Ord No.: 1112-2009

Information to be included in all Legislation Modifying a Contract:

1. **The names, contract compliance no. & expiration date, location by City/State and status of all companies (NPO, MAJ, MBE, FBE, HL1, AS1, or MBR) submitting a competitive bid or submitting an RFP or RFSQ.**

Name	C.C. No./Exp. Date	City/State	Status
Metcalf and Eddy of Ohio, Inc.	*13-5511947/??*	*Columbus/Ohio*	*Majority*
Camp Dresser McKee. Inc.	*04-2473650 / April 11, 2010*	*Columbus/Ohio*	*Majority*

2. **What type of bidding process was used (ITB, RFP, RFSQ, Competitive Bid).**
   Modified RFP

3. **List the ranking and order of all bidders.**
   1. Camp Dresser, McKee, Inc
   2. Metcalf and Eddy of Ohio, Inc.

4. **The name, address, contact name, phone number and contract number of the firm awarded the original contract.**
   Camp Dresser, McKee, Inc
   8800 Lyra Drive, Suite 500
   Columbus, Ohio, 43240

5. **A description of work performed to date as part of the contract and a full description of work to be performed during any future phasing of the contract.**

   This project continues the development and enhancement of the City's Sewer System Capacity Model (SSCM). The SSCM is the culmination of the City's long-term commitment to accurately evaluate collection system capacity deficiencies and devising economical solutions to those deficiencies. Columbus' efforts to accurately predict sanitary flows began with the "Olentangy Scioto Interceptor Sewer Tributary Study - Phase I Report". That first effort ended with the "Columbus Sewer Capacity Study – Phase III" report and model. This, in turn, was updated in method and extent by the Model Update 2000 project (MU 2000).

   The basic services to be provided under this Agreement are specialized professional technical services necessary to update the SSCM from year 2000 to 2006 conditions. The model update is necessary to ensure continued conformance with the existing Consent orders between the City of Columbus and the State of Ohio, ongoing efforts to eliminate sanitary sewer overflows, minimize Water-in-Basement (WIB) occurrences, evaluate future development/expansion of served areas and evaluate collection system capital improvement projects included in the City's Wet Weather Management Plan (WWMP), submitted to the Ohio EPA on July 1, 2005.

   Goals of the Capacity Model Update:

   1. *Make the SSCM more accessible to users and provide appropriate controls, tools, etc to ensure consistency between different users of the model. This may require the development of new tools that generate or access model parameters (e.g. sewershed areas, RTKs, and system information) and derived data (e.g. base flows, I&I values, and hydraulic grade lines).*

2. *Evaluate the modeling industry's various modeling software to provide a clear estimate of the effort required to update the SSCM to the City's desired level of accuracy, complexity, and usability.*
3. *Update the SSCM to reflect system updates since the last update (2000).*
4. *Improve accuracy and resolution by adding a more thorough flow meter/rain gage data program.*
5. *Calibrate and validate the capacity model to multiple storm events.*
6. *Devise a model extension plan that would appropriately extend the model to areas with known problems which are not included in any other investigations (e.g. areas with higher concentrations of water-in-basements or known capacity problems not included in I&I).*
7. *Provide hydraulic grade line information for all modeled sewers.*
8. *Tightly integrate all data to the City's selected GIS platform.*
    a. *The City is using ArcGIS to manage their collection system assets.*
    b. *The model will likely include the development of new GIS databases, such as sewershed data, to the same level of refinement as used in the model. Sewershed data would include all relevant data in the GIS such as slopes, dimensions, imperviousness, population, etc.*
    c. *Ideally, selected model results would be accessible via GIS system.*
9. *Provide the means for a completely independent evaluation of the WWMP Modeling*
10. *Evaluate benefits of Real Time Control in the future including features of the WWMP system configuration.*

