PROJECT DEFINITION REPORT

EVALUATION OF P SOURCES, FORMS, FLUX, AND TRANSFORMATION PROCESSES IN THE STAs

PS ID 100860

AUGUST 9, 2013

REVISION #1

Table of Contents

Approvals

The signatures in this section of the project definition report should be revised to represent the various areas providing significant resources to the project.

Temperince Morgan — 8/26/13

Temperince Morgan, Division Director, Office of Everglades Policy and Coordination — **Date**

8/16-2013

Terrie Bates, Division Director, Water Resources — **Date**

Linda Lindstrom — 8/16/2013

Linda Lindstrom, Bureau Chief, Applied Sciences — **Date**

Marcia Kivett — 9.3.2013

Marcia Kivett, Section Administrator, Budget Section — **Date**

Joel Arrieta — 9-3-13

Joel Arrieta, Field Operations (South) — **Date**

Jennifer Leeds — 9/4/2013

Jennifer Leeds, Restoration Strategies Program Manager, OPC — **Date**

Document prepared by: Kim M. O'Dell, Extension: 2650

Figure 1. Location of Everglades Stormwater Treatment Areas.

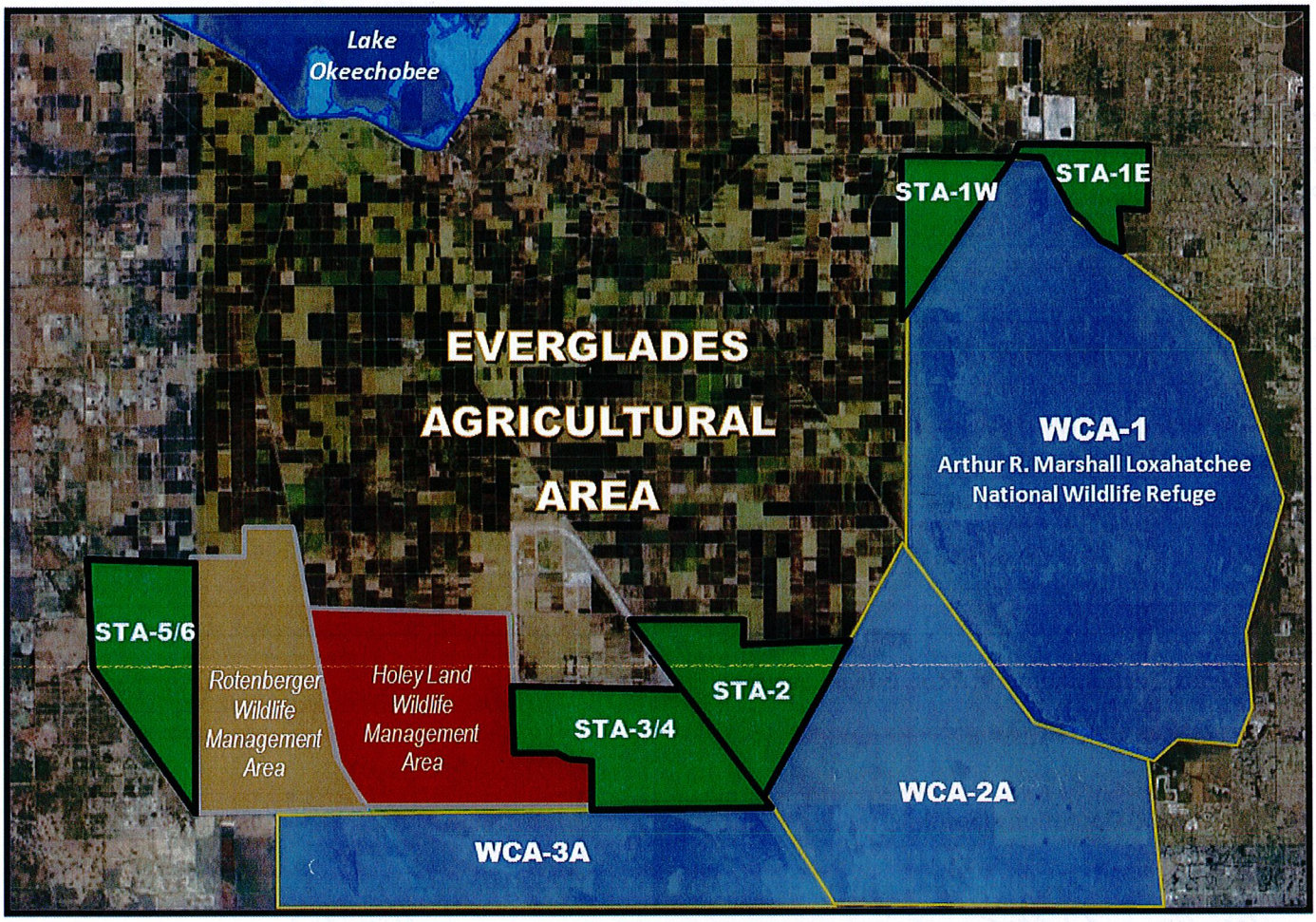


Figure 2. Proposed Approach: Transect Studies (FY15-17)

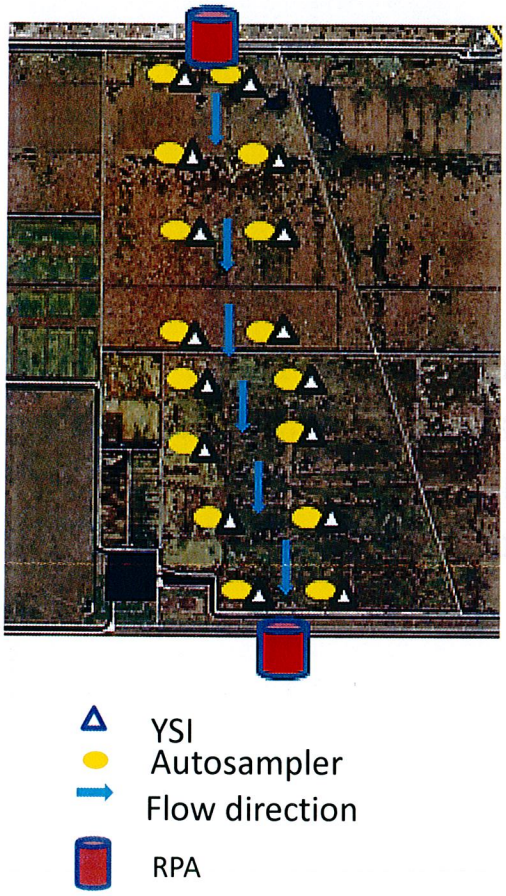
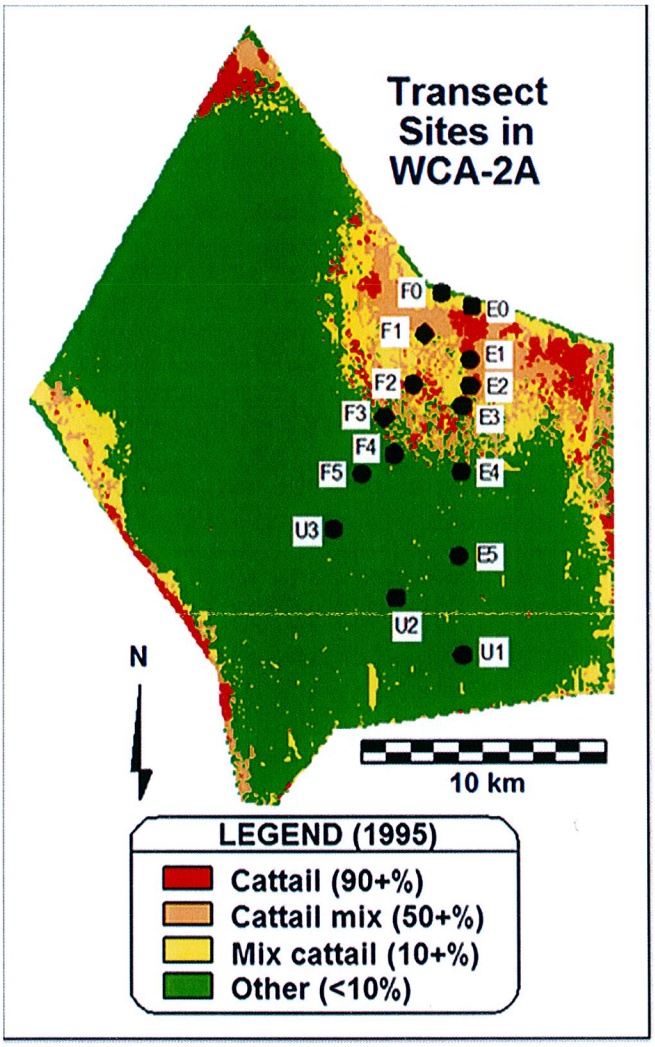


Figure 3. Example of select transect study sites in Water Conservation Area 2A.



