
**WORK ORDER INITIATION FORM
for the CITY OF CLEARWATER**

Date: 2/23/17

Project Number: _____

City Project Number: _____

1. PROJECT TITLE:

Marshall St. WRF & East WRF Permanent Wastewater Flow Monitoring

2. SCOPE OF SERVICES:

The City of Clearwater Utility department has requested the McKim & Creed provide permanent flow monitoring services of the sewer collection system in the Marshall Street WRF and East WRF service areas. McKim & Creed shall provide the rain and flow monitoring equipment with communication network (Telog). Also included, is the installation and maintenance of the permanent rain and flow monitoring equipment, as well as the engineering data analysis and monthly reporting of the recorded data. The flow monitoring equipment will be installed at the major gravity sewer outfall locations, and at major lift stations shown below. All sites are within the Marshall Street WRF and East WRF service areas. The lists below identify the proposed permanent monitoring locations:

Major Sewer Outfall:

1. Bayshore Blvd. (East WRF)
2. Gulf to Bay Blvd. (East WRF)
3. Corona Interceptor (East WRF)
4. Marshall Street (Marshall St. WRF)
5. Holt Avenue (Marshall St. WRF)

Major Lift Stations:

1. 11 (Marshall St. WRF)
2. 14 (Marshall St. WRF)
3. 16 (Marshall St. WRF)
4. 19 (Marshall St. WRF)
5. 20 (Marshall St. WRF)
6. 24 (Marshall St. WRF)
7. 45 (Marshall St. WRF)

Of the twelve (12) permanent flow meter sites identified all but three (3) will utilize open channel flow monitoring devices to ascertain and record wastewater volumes. The permanent flow meters at Lift Stations 11, 20 and 24 will utilize side pressure clamp on style flow meters to record the wastewater volumes from each station's discharge force main. It is recommended that permanent rainfall gauges be

installed at both WRFs and at Lift Stations 9, 45, 19 and 58. Further explanation of the equipment and monitoring can be found in Appendix 'A'.

The City has agreed to install 2 monitoring vaults over the force mains at LS 11 & 20 and provide conduits for power and communication to existing PLC mounting back plane. If needed, McKim & Creed will provide any engineering for this installation.

I. PRE-INSTALLATION KICK OFF MEETING

McKim & Creed will attend and conduct a kick off meeting with City officials to discuss the installation of flow and rain monitoring equipment and any safety, notification and traffic issues that may arise for the installation of equipment.

II. INSTALLATION OF FLOW AND RAIN MONITORING EQUIPMENT

McKim & Creed shall perform the installation of the monitoring equipment at the above locations, test and calibrate the equipment and communication link to the Telog server.

III. MONTHLY FLOW MONITORING/RAINFALL GAUGING REPORTING

The collected data will be recorded for each piece of equipment and uploaded to McKim & Creed's Telog 'Enterprise' server on a daily basis. Flow monitoring and rainfall gauging will be performed concurrently for one (1) calendar year. All of the flow and rainfall data recorded will be transferred daily to McKim & Creed's Telog 'Enterprise' server and the City will be able to access and download the data through a dedicated web browser application. While the City will not be able to change any of the operational characteristics of the equipment, they can monitor rainfall increments and wastewater flow at every site and visualize the effects of wet weather events prior to receiving any monthly report. Flow data summaries to be included in the monthly report shall present the flow data and observed flow conditions supported by graphical and tabular presentations of flow, level, and velocity, where applicable. Each summary shall include the following information:

Graphical Representation of Data

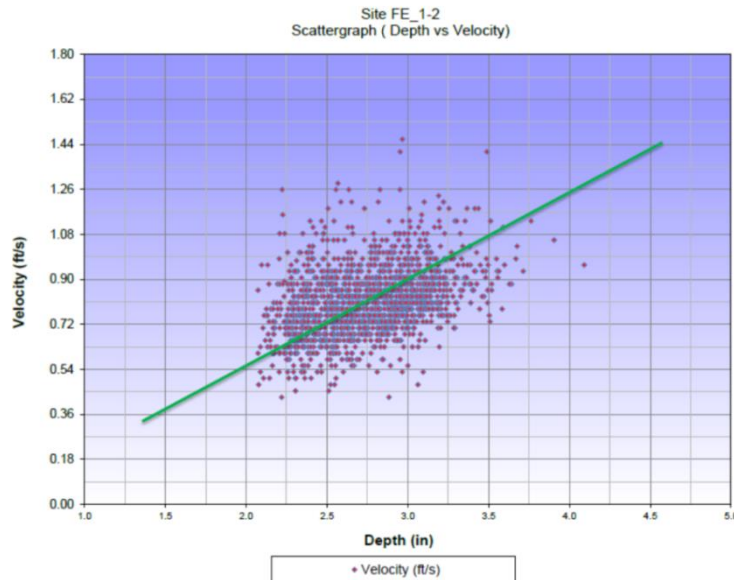
A graphical time-series weekly plot (hydrograph) of flow rate vs. time data, as well as associated recorded rainfall data, shall be presented for each specific flow meter site. An average seven (7) day dry weather hydrograph will also be prepared/presented and flow data from any significant rainfall event (greater than 0.5-inches over 24-hours) during any specific seven (7) day period will be added to the hydrograph and RDII volumes for each significant event shall be calculated and displayed on the hydrograph. Additional graphs will also be required:

- Monthly graph (scatter graph) of flow depth versus velocity readings
- Monthly flow graph depicting daily maximum, average and minimum flow rates with daily rainfall accumulations

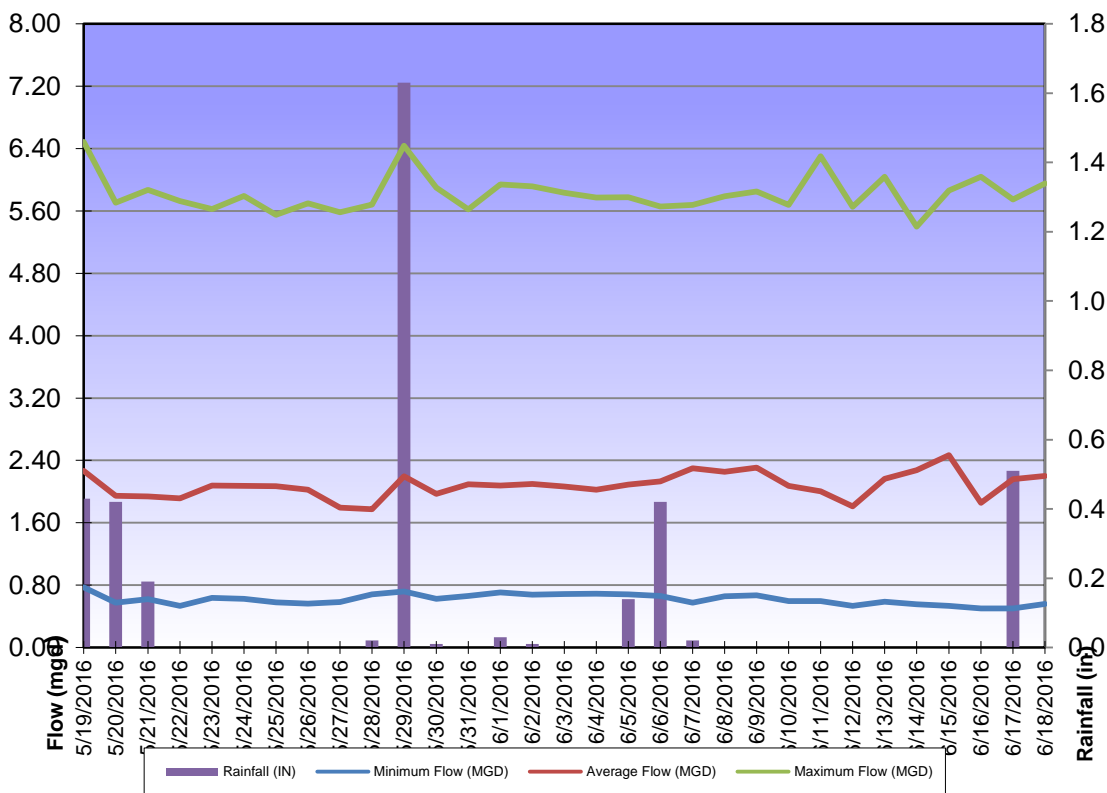
- Daily wet weather 24-hour flow volume versus recorded rainfall magnitude for events greater than 0.5-inches (regression analysis)

Graphs shall be provided in both .pdf and .xls formats. The following provides examples of graphs required.

