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SCOPE OF WORK
WASTEWATER TREATMENT AND DISPOSAL FACILITIES CPAACITY STUDY
September 14, 2005

The scope of work presented below was prepared following a discussion with the City of Escondido staff regarding the intent of the project and the final product desired. As required in the original RFQ&P, the tasks are centered around performing the following analyses:

- Wastewater Flow Analysis
- HARRF Capacity Analysis
- ELO Capacity Analysis
- Ocean Outfall Capacity Analysis

The scope and fee estimate developed herein assumes that the City will provide and/or perform the following tasks:

- Attend and participate in workshops and meetings
- Provide historical operating and performance data, as-built drawings, reports, and other documents as needed

Additional data/assistance needs are indicated individually for each task or subtasks. It is understood that the City will provide the needed resources to perform the sampling, monitoring and analyses if they are available. Otherwise, with City approval, Brown and Caldwell will provide the staff to conduct the sampling and monitoring and contract with an independent certified laboratory to perform the needed laboratory analyses. This option is described in more detail in Task 7.

Task 1 – Evaluate Wastewater Flows

Tasks relating to the evaluation of wastewater flows reaching the HARRF are described below.

Subtask 1.1 – Collect Data

It is assumed that the City will provide the latest wastewater master plan, HARRF influent and effluent flow data, HARRF influent and effluent BOD and TSS data, HARRF operational data, and SEJPA Regulator Structure and City of San Diego Pump Station 77 operational data. Influent peak flows, typically observed during wet weather conditions, will be of particular importance when determining capacities. Therefore, it is assumed that Brown and Caldwell will also receive the latest infiltration/inflow (I/I) study performed for the collection system as well as daily peak instantaneous influent flow data, if available.

Subtask 1.2 – Evaluate Data

Brown and Caldwell will evaluate the collected wastewater flow data (existing and projected) and use it for the HARRF plant analysis and outfall capacity analysis. The analysis will account for the equalization that can be achieved at HARRF and Pump Station 77. If sufficient data exist, the attenuation that occurs within the collection system, HARRF, and ELO will also be considered. Assuming accurate flow data (+/- 10 percent) are available, additional flow metering will not be necessary under this phase of the study. Supplemental flow metering may be needed to verify the historical data and is addressed in Task 7 below.

Subtask 1.3 – Wastewater Characterization Study

Brown and Caldwell will be using the activated sludge simulator, BioWin, to assess the capacity of the activated sludge system, including the aeration system. As discussed with City staff, a wastewater characterization study would be required if sufficient monitoring and performance data do not exist to enable an accurate calibration of BioWin. Based on the Variable List (a list maintained by the process control software package used at HARRF, Ops 32) provided to us by John Burcham, we strongly recommend that a wastewater characterization study be performed to supplement the existing data set. Of primary concern is the fact that BioWin is based on COD, not BOD. It is imperative, therefore, that COD data (at the very least) be collected as described below.

Brown and Caldwell will develop a sampling protocol to be reviewed by City staff. It is envisioned that the City staff can verify suitability of the sampling locations and provide the equipment necessary for the sampling program. However, should equipment be unavailabale, Brown and Caldwell will provide the equipment. The equipment will either be rented from Brown and Caldwell, if available, or a sampling equipment rental company approved by the City. The fee for equipment rental is addressed in Task 7.

There are three elements to the wastewater characterization study: (1) composite sampling, (2) diurnal sampling and (3) mass balance sampling.

Composite Sampling

Daily composite sampling will be performed over a two-week period. For each sampling day, raw influent, secondary influent (i.e., primary effluent inclusive of any return streams), and secondary effluent will be sampled and analyzed for the constituents in Table 1. Samples must be 24-hour composite samples. Mixed liquor and waste activated sludge (WAS) will be sampled on a once-per-day grab basis and analyzed for the constituents identified in Table 1.

Diurnal Sampling

At the end of the 14-day period, grab samples of primary effluent and secondary effluent will be taken at two-hour intervals over a 24-hour period. They will be analyzed for the constituents listed in Table 2.

Mass Balance Sampling

All solids handling operations will be sampled comprehensively. Supplementary analyses needed on all recycle streams (daily grabs over a two-week period) are: flow, COD, BOD, and TSS.

