



**The First 298 days with the iPads**  
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**Introduction**

The Water Resources Evaluation (WRE) section purchased several Apple iPad devices (Model3) in the Summer of 2013 in order to collect data using volunteers for the Invasive Species Management Plan effort. Since that effort concluded and additional tools were implemented we now have a data set that can describe the usage of our field collection iPads for the first 298 business days of their use.

**Usage statistics of ERM iPads for the period February 21, 2014 to April 14, 2015.**

Units were used between 26 and 72 days out of the 298 net working days in this period; 49 unit-days (ud) being the median (16%). 10 days per unit for maintenance or training across this period. The most used iPads were iPads 1 (72 ud) and 7 (70 ud) and the least used iPads were iPads 8 (26 ud) and 3 (40 ud).

**Unit-days per function**

Function	ud	% of net workdays
Lakes*	2	1%
Edu	11	3%
Code**	18	5%
Salamander	27	8%
Groundwater	37	10%
Karst	42	11%
Creeks	70	20%
Riparian	74	21%
Maintenance/Train^	76	21%

\*Lakes were slowed in adoption due to depth-profile issues

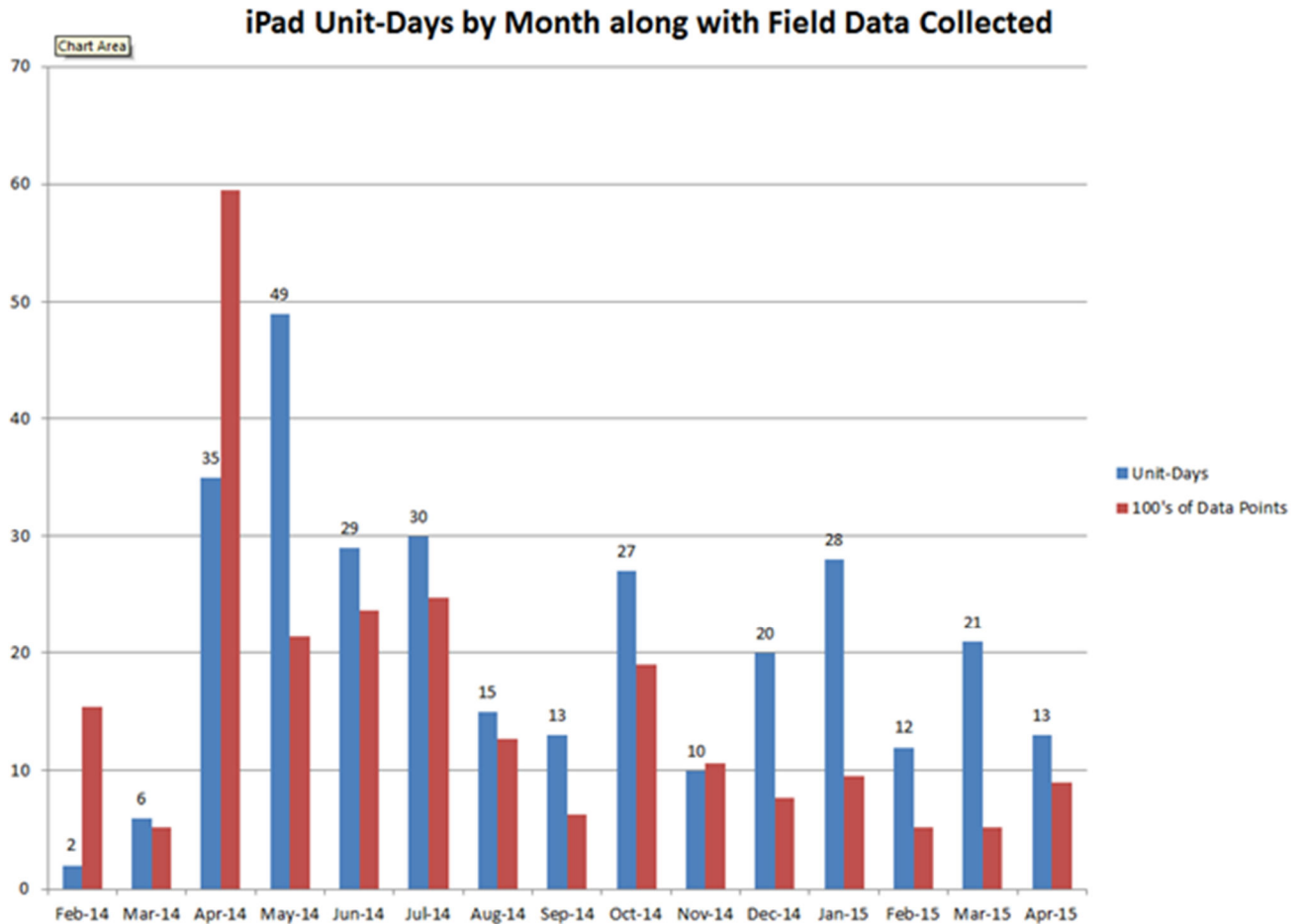
\*\*Boatdocks and Voids -- I don't see this being a long-term use of these units

