

## **Architecting and Administering an Automated Financial Reconciliation Methodology with SAS® BI**

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### **ABSTRACT**

Federal and state governments, and private industries spend countless hours performing manual reconciliations between multiple accounting and transactional systems. Pulling unstructured information from two or more systems and trying to manually determine unreconciled items was an area that Texas Parks and Wildlife Department (TPWD) targeted to improve. This paradigm shift, led by automated reconciliation, helped the agency achieve significant time efficiencies by re-designing processes and freeing up staff time to focus more on analyzing and addressing differences. Most SAS® Business Intelligence (BI) implementations center on various types of data analytics. However, by expanding the SAS BI toolset into other areas such as financial reporting and automating reconciliation, TPWD further justified the cost of using SAS BI.

### **INTRODUCTION**

As we began exploring the use of SAS BI and methods to enhance the utility of the system for users, financial reporting at TPWD was in disarray. TPWD had recently implemented a new financial system that included a reporting tool that was a product outside of SAS. The new reporting tool had several performance issues and, in many cases, generated inaccurate financial reports. Additionally, when reporting was created with the new reporting tool, very little thought was given to how the growth of data would impact a user's ability to query for reporting. The accounting at TPWD is complex, because of the use of multiple funding sources that allow for an expense to be split funded. This flexibility causes an enormous amount of expense data detail. This growth in data lead to report performance degradation. For these reasons we ultimately developed SAS BI reports for each of the following functions of our financial system at TPWD:

- Accounts Payable
- Accounts Receivable
- Budget
- Employee
- Fixed Asset
- Federal Grants
- General Ledger
- Purchase Order
- Reconciliation
- Revenue
- Uniform Statewide Accounting System (USAS) the state's accounting system

Our intention in writing this paper is to share TPWD's method for architecting and administering an automated financial reconciliation, one of the functions that was first targeted for improvement.

## **HISTORY OF RECONCILIATION AT TPWD**

Under Texas law, specifically Texas Government Code, Section 403.036(C), TPWD is required to keep accounts in balance with accounts kept by the state's Comptroller's office. In short, TPWD's internal accounting system must be reconciled monthly with the state's accounting system, the Uniform Statewide Accounting System (USAS). Reconciliations must be done on a cash basis because the State of Texas operates on a cash basis.

Historically, there was minimal documentation at TPWD regarding reconciliation methodology and even less documentation on how to create a reconciliation. "Recon", as most referred to it, was taught by word of mouth or cobbled together by piecing a variety of methods from individuals over the years that created different reconciliations. As a result, there was no consistency throughout the agency and no standardized methodology regarding the reconciliation process.

TPWD reconciliations had historically been a very manual process. Before the actual reconciliation of the two systems could begin, data from the two accounting systems had to be gathered and prepped. This process was extremely time consuming and frustrating; this, coupled with the actual reconciliation process itself, resulted in reconciliations that would take weeks to perform.

TPWD's goal was to automate areas of manual reconciliation to focus more on the analysis rather than data generation and preparation. Several manual processes that end users did as a routine part of reconciliation were automated. By standardizing and automating the reconciliation of TPWD's internal accounting system with USAS using SAS BI products, TPWD can now reconcile several million transactions by source, by journal, and by accounting detail in a matter of minutes. TPWD vastly improved in many areas including documented procedures, internal and external audits, streamlined financial processes, minimized mistakes, changed the frequency of account reconciliations, and saved a significant amount of staff time.

## **RECONCILIATION DEFINED**

Making two financial systems consistent is easier said than done. Understand that these financial systems rely on manual entry and because this method is prone to error, entries can be made incorrectly, or with incorrect assumptions. Timing can also cause unintended differences between the two systems that will also need to be identified and explained.

Account balances between systems are reconciled when every transaction is accounted for that brings the systems into balance. Reconciliation really is the method of verifying that transactions between these systems match and are in harmony with one another.

