



IT Software Controls:

Agency-wide approach needed to ensure data accuracy

June 2009

A Report by the Office of the Auditor

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MEMORANDUM

June 17, 2009

To: David Bragdon, Council President
Rod Park, Councilor, District 1
Carlotta Collette, Councilor, District 2
Carl Hosticka, Councilor, District 3
Kathryn Harrington, Councilor, District 4
Rex Burkholder, Councilor, District 5
Robert Liberty, Councilor, District 6

From: Suzanne Flynn, Metro Auditor

Re: Audit of IT Software Controls

The attached report covers our audit of the IT Software Controls at Metro. This audit was on our FY08-09 Audit Schedule.

Metro has many software systems that collect, maintain, and report data used to manage Metro operations and make decisions. Management of information technology systems is dispersed between Information Services and other departments throughout the agency. This audit looked at the actions taken by Metro departments to ensure that data was accurate. We used three systems as case studies to evaluate the agency's management of IT resources and the effectiveness of controls in software systems.

We have discussed our findings and recommendations with Michael Jordan, Chief Operating Officer, Scott Robinson, Deputy COO and management from Information Services, Finance and Regulatory Services, Oregon Zoo, Planning and Development, and Parks and Environmental Services. My office will schedule a formal follow-up to this audit within 1-2 years. We would like to acknowledge and thank the management and staff who assisted us in completing this audit.

A handwritten signature in black ink, appearing to read "Suzanne Flynn".

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Summary

Much of Metro's work is dependent on collecting, creating, and maintaining data in databases to inform decision-makers and to manage internal business functions. The management of information technology functions (IT) is dispersed between the Information Services Department (IS) and departments throughout the agency. IS supports agency-wide business process applications such as the financial accounting system and the payroll system and manages a Help Desk for desktop applications. Other software applications specific to functions that operate in individual departments are primarily managed outside of the IS Department.

The purpose of this audit was to assess whether procedures designed to ensure data quality were effective and whether Metro followed key practices that are important to successfully manage its information technology. Auditors examined three software applications from different service areas at Metro.

In the preliminary work for this audit, we found examples of software that were not integrated with agency-wide financial and human resources software (side systems). The use of these side systems resulted in duplicative data sets, increased reliance on manual processes, and increased complexity of data management and accountability. We chose three of these systems to examine:

- **Weighmaster** – used to calculate incoming and outgoing loads at Metro's waste transfer stations and calculate fees owed;
- **Custom Zoo Attendance and Revenue (CZAR)** – used to collect, consolidate and report on data from each of the Zoo's revenue centers;
- **Grant Management System (GMS)** – used to allocate expenses to grants and projects for billing purposes and to monitor projects.

Based on our review, we concluded that the process of developing new systems was not as strong as it could be. Because IT management is dispersed, Metro's security policy was not effectively protecting electronic data. In addition, the effectiveness of several of Metro's IT systems was dependent on a small number of persons due to a lack of operating manuals and system documentation.

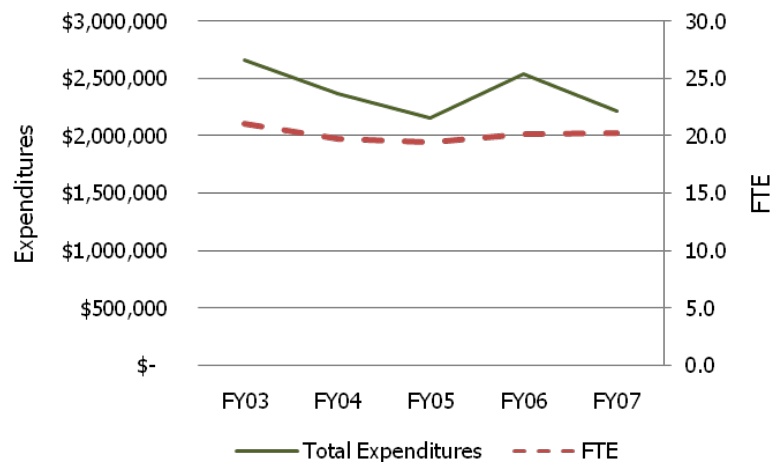
Metro was missing some key organizational elements of successful IT management. The IS Department's strategic plan is out of date and several elements have not been implemented after six years. Metro also lacked a high level IT governance body that could prioritize projects and set agency-wide standards. We also found that Metro was not able to monitor the total cost of ownership of its IT systems. We recommend that Metro take the steps necessary to put these elements into place.

Background

Metro employees rely heavily on information technology (IT) to do their jobs. Much of the agency's work is dependent on collecting, creating and maintaining data to inform decision making, and provide effective and efficient governance. The management of IT at Metro is dispersed between the Information Services Department (IS) and functional departments throughout the agency. IS supports agency-wide (i.e. enterprise) applications, such as PeopleSoft and Kronos, and manages a Help Desk for desktop applications. Other software applications are primarily managed outside of IS by individual departments.

Expenditures for the Information Services Department have declined slightly over the five year period from FY03-FY07. Expenditures on materials and services declined 35% during that period, a drop that may be due to a decline in the cost of hardware. Expenditures for staff remained fairly constant, declining 3%.

Exhibit 1
Information Services
Department expenditures
and FTE
(adjusted for inflation)



Source: Auditor's Office analysis

Many Metro systems are developed and maintained outside of the IS Department. While some costs for IT hardware and software are captured in the accounting system, the cost of staff and IT consulting services are not systematically tracked by other Metro departments. Therefore, it is not easy for Metro to determine the total amount spent on IT.

This audit examined selected controls for three software systems (applications) managed by staff outside of the IS Department to determine if they were operating effectively. The three systems we used as case studies were:

1. *Weighmaster*: Used at Metro's solid waste transfer stations to collect disposal fees and record tonnage and revenue for material coming in and leaving the facilities.

2. *Custom Zoo Attendance and Revenue (CZAR)*: Used at the Oregon Zoo to consolidate and report data on revenue generating operations.
3. *Grants Management System (GMS)*: Used to allocate expenses and generate billing data for contracts and grants in Metro's Planning and Development department.

Our analysis indicated that together, these systems are used to process about 35% of Metro's revenue each year. The systems were critical applications for collecting and reporting data about Metro's operations to management, the public and other stakeholders. Detailed flow charts for each system can be found in Appendix I.

Scope and methodology

This audit examined software applications from different service areas at Metro. The scope of this audit included Weighmaster, Custom Zoo Attendance Revenue (CZAR) and Grants Management System (GMS). We looked at the Service or Center where the application was housed and the IS Department to the extent that IS staff manage or support the application.

The objectives of this audit were to:

1. Identify where the process of data input, processing, storage, output and management trail presented barriers to operating efficiently and effectively;
2. Determine whether Metro monitored the cost of its IT applications so that it can strategically deploy its IT resources;
3. Determine whether Metro had effective controls to ensure data quality, including guidance and documentation, procedures and edit checks, and monitoring;
4. Evaluate whether Metro followed key practices that are important to successfully manage its information technology; and
5. Make recommendations to improve IT management and software controls based on weaknesses found.

To test the software controls in the systems, we developed process maps for the three systems, conducted a risk assessment to select controls for testing and evaluated controls for effectiveness. The majority of testing and analysis was based on data organized by calendar year to provide consistency across all systems. Fiscal year data was not available for all systems. We collected cost information where available.

Based on information gathered in our review of these three systems, we documented observations about Metro's IT management in five areas: (1) investment management, (2) system development, (3) enterprise architecture management, (4) information security and (5) human capital management. General recommendations for IT management at Metro are included in this report.

We also presented additional information, and made recommendations, for each of the case study systems in a letter to management. This information was not included in this report due to the sensitive and/or confidential nature of the information as it relates to security and system operation.

This audit was included in the FY09 audit schedule. We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Results

Information technology (IT) is a critical component of Metro's ability to provide efficient and effective governance in the region. Much of Metro's work is dependent on creating, managing and retaining information about the region to guide efforts and inform decision making. As a knowledge agency, Metro collects and generates a high volume of data. Data comes from a wide variety of sources and is used for many different purposes. Metro operations span a diverse set of functions including transportation and land use planning, event and educational facility management, and solid waste processing. Each of these functions has differing business processes and needs for IT.

A previous audit by this office found that Metro's IT effort is almost entirely focused on operations and maintenance of existing systems. The report recommended that a first step in moving toward best-of-class status would be to encourage and enable Metro's IT leadership to reorient its focus to developing strategic capabilities. During this audit, we also found indications of weaknesses in strategic IT management. For example, the amount of money Metro spends on information technology across the agency was not tracked. Metro did not have a process for selecting and prioritizing IT projects, and key business applications were developed outside of the IS Department.

