

PERFORMANCE AUDIT

OF THE INFILTRATION AND INFLOW
MINIMIZATION PLAN PROJECT



Prepared for the City Council

OFFICE OF

**COUNCIL
SERVICES**

City and County of Honolulu
STATE OF HAWAII

PERFORMANCE AUDIT

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MINIMIZATION PLAN PROJECT

REPORT 1999-1
JULY 1998

**PERFORMANCE AUDIT OF THE INFILTRATION AND
INFLOW MINIMIZATION PLAN PROJECT**

Findings

As is true for many other cities and towns, significant quantities of rainfall and other extraneous water enter the City's sewer system. This intrusion of extraneous water, known as infiltration and inflow (I&I), may overload sewer lines, pump stations, and treatment plants during storms. Those overloads could then result in spills, bypasses, increased costs of wastewater treatment, and premature wear of sewer machinery.

On November 22, 1991, after numerous spills and bypasses from the City's sewer system had occurred, the U.S. Environmental Protection Agency (EPA) issued a Finding of Violation and Order for Compliance against the City. The order required the City to take immediate action to reduce spills and bypasses and to take sufficient corrective measures to reduce I&I. The City negotiated with EPA and obtained what it felt was a more constructive approach in the form of a 1994 final consent decree. The City's project to produce a Long Term Sewer Rehabilitation and Infiltration and Inflow Minimization Plan (I&I project) represents one of several requirements of the consent decree. The project is to provide better information on what the City needs to do to expand and maintain its sewer system, and avoid spills and bypasses.

We found that overall, the I&I project is on time and on budget. The positive results may be due to the explicit consent decree requirement that project management be provided at the project's inception. The training on project scheduling and cost estimation techniques that the Department of Wastewater Management (WWM)* provided for its project staff may have also contributed. In addition, we understand that planning projects and studies, such as the I&I project, typically are at less risk of cost overruns and schedule delays than are construction projects. We also found that I&I project monitoring is generally adequate, and that project contracts were awarded in accordance with the procurement code.

We did identify a few areas in WWM's management of the project that could be improved:

* On July 1, 1998, the department became the Department of Environmental Services under the City's adopted reorganization plan.

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- (1) Although WWM's initial cost estimates for this project were accurate, we found that at the time the I&I project was initiated, WWM had no written policy or procedure for its engineers to follow to estimate project costs. As a result, the I&I project engineer made the initial cost estimate based on personal experience and knowledge, and on any historical data available. While such estimates are reviewed by the department, cost estimates cannot be consistent without written policies.
- (2) We found that there was no apparent order or method in how I&I project documents were filed. We also found that there is no written WWM policy or procedure to specify how project managers should organize their files, what project supporting documents should be in the files, or in what order or format the documents should be. As a result, each project manager in WWM determines how the files for their projects are organized.
- (3) We found that while WWM closely monitored the expenditures made under each contract for the I&I project, it has difficulty gathering the information on cumulative appropriations and expenditures for the I&I project. Such information has to be collected from separate computer databases, often manually, and is in a form that does not lend itself to providing a consolidated view of a project's appropriations and expenditure history.

Recommendations and Response

The department should develop and implement formal written policies specifying how project costs are to be estimated, reviewed, and approved, and specifying how contract files should be organized. It should also work with the City Administration to obtain access to the computerized information necessary for the department to easily generate periodic project reports that display the cumulative history of appropriations and expenditures.

The Department of Wastewater Management generally agreed with the recommendations made in this report and scheduled their implementation by the end of the year. We made a few clarifications to the draft report in response to the department's comments.

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I. INTRODUCTION

The Department of Wastewater Management (WWM)¹ of the City and County of Honolulu (City) is responsible for maintenance and operation of a wastewater collection system of 1,900 miles of gravity sewer mains, 69 pumping stations, and 50 miles of pressure force mains that convey wastewater to 8 wastewater treatment plants.

The sewer system represents a major public investment. WWM's capital improvement projects (CIP) for Fiscal Year (FY) 1997-98 were appropriated \$109.5 million. Over the past five fiscal years, capital projects for WWM account for over 25 percent of the City's total annual CIP dollars.

In June 1997, at the request of the Council Budget Committee Chair, the Council Chair approved two limited-scope performance audits of selected wastewater projects as a means of monitoring the use of CIP budget funds. This is the second audit.

A. OBJECTIVES OF THE AUDIT

The objectives of the audit were to:

- Report on and evaluate the history of the project, adequacy of project management and use of contractors and consultants; and current status of the project's implementation,
- Determine the project's conformance with the initial plans and budget, and
- Identify and make recommendations concerning opportunities for improvements in the WWM's CIP process.