^Maintenance or training was always performed at times when there was no other demand

## Types of Use

65% of the 298 days were spent collecting data in the field. The remainder would be maintenance and training and wayfinding (using ArcGIS online for aerials and karst likelihood data), photo documentation or education.

## Use Compared to Data Collected



Not all data collected with these units has been stored in the FSDB and not all outings were for collecting field data. That said, April 2014 had an Environmental Integrity Index quarterly water quality event, Riparian Functional Assessment and Salamander Occupancy Study yearly sampling events which created that particular spike in data volume.

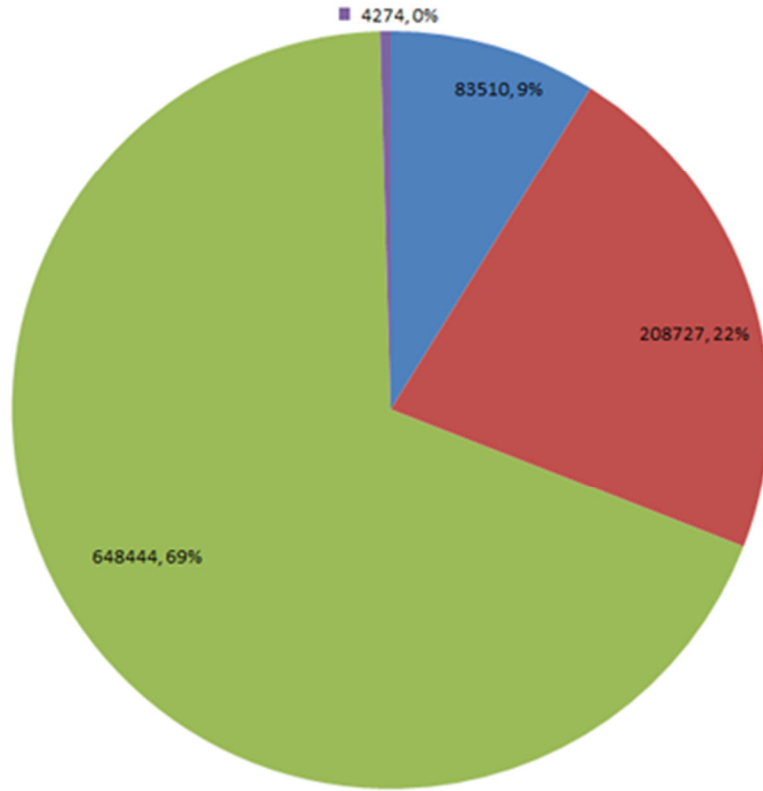
Note that the monthly average for field data collected in the two years previous to this graph was 5.8 (hundreds of data points collected) with a monthly max of 14.39.

We have managed to collect a lot more data when we need to and can be much more efficient about collecting and storing it. Throughout this study period, we converted the time savings into good progress on QC of the data we have stored in the database that we had not historically been able to fully QC.