6. An updated contract timeline to contract completion.

Task	*Description*	*Proposed Completion*
Project Start	*Execute Project (NTP)*	*Dec 2006* *(4/2007 actual)*
Mobilization	*Acquire all background data, information, and initial investigations*	*Mar 2007* *(4/2009 actual)*
Evaluate WWMP Models	*Provide a thorough review and critique of the accuracy and reproducibility of WWMP and the philosophies and methodologies of the models and their resulting data/conclusions.*	*April 2008* *(9/2008 actual)*
Evaluate SSCM	*Produce a thorough review of the SSCM' s methodologies and operations, and recommend enhancements.*	*May 2008* *(11/2009 actual)*
Update SSCM	*Provide all accompanying work required to acquire rainfall and flow monitoring data; implement recommended enhancements; update model input datasets; and calibrate to multiple storms.*	~~*June 2009*~~ *Nov 2009*

Apply Model	*Perform model runs for various scenarios I&I Impacts, WWMP Program Progress, Build Out Evaluations, Satellite Inflows, Shadeville Trunk Evaluation, ORT Discharge evaluations, Misc. system Performance Evaluations*	*~~Dec 2009~~ May 2010*

7. **A description of any and all modifications to date including the amounts of each modification and the Contract Number associated with any modification to date. (List each modification separately.)**

This project was originally set-up to be modified for the originally envisioned phases (3). The listing below is the original "general" phasing provided in the legislation request for the original contract (except where revised in red). Significant additions to the scope have been added during Phase 2 (under Mod #1) to support on-going PPM and operations efforts. These efforts included 2 "skeleton" models built and field investigations on casting elevations along the Interconnector and Scioto Main Trunk for Interim Operations procedures.

Phase(Cost)	*Task/Description*	*Proposed Start Date/CN*
Original Contract ($1,954,291.68)*	*Start, Mobilization, Evaluate WWMP Models and SSCM, Begin SSCM Updates*	*Feb 2007/*
Mod 1 ($2,562,564.93)	*Update SSCM and Operational aids for PPM*	*May 2008/*
Mod 2 (~~$1,613,892.59~~) $2,754,801.94	*Complete SSCM Update and perform all Model applications*	*~~July 2009~~ Sept 2009*

Total Costs: ~~$6,130,749.20~~ $7,271,658.55**

**Note: Includes the total contract price with contingency. Portions of the unused task costs and contingency eliminated by the initiation of the subsequent Mod are currently also included. An accurate estimate of the cost of this project phase will be provided at a later date.*

8. **A full description of the work to be performed as part of the proposed contract modification. (Indicating the work to be a logical extension of the contract is not sufficient explanation.)**

1. *Complete wet-weather calibration and validation efforts for the Model Update.*
2. *Complete model validation work.*
3. *Perform Model Applications as directed by the City:*
    a. *Perform a Sensitivity Analysis of WWMP Assumptions on WWMP Recommendations by evaluating various parameters such as I&I Impact on System Flows and WWMP Recommendations, Satellite Infiltration/Inflow estimates, the effect of Actual Program Progress on WWMP Recommendations, the effect of Projected Program Progress on WWMP Recommendations, effect of various Development Scenarios,*

    b. *Support City Facility Planning and Capital Improvement Projects Design Efforts such as Big Walnut Outfall Augmentation Trunk Sewer Evaluation, Kinnear Road Subtrunk Augmentation Trunk Sewer Evaluation, Franklin No. 1 Augmentation*

Trunk Sewer Evaluation, Westside Relief Augmentation Trunk Sewer Evaluation , Big Run Augmentation Trunk Sewer Evaluation, ORT Discharge Evaluation, Scioto Main/McKinley Avenue Overflow System Modification, WWMP Recommended Inflow Redirection (IR) Projects, and Real Time Control Feasibility.

c. The detailed scope is as follows, excerpted from the Mod Contract:

12.1 Perform a Sensitivity Analysis of WWMP Assumptions on WWMP Recommendations

The WWMP necessarily includes a variety of assumptions about build-out conditions, unmonitored area I&I rates, satellite system flows, future I&I remediation levels and effectiveness and proposed facility configurations and sizing. The ENGINEER will use the MU 2006 model to test the sensitivity of the WWMP recommendations to variability in all of these conditions and factors. Each aspect of this sensitivity analysis is described individually below.