Traditional reconciliation methods rely on manually gathering data from two systems separately to manually compile together in such a way that it helps derive which transactions match, which are missing or incorrectly posted between systems. In this method, individual data sets from both systems must be prepared and conformed separately in such a way to allow for a side-by-side visual comparison. Spreadsheet programs are typically used for side-by-side comparisons or to compile data, where staff are again, manually tasked to match "like" transactions between the two systems, defined as reconciled items, and identify any unmatched transactions from respective systems, defined as unreconciled items.

## IMPACT ON STAFF TIME

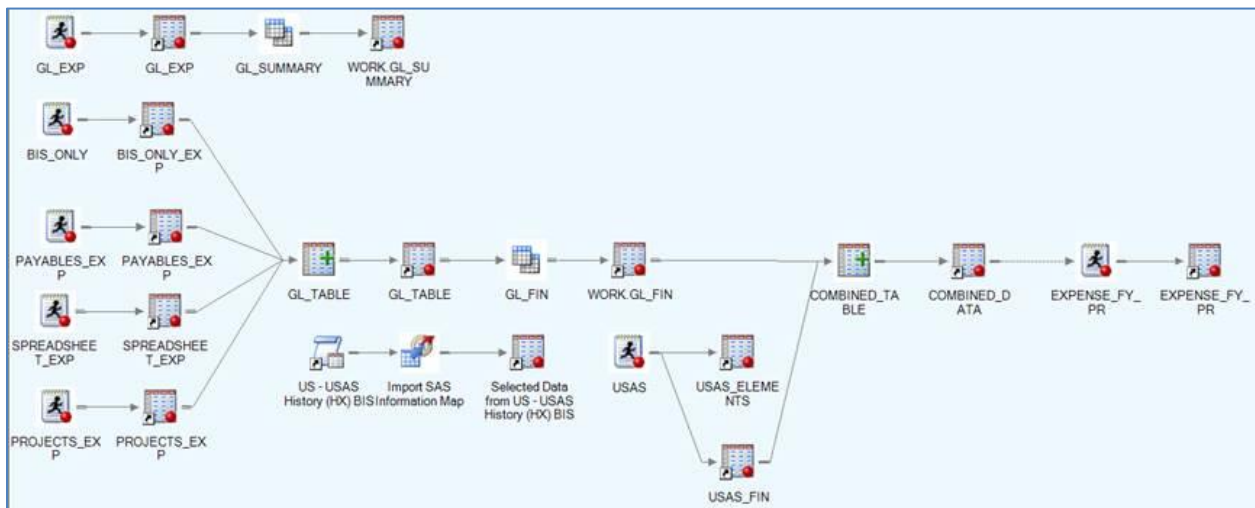
The traditional manual reconciliation method requires a significant amount of staff time spent on data preparation, as well as identification of reconciled and unreconciled items, which delays staff from addressing posting differences and timing issues.

Through the use of SAS Enterprise Guide, Information Maps and the Add-in for Microsoft Office, the traditional manual reconciliation method overall moved in a new direction at TPWD with the advancement of a reporting style the agency calls "Smart" reporting. "Smart" reporting combines multiple report outputs into one report and automates several manual processes that end users formerly performed as a routine part of their jobs. This style of reporting lead to significant time efficiencies. This paradigm shift in using "Smart" methods in turn lead to the advancement in automation of manual processes.

By automating each step in the traditional manual reconciliation method, staff achieved significant time efficiencies which allowed them to focus more on analyzing and addressing differences.