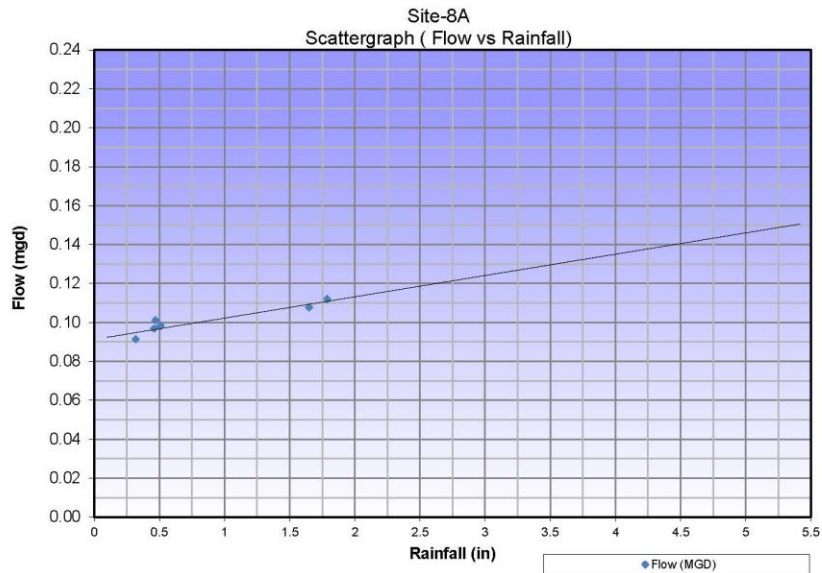
Scatter Graph



Flow Meter Site 7



Monthly 24-Hour Flow Maximums, Minimums, Averages and Rainfall Accumulation



Date	Flow (MGD)	Rainfall (IN)	R ² Value
5/19/2016	0.101	0.47	0.86
5/28/2016	0.108	1.65	
6/5/2016	0.091	0.32	
6/17/2016	0.098	0.51	
7/9/2016	0.097	0.46	
7/16/2016	0.112	1.79	

24-Hour Flow Volume (MGD) Versus Rainfall Accumulation (IN)

Tabular Data

The following data shall be submitted in electronic form with calculated statistics in .xls format for each specific flow meter/rainfall gauging site:

- Flow Meter Site Statistics:
 - Average dry weather flow rate (Million Gallons Per Day)
 - Peak hourly dry weather flow rate (Million Gallons Per Day)
 - Peak hourly wet weather flow rate (Million Gallons Per Day)
- Rainfall Monitoring Site Statistics:
 - Recorded rainfall event date (events greater than 0.5-inches)
 - Rainfall amount per event (Inches)
 - Recurrence storm interval (2, 5, 10 Year, etc.)
 - Identification of rainfall gauge used for each flow meter site analysis
- Flow Monitoring Data:
 - Time (5 Minute Increments)
 - Level (Inches)
 - Velocity (Feet Per Second)
 - Flow rate (Million Gallons Per Day)
- Rainfall Monitoring Data:
 - Time (15 Minute Increments)
 - Rainfall measured (Inches)
- Calibration records
- Data reliability summary of all meters

- Data excluded
- Maintenance activities completed
- Installation report

IV. FLOW METER MAINTENANCE

McKim & Creed staff will perform maintenance on a weekly basis. Each site will be visited to ensure that no conditions exist that could be detrimental to the recording and collection of quality flow data. During each site visit depth and velocity calibrations will be performed to ensure accurate readings are being obtained. Each flow meter will be programmed to record instantaneous velocity and flow levels during fifteen (15) minute intervals. Each flow meter site will also be checked twice daily remotely and any inconsistent data will warrant an additional site visit from the maintenance crew. Flow level, velocity and volume will be uploaded to the McKim & Creed 'Enterprise' server on a daily basis as described by the following paragraph.

V. FLOW DATA ANALYSIS

The following identifies the analysis that will be performed for each of the twelve (12) monitoring sites on a monthly basis.