Examples of select transect sites in WCA-2A:

- Highly enriched (F1)
- Moderately enriched (F2)
- Transitional (F4)
- Background (U3 and E5)

Project Description

High P concentrations and loading influence Stormwater Treatment Areas (STA) (Fig 1) performance, particularly at the front end of the treatment flow-ways. Programs such as BMPs and sub-regional controls that reduce inflow loads are considered in the mix of management options, and will continue to be researched and refined in the District's BMP program. However, many years of STA performance data demonstrates definitively that internal processes are critical to STA outflow TP levels. Previous analyses show that at the lower end of the treatment train, where the concentration and load have already been reduced significantly, inflow P concentration and loading do not have any significant correlation with outflow P concentration, suggesting that other factors (e.g. internal flux, etc.) might be the key influencing factors. Biogeochemical cycling of P within the STAs is controlled by various mechanisms and influenced by several physical, chemical, and biological factors. While numerous publications address these mechanisms and factors in both natural and

constructed wetlands, there is limited information identifying the key drivers and the magnitude of their influence in low phosphorus treatment wetland systems. A better understanding of the mechanisms and key factors is essential in formulating management strategies to further reduce and sustain low outflow TP concentrations in the STAs.

Prior to initiating any field studies, existing data will be compiled (from different sources), reviewed and analyzed. The final study plan, including sampling design will be based on previous findings and information gaps to help address the specific study questions.

Project Scope

This study has multiple objectives: (1) characterize the different P forms and cycling along the STA inflow to outflow gradient, (2) understand the composition of the residual P at the outflow, (3) determine the factors affecting P cycling along the gradient, (4) understand the differences in P forms, factors, and processes among different flow-ways (Fig 2) (best-performing versus poor-performing), and (5) compare the findings with WCA) (Water Conservation Areas) natural areas (Fig 3. Information and findings from this study will serve as basis for recommendations to improve STA performance.

Key Question

How can internal loading of phosphorus to the water column be reduced or controlled, especially in the lower reaches of the treatment trains?

Sub-questions

What are the sources (internal/external, plants, microbial, fauna), forms and transformation mechanisms controlling the residual P pools within the different STAs, and are they the same as observed in the natural system?

What are the key physico-chemical factors influencing P cycling at very low concentrations?

Background

To address water quality concerns associated with existing flows to the Everglades Protection Area (EPA), the South Florida Water Management District (SFWMD or District), Florida Department of Environmental Protection (FDEP), and United States Environmental Protection Agency (USEPA) engaged in technical discussions starting in 2010. The primary objectives were to establish a Water Quality Based Effluent Limit (WQBEL) that would achieve compliance with the State of Florida's numeric phosphorus criterion in the EPA and to identify a suite of additional water quality projects to work in conjunction with the existing Everglades Stormwater Treatment Areas (STAs) to meet the WQBEL.

A science plan will be developed and implemented to investigate critical factors that influence phosphorus treatment performance. The science plan will be developed in coordination with key state and federal agencies and experts and will be designed to increase the understanding of factors that affect treatment performance; in particular factors that affect performance at low phosphorus concentrations (<20 ppb TP). These investigations could include, but are not limited to: effects of microbial activity, phosphorus flux, inflow volumes and timing, inflow phosphorus loading rate and concentrations on phosphorus outflow, phosphorus removal by specific vegetation speciation, and the stability of accreted phosphorus. Results from these studies will be used to inform design and operations of treatment projects which will ultimately improve capabilities to manage for achievement of the WQBEL. Results from these studies will be summarized and reported as part of the annual report (South Florida Environmental Report).

Permitting (N/A)

Right of Way (N/A)

Real Estate (N/A)

Public Use

Hunting is allowed in STA ¾, cells 1A, 2A, 3A, 3B.