12.1.1 Evaluate I&I Impact on System Flows and WWMP Recommendations

The SSCM, SECAP, and LTCP Models were all developed using certain I&I estimates based upon flow monitoring data. The City's Wet Weather Management Plan assumed that these estimates were reasonably applied to all unmonitored areas. The ENGINEER will use the MU 2006 model with updated I&I rates to develop an updated characterization of the performance of the existing system and of the system after implementation of the various WWMP recommendations.

12.1.2 Evaluate the Effect of Actual Program Progress on WWMP Recommendations

An annual evaluation of the City's WWMP is required under both of the existing wet-weather-related Consent Orders. As part of that evaluation, periodic reviews of progress are also required. The ENGINEER will evaluate the effect of that progress upon various WWMP elements, including raising CSO regulator weir elevations, CSO regulator sluice gate modifications, and other early CSO-related work completed to-date. If progress significantly affects all or parts of the WWMP recommendations, the City may request that the ENGINEER make revisions to those recommendations as a separately authorized task.

12.1.3 Evaluate the Effect of Projected Program Progress on WWMP Recommendations

The ENGINEER will use the MU 2006 model to test the sensitivity of the WWMP recommendations to WWMP assumptions of system-wide program progress (completion schedules and performance effectiveness). The model will be used to simulate various program progress scenarios and determine the sensitivity of system-wide performance to these assumptions.

12.1.4 Evaluate Development Scenarios

The ENGINEER will employ the MU 2006 model to estimate the Level of Service (LoS) provided by the system under various future development conditions, including "final build-out conditions". Various build-out scenarios will be

simulated to test system performance sensitivity to these assumptions. This will include scenarios such as the recent effort to evaluate the Big Walnut Sanitary Trunk Sewer, as well as other areas of focus for future development conditions.

12.1.5 Satellite Infiltration/Inflow Estimates

The ENGINEER will use the MU 2006 model to estimate the quantity of infiltration/inflow received from satellite systems incident to the City's sewerage system under both existing and future conditions. Various satellite I&I scenarios (representing variability in both uncontrolled I&I as these systems age and variability in future levels of I&I control and its effectiveness) will be simulated to test system performance sensitivity to these assumptions.

12.2 Support City Facility Planning and Capital Improvement Projects Design Efforts

The ENGINEER will use the MU 2006 model to support several ongoing and/or anticipated facility planning and capital improvements projects being performed by or for the City. Where applicable, the ENGINEER shall provide all information (Maps, charts, models, etc) required to complete a City Table 1 form for inclusion in the Capital Improvements Program. These include the following:

12.2.1 Big Walnut Outfall Augmentation Trunk Sewer Evaluation

This project was identified by Large-scale System Solutions (LSSS) modeling efforts and described in the Detailed Minor Systems Enhancements Report. It involves a 96-inch parallel relief sewer from Williams Rd./I-270 (0145S0010) to Alum Creek Dr., south of Groveport Rd. (0261S0014), a distance of 11,910 feet.

The ENGINEER will use the MU 2006 model to evaluate the WWMP assumed design parameters for the as-yet un-designed BWO (Shadeville) Trunk Sewer and make new recommendations. Currently, the assumed shallow depth and low slope of the sewer to relieve two of the City's pump stations may cause significant problems upstream.

12.2.2 Kinnear Road Subtrunk Augmentation Trunk Sewer Evaluation

This project was also identified by LSSS modeling efforts and described in the Detailed Minor Systems Enhancements Report. It involves two relief sewer segments:

- *Segment 15-1. Relief at Third Ave./Olentangy River Rd. (0010S0379) to ORT.*
- *Segment 15-2. Parallel Relief Sewer from King Av./Olentangy River Rd. to Fifth Av/Olentangy River Rd. (0027S0156 to 0027S0246).*

The ENGINEER will use the MU 2006 model to evaluate the WWMP assumed design parameters for the as-yet un-designed Kinnear-S relief sewers and make new recommendations.