¹When the project to develop a Long Term Sewer Rehabilitation and Infiltration and Inflow Minimization Plan was started in 1992, the City's wastewater operations were administered by the Division of Wastewater Management under the Department of Public Works. Effective July 1, 1993, wastewater operations were placed under a new Department of Wastewater Management pursuant to ratification of a charter amendment by voters. In this report, "WWM" refers to both the Division of Wastewater Management with respect to the period prior to July 1, 1993, and to the Department of Wastewater Management thereafter.

B. SCOPE AND METHODOLOGY

This project was chosen for this audit based on its size, complexity, length of time since project inception, and its impact on the City's future wastewater CIP program. Our audit was limited to a review of the planning and implementation of the project from its inception through December 31, 1997.

Our audit procedures included:

- Interviewing WWM staff and other City officials to gain an understanding of the systems, processes, and management control structure for the project;
- Performing limited detail and compliance testing of project documentation;
- Analyzing and evaluating the system of project management controls;
- Identifying areas of concern and proposing recommendations for improvements in the project process.

II. BACKGROUND

The City's project (I&I project) to produce a Long Term Sewer Rehabilitation and Infiltration and Inflow Minimization Plan (I&I plan) represents one of several requirements imposed on the City in its 1994 consent decree with the U.S. Environmental Protection Agency (EPA). In this chapter, we first discuss several terms involved in the plan and provide information to help put the forthcoming I&I plan in context of other studies. We then discuss the chronology of events leading to the requirement to prepare the I&I plan.

A. THE MEANING AND SIGNIFICANCE OF THE I&I PLAN

1. What Is Infiltration And Inflow?

Infiltration and inflow (I&I) are two terms that are usually used together to refer to extraneous and unwanted water flow that enters the sewer system from foundation drains, defective joints, broken or cracked pipes, and faulty connections, or is improperly or unintentionally discharged into existing sewer lines from such sources as roof downspouts, manholes, and illegal connections to the sewer system². The City's sewer system is separate from the street drainage system; rainfall is not supposed to enter the sewer system. However, as is true for many other local governments, significant quantities of rainfall and other extraneous water sources do find their way into the City's sewer system.

The intrusion of large amounts of infiltration and inflow into the sewer system is a major problem. Once entering the system, I&I flows become part of the wastewater that must be transported and treated. That volume of flow must be anticipated in planning the size of relief sewer lines and new sewer lines, pumps, and treatment plants. The extraneous water occupies sewer system capacity that could otherwise accommodate future urban growth. Wastewater facilities may thus require expansion earlier than urban growth alone would dictate. Excessive I&I flows may also overload sewer lines, pump stations, and treatment plants during storms. Those overloads could then result in spills, bypasses, increased costs of wastewater treatment, and premature wear of machinery.

²A more detailed definition and listing of infiltration and inflow sources is provided in Appendix A.

2. The I&I Project is One of the City's Largest Studies.

At its present estimate of \$31.5 million in total cost, the project to develop an I&I plan is one of the most costly studies ever undertaken by the City. It rivals the over \$60 million spent in planning and analysis work performed for the Honolulu Rapid Transit Project which was terminated in 1993.

3. What Other Cities Have Learned About Infiltration and Inflow.

Other local government entities in the nation have struggled to meet EPA requirements to reduce spills and bypasses and accordingly have studied their I&I flows and sewer rehabilitation needs. These entities have come to two major conclusions regarding their I&I flows:

- Some local entities have found that most of their I&I flow comes from leaks and discharges from **privately owned property** rather than from leaks and discharges from within the public sewer system.³ If that is the case, even if the local government entity expends enormous resources to aggressively repair its leaky sewer lines, the amount of I&I flow will not be completely eliminated. Additional system capacity could reduce the risk of spills and bypasses but may not be cost effective in all circumstances. Such local entities must then confront the issue of whether and how to address I&I flows from private properties, a difficult and costly problem.
- Even considering I&I flows from public property alone, local government entities have found it more cost effective to transport, temporarily store, and treat the I&I flow, rather than to attempt to rehabilitate all sewer lines and laterals to prevent those leaks.

The City's final I&I plan to be issued in late 1999 may reflect the same conclusions reached by other local governments.

4. The I&I Project Is to Provide a Better Estimate of the City's Required Sewer Spending.

The final I&I plan to be submitted to EPA at the end of 1999 is to present a 20-year sewer rehabilitation plan for the City. That plan is to detail how much money the City needs to

³"In a national survey carried out by state and local agencies, it was found that the estimated percentage of total system infiltration from service laterals ranges from 30 to as high as 95 percent in some cases." Environmental Protection Agency, "Sewer System Infrastructure Analysis and Rehabilitation," October 1991, page 85.

invest in its sewer system to remedy existing deficiencies. It has been estimated that the amount of such investment may be a billion dollars or more.