Critical information in side systems

Metro's IT systems lack an agency-wide (enterprise) focus. Key information is created and managed in software applications (side systems) that are not integrated with its main financial and human resources software – PeopleSoft. The use of side systems has created duplicative data sets, increased reliance on manual processes, and increased the complexity of data management and accountability. Reliance on side systems has reduced opportunities to gain efficiency from IT and decreased the utility of Metro's investments in enterprise resource planning (ERP) systems like PeopleSoft.

During the audit, we found examples of side systems in all Metro departments. Based on our review of IT systems, we selected three systems to examine in depth. The systems were selected to provide examples from across the agency and demonstrate the critical role side systems play in functional departments and the agency as a whole.

Our analysis indicated that together, these systems were used to process about 35% of Metro's revenue each year. The systems were critical software applications for collecting and reporting data about Metro's operations to management, the public and other stakeholders. Our analysis and testing of controls for these systems demonstrated the impacts of decentralized IT management. Moreover, it provided information and recommendations to help improve the individual applications and Metro's IT environment overall.

Weighmaster

Weighmaster is used at Metro’s solid waste transfer stations to collect disposal fees and record tonnage and revenue for material coming in and leaving the facilities. The system is attached to scales, ticket printers, automatic gates, radio-frequency ID tags and touch screen displays. Weighmaster was developed by Information Systems Incorporated.

When customers bring loads to the transfer stations, they follow either a staffed (i.e. manual) or automated process. In the manual process, customers go to a scalehouse where a Metro employee uses Weighmaster to weigh the load and collect payment. In the automated process, the Weighmaster system receives information from trucks automatically using radio frequency identification tags which contain vehicle and billing information. The automated system allows the transaction to occur without staff assistance.

In addition to processing transactions and recording them in a database, Weighmaster is used for billing and accounting purposes. The system creates summary reports to management, other Metro programs, and the contractor that manages the transfer stations. In calendar year 2008, the system processed over 580,000 inbound and outbound tons totaling \$44 million in revenue. This amounts to about 20% of Metro’s total revenue. Metro paid Information Systems, Inc. \$19,000 for system support and maintenance in calendar year (CY) 2008.

Exhibit 2
Weighmaster
information CY08

Business purpose	Process incoming and outgoing loads at Metro's waste transfer stations and calculate fees owed
Users	30
Number of transactions	405,497
Value of transactions	\$44,123,791
Custom vs. off-the-shelf	Off-the-shelf with customized elements
Sources of technical support	Vendor: Information Systems, Inc. System Administrator: Parks & Environmental Services Network and Hardware: Information Services
Cost of system support	\$19,000 (Information Systems, Inc.)

Source: Auditor’s Office analysis

*Custom Zoo Attendance
and Revenue (CZAR)*

CZAR is a database used by the Zoo to collect data from each of its point-of-sale systems and other data sources. The system stores data from a variety of sources including ticketing, retail sales, food sales, education programs, vending machines and donations. CZAR was built in Microsoft Access over two years by a volunteer. The system was put into use in January 2008.

The CZAR system is based primarily on manual processes to record attendance and revenue data, and transfer it to Metro’s Finance and Administrative Services Department. CZAR is also used to generate weekly and monthly reports for managers at the Zoo. These reports provide detailed information on the productivity, profit and loss, and per capita revenue for each of the Zoo’s revenue centers.

In CY08, CZAR was used to process almost \$19 million in revenue from the Zoo. The system recorded 15,500 cashier reports and was used to generate cash packets each day of the year. The hours and cost of system development and support were not tracked.

Exhibit 3
CZAR
information CY08

Business purpose	Collect, consolidate and store data from each of the Zoo's revenue centers to facilitate daily accounting functions and reporting
Users	14 (4 regular users; 8 temps)
Number of transactions	15,500 cashier's reports; 364 cash packets and bank deposits
Value of transactions	\$18,888,162 (about \$52,000 per day)
Custom vs. off-the-shelf	Custom software built in Microsoft Access in 2003
Sources of technical support	System developer and primary technical support: Volunteer System Administrator: Oregon Zoo Network and hardware: Information Services
Cost of system support	Not available

Source: Auditor's Office analysis

Grants Management System (GMS)

GMS is used by Metro’s Planning and Development department to generate billing information, generate financial reports, and allocate expenses for grants and projects. The system uses data from Metro’s adopted budget, PeopleSoft, and past billing amounts to track grant balances and manage project expenses. GMS was built in-house by Metro staff. It is a web-based software application written in ColdFusion with data stored in a PostgreSQL database.

The system manages the relationships between project expenses and sources of funding (grants and contracts). These relationships can be complex, with multiple projects tied to one source of funding; multiple sources of funding tied to one project; or one project linked to one source of funding. GMS uses automated routines to allocate expenses but relies primarily on manual processes to generate billing reports and ensure correct invoice amounts. Data generated by GMS is also used in regular reports to management, state and federal agencies, and Metro Council to monitor grant balances and track project progress.

GMS was used to collect at least \$13.8 million in reimbursable expenses from grants and contracts in calendar year 2008. There are numerous sources of funding tracked by the system but the bulk of grant funds come from Oregon Department of Transportation and US Department of Transportation. Hours and costs for system development and support were not consistently tracked

Exhibit 4
GMS
information CY08

Business purpose	Allocate expenses to grants and projects for grant billing and project monitoring
Users	7
Number of transactions	n/a
Value of transactions	At least \$13.8 million
Custom vs. off-the-shelf	Custom application. Application is written in ColdFusion (developed by Adobe) and data sits on PostgreSQL database platform
Sources of technical support	System Developer: Planning & Development, Creative Services, Data Resource Center and Information Services System Administrator: Planning & Development; Information Services Network and Hardware: Information Services
Cost of system support	Not available

Source: Auditor's Office analysis

Effectiveness of IT management could be improved

Best practices indicate there are five key areas that influence the effectiveness of IT management:

- (1) investment management;
- (2) system development management;
- (3) enterprise architecture management;
- (4) information security; and
- (5) human capital management.

Based on our review of Metro's IT environment and in-depth analysis of case study systems, we concluded that IT management can be made more effective. Relative to the three systems we reviewed, our analysis ranked the agency at the lowest level of development for each of the five key management areas.

The table on the following page presents our ratings and provides potential next steps to incrementally increase the effectiveness of IT management at Metro.

Exhibit 5
IT management
scorecard

Management Area	Rating	General comments	Potential next steps
Investment	Stage 1 of 5	IT spending without disciplined investment approach. Project selection not part of budget process. Results of investments not monitored.	To move to Stage 2: <ul style="list-style-type: none"> • Develop project selection criteria. • Institute an investment board. • Identify business needs and associated users of each IT project. • Provide investment oversight. • Capture investment information.
System Development	Stage 1 of 5	System development processes were ad hoc; success depended on competence of individuals rather than use of proven processes. Tendency to over commit or abandon processes.	To move to Stage 2: <ul style="list-style-type: none"> • Establish & maintain project plans. • Monitor projects & communicate status. • Manage requirements to identify inconsistencies between requirements, plans and products.
Enterprise Architecture	Stage 1 of 5	The organization is aware of the value of enterprise architecture, but has not yet established the management foundation needed to develop one.	To move to Stage 2: <ul style="list-style-type: none"> • Identify a chief architect. • Vest accountability in a committee. • Commit resources. • Select a framework for developing the enterprise architecture. • Develop plans (as is, to be; describe enterprise, metrics).
Information Security	Basic	Repeatedly cited for security concerns.	Best practices: <ul style="list-style-type: none"> • Conduct risk assessment. • Promote awareness & training. • Implement controls. • Monitor and evaluate. • Coordinate security through central management.
Human Capital Management	Basic	No training. Staff vacancies and reliance on single staff person.	Best practices: <ul style="list-style-type: none"> • Identify knowledge and skills required. • Inventory IT staff skills. • Plan to fill gaps. • Evaluate progress in meeting needs.

Source: Auditor's Office analysis based on frameworks from Government Accountability Office (GAO), Control Objectives for Information and related Technology (COBIT), and Carnegie Mellon Software Engineering Institute.

Decentralized IT management has negative effects

IT system development and management is decentralized at Metro. Most IT projects occur outside of the IS Department and there is no centralized IT budget that captures all projects. As a result, funding for IT projects is dispersed throughout the agency, and authority, control and support for IT systems and data varies between departments.