Monthly reports shall contain charts, tables, and figures demonstrating at a minimum, the following quantities and calculations:

- ADF, Average Daily Flow
- ABF, Average Base Flow, established during periods of dry weather.
- ASF, Average Daily Sanitary Sewer Flow, determined by calculation

$$*ASF = ABF - GWI$$
- GWI, Non-Rainfall Groundwater Infiltration, estimated by analysis of early morning flows when the sanitary sewer contribution is very low. The difference between the early morning flows and the MSF represents an approximate estimate of GWI. GWI can also be determined empirically with the following equation.

$$*GWI = ABF - ((ABF - MBF)/0.88)$$
- MSF, Minimum Sanitary Flow, by calculation, $MSF = 0.12 * ASF$.
- MBF, Minimum Base Flow, by calculation, $MBF = MSF + GWI$.
- Ratio of MBF/ABF.
- Ratio of GWI/ABF.
- Rainfall Amount and Intensity.

- Rainfall Dependent Infiltration/Inflow, (RDI/I), directly resulting from rainfall.
*RDI/I = Total Flow Volume – ABF
- Peak RDI/I, maximum difference between the ABF and Total Flow hydrographs.
- PHF, Peak Hour Flow
- Peaking Factor = PHF/ADF
- Peak 15-minute Flow Depth
- Peak 15-minute Flow Velocity
- Peak 15-minute Flow Volume
- Current Full Pipe Capacity
- Total Monthly Flow

Ratio of GWI/Inch-Diameter Miles of Upstream Contributing Sewer Mains for each meter basin.

McKim & Creed will submit monthly flow monitoring/rainfall gauging reports to the City for review. Included in the monthly report will be raw flow data, edited flow data, (changes highlighted in yellow), raw rainfall data and changes in apparent groundwater elevation at each monitoring site. In an effort to compress the abundance of data, daily minimum, average and peak 24-hour flow rates as well as daily rainfall will be presented separately.

The monthly flow/rainfall information will also be supplemented with daily tabular data for each monitoring site that depicts the minimum, average and peak daily flow rates and the associated recorded rainfall recorded during each day. The tabular data will be utilized to create individual bar graphs for each flow metering site to help visualize the effects of any wet weather period.

In addition to the daily tabular data/graphs a monthly scattergraph will also be prepared that represents the isolated 24-hour flow measured at each site for all significant rainfall events; in excess of one half inch, in comparison to the rainfall recorded over the same 24-hours.

3. PROJECT GOALS:

- EQUIPMENT INSTALLATION
- FLOW AND RAIN DATA RETRIEVAL
- EQUIPMENT MAINTENANCE
- MONTHLY DATA REPORTING

4. BUDGET:

See Attachment "B"

This price includes all labor and expenses anticipated to be incurred by McKim & Creed for the completion of these tasks for one (1) year in accordance with Professional Services Method "B" – Lump Sum Percentage of Completion by Task, **for a fee not to exceed One Hundred Ninety-Nine Thousand, Eight Hundred Dollars (\$199,800.00).**

5. SCHEDULE:

Initial installation and calibration of the flow meters will start the monitoring and reporting period and is therefore the critical path item.

The project is to be completed within **395 days** from issuance of notice-to-proceed. The project deliverables are to be phased as follows:

Kick Off Meeting	7 calendar days
Flow Meter Installation	14 calendar days
Testing & Calibration	21 calendar days
Monitoring and Reporting	365 calendar days

6. STAFF ASSIGNMENT (Consultant):

McKim & Creed – Aubrey Haudricourt, PE, Greg Anderson, PE, Jacob Landis, EI, Sunil Khanal, EI, Craig Watts, EI, Delvin Carter, Patrick Goode, Nick Anderson and Jeffrey Kiefer.

7. CORRESPONDENCE/REPORTING PROCEDURES:

ENGINEER's project correspondence shall be directed to:
Aubrey Haudricourt

All City project correspondence shall be directed to:
Jeff Walker with copies to others as may be appropriate.

8. INVOICING/FUNDING PROCEDURES:

For work performed, invoices shall be submitted monthly to the City of Clearwater, Engineering Department, Attn.: Veronica Josef, Senior Staff Assistant, PO Box 4748, Clearwater, Florida 33758-4748.