5. **Information From the I&I Project Should Help the City to Better Manage the Sewer System.**

Upon completion of the final I&I plan, the City is to have new and improved information needed to better manage the City's sewer system:

- An updated and computerized inventory of sewer lines.
- Area-specific measurements of dry and wet weather wastewater flows and I&I factors to better size new sewer lines.
- Information necessary to set priorities for future sewer rehabilitation projects according to structural condition and wastewater flow loads.

B. KEY EVENTS LEADING TO I&I PROJECT

1. **EPA Puts Greater Emphasis on Sewer System Rehabilitation and Careful Study.**

After passage of the 1972 federal Clean Water Act, EPA's initial emphasis was on the construction of wastewater treatment plants of sufficient capacity and treatment levels. On Oahu, this is reflected in the construction, expansion, or upgrade of treatment plants at Sand Island (including deep ocean outfall), Honouliuli (including deep ocean outfall), Kailua (including deep ocean outfall), Waianae, and Waimanalo. Since the 1980's, the emphasis shifted to sewer system rehabilitation to reduce wastewater treatment plants loads from excessive infiltration and inflow. That was because in wastewater systems across the country, I&I flows were found to reduce the capability of treatment systems to transport and treat wastewater, and in severe cases, to upset the wastewater treatment process, resulting in the discharge of poorly treated wastewater into the environment. Pipeline rehabilitation was also being promoted by EPA because it was found that the capacity and structural reliability of pipelines could be restored for 30 to 70 percent of replacement cost.⁴

However, EPA recognized that a systematic evaluation of the sewer system was necessary to determine whether sewer system rehabilitation to eliminate I&I was cost-effective. EPA's experience gained in other communities over the past 15 years had identified the need for precise information regarding the condition of the sewer system infrastructure and the extent

⁴Ibid, p. 4.

of I&I. For example, flow monitoring was needed at critical points in the system to measure and compare I&I flows during dry and wet weather. This would demonstrate whether excessive flows in a sewer collection system existed, and if so, identify areas that could be corrected cost effectively.

The need for extensive study to ensure that expensive sewer rehabilitation was cost effective was described in a handbook EPA issued in October 1991 entitled "Sewer System Infrastructure Analysis and Rehabilitation". Local governments were to use the handbook as a guide in undertaking sewer rehabilitation projects.

2. Finding of Violation and Order Issued.

On November 22, 1991, after numerous spills and bypasses from the City's sewer system had occurred, the EPA issued a Finding of Violation and Order for Compliance against the City. The order required the City to take immediate action to reduce spills and bypasses and to take sufficient corrective measures to reduce I&I. Study and rehabilitation of the system was to begin immediately. A six-year sewer rehabilitation and replacement plan that included I&I corrective measures and ensured the elimination of wastewater spills and bypasses was to be submitted to EPA in two months.

Six months after the order, on June 22, 1992, the initial order was modified, mostly by changing the timetable for compliance as follows:

- The City was to immediately submit a summary of findings, conclusions and recommendations of the prior I&I studies of the collection system and the 1990 Islandwide Sewer Adequacy Plan. The City was to also report on all sewer system rehabilitation projects completed in the past five years.
- A detailed scope of work for the I&I plan was to be submitted by August 1, 1992. This was to include a characterization of the problem; description of past, present and planned I&I studies; a description of past, present and planned rehabilitation projects to reduce I&I; the City's target for an acceptable level of I&I; and an assessment of alternatives to sewer rehabilitation.
- A long-term sewer rehabilitation and I&I plan was to be submitted by December 31, 1993.

The sewer rehabilitation specified in the I&I plan was to begin 30 days after submission of the I&I plan to EPA, and all rehabilitation was to be completed within 6 years (1994 - 1999).

3. City's I&I Project Initiated.

According to WWM staff, WWM budgeted in FY1992-93 for the development of an I&I plan to satisfy the requirements contained in the EPA's order. Work on the City's project to produce an I&I plan was begun in December 1992 as a continuation of the 1990 Island-Wide Sewer Adequacy Plan⁵. The I&I project included monitoring rainfall and wastewater flows in the sewer lines to determine the relationship between the volume of sewer system flows and rainfall. The flow monitoring addressed both large sewer collection areas as a whole to identify the overall problem areas on Oahu, and as well as more detailed monitoring within such areas.

4. City Negotiates With EPA.

As described above, the EPA's order directed the City to start immediately on study and rehabilitation of the sewer system and complete everything within a six-year period beginning February 1, 1994. However, in negotiations with EPA, WWM argued that sewer rehabilitation without sufficient analysis of the system would not be cost effective, that the City did not currently have sufficient and reliable data on its sewer system, and that such data could not be developed within the order's six-year period.