Decentralized management reduced clarity about the role and authority of the IS Department and has led to a disparity between expectations and resources for IT at Metro. This limits Metro's ability to deploy IT resources strategically. Similar conclusions were reached in a 1999 audit that found

the existence of autonomous IT user groups was an obstacle to specifying and documenting standards for the IT environment. Lack of standards has a direct impact on software development and controls.

Best practices indicate that it is important to prioritize IT resources in line with business needs and provide transparent controls for IT system development. If roles, processes, policies and procedures aren't established or followed, the IS Department's ability to provide timely and effective support will be negatively affected. Moreover, the agency's ability to provide cost-effective IT management will be reduced.

During the audit, we learned of several examples of inadequate system development processes. GMS provided the clearest example of a project that was not well managed or controlled. Metro has a long history of managing grants dating back to the early 1980s. GMS is the latest iteration of software for grant management.

GMS was developed in-house beginning in FY04. The original scope of work for GMS was ambitious and broad. The purpose of the new system was to integrate several stand-alone but interrelated grant management systems (i.e. budget tracking, billing, forecasting/projections). During development of the system, the scope of work, timelines, and priorities changed several times. Similarly, project leadership changed several times. In total, at least 13 people in three different departments worked on development of GMS.

The resulting system has not met all of the expectations. There was very little documentation about how the system works and there were features that have never been implemented. About a year ago, the Budget and Finance Manager in Planning and Development decided to cease upgrades to GMS and only perform work necessary to maintain existing functions going forward due to the lack of system documentation and resources for IT projects.

There are many reasons for GMS' inadequate system development. Metro did not follow standard software development procedures and the processes used for system development were inconsistent among departments. GMS was designed without a clear understanding of the business needs for the system. As a result, the system is based on the manual processes of specific individuals similar to the system it replaced. Designing the system around a manual process reduced opportunities to gain efficiencies from automated IT systems.

Security We found Metro's security policy was not effectively protecting electronic data and other IT resources. The case studies highlighted security weaknesses in several IT systems. Metro's external auditor also documented several security concerns in their annual technical environment review. Similar security conclusions were also documented in a 2000 consultant's report that found "Enterprise security policies and procedures need to be formalized and implemented. Standards need to be applied in the area of security. Security needs to be actively administered rather than passively and should be monitored and reviewed."

Executive Order 76 is Metro's primary IT security policy. The policy has not been updated since 2004 and the language in the policy is confusing and vague. During the audit, we found that the level of security varied by department and software application. Some applications were not in compliance with Metro policy and guidelines. In addition, we found that access to network drives was a commonly used security feature for applications but there does not appear to be a policy related to how network drive access is governed.

Another security concern arose from the use of side systems which may contain data that is sensitive. Even if security is maintained for Metro's agency-wide systems (i.e. Kronos and PeopleSoft), side systems may compromise those security features by inadequately securing data. We were able to access sensitive data from PeopleSoft due to weak security controls in side systems.

To its credit, the IS Department included an objective in its FY09 budget to "develop and adopt revised policies and procedures for information security management and records retention to reflect current legal and regulatory requirements." At the time of this report, revised security policies had been drafted but not adopted.

*System documentation
and understanding*

The effectiveness of many of Metro's IT systems was dependent on a small number of key personnel. Reliance on key personnel puts business continuity at risk if key staff or contractors leave. In extreme cases, personnel changes could render IT systems inoperable.

Concentrating knowledge in a few key personnel also presents risks related to segregation of duties and system documentation. Lack of segregation of duties creates the opportunity for a person to commit fraud or error without detection. During the audit, several people expressed concerns about risks to key systems. Metro does not have a way of evaluating and addressing these risks.

All three case study systems depended on key personnel or contractors to varying degrees. CZAR appeared to be the least dependent on key personnel since the system and processes were well documented. Weighmaster may be at relatively higher risk because it is dependent on a contractor who is a sole proprietor. Nonetheless, the system and processes

were well documented, which provides some assurance that the system could remain operational during staff or contractor transitions. GMS presents the most risk among the case study systems. It was entirely dependent on the memory and experience of one or two employees to ensure that the system remains operational. Moreover, since there was very little documentation for GMS and the grant billing process in general, knowledge of critical system controls existed only in the source code (i.e. behind the scenes statements that tell the computer processor what to do).

We also discovered that operating manuals and system documentation for IT systems were not consistently available or current. Weighmaster and CZAR documentation had elements of guidance, procedures and monitoring. However, our testing of management controls to ensure data quality found areas where procedures should be clarified and monitoring improved.

Documentation for GMS was minimal. Few elements of guidance, procedures and monitoring existed. Controls for GMS were not well documented and did not provide reasonable assurance of data accuracy, validity and completeness. GMS also lacked the ability to review transactions and changes that were made to the data and software (management trail). This reduced the ability to oversee and ensure data accuracy. Testing found areas where guidance procedures and monitoring for GMS should be improved.

Application controls can be improved

During the audit, we found that methods to ensure data validity, accuracy and completeness (controls) varied considerably between software applications. Controls for GMS were weak and did not provide reasonable assurance of data validity, accuracy and completeness. Staff used manual processes to help maintain accurate billing data. Weighmaster and CZAR controls were relatively effective. Nonetheless, we found controls in each case study system that could be improved.

Weighmaster

Overall, application controls for Weighmaster were working as intended. The system appeared to be well designed to meet Metro's business needs. Testing of Weighmaster controls revealed opportunities for improvement in the following areas:

Data input:

- Inconsistent application of discounts for recyclable materials.
- Controls to prevent theft were weaker at Metro Central.
- Reasons for manual weight changes were not always documented.
- Use of same scale for entry and exit limits identification of manual transactions.

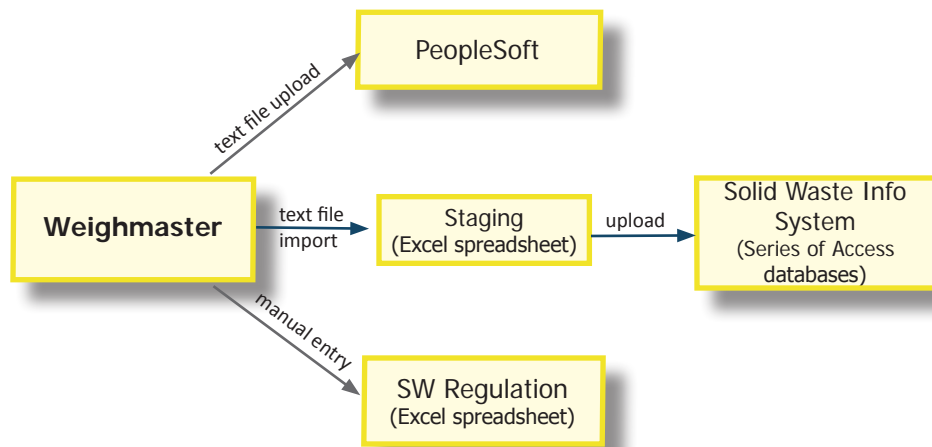
Data output:

- Manually entered weights were not routinely reviewed.
- Selected automated calculations in Weighmaster appeared to have minor errors.
- Frequency of random cash counts did not meet Metro's goal.

Management trail:

- Documentation for periodic updating of truck tare weights was not readily available or regularly reviewed.
- Insufficient segregation of duties for system administrator.
- Little automated integration with other IT systems increased staff time for manual data manipulation.
- Fragmented data management decreased Metro’s ability to get comprehensive data sets. Other systems used and manipulated Weighmaster data but there was no central repository or integration of these data sets. See exhibit 6 below.

Exhibit 6
Weighmaster data flow



CZAR Effective controls for CZAR are primarily the result of well designed manual processes for cash handling. Because CZAR is used to collect data from systems that “don’t talk to each other,” the need for manually intensive processes is required to ensure the validity, accuracy and completeness of data. Manual processes that were required for cash handling reduced opportunities to gain efficiencies from IT systems. Testing of CZAR controls revealed opportunities for improvement in the following areas:

Data input:

- Security of CZAR database can be improved.
- Procedures used to stage labor data for profit/loss statements could be improved to ensure consistency and accuracy of analysis.

Data output:

- Data transferred from CZAR to PeopleSoft can be streamlined by using electronic input files.

Management trail:

- Attendance data in CZAR was not easily tracked back to its original sources.