12.2.3 Franklin No. 1 Augmentation Trunk Sewer Evaluation

This project was also identified by LSSS modeling efforts and described in the Detailed Minor Systems Enhancements Report. It involves a parallel 30-inch Relief Sewer from Fifth Ave./Dublin Rd. to Timberman Rd./Goodale Blvd. (0049S0060 to 0010S0016), a distance of 13,950 feet.

The ENGINEER will use the MU 2006 model to evaluate the WWMP assumed design parameters for the as-yet un-designed FR1 relief sewer and make new recommendations.

12.2.4 Westside Relief Augmentation Trunk Sewer Evaluation

This project was also identified by LSSS modeling efforts and described in the Detailed Minor Systems Enhancements Report. It involves a parallel 30-inch Relief Sewer from Edwin St. /Mound St. to Harrisburg Pike/Mound St. (0022S0284 to (0007S0013), a distance of 2,450 feet.

The ENGINEER will use the MU 2006 model to evaluate the WWMP assumed design parameters for the as-yet un-designed WSR relief sewer and make new recommendations.

12.2.5 Big Run Augmentation Trunk Sewer Evaluation

This project was also identified by LSSS modeling efforts and described in the Detailed Minor Systems Enhancements Report. It involves a parallel 60-inch Relief Sewer from north of Big Run Rd./Gantz Rd. to Jackson Pike (0071S0219 to 0070S0048), a distance of 11,610 feet.

The ENGINEER will use the MU 2006 model to evaluate the WWMP assumed design parameters for the as-yet undesigned BRN relief sewer and make new recommendations.

12.2.6 ORT Discharge Evaluation

The ENGINEER will use the MU 2006 model to evaluate the Olentangy-Scioto Relief Trunk Sewer (ORT) configuration currently proposed in the WWMP. The WWMP proposed that the ORT discharge into the Interconnecting Trunk Sewer upstream of the Interconnector Flow Control Structure in order to optimize treatment options at Jackson Pike Wastewater Treatment Plant (JPWWTP) before diverting excess flows to Southerly Wastewater Treatment Plant (SWWTP). In some larger flow events, this configuration caused modeled flows to back-up into the Scioto Main Replacement Sewer at locations further upstream and discharge into the ORT. This condition and the outlet connections of the ORT will be the focus of this evaluation.

12.2.7 Scioto Main/McKinley Avenue Overflow System Modification

The ENGINEER will use the MU 2006 model to evaluate the modifications needed to the system to support safe use of the existing vortex valve system storage facility and protect the system if flows are surcharged in the downstream system. Currently the system experiences serious flooding problems if flows are backed up in this line. The new model will be used to support and refine current efforts to evaluate these conditions.

12.2.8 WWMP Recommended Inflow Redirection (IR) Projects

The ENGINEER will use the MU 2006 to evaluate the effects and extents of design alternatives proposed by the City's Project Consultants in the IR projects currently underway in the downtown area. The ENGINEER shall also make refinements to those extents as required to ensure the work proposed under the IR projects meet or exceed minimum WWMP expectations and City design requirements. Those projects may include: Town and Fourth (CIP 712) Cherry and Fourth (CIP 707) and Mound East of 71 (CIP 709).

The ENGINEER shall provide, at a minimum a Technical Memorandum for each project that includes information about recommended pipe geometry, planimetric locations, flow data and overflow activation. It is anticipated that this will be an iterative process that may require several meetings and model out-put re-evaluations to achieve stated goals.

12.3 Modeling Review of WWMP Storage Tank Recommendations

Local Storage facilities are proposed in the Northern CSO areas (Frambes Ave, Noble and Grant, Mound, Kerr and Russell, Third Ave, King Ave, Indianaola Ave). The ENGINEER will employ the MU 2006 model to support the City's efforts in verifying and/or clarifying the sizes and general locations of the Storage Tanks recommended in the WWMP.

12.4 Support City I&I Remediation Planning

The ENGINEER will employ the MU 2006 model to support the City's efforts in identifying sub-systems for which I&I remediation may be feasible and beneficial. Where requested, the ENGINEER shall also provide statistical analysis expertise (both from His own resources and sub-consultants, if required), in the evaluation of remediation work results. There are three areas of I&I remediation which this task will address:

12.4.1 I/I Study Areas – The ENGINEER will evaluate the impact of I&I reduction in the City's current I&I study areas. These include the major I&I basin areas (Livingston/James, West 5th Avenue, Barthman/Parsons, Early Ditch and Northwest Alum Creek) and the second round of basin studies currently being initiated. The MU 2006 model will be used in evaluating existing reduction efforts and identifying new areas for concentration.