For example, the City was using only one measurement of the relationship between rainfall, other I&I sources, and I&I flow (I&I factor) to plan and size sewer lines in all parts of the island. That factor had been developed over 50 years ago from mainland data. That is, a single mainland-based estimate of I&I flow was being used by the City to plan and size all sewer lines, whether for the wet windward parts of Oahu or for the drier leeward side. Since this factor was not developed from Oahu data, the City was finding that the use of this factor, especially in the wet windward side, had led to undersized facilities, and that spills and bypasses from the sewer system were the result. A new set of area-specific I&I factors was needed that was based on actual measured rain and I&I flows on Oahu and developed over a sufficient time period to provide statistical reliability. In the previous Islandwide Sewer Adequacy Plan issued in 1990, only one month of I&I flow monitoring had been done in only a few of the 10 sewer collection areas on Oahu. Finally, WWM stated there was no detailed data available on the extent of hydraulic and structural deficiencies of the City's wastewater system and the priority of each system component to be fixed or replaced.

WWM also pointed to the experience of other cities that invested a lot of resources in sewer rehabilitation only to find the effort was not cost effective. For example, the city of Houston, Texas, started rehabilitation of their system under a similiar EPA order without

⁵The 1990 Islandwide Sewer Adequacy Plan was an extensive City study to develop a computerized sewer database, understand existing sewer flows and project future flows, identify where the sewer system's capacity was inadequate, and monitor I&I flows in wet weather. WWM reports that many of the study's results were rendered obsolete by stricter performance requirements for sewer systems that were subsequently issued by EPA.

extensive study of their system. Later, Houston officials returned to EPA for modification of the EPA order when they found that the rehabilitation Houston had completed pursuant to the order did not significantly reduce I&I and was not cost effective.

With these points in hand, WWM initiated discussions with EPA in the hope of gaining more favorable terms in the EPA order.

5. Council's Consultant Expresses Concern About I&I Project Expenditures.

In 1993, the City Council contracted with a mainland engineering and consulting firm to perform a review of the City's wastewater system and budget. As part of this review, the consultant evaluated WWM's proposed wastewater budget for FY 1993-94. That budget included a request for \$8 million in the operating budget to perform I&I studies. At the request of the Council's Budget and Finance Committee, further information was provided by the Budget Department (D-281, 1993) on the I&I project budget. That information stated that the FY 1994 budget request was, in fact, the second year of a six-year I&I study (FY 1993 to 1998), whose total cost over the period would be \$39 million. The first year's \$5.5 million I&I appropriation had been appropriated for the previous year as I&I studies for the Honouliuli and Sand Island wastewater treatment plants.⁶

With respect to the FY 1994 \$8 million request, the consultant questioned the amount requested for the I&I project, which in their opinion was the most detailed, comprehensive, and costly they had ever encountered. They expressed concern that City resources were going into detailed studies when those resources could better be spent on repairing the system. The consultant recommended that more limited I&I studies be performed, leading to correction of problems sooner rather than performing years of comprehensive and expensive study. They also recommended that the high cost of the I&I studies be budgeted as a capital expense.

WWM defended its budget request and disputed the recommendation of the consultant, arguing that the proposed work program had already been accepted by EPA. The Council ultimately budgeted \$6 million for the I&I project in the FY 1994 capital budget.

6. Final Consent Decree Filed.

The City's negotiations with EPA culminated in the issuance of the EPA Section 309 consent decree in U.S. District Court on October 3, 1994. The final decree⁷ included requirements

⁶The funds were requested by the Mayor in the operating budget, but the Council appropriated the funds in the capital budget.

⁷Civil No. 94-00765DAE.

to develop a spill reduction action plan, a preventive maintenance system for inspecting and cleaning sewer lines, a computerized system for collecting and analyzing sewer line data including assessments of condition, and supplemental environmental programs.

The decree also imposed certain requirements on the City to rehabilitate the sewer system and minimize I&I flows to prevent or reduce sewer spills. Under these requirements, the City was to establish a program approved by EPA to minimize I&I flows by rehabilitating the system over a 20-year period. The City was also to evaluate measures to minimize I&I flows and implement those found cost-effective, and provide adequate capacity throughout its collection system. In order to achieve this program, the decree provided that the City must prepare an I&I plan in accordance with the previously described EPA handbook.

