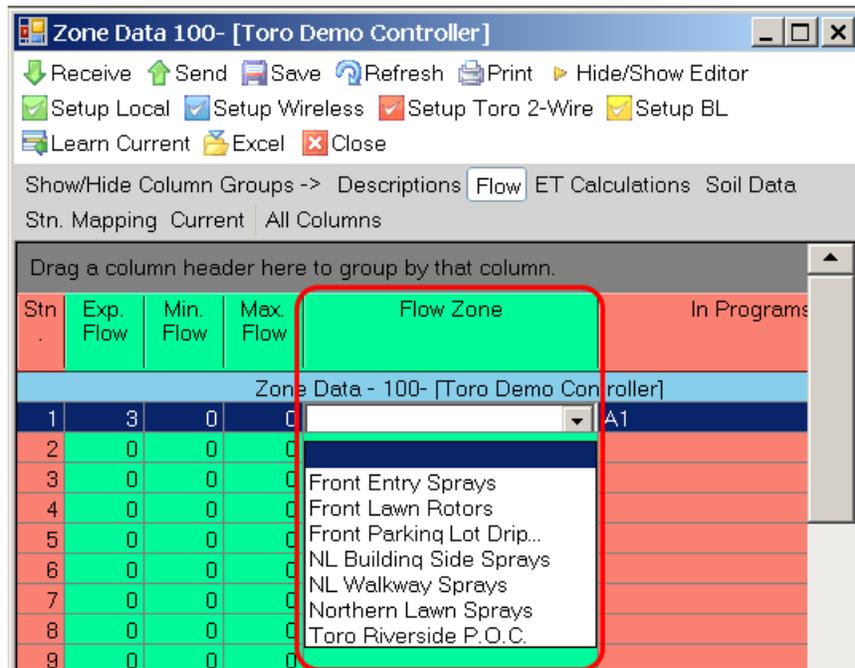
You can now Run Scheduler / Optimizer for Flow Optimization.