12.4.2 New WIB Investigation Areas – The ENGINEER will employ the MU 2006 model to identify new areas where I&I reduction may be of value for WIB impact mitigation. This subtask will include a system-wide analysis of the potential locations of WIBs and surface flooding using the recently-developed LIDAR data for estimating basement and surface elevations.

12.4.3 Statistical Analysis of Pre- and Post-Remediation efforts – The ENGINEER will provide statistical analysis expertise as required and requested in evaluating the effects of completed of on-going remediation efforts in Clintonville and other areas and other separation and inflow redirection efforts.

12.5 Real-Time Control Feasibility Study

The ENGINEER will evaluate the potential benefits of real-time control (RTC), including real-time operation of certain features of the WWMP system configuration, using the updated model. This will be accomplished through a series of subtasks. The earlier subtasks will address short-term, project-specific opportunities to incorporate RTC into existing facilities, and near-term WWMP facilities as they are being planned and designed. The later subtasks will develop increasingly sophisticated, system-wide RTC strategies for global system optimization.

12.5.1 Continued Support to the City's TE/PE Wet Weather Operations Plan Modifications

The ENGINEER will continue involvement with the City's TE/PE Wet Weather Operations Plan Modifications working group. The ENGINEER will continue to attend regular meetings of the group and perform model simulations to represent various operating scenarios to support the group's operational planning objectives.

12.5.2 Evaluate RTC optimization of existing system and near-term WWMP facilities

The ENGINEER will use the updated model to evaluate opportunities to incorporate RTC strategies into the operation of the City's existing facilities. While the focus of subtask 12.5.1 will be on supervisory control, this subtask will focus on automatic control. The strategies will generally involve the use of local controls, or limited remote control strategies, which are the most complex but often can also provide the most benefit.

The key objective will be to identify opportunities to use RTC to optimize the performance of existing facilities and those facilities defined in the WWMP that will be coming on-line in the near term. The specific facilities to be evaluated for RTC implementation include:

- *Whittier Street Storm Tanks,*
- *Alum Creek Storm Tanks,*
- *Deshler Tunnel,*
- *OSIS,*
- *Upper Scioto West Interceptor siphons,*
- *BWARI,*
- *BWOAS,*
- *the plant Interconnector and related control structures, and*
- *Lockbourne Intermodal Subtrunk.*
  (The OARS tunnel will also be evaluated for RTC per the separate subtask described below.)

12.5.3 OARS tunnel flow control requirements

Because of its magnitude and importance in the overall WWMP improvement plan, a separate subtask to evaluate the OARS tunnel has been defined. Current efforts to model and evaluate tunnel control strategies are focused on preventing

the formation of disruptive and potentially dangerous hydraulic transients, and this task will not duplicate that effort.

The ENGINEER will apply the updated model to evaluate opportunities to optimize the overall system performance by implementing automatic remote RTC strategies. For example, balancing storage operation between the local off-line storage tanks (see Task 12.3) and the OARS tunnel can be evaluated.

12.5.4 System-wide RTC strategy

The nature of the existing sewer system in Columbus lends itself to optimization with RTC. The facilities proposed in the WWMP will only serve to increase the potential for RTC to enhance system performance. The Columbus system provides an opportunity to employ both:

- *in-system storage approaches to optimize wet-weather flow capture and*
- *flow diversion approaches to optimize wet-weather flow conveyance.*

Both approaches can maximize treatment system effectiveness in reducing wet weather loads to the receiving streams.

The ENGINEER will use the updated model to extend the analysis of RTC strategies for the existing and near-term WWMP facilities and produce a comprehensive RTC strategy for the Columbus sewer system. It is expected that this strategy will incorporate system flow levels and flow rates, spatially-distributed rainfall depths, the status of various operating devices (e.g. pump on/off status, tank/tunnel depths, gate open/closed/position status, etc.) and other information as may be available and useful and produce a remote automatic control strategy to optimize system performance.