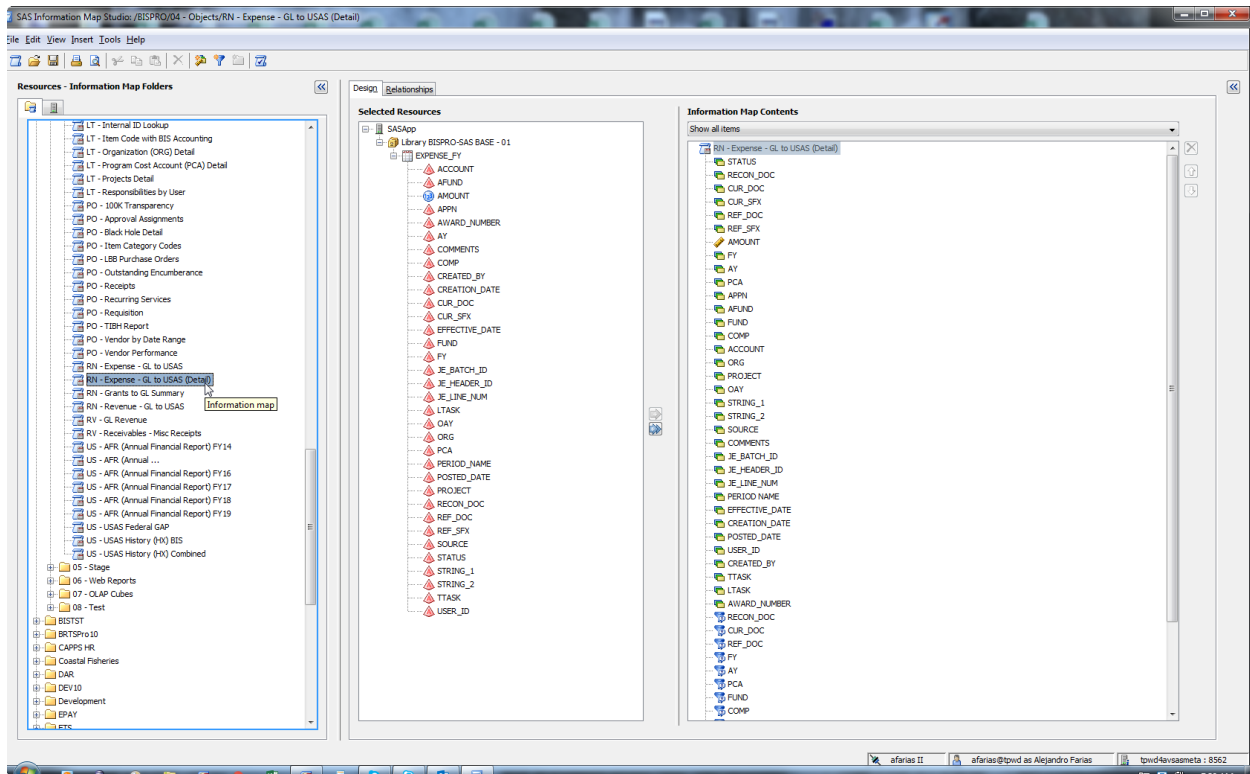
## SAS BI TOOLS UTILIZED

Enterprise Guide is used to establish a connection to both accounting systems which allows the ability to bring both sets of data into one location, to be prepared and conformed separately, before they are automatically compiled and defined using the auto-match algorithm. Display 1 illustrates the Enterprise Guide process flow that TPWD developed which creates the automated financial reconciliation.



**Display 1. TPWD's Enterprise Guide process flow that combines two different accounting systems, applies our auto-matching algorithm, and creates a detailed expenditure reconciliation table.**

Information Maps are used in conjunction with the Add-in for Microsoft Office in Excel to create pivot styled reconciliation reports. These tools offer the ability to query and filter the reconciliation table by a multitude of fields and provides a method of grouping "like" transactions between the two systems, which allows identification of any unmatched transactions; essentially auto-matching any reconciled items and identification of unreconciled items. Display 2 below illustrates the RN – Expense – GL to USAS (Detail) Information Map that is built on the EXPENSE\_FY\_PR table created in the Enterprise Guide project above.



**Display 2. TPWD's Information Map that is built on the EXPENSE\_FY\_PR table created in the Enterprise Guide project above (see Display 1).**

The final reconciliation report that end-users work with is designed using the SAS Add-in for Microsoft Office. Display 3 below illustrates an example of a completed detailed expenditure reconciliation by "STRING" and "SOURCE", created using the SAS Add-in for Microsoft Office using a pivot table styled report.