- There was very little coordination and communication between the CZAR system administrator and Metro's IS department. This decreased Metro's ability to manage risks associated with data security and disaster recovery. In addition, it decreased the agency's ability to create an agency wide (i.e. enterprise) data model.
- Little automated integration with other IT systems required staff time for manual data manipulation.

GMS Controls for GMS were not well established or documented. Lack of controls in the system raised doubts about the effectiveness of the system in terms of data accuracy, validity and completeness. The usefulness of the system was based almost entirely on the knowledge and manual processes of the Grant Accountant and Management Analyst. The genesis of the problem appeared to be twofold.

First, the business processes for grant management were not well understood or documented when the system was being developed. In effect, the system was designed to replicate the manual routines of one or two staff members while replacing the previous software. As a result, little time was spent identifying the most effective and efficient system for grant management.

Second, documentation for the system was incomplete. Knowledge about how the system works and was used was not available. This impacted staff that had to learn the system on their own and implement grant processes as they went. Lack of documentation also impacted technical support staff and managers. System administrators had to rely on source code to understand the system's controls. Managers are asked to make important decisions based on data from a system for which there is no transparency about how data is generated.

Based on our review and testing of application controls, we do not believe GMS is fully meeting Metro's business needs. Inadequate system development processes, and incomplete documentation for system functionality and grant procedures has reduced the utility of the system. In the long-term, Metro will need to evaluate the most cost effective plan to ensure grants management data is accurate, valid and complete. In the short-term, opportunities exist to improve application controls in the following areas:

Data input:

- There was no procedure manual for the GMS system.
- Data entry relied heavily on manual processes for which there were few controls to ensure consistency and prevent errors.
- Technical documentation for GMS was out of date and informally maintained.
- There was no policy to govern establishment of new GMS users and appropriate levels of access to system data and elements.

Metro missing elements of successful IT management

Data output:

- Data transfer from GMS to PeopleSoft can be streamlined by using electronic input files for data from the monthly invoice requests.
- There were no documented procedures for monthly invoice request review and approval.

Management trail:

- Policies and procedures for grant and project management are informal and inadequately documented.
- Many of the manual processes for GMS data input and output are replicated for other systems which may result in inconsistent data between systems.

Without strengthening the IS Department's role, authority and capability, Metro will be unable to reduce the negative impacts of decentralized IT management. Metro lacked three key elements of successful IT management: (1) strategy; (2) governance; and (3) data to monitor total cost of ownership. Focusing on strategy, governance and costs will provide a solid foundation for Metro to improve IT management and align with best practices. In order to accomplish this, Metro will need to either realign resources back to the IS Department or assign additional resources.

Strategy

The IS Department's strategic plan is out of date. Many elements of it have not been implemented after more than six years. Metro's Chief Information Officer (CIO) began to develop a new strategy for the IS Department in November 2007, but a new strategic plan has not been adopted or implemented. One of the objectives for the IS Department in the FY09 budget was to "develop and adopt a new five-year strategic Information Technology plan." In the absence of a documented strategic plan, the Director of IS used an informal roadmap to guide its near-term work. The roadmap focused on projects related to deploying new servers, managing the telephone system and planning for disaster recovery.

Creating and implementing a strategic plan for the IS Department that addresses Metro's IT management needs will not be an easy task. Historically, the IS Department has focused on supporting existing systems with few resources devoted to strategic development. This is partly because other government entities have transferred functions to Metro over time. As new functions were added, they brought their own processes and IT systems which were not fully integrated into existing systems.

A new strategic plan for IT will also have to address recent organizational changes as well. The CIO position was created in 2007 to provide high-level guidance and strategy for IT. Shortly thereafter, the CIO became Deputy Chief Operating Officer; a new position that includes the duties of the CIO position among other responsibilities. In addition, several changes to Metro's organizational structure occurred over the last two years. IS became its own department for the first time in FY09 after previously being

part of the Finance and Administrative Services Department. Also, the agency-wide restructuring in October 2008 created new responsibilities for the department.

These challenges and changes may provide an opportune time to make progress on defining a strategic plan for IT. Best practices indicate that information needs and related information systems should be reassessed as objectives change or as reporting deficiencies are identified. When objectives change, information needs may also change. To align with best practices it will be important to focus on incremental steps the agency can take to gradually improve over time.

A first step would be to establish a vision and long-term goal for Metro's IT environment. Ideally, IT should provide the tools necessary for an agency wide (i.e. enterprise) data model. An enterprise data model could reduce duplication of effort, decrease the need for side systems, and integrate systems to provide seamless and complete access to data. If an enterprise data model is the long-term goal, a key requirement will be to define the information architecture and classification scheme to ensure the integrity and consistency of all data. The need to upgrade or replace Metro's accounting and human resource system, PeopleSoft, in 2013 may provide a pivotal opportunity to make progress toward an enterprise data model.

Once a vision and goals are established, Metro will need to develop a plan to meet its IT objectives. A critical part of the plan will be to more clearly define the IS Department's role and authority. To effectively meet the IS Department's evolving role in the agency, Metro needs to define the IT process, organization and relationships so that expectations for IS will be clearly understood. One way to do this would be to use memorandums of understanding (MOUs) to formally document IS' relationships with other Metro departments.

Establishing formal roles and responsibilities may impact resource allocation. Best practices demonstrate that resources for IT management should be deployed in line with expectations and responsibilities. During the audit we learned that IS had been given additional responsibilities to manage the telephone system and centralize database administration duties. Given these changes, Metro may need to review resource levels to ensure that IT investments are aligned and delivered in accordance with the agency's strategies and objectives.

Governance Metro lacks a high level IT governance body to prioritize projects and establish agency-wide standards. In 2000, the Information Technology Steering Committee (ITSC) was established to serve as Metro's IT governance board. The group met semi-regularly and completed projects until about a year ago when it was disbanded by the CIO.

The ITSC was disbanded because there were questions about its effectiveness. We learned of several examples that indicate the governance group did not have sufficient authority or input from senior management to be successful. In late 2007, the CIO began developing a new framework for IT governance at Metro. The proposed framework recommended creating three committees:

- Information Technology Executive Committee to focus on aligning high level strategic and resource allocation decisions;
- Technical Advisory Group to establish standards and toolsets for application development; and
- Project Prioritization Committee to identify common business needs, evaluate project proposals, and track progress for approved projects.

The proposed framework has not been implemented and currently Metro doesn't have an IT governance body.

IT governance is important for any organization, but it is especially valuable at Metro because of the agency's decentralized IT management structure. IT governance ensures effective information management and security principles, policies, and processes are in place. Moreover, the body reviews performance and compliance metrics to ensure that the agency is managing IT systems in line with the governance framework.

Lack of an IT governance framework limits Metro's ability to integrate strategic business needs, set priorities and establish standards. As a result, Metro may be missing opportunities to improve services to its customers. Moreover, the agency may not be making efficient and effective use of its IT resources.

Total cost of ownership

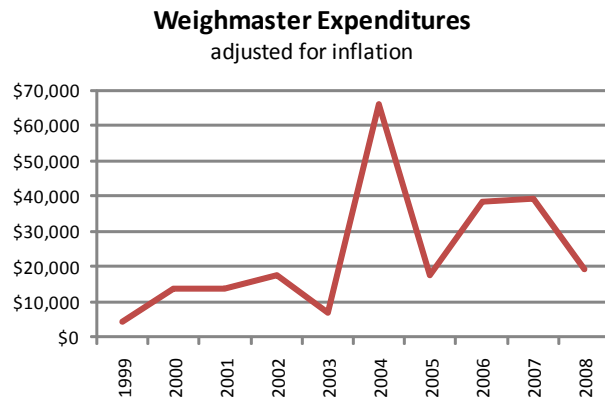
During the audit, we discovered that data is not available to monitor total cost of ownership of IT systems. Lack of expenditure data for system development, support and ongoing maintenance makes it difficult to manage and prioritize IT needs. In addition, it limits the agency's ability to determine if IT investments are generating benefits in excess of their costs.

Best practices indicate that understanding the status of IT systems is a basic need for every enterprise. A key aspect of IT management is to provide effective and efficient delivery of IT components and early warning of any deviations from plan, including cost, schedule or functionality that might impact expected outcomes. Monitoring total cost of ownership is one way to increase accountability for achieving the benefits, and controlling the costs of IT investments.

Our analysis of case study systems provided evidence that cost data was not consistently collected and monitored. Weighmaster was the only system where it was possible to determine the cost of support and maintenance. In calendar year 2008, Metro spent \$19,000 for Weighmaster support and maintenance, or about \$436 for every \$1 million in fees processed by Weighmaster.