Other plant data that may be requested include:

- Plant O&M Manual
- Plant's monthly DMR permit reports for the last three year

- Solids stream recycle flows
- Recycle concentrations
- If they are separate digester feeds:
  - Scum flow and concentration
  - Grit flow and poundage

It is anticipated that better raw data may be available for plant influent flows and loads than for internal plant sludge and liquid streams. Brown and Caldwell will work with the City to derive or estimate missing data. However, new monitoring or metering installations or data collection may be necessary (to be performed under Task 7). It is assumed that the City will provide the following:

1. Composite samplers and staff to perform the required composite, diurnal, and mass balance sampling if available, otherwise Brown and Caldwell will provide sampling equipment and staff under Task 7

2. Current flow and loading data as described previously, as well as the adopted planning projections for the plant

3. A person to gather materials identified above and to explain the City's format for record keeping relative to past contracts and as-built drawings. That same person will identify which staff member can best discuss each process system and help arrange meeting times for discussion.

Summary tables of data will be generated as input into the final report prepared under Task 5.

Table 1
Analyses Required for Composite Wastewater Characterization Study
(shaded boxes indicate data essential to BioWin calibration)

Parameter	Raw influent	Primary effluent	Secondary effluent	Mixed liquor	WAS	RAS
Flow	X	X			X	X
tCOD – total COD	X	X	X		X	X
sCOD – soluble COD (1)		X	X			
ffCOD – floc COD (2)		X	X			
$CBOD_5$ – 5-day carbonaceous BOD	X	X	X			
$sBOD_5$ – soluble BOD_5 (1)		X	X			
TSS - total suspended solids	X	X	X	X	X	X
VSS – volatile suspended solids	X	X	X	X	X	X
TKN – total Kjeldahl	X	X	X			
sTKN – soluble Kjeldahl (1)		X	X			
NH_3 – ammonia nitrogen (1)	X	X	X			
NO_2 – nitrite nitrogen (1)			X			
NO_3 – nitrate nitrogen (1)			X			
P – total phosphorus	X	X	X			
PO_4-P – soluble orthophosphate (1)	X	X	X			
Alkalinity (as $CaCO_3$)		X	X			
VFAs – volatile fatty acids		X				
Temperature				X		

(1) Filtrate from filtration through 0.45 μm fiberglass filter.
(2) Filtered, floc COD is a measure of readily biodegradable COD.
(3) Parameter already regularly measured and recorded in monthly plant report. COD, BOD, NH_3-N, and alkalinity not measured daily. COD and BOD are not measured on the same day--would need to be measured on same day.

Table 2
Diurnal Sample Characterization
(performed on influent grab samples collected every 2 hours over a 24-hour period)

Parameter	Primary effluent	Secondary effluent
Flow	X	
COD	X	
ffCOD	X	X
BOD	X	
TSS	X	
TKN	X	
TP	X	

Task 2 – Determine the Capacity of HARRF

Evaluation of the hydraulic and treatment capacity at HARRF will be performed under this task.

Subtask 2.1 – Establish Process Objectives

The objective of this subtask is to collaboratively develop process objectives and evaluation criteria for conducting the HARRF capacity analysis.

Brown and Caldwell will conduct one workshop with the City of Escondido engineering and operations staffs to identify minimum and maximum operating and process criteria, including:

- Number of units in service/out of service to meet peak demands
- Attended operations
- Effluent limits
- Liquid versus solids stream inventories and need to provide peak capacity
- Reserve capacity
- Construction versus operations flexibility

Meeting notes will be prepared that summarize the discussions and findings of the workshop.

Subtask 2.2 – Plant Hydraulic Profile Analysis

The objective of this task is to determine if the hydraulic capacity of HARRF matches or exceeds the process capacity identified in subsequent tasks. Brown and Caldwell will estimate the plant hydraulic profile and energy grade-line for the liquid stream using an in-house plant hydraulic model called PROFILE. The model will be developed using available data obtained from the existing drawings and calibrated to field conditions. The calculations performed by PROFILE will be compared to the observations by the Operations staff during high flow events. If the calculations and observations do not agree, field measurement of weir and water surface elevations and stress testing will be conducted (under Task 7).

In summary, activities will include the following:

- Conduct field reconnaissance and review of plant data
- Construct hydraulic model of liquid stream unit processes
- Calibrate hydraulic model to field conditions
- Arrange and conduct hydraulic stress tests for unit processes as required based on model results and field reconnaissance
- Identify flow restrictions (bottlenecks)
- Summarize findings and prepare report with recommendations

We assume that the City will provide the following items:

- Operating schemes for each unit process including operating levels and recycle rates
- Pump performance curves and operating points

At the conclusion of this task, Brown and Caldwell will produce a technical memorandum that reports the hydraulic capacity of the various hydraulic structures at HARRF, identifies the bottlenecks and provides recommended improvements.