Sum of AMOUNT	SOURCE	BIS Only CTX-Cash Revenue UB	BIS Only CTX-Cash Transfer In/Out	BIS Only CTX-Cash Transfer UB	Pagables-Purchase Invoices	Projects-Labor Cost	Projects-Miscellaneous Transaction	USAS	Grand Total
2019-19285-10039-0642-7303					-6,287.47				6,287.47
2019-19285-10039-0642-7304					440.65				440.65
2019-19285-10039-0642-7334					-4,907.50				4,907.50
2019-19285-10039-0642-7395					-241.63				241.63
2019-19285-10039-0642-7504					-148.57				148.57
2019-19285-10039-0642-7806					-4.46				4.46
2019-19285-10039-0642-7861					-24.44				24.44
2019-22282-25013-0642-7002						-16,246.61			16,246.61
2019-22282-25013-0642-7022						-198.96			198.96
2019-22282-25013-0642-7033						-220.97			220.97
2019-22282-25013-0642-7040						-91.26			91.26
2019-22282-25013-0642-7042						-139.21			139.21
2019-22282-25013-0642-7095					-8.83				8.83
2019-22282-25013-0642-7106					-84.96				84.96
2019-22282-25013-0642-7107					-89.25				70.31
2019-22282-25013-0642-7210					-137.13				23.10
2019-22282-25013-0642-7256					-1,187.53				1,187.53
2019-22282-25013-0642-7266					-1154				1154
2019-22282-25013-0642-7304					-763.90				763.90
2019-22282-25013-0642-7338					-226,842.79				89,952.09
2019-22282-25013-0642-7342					-12,953.72				44.56
2019-22335-45001-0642-7266					-8,528.00				8,528.00
2019-22335-45001-0642-7806					-0.62				0.62
2019-24004-10043-0642-7345					-38,500.00				38,500.00
2019-24016-25013-0642-7345					-303,005.96				303,005.96
2019-29003-13802-0642-7266					-93.85				93.85
2019-29003-13802-0642-7276					-53.94				53.94
2019-29003-13802-0642-7291					-0.63				0.63
2019-29003-13802-0642-7299					-166.40				166.40
2019-29003-13802-0642-7300					-462.85				462.85
2019-29003-13802-0642-7330					-32.70				32.70
2019-29003-13802-0642-7334					-185.62				185.62
2019-29003-13802-0642-7502					-1,202.46				1,202.46
2019-29003-13802-0642-7503					-18.08				18.08
2019-29003-13802-0642-7504					-311.74				311.74
2019-29003-13802-0642-7516					-328.92				224.13
2019-29003-13802-0642-7961					-99.22				38.87
2019-5016-80327-0642-7032						-2,426.38			2,426.38
2019-5016-81143-0642-7042						-2,038.68			2,038.68
2019-5016-83327-0642-7041						-2,568.17			2,568.17
<b>Grand Total</b>		<b>-297,969.97</b>	<b>-129,389.59</b>	<b>-2,234,013.10</b>	<b>-1,556,890.14</b>	<b>-50,192.85</b>		<b>-149,442.40</b>	<b>4,094,572.83</b>
									<b>-282,845.22</b>

**Display 3. TPWD's example of a pivot table styled detailed expenditure reconciliation report.**

## DEVELOP A RECONCILIATION TABLE

As each step in the traditional manual reconciliation method was reviewed for automation, the documentation for the new reconciliation methodology was created. This documentation shaped the construct of the reconciliation table design, how it would be developed, and how business users were to use the table to identify which transactions matched, which were missing or incorrectly posted between systems. This section details the steps to develop a reconciliation table that evolved during our implementation.

### REVIEW SOURCE SYSTEMS INDEPENDENTLY

The first step in development of a reconciliation table is to determine if you have the data necessary to create the table. An independent review of each source system helps to understand the logical flow of data within each system and allows the inventory of data that is readily available. Reviewing data from these systems independently will also help formulate the automated data collection and consolidation method to centralize.

TWPD reviewed each systems' unstructured data independently, with SAS Enterprise Guide, to understand the logical flow of data with each system. As an example, TWPD's internal accounting system is comprised of several sub-ledgers that summarize data into a single general ledger. Each sub-ledger can store data detail differently, therefore it was necessary to understand each sub-ledger structure to allow automated data collection of data detail from those sub-ledgers.

### IDENTIFY, DATA PROFILE, AND PREPARE PARALLEL DATA

The second step is to identify parallel data within each system. Parallel data are "like" elements from each system that will be used to derive which transactions match, which are missing or incorrectly posted between systems. Additionally, this assessment will give you a sense for how much preparation will be required of your data prior to appending.