The EPA's requirements for the content of the I&I plan may be summarized as consisting of a short term assessment, a long term assessment, and the development and implementation of a final sewer rehabilitation plan. The short term assessment, in addition to flow and rain monitoring, was to include a preliminary assessment of hydraulic capacity and structural integrity of the City's sewer lines. Reports were to be submitted to EPA to identify projects to be budgeted to address the conclusions of those hydraulic and structural assessments. The long term assessment was to be a detailed analysis of flow and rain monitoring, and of hydraulic capacity and structural integrity data. The long term assessment was to also include pilot sewer rehabilitation projects to evaluate the cost effectiveness of alternative rehabilitation methods. All of the results of the assessments were to be incorporated into the final I&I plan, which the City was to submit to EPA by December 31, 1999.

A final plan was to be prepared and include:

- Flow monitoring data measuring the reduction of I&I after completion of rehabilitation in the pilot study;
- An assessment of the feasibility of extending rehabilitation to other areas of the island and of the feasibility of rehabilitating private laterals, if appropriate;
- Identification of an appropriate "design storm", the characteristics of which would be used to determine the level of allowable I&I in each area of the island;
- Design standards for allowable I&I in each area;
- A program to be approved by EPA for rehabilitating the sewer collection system over a 20-year period, based on the final assessment of cost effectiveness of the available techniques for sewer rehabilitation, as determined in the pilot study. The program must include prioritization and scheduling of the rehabilitation of sewer lines in the various areas; detailed project descriptions; project timetables and costs, and 5-year milestones to monitor completion of the work. The approved program was to be completed by December 31, 2019.

A summary of the documents required in the decree and the timetable to be submitted to EPA is provided in Appendix B.

7. Council Approves Final Decree.

The City Administration requested the City Council's approval of the final consent decree and its terms.⁸ Approval was granted on May 25, 1994, by the Council's adoption of Resolution 94-136.

⁸Departmental communication 538, 1994.

III. FINDINGS AND RECOMMENDATIONS

We found that overall, the I&I project is on time and on budget. The positive results may be due to the explicit consent decree requirement that project management be provided at the project's inception. The training on project scheduling and cost estimation techniques that WWM provided for its project staff may have also contributed. In addition, we understand that planning projects and studies, such as the I&I project, typically are at less risk of cost overruns and schedule delays than are construction projects.

Although we found that the project was on time and on budget, we did identify a few areas in WWM's management of the project that could be improved.

FINDING NUMBER ONE:

THE I&I PROJECT GENERALLY CONFORMS TO ITS INITIAL PLAN AND BUDGET.

One of the objectives of this audit was to determine the I&I project's conformance with its initial plan and budget. For this purpose, we used the information on the I&I project presented by the Budget Department in its 1993 memorandum⁹ to the Council as the initial plan and budget for the project. To our knowledge, this represents the first and only detailed description of the plan and budget for this project that was presented to the Council. We understand from WWM that the plan described in the memorandum conforms to the requirements contained in the City's 1994 final consent decree.

As presented in the memorandum, the budget for the I&I project originally anticipated spending \$39 million for the six-year period FY 1993 through 1998. Funds were to be used for the short and long term assessments called for in the final consent decree, including flow and rain monitoring, study of I&I flows from private sources, and field investigations of sewer lines. Funds were also to be used to build a computerized database detailing sewer system conditions. The amount did not include any reconstruction or repair of deteriorated or overloaded sewer lines.

As of December 31, 1997, the project to develop the I&I plan generally conforms to the initial plan and budget. The total cost of completing the I&I plan is now set at \$31.5 million, or nearly \$8 million (20 percent) less than anticipated in the initial plan. WWM

⁹Departmental communication 281, 1993.

attributes this reduction to the depressed construction industry in Hawaii, which condition has reduced the cost of I&I project contracts, and also to reductions in the scope of the project.

The six years of appropriations appears to have been implemented fully. Of the \$31.5 million appropriated, \$18.6 million was expended as of December 31, 1997, \$10.1 million was encumbered, and less than \$315,000 lapsed. The latest \$2.5 million appropriation for FY 1997-98 remained unallotted as of December 31, 1997, which is not unusual.

Work progress in the I&I project is on schedule. As of December 31, 1997, four years of I&I flow monitoring had been completed, the fifth year was still in progress and the contract for the sixth year was awarded. WWM plans to continue the flow monitoring but perform it "in-house" in FY 1999 and beyond to comply with the consent decree requirements. The required reports for FY 1993, 1994, and 1995 were delivered to EPA on time. The final I&I plan is reportedly on schedule for submittal to EPA on December 31, 1999. Projects to rehabilitate sewer lines with severe hydraulic or structural problems have been identified. The first pilot rehabilitation project was completed in the Enchanted Lakes area of Kailua. Only the mainlines and manholes and no public laterals in the project area were worked on because WWM wanted to avoid any excavation. The second pilot rehabilitation project is planned to rehabilitate public laterals in the Enchanted Lakes area using a "trench-less" technology. The cost effectiveness of rehabilitating private laterals is still under analysis. Details on the project's status are displayed in Appendix C.