Subtask 2.3 – Primary Clarifier Evaluation

Brown and Caldwell will evaluate the performance of the primary clarifiers to remove BOD and TSS and estimate the effect on downstream processes. We will conduct a statistical evaluation of historical primary clarifier performance data and full scale stress testing to determine the maximum seasonal capacity and impacts to downstream process units. The following activities will be performed under this task:

- Analyze historical primary clarifier performance data to (a) statistically correlate TSS and BOD removals with hydraulic and mass loading and (b) estimate the non-settleable TSS concentration and the solids settling parameter
- Conduct full scale stress tests to measure the non-settleable TSS and effluent TSS concentrations to quantify primary clarifier performance

At the conclusion of this task, we will prepare a technical memorandum (TM) containing a summary of the findings and recommendations for improving the performance of the primary clarifiers.

Subtask 2.4 – Biological Process Evaluation

The biological treatment process is one of the two most sensitive processes at a treatment plant that dramatically influence effluent quality and, often times, plant capacity. Brown and Caldwell will identify the maximum biological treatment capacity with respect to current wet and dry weather permit requirements and operating conditions and estimate biological system capacity. This task will involve a combination of some full-scale operational testing and computer simulations using BioWin to identify process capacity. The investigation will determine limits under seasonal conditions and current and potential future permit requirements. Activities under this subtask include the following:

- Model calibration – data from composite and diurnal testing (Subtask 1.3) and the evaluation of historical operating data will be used to calibrate BioWin
- Analysis of BioWin simulation data
- Prepare and review with City staff the results and recommendations

The as-built drawings and equipment performance data provided for the biological process should include, but not limited to, aeration system configuration, blower performance data, diffuser data, tank configuration, and operating objectives (MLSS and DO concentration, SRT, HRT, etc.)

At the conclusion of this subtask, the following items will be generated:

- A TM that provides a summary of the BioWin results and a discussion on the process capacity of the City's activated sludge system

- Up to three alternative biological system simulation analyses

Subtask 2.5 – Secondary Clarifier Evaluation

Performance and efficiency of the secondary clarification process is critical in achieving permit limits. Brown and Caldwell will establish the maximum capacity of the secondary clarifiers, identify inefficiencies, and determine any operational adjustments to maximize secondary clarifier capacity given the current configuration of the two different pairs of secondary clarifiers. Activities included in this subtask are as follows:

- Conduct field inspection of clarifiers
- Evaluate secondary clarifier performance, MLSS, RAS flow, SVI, and WAS flow data and conduct statistical analyses
- Conduct field tests measuring the dispersed suspended solids (DSS), effluent TSS, flocculated suspended solids (FSS), and activated sludge settleability for each clarifier
- Evaluate influent and distribution hydraulics
- Prepare TSS, ESS, DSS and FSS curves
- Prepare velocity gradient model and diagrams for one clarifier
- Analyze the field data and conduct a state point analysis
- Summarize data and findings and develop recommendations
- Discuss findings with City staff
- Prepare a TM discussing the findings and recommendations

At the conclusion of this subtask, the following items will be produced:

- State point analysis
- Mass flux curves demonstrating the DSS, ESS, FSS, and TSS performance
- A TM describing secondary performance testing and capacity results

Subtask 2.6 –Mass Balance Analysis

Understanding how solids are inventoried, accumulated, and consumed in the liquid and solids stream processes are key to understanding the capacity of the whole plant. Performing a mass balance using historical data also helps determine the accuracy of flow, TSS, and BOD measurements. The mass balance links the results of the previous tasks together to assess the tradeoffs between increasing performance in one section of the plant.