Data profiling identified parallel data from each system for reconciliation. Data profiling examines characteristics, information, and summaries of data to glean insights that will aid in cleaning, standardizing and aligning data between systems for reconciliation purposes. Being intimately familiar with the quality, quantity, structure and content of each data source is vital to automation of data collection and consolidation.

Data profiling includes but is not limited to: file and data formats, category or time dimensions, data pattern irregularities such as inconsistent use of abbreviations, inconsistent use of data fields, lack of cross-validation rules, data migration from legacy systems, data decay, data inequalities such as typos, character transpositions, etc. Data profiling is time consuming, however producing automated data collection and consolidation cannot be done without a proper data inventory from each system.

TPWD identified parallel data that included accounting string segments, journals numbers, time dimensions, transaction amounts, descriptive flex fields, etc. Table 1 below includes a full list of parallel data TPWD identified for reconciliation.

Element Number	Name	Type	Format	Length	Purpose
1	STATUS	Character	\$	1	Defines if the transaction is posted or unposted.
2	RECON_DOC	Character		150	Derived from the auto-matching algorithm.
3	CUR_DOC	Character	\$	150	Current document.
4	CUR_SFX	Character	\$	9	Current document suffix.

5	REF_DOC	Character	\$	150	Reference document.
6	REF_SFX	Character	\$	9	Reference document suffix.
7	AMOUNT	Numeric	COMMA	8	Transaction Amount. Sign flipped base on the system of record.
8	FY	Character	\$	4	Fiscal year.
9	AY	Character	\$	25	Appropriation year.
10	PCA	Character	\$	25	Program cost account.
11	APPN	Character	\$	15	Appropriation.
12	AFUND	Character		6	Appropriated parent fund.
13	FUND	Character	\$	25	Appropriated child fund.
14	COMP	Character	\$	20	Comptroller object. Defines transaction type (revenue, expense, transfer, etc.).
15	ACCOUNT	Character	\$	25	TPWD object. Defines a lower level transaction type (revenue, expense, transfer, etc.).
16	ORG	Character	\$	25	Organization. Defines the business unit.
17	PROJECT	Character	\$	25	Project.
18	OAY	Character	\$	25	Original appropriation year.
19	STRING_1	Character	\$	54	A concatenation of APPN-FUND-COMP
20	STRING_2	Character	\$	106	A concatenation of AY-PCA-APPN-FUND-COMP.
21	SOURCE	Character	\$	51	Defines the system of record for the transaction.
22	COMMENTS	Character	\$	510	Provides descriptive information about the transaction. A concatenation of different data descriptive elements by sub-ledger category and source from TPWD internal accounting system and the States' accounting system USAS.
23	JE_BATCH_ID	Character	\$	40	General ledger batch identification number.
24	JE_HEADER_ID	Character	\$	40	General ledger header identification number.
25	JE_LINE_NUM	Character	\$	40	General ledge line identification number.
26	PERIOD_NAME	Character	\$	15	Month and year.
27	EFFECTIVE_DATE	Character	\$	8	Effective date of transaction.
28	CREATION_DATE	Character	\$	8	Created date of transaction.
29	POSTED_DATE	Character	\$	8	Posted date of transaction.
30	USER_ID	Character	\$	40	User identification number responsible for posting entry.
31	CREATED_BY	Character	\$	100	User name responsible for posting entry.
32	TTASK	Character	\$	25	Top task. An expenditure tracking element group.
33	LTASK	Character	\$	25	Lower task. A more finite expenditure tracking group.
34	AWARD_NUMBER	Character	\$	25	Award number is used for tracking federal or non-federal project groups.

**Table 1. TPWD's full list of parallel data identified for reconciliation.**

## **CREATE NEW FIELDS**

With the identification of parallel data elements, new data fields, that were not within either system were created to allow for a summarized reconciliation in such a way that helps derive which transactions match, which are missing or incorrectly posted between systems easily. TPWD coined these new data fields and named them "STRING" and "SOURCE". The concept and development of these fields were fashioned to work in conjunction with how the final pivot table report is created, viewed, and modified for reconciliation in the SAS Add-in for Microsoft office tool.