FINDING NUMBER TWO:

PROJECT MONITORING IS GENERALLY ADEQUATE.

The consent decree with EPA required the City to develop and implement a system to coordinate all the various tasks and activities required under the decree. A program manager and coordinator were therefore assigned at the inception of the project to develop and implement all of the consent decree activities. As stated earlier, the I&I project was one required element of the consent decree. Management of the I&I project was assigned by WWM to a project engineer in the planning branch. The I&I project manager monitored performance to plan, expenditures to budget, justifications for contract amendments, status of required deliverables, and provided overall coordination between the consultants and other City departments.

FINDING NUMBER THREE:

CONTRACTS FOR THE PROJECT WERE AWARDED IN ACCORDANCE WITH THE PROCUREMENT CODE.

WWM organized the work for the I&I project, which was to span a number of years, into increments. WWM awarded the contract for each increment separately, using the qualified list method, a selection process provided in the procurement code.

Although the contracts for the increments were separately awarded, we found that the same consultant was selected each time as the prime consultant. This appears to have occurred because the successful consultant of the first phase, by virtue of the knowledge and experience gained in that phase, obtained a clear advantage over other consultants in the selection process for subsequent study phases.

FINDING NUMBER FOUR:

PROJECT FILES ARE DISORGANIZED, BUT A NEW POLICY TO ADDRESS THIS HAS BEEN DEVELOPED.

In conducting the fieldwork for this audit, we found that there was no apparent order or method in how I&I project documents were filed. It was difficult to determine where in the I&I project's large collection of files any particular document or kind of document could be located.

We understand the department is in the process of establishing a project document policy in response to our previous wastewater project audit, which recommended the policy.¹⁰ The new policy, which currently appears to apply to the department's planning division only, specifies how project managers should organize their files, what project supporting documents should be in the files, in what order and format the documents should be, and records the fact that documents have been properly reviewed.

FINDING NUMBER FIVE:

WWM'S PROCESS FOR COST ESTIMATION CAN BE IMPROVED.

Although the department's cost estimates for this project were found to be accurate, we also found that at the time the I&I project was initiated, WWM had no written policy or procedure for its engineers to follow to estimate project costs. As a result, the I&I project

¹⁰Office of Council Services, Performance Audit of the Gulick Avenue Relief Sewer Project, Department of Wastewater Management, February 1998.

engineer made the initial cost estimate based on personal experience and knowledge, and on any historical data available.

We found that these initial cost estimates are subject to internal departmental review and adjustment. However, without written departmental policies or procedures governing the cost estimation process, there can be no consistency in how baseline project cost estimates are developed in WWM. Also, without departmental procedures for estimating project costs, there is the risk that the cost estimates may not consider all pertinent factors (for example, the present economic climate) and therefore be in error. Further, that practice cannot provide reliable historical data on which future estimates can be based.

RECOMMENDATION:

WWM should develop and implement a formal written policy specifying how project costs are to be estimated, reviewed, and approved. The policy may document various aspects of the existing process, as appropriate.

FINDING NUMBER SIX:

IT IS DIFFICULT FOR THE DEPARTMENT TO GATHER INFORMATION ON THE CUMULATIVE APPROPRIATIONS AND EXPENDITURES FOR PROJECTS.

We found that WWM closely monitored the expenditures made under each contract for the I&I project. However, we found that WWM has had difficulty gathering the information on cumulative appropriations and expenditures for the I&I project. Such information has to be collected, often manually, from separate computer databases of the Department of Finance, and is in a form which does not lend itself to providing a consolidated view of a project's appropriations and expenditure history.

We believe it is important to keep track of cumulative project appropriations and expenditures throughout the full term of a project, which may span a number of increments and entails several contracts. Keeping track of the full history of appropriations and expenditures enables WWM to keep abreast of its budget performance to date. Upon completion of the project, WWM can accurately report to the Council, the Mayor, and to the public how it implemented the budget authorizations and what was the final cost of a completed project.

WWM states that it has recently begun to manually track these appropriations and expenditures over the full term of projects. So far, however, only new projects are being tracked, and considerable effort is still required to collect and consolidate the necessary information.

RECOMMENDATION:

WWM should work with the City Administration to obtain access to the computerized information necessary for WWM to easily generate periodic project reports showing the cumulative history of appropriations and expenditures. At a minimum, the report should be prepared at the close of each fiscal year.