Stakeholder Considerations (N/A)

Public Outreach (N/A)

Operations

Normal operational changes are expected during the study for testing purposes. Staff will make specific recommendations of operational modifications for testing purposes and this would normally be conveyed to the operations staff via email.

Operations and Maintenance

Any modification in or issues with STA operation will be communicated to the control room engineer. Pump and structure maintenance and troubleshooting is done by the Clewiston field station. The site installation of new equipment will be coordinated with the Field Station and STA site coordinator. Vegetation control is done by Vegetation Management Section.

SCADA, Instrumentation, Telemetry

Any additional instrumentation or telemetry will be determined in future fiscal years.

Security

No extra security will be needed for this study

Information Technology (N/A)

Environmental

There will no additional impacts to any existing wetlands or sensitive areas. The avian protection plan governs this area and will affect the project if birds nest. The study will be shut down when birds are found nesting.

Monitoring

TBD

Commissioning (N/A)

Lessons Learned

Conceptual Alternative Options (N/A)

Cost Estimates

$5,745,375

Recommendations

Project Milestones

FY	Activities
FY14	Draft study plan and design
	Procurement (contractual consultants, equipment, supplies
	Literature review & Historical Data Analysis
	Workshop
	Conceptual Plan Refinement
	Study plan peer review
	Finalize study plan
	Set-up equipment and transect locations
Fy14-15	Ecological surveys; initial soil and vegetation studies
FY15-17	Transect data collection
	WCA data collection
	Controlled studies (mesocosms, cores, test cells)
FY17-18	Data synthesis, analysis, conceptual model update, enhance algorithms for STA dynamic simulation models, and final report

Resource Requirements

Role	FTE	Bureau/Section
Study lead; sub-study lead for transect and soil characterization – Delia Ivanoff	0.6	ASB/WQTT
Principal scientist; sub-study lead for organic P and WCA investigations – Sue Newman	0.3	ASB/ESA
Sub-study lead: Floc transport	0.1	ASB/ESA
Sub-study lead: Fauna	0.1	ASB/ESA
Conceptual model development & modeling	0.2	ASB/ESA & WSB/HESM
Sub-study lead: Soil sorption and P flux – Odi Villapando	0.2	ASB/WQTT
Sub-study lead: Hydraulic and hydrologic measurements	0.1	IMB/HDM
Data mining; data analysis lead	0.1	WQB/CAR
Sub-study lead: Microbial	0.5	ASB/WQTT
Business lead – Kim O'Dell	0.1	ASB/WQTT
Additional: Field staff	0.5	ASB/WQTT & ASB/ESA
TOTAL	**2.8**	

Contractual support – TBD

Contractual laboratory - TBD

Equipment –

Purchase of Lab equipment (HPLC detector) - $9,450

Facilities - TBD

Project Deliverable and Schedule

Due to the complexity of the question and investigations needed for this effort, the following sub-studies are suggested:

Substudy	Location	Brief Scope	Duration
1	STA transects	Sampling at limited locations along transects to quantify and characterize the sources and different forms of P, enzyme activities, and key factors that influence P storage and cycling (physico-chemical, hydrologic, microbial, biota). Include best performing and poor performing cells and flow-ways.	2 years
2	WCAs	Focused sampling at discrete sites that capture different habitat and trophic conditions to identify P sources, quantify and characterize the different forms of P, associated enzyme activities, and key factors influencing P storage and mobilization for comparison with the findings in the STAs.	2 years
3	Core (or microcosm) Studies	Multiple soil cores will be collected along the study transects and incubated with various treatments that could isolate further the key influencing factors. For example, add calcium, magnesium, sulfate and iron, vary water depths/UV exposure, with and without biota.	2 years*
4	Test cell or field mesocosms	Manipulative studies (test cell scale) to isolate and test the influence of key variables, e.g. to compare with and without vegetation differences, test response for when SAV dies off and decomposes, test soil accretion characteristics, etc.	4 years*

*Sub –studies 3 & 4 will be best conducted after the historical data analysis and preliminary surveys, so that the most appropriate test variables can be determined.

In addition, a comparison of properties and mechanisms within a soil-less treatment area (STA-3/4 PSTA) project site will be included in the historical data analysis and in the evaluation phase of this study.