"STRING" is a concatenation of different core accounting data segments that exist separately within each system. "SOURCE" is a descriptive text field that differentiates between TPWD's internal accounting system (by sub-ledger source and category) and the state's accounting system (USAS). By using "Smart" reporting concepts, the next logical progression was to develop "Smart" descriptive data fields to enhance automated reconciliation. "Smart" data fields are a concatenation of differing descriptive data elements (by sub-ledger source and category) from TPWD's internal accounting system. As an example, the COMMENTS data field is a "Smart" field.

## IDENTIFY THE SYSTEM OF RECORD

As part of the preparation of data, a decision must be made on which system is the system of record, or the primary system to be reconciled against. Identifying the primary system is necessary in order to change the signs of transaction amounts (by multiplying by negative one through calculation) that will help identify which transactions match, which are missing or incorrectly posted between systems easily when appended and summarized for all data. Again, this concept and development is fashioned to work in conjunction with how the final pivot table report is created, viewed, and modified for reconciliation in the SAS Add-in for Microsoft office tool.

## APPEND DATA

The third step to creating a reconciliation table is to append or combine parallel and newly created data from each system to form one table. The appended or combined data table will be referenced in creating the auto-match algorithm.

## CREATE THE AUTO-MATCHING ALGORITHM

The final step prior to materializing the reconciliation table is creating the auto-matching algorithm. This specific step can be the most time consuming and greatly depends on the level of complexity that exists in the systems you are trying to reconcile.

The concept of creating the auto-matching centers around the use of a CASE statement. A CASE statement reads logical statements (IF-THEN-ELSE) and returns a value when the first logical statement is met, otherwise it will return the value in the ELSE clause. Therefore, the order you place your logical statements matters when creating the CASE statement.

Below is a simple CASE statement written to be used within PROC SQL.

`(CASE WHEN Table.Column_A = 1 THEN 'Batman' ELSE 'Robin' END) as Super_Hero`

Clarifying this example, a new data field (i.e. column) "Super\_Hero" is created by applying logic on data that exists in Column\_A. "Batman" is assigned to the "Super\_Hero" column any time the number 1 exists in Column\_A and any other number that exists in Column\_A will be assigned "Robin" instead.

This simple example explains how the auto-matching algorithm was developed. Initially, we identified journal numbers (CUR\_DOC and REF\_DOC) from both systems (by source) to create a new field called RECON\_DOC. The RECON\_DOC is generated by use of a very complex CASE statement.