Under this subtask, Brown and Caldwell will do the following:

- Evaluate historical data and previous task results
- Perform data and statistical analyses
- Prepare a calibrated mass balance model
- Calibrate and analyze model results
- Prepare mass balance diagrams
- Summarize data and develop recommendations
- Discuss findings with City staff
- Prepare a TM

We assume that the City will provide/perform the following:

- Historical process flow and concentration data to and from unit processes.
- Support construction of the mass balance model
- Participate in workshops and preparation of recommendations

At the conclusion of this subtask, the following items will be produced:

- Calibrated mass balance model
- A TM describing the mass balance analysis and a summary of the results and recommendations

Subtask 2.7 – Solids System Evaluation

Brown and Caldwell will determine the capacity of the solids handling treatment process including thickening, stabilization, and dewatering. This task does *not* include an analysis of the capacity of the biosolids end-of-treatment facilities (i.e., final re-use or disposal facilities such as landfills, land application areas, etc.). We will perform the following tasks:

- Evaluate thickener performance and polymer consumption
- Conduct a desktop capacity analysis of the thickeners
- Evaluate digester performance and mixing and heating systems
- Evaluate dewatering centrifuge performance and polymer consumption
- Conduct desktop capacity analysis of the dewatering centrifuge
- Review results with City staff
- Prepare a TM

Since the SRT of the digesters can range from 12 to 30 days, full-scale testing will be limited to the capacity of the support systems. Evaluating the differences in solids destruction with different SRTs requires 2 to 3 SRTs between tests to stabilize the organisms to new conditions. The schedule and budget currently do not include differential digestion testing. We assume that the City will provide solids system performance data.

At the conclusion of this subtask, the City will receive a TM that summarizes the solids system capacity results and recommendations.

Subtask 2.8 – System Integration and Plant Optimization Report

Brown and Caldwell will combine the information from all the above tasks to form an integrated assessment of the plant capacity and bottlenecks. We will develop a prioritized list of improvements to maximize plant capacity and estimate the cost of each improvement. We plan to execute this subtask as follows:

- Conduct sensitivity analyses comparing component performance
- Analyze and compare plant performance against manufacturers/design data
- Prepare a prioritized list of bottlenecks
- Develop composite rating diagrams establishing the rated plant capacity

- Prepare an order of magnitude opinion of the construction cost of each recommended improvements
- Prepare a draft Plant Capacity Report
- Review results and draft report with the City staff
- Amend report based on the City's comments and, if necessary, submit the final report to the Regional Water Quality Control Board for approval

At the end of this subtask, the City will receive the following:

- Five hard copies of the draft Plant Capacity Report and one electronic copy in PDF format
- Five copes of the final Plant Capacity Report and one electronic copy in PDF format

Task 3 - Determine the Capacity of the ELO

Our approach for analyzing the ELO capacity is described below.

Subtask 3.1 - Construct Hydraulic Model

Brown and Caldwell will evaluate the feasibility of using H2OMap Sewer in constructing a hydraulic model. If it is deemed that H2OMap Sewer is incapable of producing reliable results, Brown and Caldwell will use another 'off-the-shelf' modeling software (e.g., InfoWorks) and physical data (eg; inverts, pipe sizes etc) obtained from as-built plans, existing models and available GIS data provided by the City to generate a model. The hydraulic model will include sealed manholes, diversion structures, gravity and surcharge flows, head and pipe friction losses. It is assumed that a field survey will not be performed.

Note that the fee estimate does not include the purchase of the software. If H2OMap Sewer is used, it is assumed that the license can be temporarily transferred to Brown and Caldwell for use in our computer. Brown and Caldwell already owns a license for InfoWorks; therefore, the software does not have to be purchased.

Subtask 3.2 – Conduct Capacity Evaluation

Brown and Caldwell will evaluate the existing capacity of the ELO using the hydraulic model constructed in Subtask 3.1. Model calibration will be conducted using available data and supplemental data collected under Task 7. The maximum ELO capacity is defined as the maximum peak flow entering the outfall without causing spills. The effect of downstream back-water effects will be taken into account when assessing the ELO capacity. Results from the hydraulic model will provide:

- Profile sections showing gravity and surcharged hydraulic grade lines
- Pipe-full and maximum capacities per pipe segment
- Accurate flow/depths at control and storage structures

- Outflows to the Ocean Outfall for varying tide levels

Subtask 3.3 – Determine Needed Land Outfall Improvements

Brown and Caldwell will compare the outfall capacity with the assumed outfall capacity of 20.1 MGD. If any pipe segments have a capacity less than 20.1 MGD, capacity improvements will be developed accordingly. Cost estimates will also be provided. Using the model, up to five alternative capacity improvement projects will be determined, which may include upsizing pipe sections to alleviate capacity restrictions, providing upstream storage, sealing manholes (within limits of pressure ratings), re-grading pipe, and even installing a new outfall.

Subtask 3.4 – Prepare Construction Cost Estimate of ELO Improvements

Brown and Caldwell will develop an order of magnitude opinion on the construction cost of the recommended alternatives and determine the most cost-effective alternative.