Project Funding Sources

Funding source for this project will be from the Restoration Strategies Science Plan budget within the B199 functional area and multiple fund types.

Appendix A

Cost Estimate

Total by FY

FY	Contracts	Equipment	Supplies	Subtotal	With 30% contingency
13	$ -	$ 9,450	$	$ 9,450	**$ 9,450***
14	$ 1,050,000	$ 368,250	$ 22,000	$ 1,440,250	**$ 1,872,325**
15	$ 1,040,000	$ 30,000	$ 27,000	$ 1,097,000	**$ 1,426,100**
16	$ 795,000	$ -	$ 25,000	$ 820,000	**$ 1,066,000**
17	$ 700,000	$ -	$ 15,000	$ 715,000	**$ 929,500**
18	$ 340,000	$ -	$	$ 340,000	**$ 442,000**
TOTAL	**$ 3,925,000**	**$ 407,700**	**$ 89,000**	**$ 4,421,700**	**$ 5,745,375**

*- 30%Contingency not applied to this item

With 30% contingency

FY	Contracts	Equipment	Supplies	Subtotal
13	$	$ 9,580.57*	$	$ 9,580.57*
14	$ 1,365,000	$ 478,725	$ 28,600	$ 1,872,325
15	$ 1,352,000	$ 39,000	$ 35,100	$ 1,426,100
16	$ 1,033,500	$ -	$ 32,500	$ 1,066,000
17	$ 910,000	$ -	$ 19,500	$ 929,500
18	$ 442,000	$ -	$	$ 442,000
TOTAL	**$ 5,102,500**	**$ 527,175**	**$ 115,700**	**$ 5,745,505.57**

* Contingency (freight) included (item already purchased)

** FY14 Equipment: RPA, auto samplers, GPS units, field meters, floc measurement equipment, pressure transducers, redox meter, & benthic plume equipment.

*** Review of conceptual models, review of study plan/design, and workshops

Total by Category

Category	Cost	With 30% contingency
Contractual	$ 3,925,000	$ 5,102,500
Equipment	$ 407,700	$ 527,175
Supplies	$ 89,000	$ 115,700
TOTAL	**$ 4,421,700**	**$ 5,745,375**

References

Kadlec, R.H. and S.D. Wallace. 2009. Treatment Wetlands, Second Edition. Taylor and Francis Group, Boca Raton, FL.

Noe, G.B., J.W. Harvey, and J.E. Saiers. 2007. Characterization of suspended particles in Everglades wetlands.
Limnology and Oceanography 52:1166-1178.

Pant, H. K., K. R. Reddy, and F. E. Dierberg. 2002. Bioavailability of Organic Phosphorus in a submerged Aquatic
Vegetation-Dominated Treatment Wetland. J. Environ. Qual. 31:1748-1756.

Turner, B.L., S. Newman, and J.M. Newman. 2006. Organic phosphorus sequestration in subtropical treatment
wetlands. Environmental Science and Technology 40:727-733.

Photographs

Project Schematic Diagram

PROJECT CLASSIFICATION CHECKLIST

The purpose of this checklist is to document the appropriate accounting treatment/classification for projects (capital vs. expense).

(This completed checklist is required to be attached to the Project Definition and Long Text within Project Systems. A revised checklist will be required to be completed and attached, should the nature of the project or District ownership % subsequently change.)

Project Definition Number: 100860

Project Name: Evaluation of P Sources, Forms, Flux, and Transformation Processes in the STAs

Functional Area: B199

Division: 4340 Water Resources mk

Total Estimated Project Cost: $5,745,375

Total Estimated Capital Cost: $500,000

Project Manager or Supervisor: Delia Ivanoff

Signature: DB Ivanoff

Date: Aug 9, 2013

Project Description (If a replacement or refurbishment of an existing asset, please indicate below and within the Project Name. If a building replacement, please also indicate below the existing building number):

This study will address the reduction or control of internal phosphorus loading to the water column in the Southern STAs, especially in the lower reaches of the treatment trains. A better understanding of the mechanisms and key factors is essential to formulating management strategies to further reduce and sustain low outflow TP concentrations.