IV. AGENCY RESPONSE

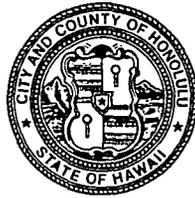
The Department of Wastewater Management agreed with the recommendations made in this report. Regarding the need for a policy specifying how project costs are to be estimated and approved, it stated that the recommendation will be forwarded to the Department of Design and Construction which will be responsible for wastewater projects under the City's adopted reorganization plan. Regarding the need for access to computerized information to generate reports on the cumulative history of appropriations and expenditures, the department stated that it has begun working with the Department of Finance to gain such access.

Both actions are planned for completion by the end of calendar year 1998.

ENVIRONMENTAL SERVICES
DEPARTMENT OF ~~WASTEWATER MANAGEMENT~~
CITY AND COUNTY OF HONOLULU

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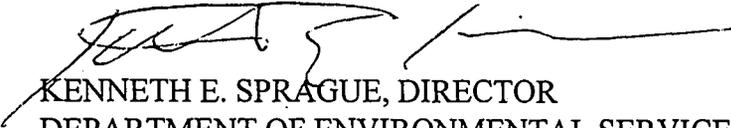
DIR 98-35

July 10, 1998

MEMORANDUM

TO: DIANE E. HOSAKA, DIRECTOR
OFFICE OF COUNCIL SERVICES

ATTN: IVAN KAISAN, LEGISLATIVE AUDITOR

FROM: 
KENNETH E. SPRAGUE, DIRECTOR
DEPARTMENT OF ENVIRONMENTAL SERVICES

SUBJECT: *OCS DRAFT REPORT --PERFORMANCE AUDIT OF THE PROJECT TO
DEVELOP AN INFILTRATION AND INFLOW MINIMIZATION PLAN (June 29,
1998)*

Thank you for the opportunity to review the subject draft report. According to your request, we have reviewed the report and provide our comments herewith. We note, and appreciate, that you have incorporated some of our comments the preliminary draft report (May 29, 1998). Of the six findings, the final three are perhaps the most critical and contain recommendations. We offer the following comments and suggestions on those.

1. **Principal Findings and Recommendations.** Two primary findings that included recommendations are that: Wastewater Management's (WWM's) process for Cost estimating can be improved (*finding #5*) and; WWM has had difficulty in tracking cumulative project appropriations and expenditures throughout the full term of a project (*finding #6*).
 - a. *Finding # 4--Cost Estimating.* We agree that, we may improve the consistency and reliability of the Department's project cost estimates with a formal, written policy. However, the audit should also point out that WWM does require in-house estimates by the project engineer with review by branch heads or division

chiefs. These in-house estimates and project scope, can provide a basis both for checking which factors have been considered in a project cost and for adjustment during contract negotiation.

This finding should also emphasize that the original estimate for this program was quite good. The actual cost of the project, is within 20% (under budget) of the original projection made six years ago. This is a commendable accomplishment--particularly given the variations that have occurred in the island's economy in that time.

- b. *Finding #6--Tracking project appropriations and expenditures.* As a result of the draft audit report, Department of Finance has begun working with WWM to provide access to appropriate computerized information necessary for monitoring the cumulative history of appropriations and expenditures.

Please contact Mr. Ed Pier, extension 6665, if you have any questions on this matter.

APPROVED:



BENJAMIN B. LEE, FAIA
Acting Managing Director

cc: Randall K. Fujiki, Director, Department of Design & Construction
Roy K. Amemiya, Director, Department of Finance

Performance Audit of the Infiltration and Inflow Minimization Plan Project

RECOMMENDATION	AGREE / DISAGREE	ACTION TO BE TAKEN	WHEN TO BE COMPLETED
<p>1. WWM should develop and implement a formal written policy specifying how project costs are to be estimated, reviewed and approve. This policy may document various aspects of the existing process, as appropriate.</p>	<p>Agree</p>	<p>Since the Dept. of WWM has been dissolved and absorbed into the new Department of Design & Construction, this recommendation will be forwarded to the new department for consideration and appropriate action.</p>	<p>12/31/98</p>
<p>2. WWM should work with the City Administration to obtain access to the computerized information necessary for WWM to easily generate periodic project reports showing the cumulative history of appropriations and expenditures. At a minimum, the report should be prepared at the close of each fiscal year.</p>	<p>Agree</p>	<p>Action has already begun with Dept. of Finance to provide appropriate access to computerized accounting information necessary for cumulative history of appropriation and expenditures.</p>	<p>12/31/98</p>