Metro pays \$5,485 for annual support costs. Below is historic cost information for Weighmaster support, maintenance and improvements. The spike in expenditures in 2004 was the result of a system upgrade to add the ability to process credit card transactions and upgrade the point of sale functionality for Metro’s latex paint operation.

Exhibit 7
Weighmaster expenditures
(adjusted for inflation)



Source: Auditor’s Office analysis

Metro did not monitor the cost of CZAR development and ongoing maintenance. The Zoo did not track project hours or costs during the two year development of the system.

Similarly, Metro did not systematically monitor the cost of GMS development and ongoing maintenance. Some information was available to track system development costs. Based on available data it appears that Metro spent at least \$68,000 in staff time developing and upgrading GMS between FY04 and FY08. This data represents the staff costs of just two of at least thirteen Metro staff members who worked on the project. Within the last year, the technical support person for GMS has tracked projected and actual hours for system upgrade projects but this appears to be ad hoc.

Lack of consistent data to manage the total costs of ownership of IT systems results from several factors. The primary reason was that each department uses its discretion for how to code IT hardware and software costs. We found that some cost data is captured in the accounting system but this data is not specific to individual IT systems and is not consistent across departments. In addition, coding labor costs, and materials and service expenditures by project was not done by most of the departments at Metro, including IS. This makes it very difficult to monitor projects, and compare expected and actual outcomes.

RECOMMENDATIONS

Recommendations

1. In order to improve management of IT resources, Metro should define processes, organization and relationships of IT management which includes assigning leadership, creating a governance framework, establishing roles and responsibilities, and committing sufficient resources.
2. In order to create a strategic plan to gradually improve the effectiveness and efficiency of IT management in each of five key management areas Metro should:
 - a. Take steps to move the agency toward enterprise data management.
 - b. Collect data to enable departments and IT governance to evaluate the total cost of ownership of IT systems.
 - c. Standardize software development processes and procedures.
 - d. Develop written procedures and training plans.
 - e. Update and implement the information security policy for the agency.

MANAGEMENT RESPONSE



Date: June 11, 2009

To: Suzanne Flynn, Metro Auditor

From: Michael Jordan, Chief Operating Officer
Scott Robinson, Deputy Chief Operating Officer
Rachel Coe, Director, Information Services
Teri Dresler, Director, Parks and Environmental Services
Tony Vecchio, Director, Oregon Zoo
Robin McArthur, Director of Planning and Development

cc: Margo Norton, Director of Finance and Regulatory Services
Diane Arakaki, Finance Manager, Planning and Development
Jeff Tucker, Finance Manager, Parks and Environmental Services
Craig Stroud, Finance Manager, Oregon Zoo
Carmen Hannold, Assistant Director of Operations, Oregon Zoo

Re: IT Software Controls Audit

This memorandum serves as management's response to the final audit report transmitted by your office on May 27, 2009. We appreciate the thorough research and thoughtful conclusions provided by your office in this audit.

The audit report further reinforces the rationale which led to hiring a CIO in November of 2007. Since that time, management focus has been placed on organizing Information Services resources, elevating the decision framework for information system investments and placing focus on leveraging investments to serve the greater enterprise. These efforts began in 2008 and have resulted in creation of an Information Services Department, elevating the department to the senior level, introduction of an information technology governance framework, leveraged investments in physical infrastructure to provide agency-wide efficiencies and leveraged investments in new applications which serve the agency-wide needs.

An important requisite of managing information resources of the agency involves managing a consolidated physical infrastructure. Efforts to consolidate the management of physical infrastructure began in 2008. In the coming months, nine main Metro and MERC sites will be upgraded to high speed fiber connections with centralized network management. The service will provide both Metro and MERC a wide variety of technology opportunities, including the ability to better manage enterprise systems and decentralized data and disaster recovery.

While these efforts have been undertaken, a significant body of work exists to address legacy information systems and bring the full vision of an enterprise data model to the agency. With existing resources this work will progress at a measured pace. Resource allocations required to support the modernization of the agency information services model will need on-going commitment to achieve a more rapid integration of data systems across the agency.

Response to Recommendations in the Auditor's Report

The following summarizes the Information Services response to the specific recommendations in the Auditor's report.

Recommendation 1:

In order to improve management of IT resources, Metro should define processes, organization and relationships of IT management which includes assigning leadership, creating a governance framework, establishing roles and responsibilities, and committing sufficient resources.

Response:

Management agrees and supports this recommendation overall. Information Technology provides a foundation for supporting essential data, financial, communication and administrative business systems throughout the agency. Recognition of this crucial role resulted in the development of the Information Services Department in 2008. As a new department, a number of technical and organizational issues needed to be addressed. The groundwork for policy revision, mission, vision and values, oversight, standards and a strategic plan were being laid just as work on the Sustainable Metro Initiative (SMI) began.

While the implementation of SMI delayed the creation of an IT strategic plan and implementation of the new IT governance structure, the organizational changes employed as a result of SMI allow a greater line of sight between a Metro IT strategic plan and IT related work being done throughout the agency. An example of this is the restructuring of general ledger coding in the financial and time keeping systems. This change will allow departments the ability to more accurately code IT work being done and facilitate better tracking of expenses, projects costs and technology investments. Further, the Sustainable Metro Initiative was able to identify and adjust a number of embedded FTE whose duties were primarily IT focused. The reconfiguration of these positions and greater reliance on the services and resources of the Information Services Department has provided the cornerstone for more formalized departmental agreements.

Work initiated, yet to be completed includes the 5 year strategic plan, business continuity and disaster recovery planning, memorandums of understanding between key stakeholder departments, refinement of the IT project intake, prioritization process and IT governance systems. In addition, the development and implementation of an agency wide enterprise data model will require on-going resource commitment. Development of policies including, security, remote access, telecommuting, email and guest wireless access has been ongoing.

The memorandums of understanding with agency departments will be formulated in tandem with business continuity planning, since both require a high level of understanding of the current data and information technology needs of each of the departments. Completion of IT policies will be done in conjunction with other policy re-work in the agency. Project intake and governance will be the next step undertaken. This is a crucial step in managing expectations, resources and costs of technology within the agency. Finally, the strategic plan will be written using departmental input and the new IT governance structure.

Recommendation 2:

In order to create a strategic plan to gradually improve the effectiveness and efficiency of IT management in each of five key areas Metro should:

- A. Take steps to move the agency toward enterprise data management

Response:

Management agrees that enterprise data management is essential to the future roadmap and success of the agency. While the agency has effectively pursued enterprise data management for core business processes (financial management, human resource management, time tracking and core productivity systems), additional work and focus is required to better incorporate systems designed and acquired to support the individual business lines of the agency. Work has begun to prioritize work efforts surrounding enterprise data management. While not reflecting one of the three systems audited, the Solid Waste Information System (SWIS) exhibits similar flaws in its lack of an enterprise approach. Due to the significant volume of business data managed by SWIS, Information Services has begun a work effort to develop an enterprise data management approach to SWIS as a springboard for the creation of a data warehouse. Because SWIS contains valuable information and is integrated with other software products, such as Weighmaster, it represents an appropriate model for centralized enterprise data management for the agency.

- B. Collect data to enable departments and IT governance to evaluate the total cost of ownership of IT systems.

Response:

One of the primary observations and subsequent recommendations out of the Sustainable Metro Initiative, was the recognition that, the standard chart of accounts were not being used consistently across the agency. As part of the SMI, renewed focus has been placed on standardizing the use of existing accounting codes across the agency to improve the ability to track appropriate costs associated with acquiring and subsequently supporting systems. In addition, appropriate system costs are being identified and moved to the Information Services department to improve the transparency surrounding overall cost of ownership associated with each system. With improved cost information, the IT governance framework presented in February of 2008 can be fully implemented in order to guide system investment decisions.

- C. Standardize software development processes and procedures.

Response:

Information Services has more recently adopted an agile software development methodology known as scrum. Scrum is an iterative framework for managing complex work and is particularly useful for new software development. It allows both flexibility of design and greater, more timely user input. Agile software development methods promote a disciplined project management process that encourages frequent inspection and adaptation, a leadership philosophy that encourages teamwork, self-organization and accountability, a set of engineering best practices that allow for rapid delivery of high-quality software and a business approach that aligns development with customer needs and agency goals.

- D. Develop written procedures and training plans.