**FY 14 4Q : Number of Records By Locking Status: 944955 Total Count**

Chart Area

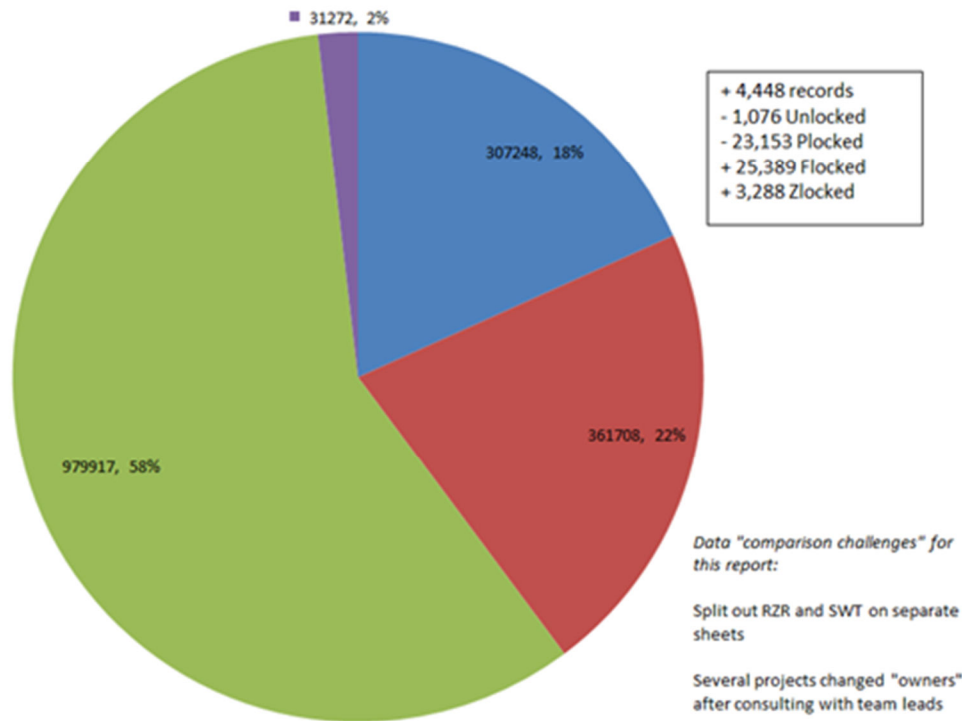
■ Un-Locked ■ P-Locked ■ F-Locked ■ Z-Locked



**EY 15 3Q : Number of Records By Locking Status: 983440 Total Count**

Chart Area

■ Un-Locked ■ P-Locked ■ F-Locked ■ Z-Locked



Note the total number of records increased by 38k and the number of records F-locked or Z-locked increased by 358k; this represents a tremendous increase in efficiency for our WRE section.

**iPad-related Operations Costs**

Cell svc: \$40 per month per unit (\$280/mo).  
 FulcrumApp.com: (\$159/mo total).

**Reservations Tool**

Individual SharePoint calendars have been created for each unit using the same template. Individual unit calendars are then viewed through a single calendar view using the Calendar Overlays feature of SharePoint 2013. This approach is not very scalable, but works well for small workgroups such as ours. Staff seems willing to accept the tool (as clunky as it is).

## All WRE iPads

August 2015

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
26	27 9:30 am - 1:30 pm TPDES Sediment Sampling	28 8:00 am Onion Creek - Dripping Springs 8:00 am Girdling Fieldwork 8:00 am TLAP Monitoring	29 8:30 am - 12:30 pm Canceled: Girdling fldwk	30	31 8:30 am - 12:30 pm Canceled: Girdling fldwk rainout date
2	3	4 9:00 am - 1:00 pm Canceled: Girdling fldwk rainout	5	6 9:00 am - 11:00 am Barton Springs Biweekly	7 8:30 am - 3:30 pm Dripping Springs Effluent Study
9	10	11	12	13	14
16	17	18 9:00 am - 11:00 am Barton Springs Biweekly	19	20 TLAP Monitoring 9:00 am iPad Maintenance 9:00 am Routine Maintenance + 3 more items	21
23	24 9:00 am - 4:00 pm LBL Bellingier	25	26 7:00 am - 11:00 pm Source Water Investigation	27 7:00 am Reclaim Water - Team 1 8:00 am Rewiwi Team 2 2:00 pm Demonstration For Sustainable + 2 more items	28 9:00 am - 1:00 pm Canceled: Girdle/Gap fieldwork
30	31	1 8:00 am Barton Springs Quarterly 9:00 am Girdling fldwk	2 9:00 am - 2:00 pm Canceled: Girdling fldwk	3 8:00 am Susan Wall Teacher Training 8:00 am Susan Wall Teacher Training 8:00 am Susan Wall Teacher Training + 5 more items	4

## Networking

There is a certain freedom/resiliency of connectivity that comes with not having to authenticate to the COA LAN and as such we have not pursued getting these units configured with Airwatch and/or Netmotion software.

## FulcrumApp

FulcrumApp.com is key for our data collection. This web service allows the export of files in several formats (we choose .csv) and as such requires a good deal of PL/SQL code writing for each new app (so creating one water quality app means that we can collect data comfortably with just a few loading scripts to be run at the end of the day). The actual forms and the web-based tools to create/manage them are superior to any product I've seen ... calculated fields, validation, one-to-many recordsets; photographs; spatial-video; bar codes, urls support, signatures, filterable record-lookups and many useful features.

Points are extracted from our database based upon the current chain of custody default lists and loaded manually into each app through the FulcrumApp.com web application. This step could be obviated if we can harness the FulcrumApp API. I do not see ArcGISOnline (AGOL) and the Collector app replacing this functionality any time soon. Their interface too limited their data schemae too inflexibly asset-based.