The ENGINEER will specifically explore the opportunity to employ distributed (decentralized) RTC strategies for system optimization, and will compare the advantages and disadvantages of distributed versus global RTC strategies.

12.5.5 System optimization using predictive RTC algorithms

The ENGINEER will evaluate the potential to employ global predictive RTC algorithms to enhance the reactive RTC strategies developed under subtask 12.5.4. This analysis will be performed in parallel with the system-wide strategy developed in subtask 12.5.4 and will be incorporated into that strategy. The opportunity for enhanced flow capture provided by the prediction of rainfall depth/distribution characteristics will be evaluated against the uncertainty introduced by the predictions. These trade-offs will be assessed and defined in the system-wide RTC strategy.

12.6 <u>Support City Planning for Sustainable Wet Weather Management</u>

The ENGINEER will use the MU 2006 model to simulate the effect of various scenarios for use of green stormwater infrastructure (GSWI) within the combined sewer area to manage wet weather impacts. These scenarios will include various stormwater management practices for reducing imperviousness and altering the hydrologic response of the combined sewer area to more closely mimic the pre-development hydrology. These practices may be integrated with

urban redevelopment, urban greenspace planning and other anticipated future scenarios.

The ENGINEER will evaluate the extent to which the WWMP CSO area facilities may be potentially reduced through the enhanced integration of GSWI into the improvement plans. The use of GSWI to support RDII remediation planning and separate stormwater system flow/load management will also be assessed using the updated model to characterize the potential system-wide effectiveness of GSWI.

12.7 Support Ad-Hoc City Planning and Design Project Needs

The ENGINEER will provide modeling support to various City planning and design project needs as directed by the City. This subtask provides an allowance for the ENGINEER to apply the MU 2006 or perform other specialized modeling, analysis and evaluation to address specific needs as they arise.

9. If the contract modification was not anticipated and explained in the original contract legislation a full explanation as to the reasons the work could not have been anticipated is required. (Changed or field conditions is not sufficient explanation. Describe in full the changed conditions that require modification of the contract scope and amount.)

The modification was anticipated.

10. An explanation of why the work to be performed as part of the contract modification cannot be bid out. (Indicating the work to be a logical extension of the contract is not sufficient explanation.)

The work included herein is an integral part of the original requested product. Seeking to provide such from another vendor will cause significant increases in cost.

11. A cost summary to include the original contract amount, the cost of each modification to date (list each modification separately), the cost of the modification being requested in the legislation, the estimated cost of any future known modifications and a total estimate of the contract cost.

See item #7 above.

12. An explanation of how the cost of the modification was determined.

The work was estimated from a Task/hour breakdown.

13. Sub-Consultants identified to work on this contract, their contract compliance no. & expiration date, and their status (NPO, MAJ, MBE, FBE, HL1, AS1, or MBR):

Name	C.C. No./Exp. Date	Status
Stantec	*11-2167170 / January 7, 2010*	*MAJ*
Donohue IDEAS	*06-1716807 / June 11, 2011*	*FBE*
Dynotec	*31-1319961 / May 13, 2011*	*MBE*

Brown and Caldwell	*68-0442806 / June 17, 2010*	*MAJ*
BPR/CSO	*C.C. No. pending*	

14. <u>Scope of work for each subcontractor and their estimate of dollar value to be paid.</u>

Stantec	*CIP project evaluation*	*$186,240*
Donohue IDEAS	*Model application support*	*$157,300*
Dynotec	*Model application support*	*$144,463*
Brown and Caldwell	*Evaluate I/I impacts*	*$ 43,456*
BPR/CSO	*RTC feasibility evaluation*	*$52,633*

Note: The Contract should be considered to include any and all work that is anticipated to be awarded to the company awarded the original contract throughout the contract/project timeline. This includes the original contract and any and all future anticipated modifications to the contract to complete the contract/project.

Updated as of 4-3-09 (JPM)