Response:

Management agrees that business processes and system protocols need to be documented and subsequently supported with appropriate training to ensure business continuity. While appropriate in general, several systems and processes will require study to determine if the existing business process and supporting system are appropriate or require replacement. As we move increasingly towards an enterprise approach, side systems will be disposed of in deference to an integrated systems approach. This will require appropriate resources and time to fully transform the agency's management and system practices.

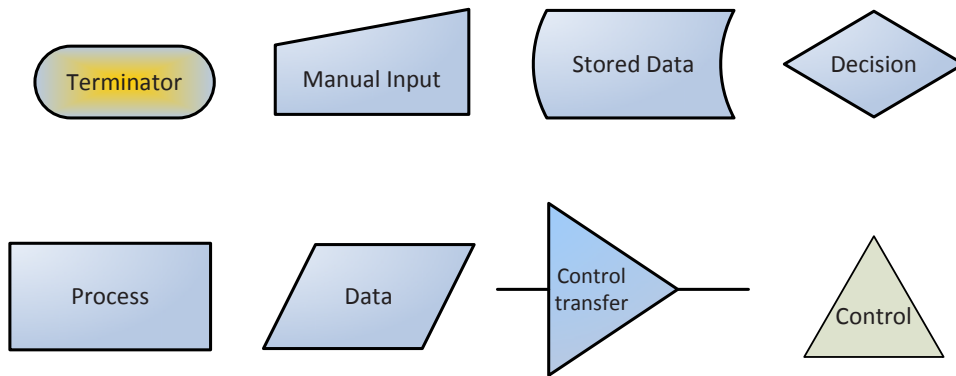
- E. Update and implement the information security policy for the agency.

Response:

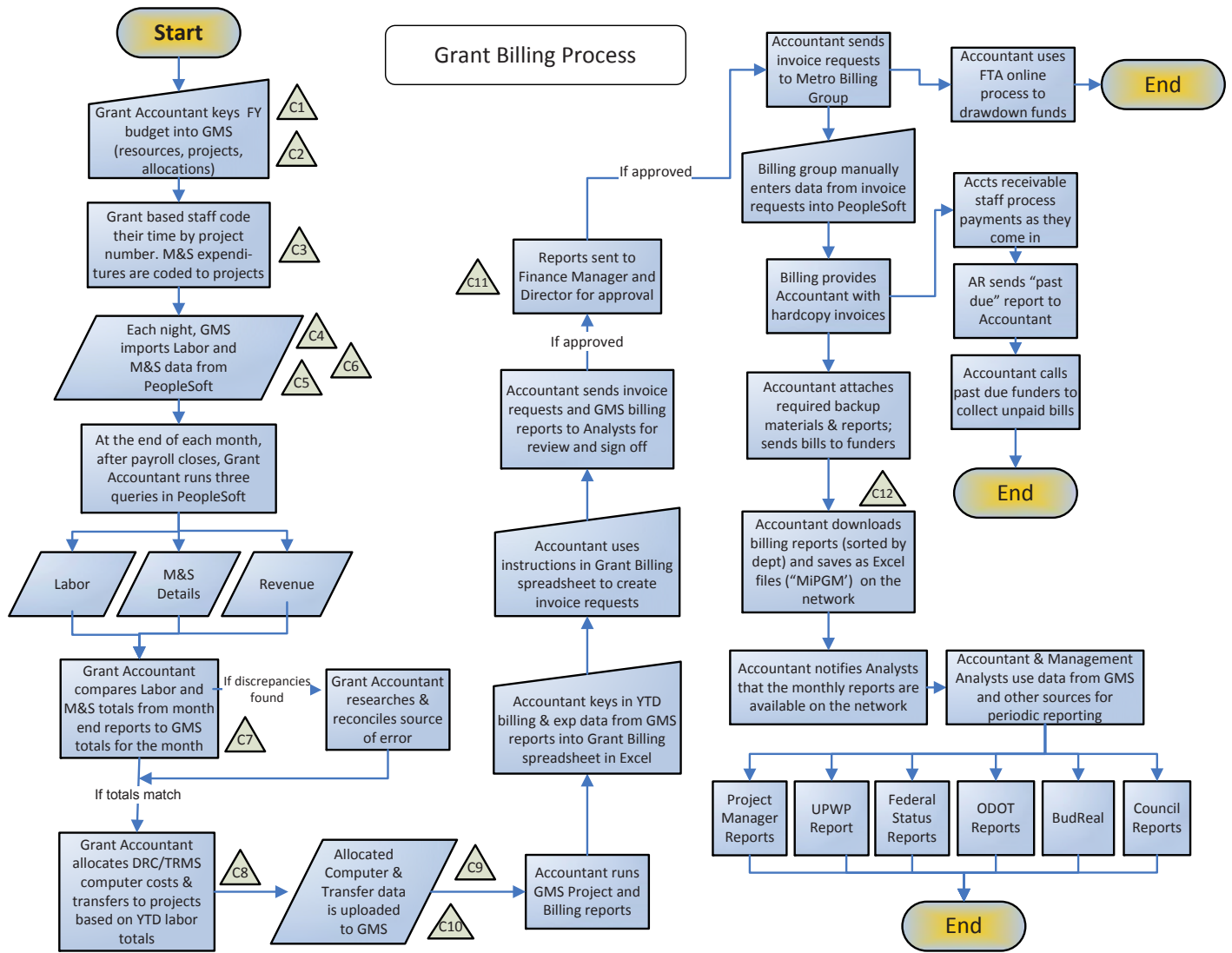
Management agrees that the information security policy is in need of an update in light of changing business practices, underlying technologies, and an overall move towards managing agency data within the context of enterprise data as Metro. This work will be continued within the context of the strategic planning work scheduled for 2009-10 fiscal year.

APPENDIX I

Process Map Key



Grants Management System (GMS)

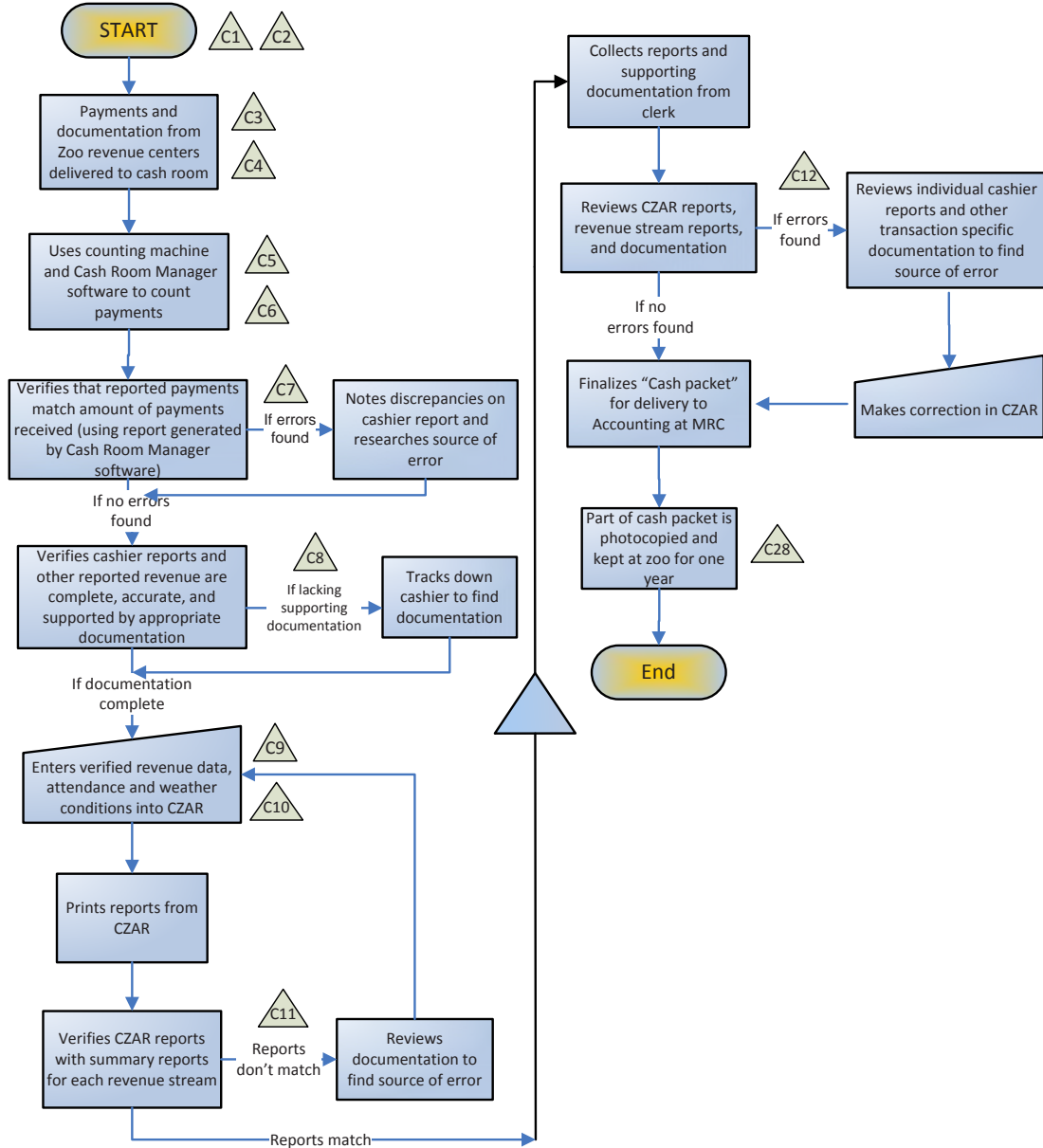


Custom Zoo Attendance and Revenue (CZAR)