Interestingly, Fulcrum recently announced the option to pipe their data into AGOL.

## ArcGIS Online

Per above, AGOL is excellent for consuming data in the field but in what I've seen so far, not so great at collecting it; moving data into SDE and getting good version support between AGOL and GISWPDR will make things go more smoothly. Collecting critical environmental feature locations with AGOL would be

the test case for our transition. The actual limitations and ease-of-use of the tools will be the factor that can win adoption.

### **Gmail**

Gmail accounts and associated iCloud accounts are crucial to the sanctioned use of these units; we have established extremely strong passwords for these accounts and a master list is stored securely in a backed-up location.

### **Box**

Box.com is the current standard for transferring data from these units back to the LAN or making data available on the units (essentially serving as a local filesystem). We use free accounts associated with the gmail accounts to provide authorized access and use a single paid account to host the filesystem/manage permissions.

### **Numbers**

The iOS-native app "Numbers" is powerful and elegant and has the ability to convert in and out of Excel. We used this app to develop a Flow-Measurement template that is essential and powerful; the invasive group has used a simple spreadsheet to collect arundo observation information in the field.

### **Power Concerns**

There is some increased reliance on the units for navigation which requires the screen to be on for longer and the units to negotiate connections to towers and/or wifi hotspots as they pass available points. Running with WIFI off and screen brightness cranked down gets a unit to an easy 6 hours of use. Airplane mode with periodic manual connection stretches unit life to 9 hours. Car chargers and Anker backup units can augment high-power operations ... but are not as reliable or convenient as operating with low-power expectations.

### **Case Wear**

The cases are "Lifeproof Nuud" cases. I've not seen an equivalent water-proof case for non-Apple units (e.g. Android Tablets). Some units were worn-down a great deal more than others ... and it is most likely that this has to do with whether the unit was stored in a backpack without the "screen shield" on it. We will likely have to replace all the cases in the next two years.

### **Loss**

There have been no losses of units since the Invasive Species Monitoring undertaken in the summer of 2013. One destroyed and lost; one replaced due to damaged screen.

### **Interest/ Areas for growth**

The Education group would like to use more of these units more often. They would like to be able to connect microscopes to them so that they can look close-up at objects kids find in the field/ use them as

tools to get kids interested in science; there are physical hurdles (the clip-on microscopes they've produced to me as examples don't work with the Lifeproof cases).

The Salamander team has used these units for Occupancy data collection but there is a need to get them collecting surface counts/ photo recapture data using these units as soon as possible. Standardizing their Quality Assurance Project Plans and data collection goals under the new team lead would go a long way toward streamlining data collection for JV and BSS.

The Riparian group is the group that has taken the greatest advantage of the power of the data collection flexibility; their creativity seems boundless but there is related work involved with the app creation and post-processing script development.

Lakes/Creeks/Groundwater now have one app that covers their essential needs and I hope that they will continue to collect quality data in a reproducible manner for the long haul.

Documentation remains a challenge as the operating systems and apps are mutating at the speed of modernity. Developing something more than simple overviews such as this and creating a manager manual describing the workflow generally with appendices that cover specific tasks would be useful.

### **Software Enhancements**

There is a "manager" role in the FulcrumApp web application and we now have set up an account with this role so a user who can manage the loading of the iPad apps and downloading of the data so that it would be possible to describe a workflow for individuals who can keep the apps maintained without unwittingly causing a calamity.

Fulcrum supports "webhooks" which pushes the data collected through the iPads to whatever REST service you identify. This is the key to automating data collection AND creation of chains of custody (COCs) on the fly. Developing a REST service exposed to the internet that can hand-off valid packets to a COA service (PULL) is one solution to mapping the data from Fulcrum to City of Austin servers. Another is exposing a data layer on Fulcrum and managing pulls on a routine basis. Once the data is housed in COA servers, a web application that the iPad users in their "non-privileged" network mode could authenticate with user/password, verify the COCs they want to generate and then authorize the transmission of those COCs to the contract lab. This would have to be a fully-automated system that receives the data and creates the COC. This database could be a separate one from the final destination. I believe that the "record query" concept would allow the transmission of data packets that contain bottle sets/ etc to ensure that the data and the application remain distinct.

### **Conclusion**

Electronic data collection has greatly enhanced our efficiency and accuracy. Moving toward a corporate standard in data collection based on AGOL is forthcoming. The current methodology, however, has much to recommend it in terms of flexibility and separation of concern and it would be useful to bring some of the successes of this early effort into our departmental standards day-forward.