To be completed by Project Manager/Supervisor:

1. **Is this project part of an inter-agency agreement which results only in pass-thru funding to the other agency?**

   Yes ☐

   If yes, this project is expense – please proceed to conclusion.

   No ☒

2. **Does this project have elements of both repair and improvement?**

   Yes ☐

   If yes, please indicate the estimated amount/description of each:

   - **Repair: $_____/_____**
   - **Improvement: $_____/_____**

(Please also attach supporting documentation (ie. bid, etc.).

No [X]

3. Is this project considered an improvement (ie. Provides additional value either by

(a) Lengthening the existing capital asset's estimated useful life:

Yes [ ]

If yes, please indicate the estimated useful life: _____yrs. (please also attach supporting documentation (ie. engineering study, etc.))

No [X]

OR:

(b) Increasing the existing capital asset's ability to provide service (ie. Greater effectiveness or efficiency)?

Yes [ ]

If yes, please provide explanation:_____

_____

_____

(please also attach supporting documentation (ie. engineering study, etc.)

No [X]

4. If this project is related to a canal/levee repair or refurbishment, please indicate if this project:

a. Is to re-design the canal/levee beyond the original design capacity (resulting in increased efficiency or productive capacity of the canal/levee):

Yes [ ]

No [ ]

N/A [X]

5. If this project is related to software upgrades or enhancements, please indicate if:

a. Is it reasonably assured that the expenditures will result in additional capacity/functionality/efficiency/or increase the useful life of the existing asset (ie. Is the computer software able to perform tasks that it was previously incapable of performing or does it increase the level of service provided by the software without the ability to perform additional tasks?):

Yes [ ]

No [ ]

N/A [X]

b. If internal or external costs to develop internal use software, has the design of the chosen path of the software configuration already been determined or does evaluation of alternatives still need to occur?

Software configuration has already been determined [ ]

Evaluation of alternatives still needs to occur [ ]

N/A [X]

6. Is this is a parent project?

Yes [ ]

If yes, please indicate the children project numbers:_____

No [X] child of project 100801

7. If an asset results, will the District's ownership be 100%?

Yes [X] Direct asset purchases of Remote phosphorus analyser, auto samplers, etc. MK

No [ ]

If no, please provide explanation:_____

_____

_____

_____

N/A [ ]

8. If this project is related to construction of monitoring wells, will the wells be torn down at the end of the study?

Yes [ ]

No [ ]

N/A [X]

9. Is this project an initial feasibility study?

Yes [ ]

No [X]

10. **Please indicate <u>all</u> applicable fund numbers for this project (Note: if all applicable funds are not yet known, please indicate this fact):**

    a. **For capital project phases or direct asset purchases, if applicable: _____(Note: this (these) fund number (s) should begin with a "4" and the related commitment items for each network activity and wbs element should begin with a "58")**

    b. **For expense project phases, if applicable: _____217000_____(Note: this (these) fund number (s) should begin with a "2" and the related commitment items for each network activity and wbs element should begin with a "51" – "57")**

To be completed by Fixed Asset Accounting:

Direct Asset purchases will use fund 406000.

1. **If this project is a replacement or refurbishment of an existing asset:**

   Is the existing asset separately recorded on the books?

   Yes ☐

   No ☒

   Please indicate:

   - **Asset No.: _____**
   - **Net Book Value: $_____**
   - **Remaining Useful Life: _____yrs.**

CONCLUSION:

Based on the above information (and information contained in the PMP, Long Text, etc.), this project should be classified as:

CAPITAL ☐

EXPENSE ☐

COMMENTS: Direct Asset purchases for FY13 include an HPLC detector ($9,450). Additional equipment for purchase in future years may include: Rapid Phosphorus Analyzers, auto samplers, GPS units, field meters, floc measurement equipment, pressure transducers, redox meters and benthic plume equipment._____

COMPLETED BY: Meryl S. Pasner — **DATE:** 9/4/2013

Fixed Asset Accountant

APPROVED BY: Lindsay Anderson — **DATE:** 8/16/2013

Bureau Chief

Marcia Kivett — 9-2-13

Section Administrator – Budget Support (M. Kivett)

Richard Sauk — 4 SEPT 2013

Section Administrator – Metrics

S. Kuhlman — 9-4-13

Accounting Manager – Fixed Assets

(LAST UPDATE: 3/6/13)