City Invoicing Code: 0327-96665-563800-535-000-0000

9. INVOICING PROCEEDURES

At a minimum, in addition to the invoice amount(s) the following information shall be provided on all invoices submitted on the Work Order:

A. Purchase Order Number and Contract Amount.

- B. The time period (begin and end date) covered by the invoice.
- C. A short narrative summary of activities completed in the time period
- D. Contract billing method – Lump Sum or Cost Times Multiplier
- E. If Lump Sum, the percent completion, amount due, previous amount earned and total earned to date for all tasks (direct costs, if any, shall be included in lump sum amount).
- F. If Cost Times Multiplier, hours, hourly rates, names of individuals being billed, amount due, previous amount earned, total earned to date for each task and other direct costs (receipts will be required for any single item with a cost of \$50 or greater or cumulative monthly expenses greater than \$100).
- G. If the Work Order is funded by multiple funding codes, an itemization of tasks and invoice amounts by funding code.

10. SPECIAL CONSIDERATIONS:

- The consultant named above is required to comply with Section 119.0701, Florida Statutes (2013) where applicable.
- City will provide and install two monitoring vaults over the force mains at LS 11 & 20 and provide conduits for power and communication to existing PLC mounting back plane.

PREPARED BY:

{Name}

{Title}

{Firm}

Date

APPROVED BY:

Michael D. Quillen, PE

City Engineer

City of Clearwater

Date



CITY OF CLEARWATER ENGINEERING DEPARTMENT

WORK ORDER INITIATION FORM CITY DELIVERABLES

1. FORMAT

The design plans shall be compiled utilizing the following methods:

1. City of Clearwater CAD standards.
2. Datum: Horizontal and Vertical datum shall be referenced to North American Vertical Datum of 1988 (vertical) and North American Datum of 1983/90 (horizontal). The unit of measurement shall be the United States Foot. Any deviation from this datum will not be accepted unless reviewed by City of Clearwater Engineering/Geographic Technology Division.

2. DELIVERABLES

The design plans shall be produced on bond material, 24" x 36" at a scale of 1" = 20' unless approved otherwise. Upon completion the consultant shall deliver all drawing files in digital format with all project data in Autodesk Civil 3D file format. If not available Land Desktop files are still acceptable, however the City or Clearwater is currently phasing out Land Desktop.

NOTE: If approved deviation from Clearwater CAD standards are used the Consultant shall include all necessary information to aid in manipulating the drawings including either PCP, CTB file or pen schedule for plotting. The drawing file shall include only authorized fonts, shapes, line types or other attributes contained in the standard release of Autodesk, Inc. software. All block references and references contained within the drawing file shall be included. Please address any questions regarding format to Mr. Tom Mahony, at (727) 562 4762 or email address Tom.Mahony@myClearwater.com.

All electronic files (CAD and Specification files) must be delivered upon completion of project or with 100% plan submittal to City of Clearwater.



WORK ORDER INITIATION FORM

PROJECT BUDGET

Task	Description	Unit Price	Equipment & Labor	Total
1.0	Flow Meter Installations and Calibrations:			
A	9 – FloWav Sensors with Telog Ru-32 RTUs	9 @ \$1,000 ea.	\$9,000	\$9,000
B	3 – Fuji Transit Time C Flow Meters with Telog Ru-32 RTUs * *Note – City to install 2 monitoring vaults over the force mains at LS 11 & 20 and provide conduits for power and communication to existing PLC mounting back plane.	3 @ \$2,000 ea.	\$6,000	\$6,000
				\$15,000
2.0	Rainfall Gauge Installations and Calibrations:			
A	6 – Texas Electronics Tipping Buckets with Telog RG-32 RTUs	6 @ \$500 ea.	\$3000	\$3,000
				\$3,000
3.0	Flow Meter Maintenance and Calibrations:			
A	9 – FloWav Sensors with Telog Ru-33 RTUs for 12 months.	9 X 12 @ \$850ea./month	\$91,800	\$91,800
B	3 – Fuji Transit Time C with Telog Ru-32 RTUs for 12 months	3 X 12 @ \$200ea./month	\$7,200	\$7,200
				\$99,000
4.0	Rainfall Gauge Maintenance and Calibration:			
A	6 – Texas Electronics Tipping Buckets with Telog RG-32 RTUs	6 X 12 @ \$150ea./month	\$10,800	\$10,800
				\$10,800
5.0	Monthly Reporting			
A	12 Flow Meters and 6 Rainfall Gauges for 12 Months	12X 12 @ \$500ea./month	\$72,000	\$72,000
				\$72,000
Total				\$199,800