Below is the existing CASE statement (i.e. auto-matching algorithm) created by TPWD that creates RECON\_DOC for the detailed expenditure reconciliation table (EXPENSE\_FY\_PR):

```
PROC SQL;
CREATE TABLE LIBRARY.EXPENSE_FY_PR AS
SELECT
/* RECON_DOC */
(CASE
WHEN t1.SOURCE = 'Projects-Miscellaneous Transaction' THEN t1.'REF_DOC'
```

```

WHEN t1.SOURCE = 'BIS Only-CTX-Cash Transfer UB' & SUBSTR(t1.'CUR_DOC'n,1,2) = 'JF' &
SUBSTR(t1.'REF_DOC'n,1,2) = 'JF' THEN t1.'REF_DOC'n /* Added 07-14-14 per KP*/
WHEN t1.SOURCE = 'Projects-Usage Cost' THEN t1.'REF_DOC'n
WHEN t1.SOURCE = 'BIS Only-CTX-Cash Transfer In/Out' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'J' &
SUBSTR(t1.'REF_DOC'n,1,1) = 'J' THEN t1.'REF_DOC'n /* Added 09-03-14 per KP*/
WHEN t1.SOURCE = 'BIS Only-CTX-Cash Transfer In/Out' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'G' &
SUBSTR(t1.'REF_DOC'n,1,1) = 'T' THEN t1.'REF_DOC'n /* Added 04-09-15 per KP*/
WHEN t1.SOURCE = 'Payables-Purchase Invoices' & SUBSTR(t1.'CUR_DOC'n,1,2) = 'K0' &
SUBSTR(t1.'REF_DOC'n,1,1) = 'T' THEN t1.'REF_DOC'n /* Added 01-08-15 per KP*/
WHEN t1.SOURCE = 'Payables-Purchase Invoices' & SUBSTR(t1.'CUR_DOC'n,1,2) = 'K1' &
SUBSTR(t1.'REF_DOC'n,1,1) = 'T' THEN t1.'REF_DOC'n /* Added 01-08-15 per KP*/
WHEN t1.SOURCE = 'Payables-Purchase Invoices' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'G' &
SUBSTR(t1.'REF_DOC'n,1,1) = 'T' THEN t1.'REF_DOC'n /* Added 09-04-14 per KP*/
WHEN t1.SOURCE = 'Payables-Purchase Invoices' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'K' &
SUBSTR(t1.'REF_DOC'n,1,1) = 'I' & t1.'CUR_SFX'n = '001' THEN t1.'REF_DOC'n /*Added 09-08-14 per
KP*/
WHEN t1.SOURCE = 'Payables-Purchase Invoices' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'J' &
SUBSTR(t1.'REF_DOC'n,1,1) = 'J' THEN t1.'REF_DOC'n /* Added 01-08-15 per KP*/
WHEN t1.SOURCE = 'Payables-Purchase Invoices' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'J' &
SUBSTR(t1.'REF_DOC'n,1,1) = '9' THEN t1.'REF_DOC'n /* Added 05-12-16 per KP*/
WHEN t1.SOURCE = 'Payables-Purchase Invoices' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'J' &
SUBSTR(t1.'REF_DOC'n,1,1) = '2' THEN t1.'REF_DOC'n /* Added 05-12-16 per KP*/
WHEN t1.SOURCE = 'Payables-Purchase Invoices' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'J' &
SUBSTR(t1.'REF_DOC'n,1,1) = '1' THEN t1.'REF_DOC'n /* Added 05-12-16 per KP*/
WHEN t1.SOURCE = 'Payables-Purchase Invoices' THEN t1.'CUR_DOC'n
WHEN t1.SOURCE = 'USAS' & t1.'REF_DOC'n LIKE 'BURDEN%' THEN t1.'REF_DOC'n
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'Y' THEN t1.'REF_DOC'n
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'C' THEN t1.'REF_DOC'n
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,2) = 'JF' & t1.'REF_DOC'n <> " THEN
t1.'REF_DOC'n /*Revised 02-24-16 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'J' & SUBSTR(t1.'REF_DOC'n,1,1) = 'J'
THEN t1.'REF_DOC'n /* Added 12-30-14 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'J' & SUBSTR(t1.'REF_DOC'n,1,1) = '9'
THEN t1.'REF_DOC'n /* Added 02-05-15 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'J' & SUBSTR(t1.'REF_DOC'n,1,1) = '2'
THEN t1.'REF_DOC'n /* Added 02-05-15 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'J' & SUBSTR(t1.'REF_DOC'n,1,1) = '1'
THEN t1.'REF_DOC'n /* Added 02-05-15 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,4) = 'G802' & SUBSTR(t1.'REF_DOC'n,1,1) = 'K'
THEN t1.'REF_DOC'n /* Added 02-05-15 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'G' & t1.'REF_DOC'n = " THEN
t1.'CUR_DOC'n /* Added 03-12-15 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'G' & t1.'REF_DOC'n NOT = " THEN
t1.'REF_DOC'n /* Added 03-12-15 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,2) = 'KX' & SUBSTR(t1.'REF_DOC'n,1,1) = 'I'
THEN t1.'REF_DOC'n /* Added 04-09-15 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,2) = 'KX' & SUBSTR(t1.'REF_DOC'n,1,1) = 'K'
THEN t1.'REF_DOC'n /* Added 08-26-14 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,3) = 'KGL' & SUBSTR(t1.'REF_DOC'n,1,1) = '8'
THEN t1.'REF_DOC'n /* Added 08-30-14 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,3) = 'KAP' & SUBSTR(t1.'REF_DOC'n,1,1) = '8'
THEN t1.'REF_DOC'n /* Added 08-04-17 per AF*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,3) = 'KGL' & SUBSTR(t1.'REF_DOC'n,1,3) =
'KGL' THEN t1.'REF_DOC'n /* Added 01-08-15 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,3) = 'KAP' & SUBSTR(t1.'REF_DOC'n,1,3) =
'KAP' THEN t1.'REF_DOC'n /* Added 08-04-17 per AF*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,3) = 'KGL' & SUBSTR(t1.'REF_DOC'n,1,3) =
'W00' THEN t1.'REF_DOC'n /* Added 05-12-16 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,3) = 'KAP' & SUBSTR(t1.'REF_DOC'n,1,3) =
'W00' THEN t1.'REF_DOC'n /* Added 08-15-17 per AF*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'K' & SUBSTR(t1.'REF_DOC'n,1,1) = 'T'
THEN t1.'REF_DOC'n /* Added 09-08-14 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'K' & SUBSTR(t1.'REF_DOC'n,1,1) = 'I' &
t1.'CUR_SFX'n = '001' THEN t1.'REF_DOC'n /*Added 09-08-14 per KP*/
WHEN t1.SOURCE = 'USAS' & SUBSTR(t1.'CUR_DOC'n,1,1) = 'K' & SUBSTR(t1.'REF_DOC'n,1,1) = 'I' &
t1.'CUR_SFX'n <> '001' THEN t1.'CUR_DOC'n /*Added 09-08-14 per KP*/