CZAR Data Input – Cash Room Process

① Cash Room Clerk

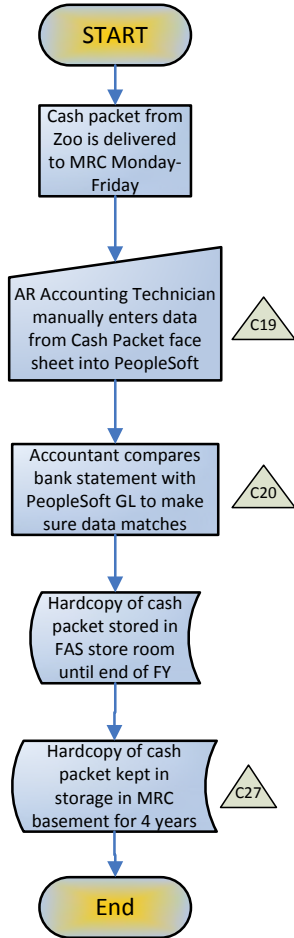
② Cash Room Supervisor or Financial Reporting Manager



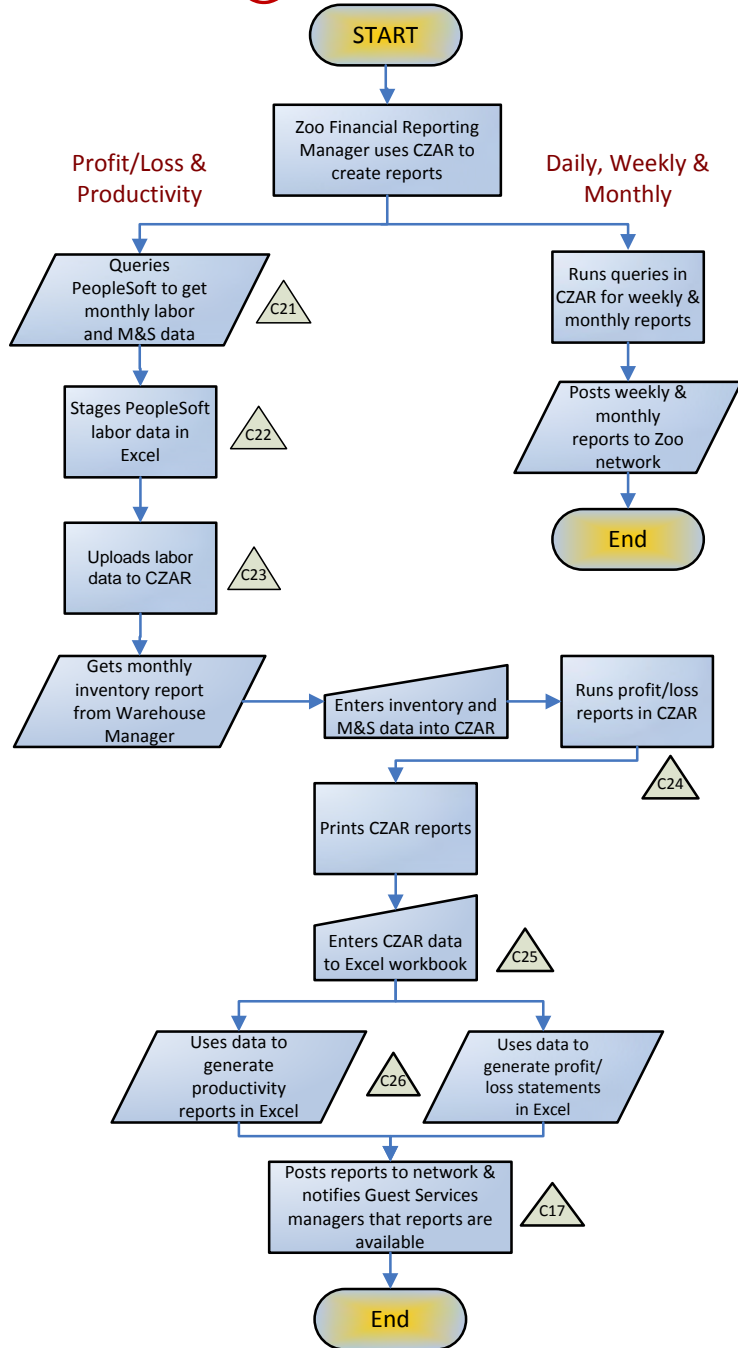
Custom Zoo Attendance and Revenue (CZAR)

