

WORK ORDER INITIATION FORM for the CITY OF CLEARWATER

Date: 4/30/18
M&C Proposal Number: 17266
City Project Number: 18-0024-UT

1. PROJECT TITLE:

Northeast WRF Basin Inflow & Infiltration Permanent Flow Monitoring

2. SCOPE OF SERVICES:

The City of Clearwater Utility department has requested the McKim & Creed to provide permanent flow monitoring services for the sewer collection system in the Northeast WRF service areas. McKim & Creed shall provide its' rainfall gauging and flow monitoring equipment and its' remote telemetry unit communication platform (Telog) to record and process the collected data. Included in this work order is maintenance of permanently installed rainfall and flow monitoring equipment, as well as, the engineering real-time data analysis and monthly reporting of the recorded data. Additionally, a McKim & Creed Health and Safety Plan, tailored for the work to be performed, will be submitted.

The proposed locations of the flow monitoring equipment will be at two (2) major gravity sewer outfall locations and at four (4) major lift stations, as shown below.

Major Sewer Outfall:

1. N. Belcher @ Beginning of Alligator Creek
2. US 19 & Alligator Creek

Major Lift Stations:

1. Lift Station 53
2. Lift Station 42
3. Lift Station 46
4. Lift Station 58 (2 Meters)

Of the seven (7) permanent flow meter sites identified; all will utilize open channel flow monitoring devices to ascertain and record wastewater volumes. Permanent rainfall gauges will be installed at the Fire Station (N. Belcher and Logan); and at LS 55, LS 46, and LS 58.

I. MONTHLY FLOW MONITORING/RAINFALL GAUGING REPORTING

The collected data will be recorded for each piece of equipment and automatically uploaded to McKim & Creed's Telog 'Enterprise' server on a daily basis as currently is available for the East and Marshall Street Basins. The City will be able to access and download the Northeast Basin data through the same dedicated web browser application as is used for the East and Marshall Street systems and as before; the City will not be able to change any of the

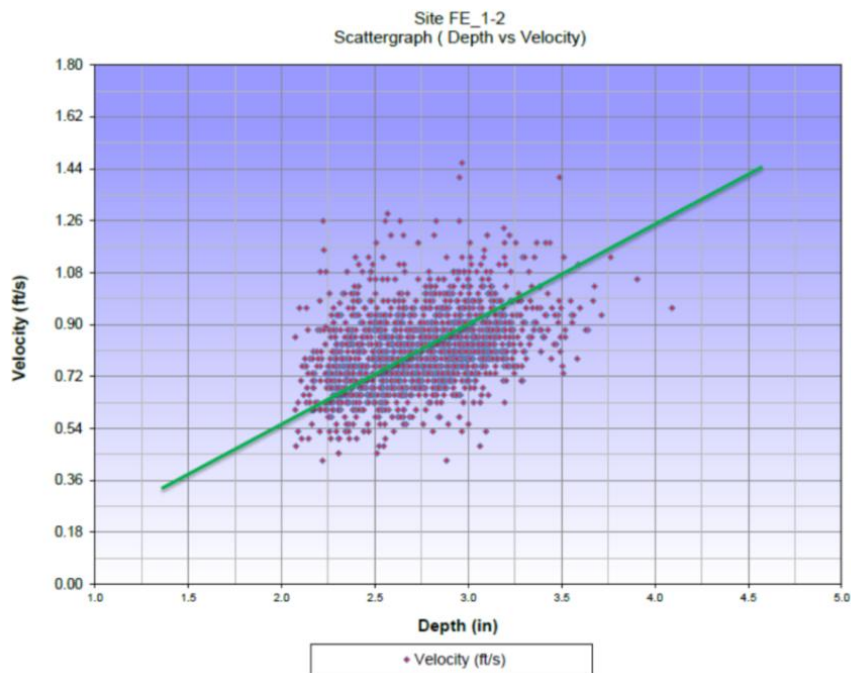
operational characteristics of the equipment, they can monitor rainfall increments and wastewater flow at every site and visualize the effects of wet weather events prior to receiving any monthly report. The flow monitoring and rainfall gauging will be performed concurrently for one (1) calendar year beginning May 1, 2018. 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:

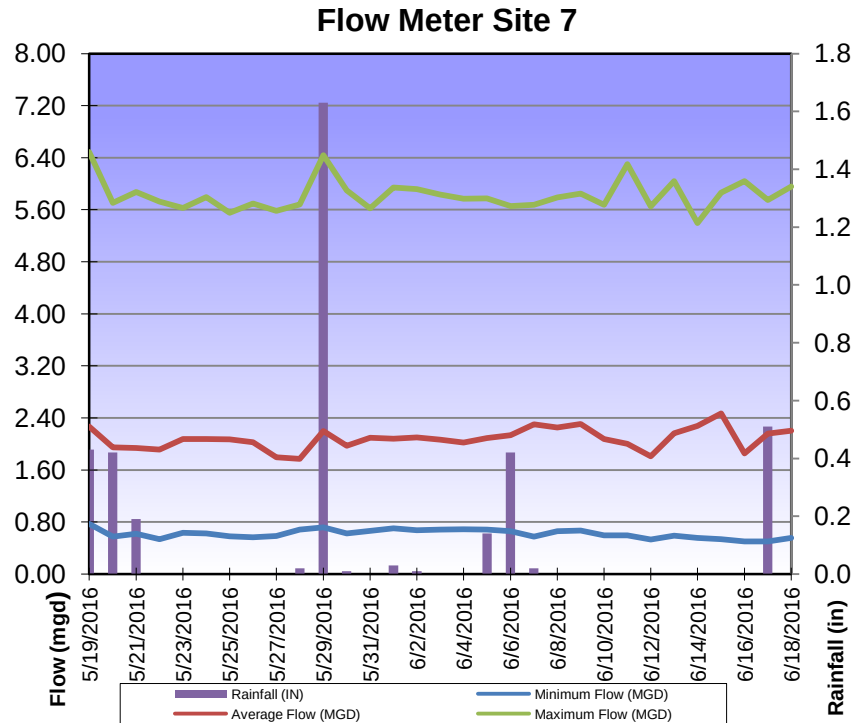
Graphical Representation of Data

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 including:

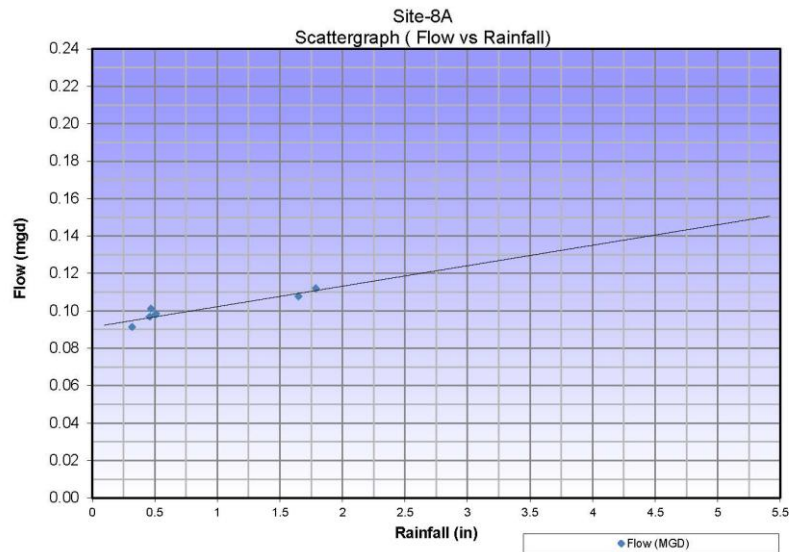
- Monthly graph (scatter graph) of flow depth versus velocity readings
- Monthly flow graph depicting daily maximum, average and minimum flow rates with daily rainfall accumulations
- Daily wet weather 24-hour flow volume versus recorded rainfall magnitude for events greater than 0.5-inches (regression analysis)

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





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 Excel™ 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 (15 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

II. 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. Site visits will be documented; including date of visit, maintenance activities performed, equipment calibrations performed and equipment that was replaced. Site visit documentation will be included with each monthly report.