```



```
ELSE t1.'CUR_DOC'n
END)
AS 'RECON_DOC'n,
ETC.,
QUIT;
```

As our automated reconciliation process matured, sometimes matching issues would occur on logic that had already been properly tested. We were able to identify that an upstream business process had changed to include a new journal number definition that had not been previously coded in our auto-matching algorithm. We concluded that any business processes that changed journal numbers or added sources impacted our matching logic and would need to be communicated to the SAS architects to ensure changes to the matching logic would be created or updated.

Through time, trial and error the CASE statement was refined to improve its auto-matching capability. Additionally, we documented when each logical statement was added to the CASE statement; allowing us to keep track of matching and unmatching metrics before and after the specific statement was added.

## **CREATE A RECONCILIATION TABLE**

Materializing the reconciliation table completes the table development process, however prior to creation, the following considerations must be evaluated and addressed:

- Frequency and method of updating the reconciliation table
- Storage and access of the reconciliation table
- Indexing specific data fields

Be mindful that early in the creation and use of your reconciliation table, the considerations above may not impact table generation or your end users, however because of time and data growth, these considerations can eventually impact end-users. Data growth can impact data storage limits and can also drain network resources, but more importantly, it can impact the end-user's ability to query information in a timely manner.

At TPWD, we worked with reconcilers to determine what fields are most used to query the reconciliation table and created indexes on those commonly used fields to improve and maintain query performance. Overall, the process to materialize the reconciliation table each day is typically 4 hours and it is written to the BI financial reporting data repository. The process runs nightly to assure that any new transactions or changes are captured. Currently, the detailed expenditure reconciliation table is approximately 31 million rows of data that span nine fiscal years.

## **REPORTING**

Working with reconcilers to understand the most effective way to structure the final report based on how it is manually done is the most critical lesson learned with development of any phase of architecting an automated reconciliation.

Having a good understanding of the manual process of reconciliation, how reconcilers identify which transactions match, which are missing or incorrectly posted between systems, provides the foundation of how to most efficiently design the look and use of the final reconciliation report.

In our experience, the final reconciliation report drove the most effective and efficient design to create an automated reconciliation table. Do not discount the reporting aspect and always "begin with the end in mind."

## CONCLUSION

We hope some of the lessons we learned prove useful to other SAS users who are involved in implementing an automated reconciliation method. We invite others to correspond with us to share their experiences, ideas for best practices, or questions as they may arise.

As a final note, it is very important to receive constant feedback from reconcilers to determine if the reconciliation report is accomplishing its goals. As reconciliation requirements change, so will your process. Remember, automation of reconciliation should serve to simplify the process of identifying which transactions match, which are missing or incorrectly posted between systems for the end-user, not make it more complicated.

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