Data Output – AR & Zoo Reporting Process

① Accounts Receivable

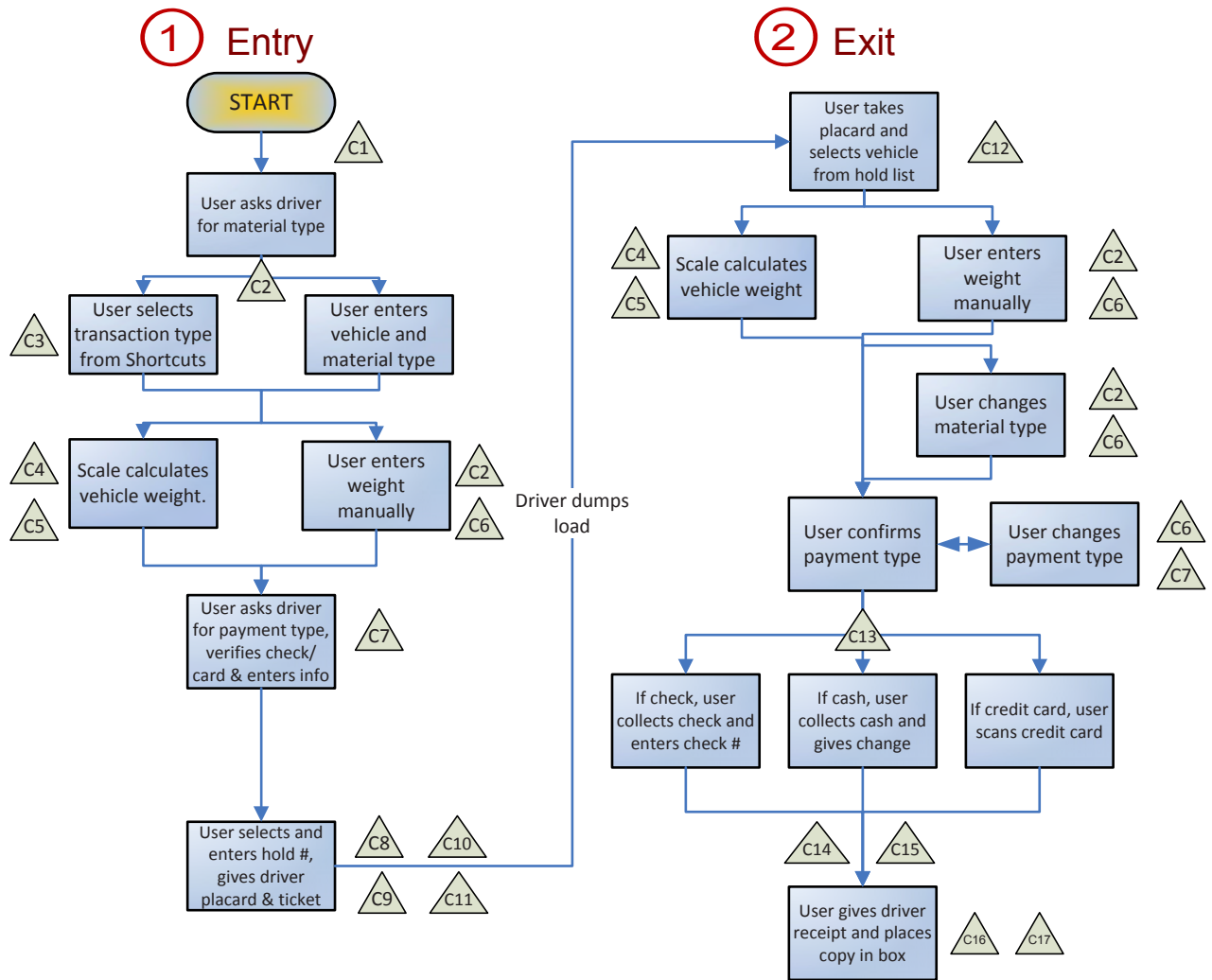


② Zoo Reports

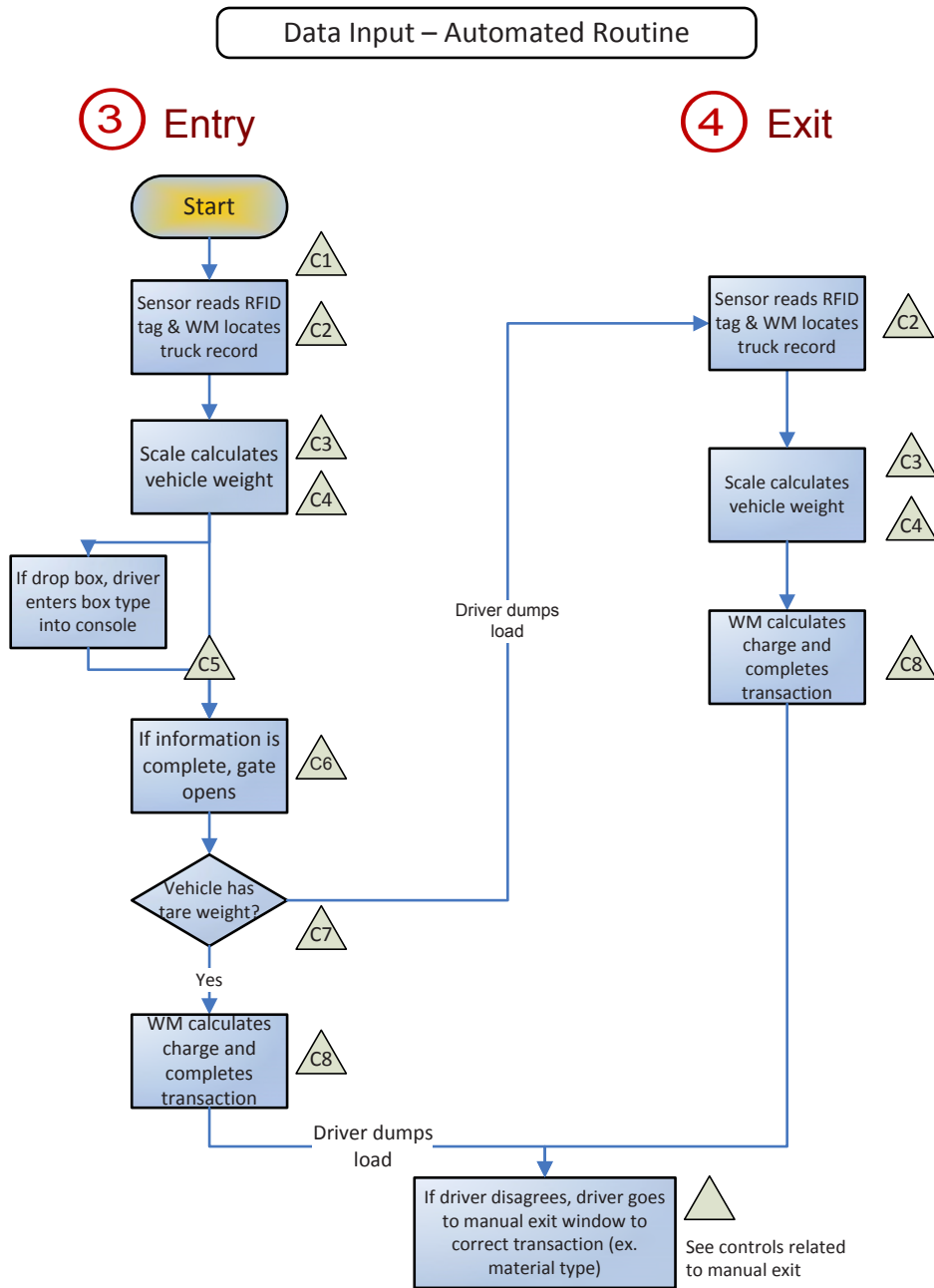


Weighmaster

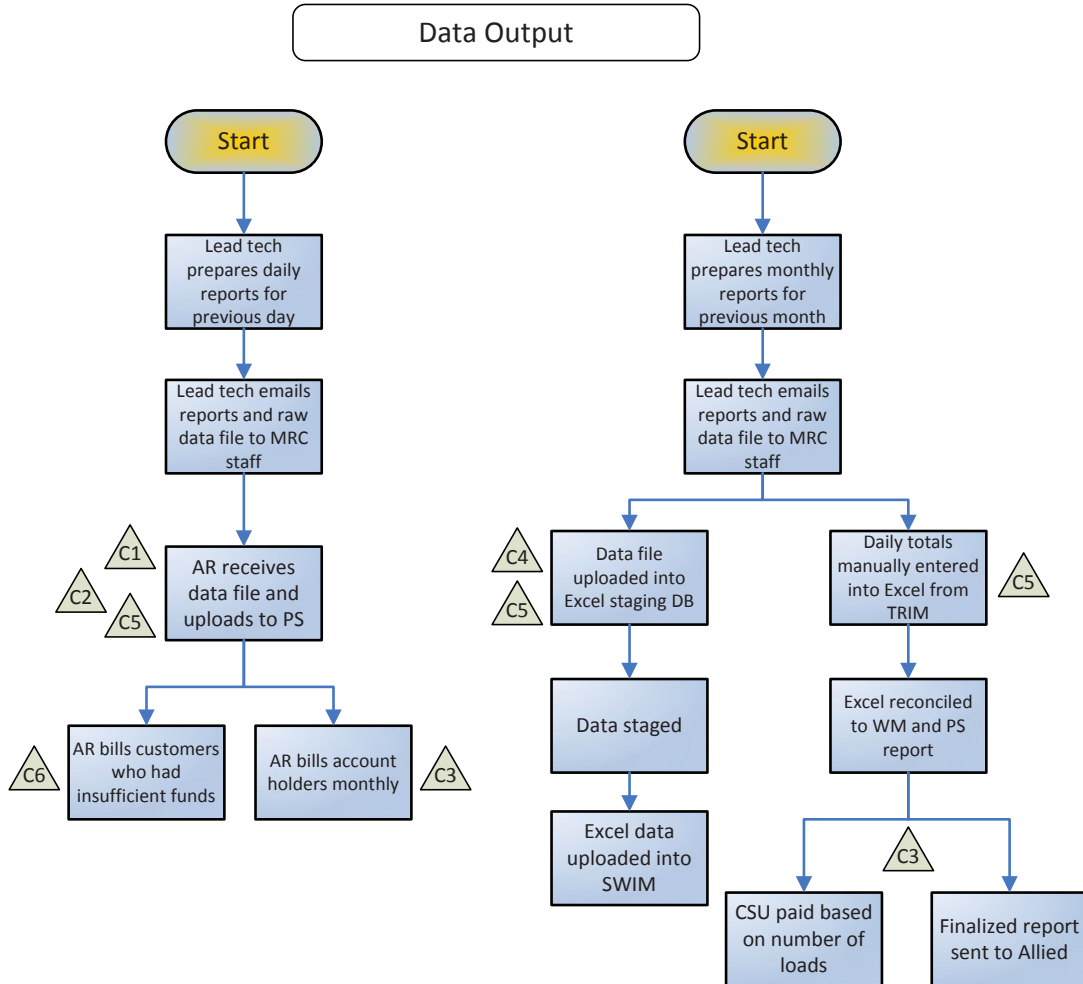
Data Input – Self-haul (Manual Routine) Process



Weighmaster



Weighmaster





METRO

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