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.

III. 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.
$$*RDI/I = \text{Total Flow Volume} - ABF$$
- 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:

- 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 in accordance with Professional Services Method "A" – Cost Times Multiplier Basis - Percentage of Completion by Task, **for a fee not to exceed One Hundred Twenty Three -Thousand, Four Hundred Dollars (\$123,400.00).**

No permitting is anticipated for this project.

5. SCHEDULE:

Installation and initial calibration of equipment will start on May 1, 2018 and continue throughout the month. Data captured during this period will be added to the first monthly report for the month of June.

Invoicing for maintenance and continued calibrations, recording of data and reporting for the flow meters/rainfall gauges will be from June 1, 2018 and continue until May 31, 2019. With the first invoice to the City by July 15, 2018.

The project will span **395 days** from May 1, 2018 as the last monthly report will be submitted for review on or before June 30, 2019. The project deliverables are to be phased as follows:

Begin Meter/Gauge Maintenance	1 calendar day
Perform Maintenance	365 calendar days
Conduct Monitoring and Reporting	395 calendar days

6. STAFF ASSIGNMENT:

City's Staff:

Jeff Walker, PE	Project Manager
Jeremy J. Brown, PE	Utilities Engineering Manager
Richard G. Gardner, PE	Public Utilities Assistant Director

McKim & Creed Project Staff

Aubrey Haudricourt, PE	Project Manager
Greg Anderson, PE,	Project Analysis Coordinator
Pratika Patil, EI,	Project Team Engineer
Sunil Khanal, EI,	Project Systems Analysis
Craig Watts, EI,	Project Systems Analysis

Mc Kim& Creed Field Installation, Maintenance and Calibration Staff

Delvin Carter, Patrick Goode, Quint Shelton, Charles Rials, Tony Goode

7. CORRESPONDENCE/REPORTING/COMMUNICATION PROCEDURES:

ENGINEER's project correspondence shall be directed to Jeff Walker, PE.

All City project correspondence shall be directed to the Project Manager, with copies to the Utilities Engineering Manager and Public Utilities Assistant Director.

ENGINEER shall provide a minimum of forty-eight (48) hours' notice prior to conducting fieldwork/site visits. ENGINEER shall provide a minimum of seven (7) days notification for site visits requiring the assistance of City Operations and Maintenance personnel.

ENGINEER acknowledges that all City directives shall be provided by the City Project Manager.

In addition to the original copies delivered as stated in the scope of work, all project deliverables will be submitted in electronic format on CD or other City approved device prior to approval of final invoice.

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: **NE: 0421-01355-530300-535-000-0000**

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. City Project Number, 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.

PREPARED BY:

Aubrey Haudricourt, PE.
Senior Project Manager
McKim & Creed

Date

APPROVED BY:

D. Scott Rice, 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 must be delivered upon completion of project or with 100% plan submittal to City of Clearwater.



NORTHEAST PERMANENT WASTEWATER FLOW MONITORING

WORK ORDER INITIATION FORM PROJECT BUDGET

Task	Description	Unit Price	Total # Units	Total
1.0	Flow Meter Maintenance and Calibrations:			
1.1	7- FloWav Meter Installation and calibration	\$1000ea.	7	\$7,000
1.2	7 – FloWav Sensors with Telog Ru-33 RTUs for 12 months.	\$800ea./month	84	\$67,200
				\$74,200
2.0	Rainfall Gauge Maintenance and Calibration:			
2.1	4 – Texas Electronics Tipping Buckets with Telog RG-32 RTUs	\$150ea./month	48	\$7,200
				\$7,200
3.0	Monthly Reporting			
3.1	7 Flow Meters and 4 Rainfall Gauges for 12 Months	\$500ea./month	84	\$42,000
				\$42,000
Grand Total				\$123,400