Subtask 3.5 - Document Model Findings

Brown and Caldwell will document the model building and calibration activities, the capacity analysis results, the alternative improvement projects, and the capital cost for the recommended improvements in a TM.

Task 4 - Determine Ocean Outfall Capacity

Our approach for analyzing the ocean outfall capacity is described below.

Subtask 4.1 – Collect Supplemental Data

In addition to the information collected in Task 1, Brown and Caldwell will review existing reports relating to the ocean outfall, historical hydraulic models from BC archives, and any data provided by the City relating to marine inspections of the outfall especially as it relates to pipe condition (leaks, marine growth, physical damage to pipe) and uniformity of flow from diffuser ports. We will also gather data for the receiving water as it relates to seasonal density structure and currents. We will assess and report to the City if additional diver or ROV inspection is needed to characterize the outfall condition more completely. Lastly, any available data for outfall system hydraulics will be reviewed.

Subtask 4.2 – Review Regulatory Requirements

Brown and Caldwell will review the current NPDES permits, and any recent reports or communications from the RWQCB regarding the effluent discharge, to determine recent or current discharge issues. We can accompany the City to meet with the RWQCB staff to review the permit and request input for the study. At the conclusion of this subtask, a summary of regulatory issues and constraints will be prepared.

Subtask 4.3 – Model Ocean Outfall Hydraulics

Brown and Caldwell will use our proprietary diffuser hydraulics programs DIFF$$ and DIFFZ to model system hydraulics for existing and projected design flows. The hydraulic modeling results will be compared against capacity requirements to determine hydraulic bottlenecks and the need for and alternatives for enhanced hydraulic capacity. The improvement projects identified will be prioritized.

Using the CORMIX and PLUME series dilution models, we will simulate initial and subsequent dilution for existing and projected design flows. The model output will be compared against permit limitations and determine if there is a need to improve treatment performance at the HARRF (and the SEWRF) or at the diffusers.

<u>Subtask 4.4 – Prepare Construction Cost Estimate of Ocean Outfall Improvements</u>

Brown and Caldwell will prepare an order of magnitude opinion of probable construction costs for outfall system improvements.

<u>Subtask 4.3 – Prepare Ocean Outfall Report</u>

Brown and Caldwell will prepare a report that will document regulatory issues, hydraulic and dilution modeling, and any required improvements. This report will be incorporated into the main TM prepared for the capacity study. Five draft copies of the report will be prepared for City's review. Brown and Caldwell will meet with City staff to review findings, conclusions, and recommendations and discuss any City comments. We are also prepared to accompany the City to meet with RWQCB staff to present and discuss the proposed improvements and predicted performance. Brown and Caldwell will provide five copies of the final report that will incorporate comments and suggested edits received from the City and RWQCB.

Task 5 – Prepare Project Report

Brown and Caldwell will consolidate all the results and findings from Tasks 1 to 4 into a Project Report. Five copies of the draft Project Report will be prepared for City's review. Brown and Caldwell will work with City staff to review findings, conclusions, and recommendations and discuss any City comments. The City will be provided with five hard copies and an electronic (PDF format) copy of the final report that will incorporate comments and suggested edits received from the City and RWQCB.

Task 6 – Project Management

Brown and Caldwell will manage, administer, and provide ongoing coordination for efficient utilization of resources for the project. This task includes technical and financial management of the contract, liaison with the City, SEJPA, HARRF and SEWRF operational staff, project team, and subconsultants (if needed for flow monitoring). Major activities include:

- Quality assurance and quality control check on all reports and TMs submitted to the City.

- Preparation of a project management plan that covers all preliminary engineering phase work (The plan will define the personnel, project schedule, scope of services, project control reports, method of estimating completion of work, invoicing, records storage, project filing, and calculation filing)
- If necessary, creation of subagreements and manage subconsultants
- Utilization of the program schedule prepared under Item 1 above to monitor the progress of the work in relation to established time and budget constraints
- Updating and coordinating schedule revisions with the City
- Submitting monthly progress reports to be submitted with the monthly invoice
- Attending up to five project management coordination meetings with the City staff (Note that this will not preclude Brown and Caldwell team members from frequently communicating with the staff during the course of the study)
- Conducting project team meetings on a regularly scheduled basis to discuss current activities, track progress, and identify issues (an initial project kickoff meeting will be conducted to introduce all team members to the project objectives and provide initial direction and input from the City)
- Preparation of monthly invoices broken down by task, budget and percentage complete
- If needed, preparation of a Field Work Safety Plan to guide field activities during the investigation

We assume that the City will provide the following:

- Identification of a project manager for coordination of City decisions
- Timely review of products and decisions on issues critical to scheduled progress
- Identification and involvement of appropriate City division or section staff
- Coordination by the City Project Manager to collect comments and resolve any conflicting comments from all City reviewers prior to returning to Brown and Caldwell
- All documents available (as mentioned in Tasks 1 to 4) to facilitate performing the study

Task 7 – Additional Support

Subtasks described below requires City written approval (e-mail is acceptable) prior to commencement.