V. APPENDICES

APPENDIX A

DEFINITIONS AND SOURCES OF INFILTRATION AND INFLOW

	INFILTRATION	INFLOW
Short Definition	Unwanted groundwater that enters through the pipe (cracks, holes, open joints), and manhole sidewalls and base (porous material or structural damage).	Unwanted water (surface and groundwater) that enters a sewer line from connections.
Dry Weather Sources	<p>High ground water levels or perched ground water level entering through:</p> <ul style="list-style-type: none"> ▶ Broken/cracked/deteriorated lines. ▶ Broken/ cracked/deteriorated joints and connections. ▶ Structurally damaged manhole sidewalls and bases. <p>Lines that run under streams/creeks or storm sewers that have:</p> <ul style="list-style-type: none"> ▶ Broken/cracked/deteriorated lines. ▶ Broken/ cracked/deteriorated joints and connections. 	<p>Surface water run-off from commercial and private residential property (examples - car washes, water sprinklers) entering through:</p> <ul style="list-style-type: none"> ▶ Access holes in manhole covers, annular space between the cover and frame and improperly seated frame. ▶ Surface breaks in the manhole structure (at or near the frame/chimney). ▶ Clean-outs (no cover, cracks, poor seal). ▶ Breaks in line or poor connections at or close to ground level. ▶ Porous pipe at or near ground level. <p>Illegal industrial / commercial discharge to sewer line.</p> <p>Storm sewer overflow (blockage) that enters through manholes as above.</p> <p>Storm sewer connection to sewer line (runoff from residential/commercial).</p> <p>Illegal foundation, basement, area and sump connections to sewer line.</p>
Wet Weather Sources	<p>Storm water that percolates through the soil and enters through:</p> <ul style="list-style-type: none"> ▶ Broken/cracked/deteriorated lines. ▶ Broken/ cracked/deteriorated joints and connections. ▶ Structurally damaged manhole sidewalls and bases. 	<p>Illegal roof, foundation, basement, area and sump connections to sewer line.</p> <p>Surface storm water from any source that can flow into:</p> <ul style="list-style-type: none"> ▶ Access holes in manhole covers, annular space between the cover and frame and improperly seated frame. ▶ Surface breaks in the manhole structure (at or near the frame/chimney). ▶ Clean-outs (no cover, cracks, poor seal). ▶ Breaks in line or poor connections at or close to ground level. ▶ Porous pipe at or near ground level. <p>Storm sewer overflow entering as above.</p> <p>Storm sewer connection to sewer line.</p>

Source: Compilation of information by Office of Council Services

**APPENDIX B
EPA SCHEDULE AND PHASING OF I&I PROJECT**

PHASE	DESCRIPTION	PROJECTED WORK PERIOD	DELIVERABLES TO EPA	
			REPORT	DUE DATE
I	I&I Assessment Phase	12/1/92-12/31/98		
	Stage I-Interim I&I Assessment	12/1/92 - 10/31/94	Interim Assessment	10/31/94
	Stage II-Preliminary Cost- Effectiveness Assessment	12/1/92 - 12/31/95	Preliminary Cost Effectiveness	12/31/95
	Stage III-Final Sewer I&I Plan	9/1/96 - 12/31/98	Final Sewer I&I Plan	12/31/99
II	Pilot Study	10/1/96 - 12/31/98	Plan for Pilot Study	12/31/98
III	Rehabilitation Program	7/1/99 - 12/31/2019 (plan implementation)	Final Sewer Rehabilitation and I&I Plan	12/31/99

Source: Compilation of data by Office of Council Services.

**APPENDIX C
HISTORY OF APPROPRIATIONS FOR THE
LONG-TERM SEWER REHABILITATION AND INFILTRATION AND INFLOW PLAN**

FY	ORD	APPROPRIATION						USE OF APPROPRIATION THROUGH 12/31/97				
		LAND	PLAN	DESIGN	CONSTRUC	INSPECT	TOTAL	UNALLOT	EXPEND	ENCUMB	LAPSED	TOTAL
1992-93	92-78	\$0	\$5,500,000	\$0	\$0	\$0	\$5,500,000	\$0	\$5,492,038	\$0	\$7,962	\$5,500,000
1993-94	93-49	0	6,000,000	0	0	0	6,000,000	0	5,980,240	0	19,760	6,000,000
1994-95	94-42	0	6,000,000	0	0	0	6,000,000	0	4,671,643	1,273,369	54,988	6,000,000
1995-96	95-25	0	7,000,000	0	0	0	7,000,000	0	1,998,170	4,769,933	231,897	7,000,000
1996-97	96-31	0	4,500,000	0	0	0	4,500,000	0	441,430	4,058,569	0	4,500,000
1997-98	97-38	0	2,500,000	0	0	0	2,500,000	2,500,000	0	0	0	2,500,000
TOTAL		\$0	\$31,500,000	\$0	\$0	\$0	\$31,500,000	\$2,500,000	\$18,583,522	\$10,101,871	\$314,607	\$31,500,000

Source: Budget Ordinances / CIP Budget Reports / Finance Directors Quarterly Reports/Expenditure Reports.