Subtask 7.1 – Sampling and Monitoring Support

Brown and Caldwell will provide staff and equipment necessary to conduct the wastewater characterization described in Subtask 1.3 and support of other unforeseen sampling or monitoring necessary to complete the study. This includes field testing, preparing sampling equipment, collecting samples, monitoring HARRF process units, and delivering samples to a certified contract laboratory. Brown and Caldwell will administer the contract with the laboratory and review all results generated. Sampling equipment required for the study, but not available from the City, will be rented. Rental and other contract laboratory fees related to the study will reimbursed by the City.

Subtask 7.2 – Wastewater Flow Monitoring

Brown and Caldwell will monitor the flow rate at three separate locations for a 2-month period to verify and supplement flow information currently being collected at the HARRF. MGD Technologies will be used to install and monitor the flows using ADFM meters. The City of Escondido will receive two hardcopies of reports generated by MGD.

Subtask 7.3 - Field Measurement of Weir and Water Surface

Brown and Caldwell will use a GPS-Laser-based system to determine the weir and water surface elevations of process areas where a conflict exists between hydraulic model results and observations by City staff (see Subtask 2.3). A field staff consisting of two people will determine critical elevations of up to 40 locations throughout HARRF.

Subtask 7.4 – Storm Flow Modeling

Brown and Caldwell will develop a storm flow model that can illustrate the effects of excessive I/I in the system and help validate removal programs. This is a labor-intensive process since the events are difficult to capture and the causes for changes in performance are difficult to isolate.

Brown and Caldwell will evaluate the risk of wastewater overflows associated with the existing equalization and treatment facilities. (The risk of overflow is related to the wet weather event return interval. For example, a 15 percent risk of overflow in any year corresponds to a wet weather event with a 6.7-year return interval.) We will then evaluate the increased equalization volume and/or treatment capacity needed to handle a 10-year wet weather event (10 percent risk of overflow in any year) and a 20-year wet weather event (5 percent risk of overflow in any year).

This analysis requires 1-2 years of hourly plant influent flow data and corresponding hourly rainfall data for the area tributary to the plant. The base flow component is subtracted from the influent flow to isolate the wet weather flow components - ground water infiltration and the rainfall-derived infiltration and inflow components. These wet weather flow components are statistically analyzed using CAPE, Capacity Assurance Planning Environment, developed by BC. The resulting correlation relates rainfall values averaged over a range of time scales (e.g., 1 hour, 1 day, 7 day, 30 day, 90 day) to wet weather component flows. This approach accounts for antecedent rainfall conditions over the past hour up to the past three to six months.

The system-specific correlation is then used to develop a synthetic influent flow hydrograph to represent anticipated flow patterns for the existing system or for other planning horizons. A long period of hourly rainfall data is used to generate anticipated wet weather flow component patterns (i.e., ground water infiltration and rainfall-derived infiltration and inflow), which are then added to the anticipated base flow pattern to produce the synthetic hydrograph. A 50-year period, or longer, of historic rainfall data is needed to estimate 20-year wet weather events. The synthetic hydrograph is run through a flow routing program to direct flows greater than available treatment capacity to storage. The series of annual maximum storage volume requirements are analyzed statistically to develop a curve of storage volume as a function of wet weather event return interval. This curve can be used to determine the magnitude of the wet weather event that could be handled by existing facilities, as well as to determine storage volume requirements needed to handle a given wet weather event return interval. The flow routing analysis can be re-run to analyze storage volume reductions with a greater treatment capacity.

The City will receive five copies of a draft TM that summarizes the findings and recommendations derived from this subtask. Five copies of the final TM that incorporates comments from the City will be provided. An electronic copy in PDF format will also be submitted.

SCHEDULE

Brown and Caldwell proposes to complete the tasks described in this scope of work within ten months after receiving the Notice to Proceed.

END OF SCOPE