goodyearEDA.R

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```
setwd("~/Dropbox/Home/Projects/Goodyear")
load("goodyearMoWater.rda" )
ls()
```

```
##  [1] "Bin1"     "Bin2"     "Bin3"     "Bin4"     "Bin5"     "Bin6"
##  [7] "Bin7"     "Brine"    "goodyear" "rawField" "rawFlow"
```

```
library( lubridate)
```

```
##
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
library( viridis)
```

```
## Loading required package: viridisLite
```

```
library( scales)
```

```
##
## Attaching package: 'scales'
```

```
## The following object is masked from 'package:viridis':
##
##     viridis_pal
```

```
suppressMessages(library( fields))

# primary data set
print( dim( goodyear))
```

```
## [1] 3508   29
```

```
# variable names
print(names( goodyear))
```

```
##  [1] "ID"                    "date"                  "TDS"
##  [4] "Sulfate"               "Chloride"              "Arsenic"
##  [7] "Selenium"              "Chromium"              "Copper"
## [10] "Zinc"                  "Nitrate"               "Nitrite"
## [13] "Phosphorus"            "COD"                   "Boron"
## [16] "Color"                 "Thallium"              "DOC"
## [19] "Nitrate...Nitrite.as.N" "Sulfide"              "Conductivity.S.m"
## [22] "Conductivity.µS.cm"    "DO.mg.L"               "ORP"
```

```
## [25] "pH"                    "Temp..Celsius"          "Inflow"
## [28] "Outflow"               "H2S.mg.L"
```

```
# observations by brine and bins
table( goodyear$ID)
```

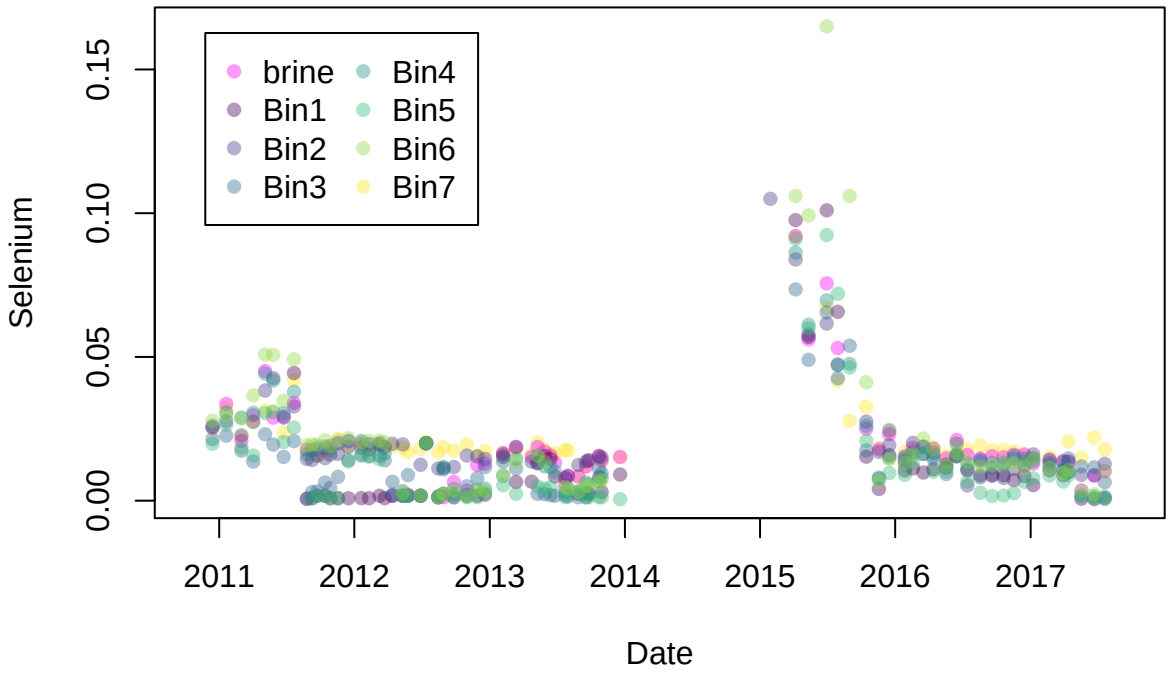
```
##
##  Bin1  Bin2  Bin3  Bin4  Bin5  Bin6  Bin7 brine
##   439   439   439   438   438   439   438   438
```

```
# summary stats
t( stats( goodyear))
```

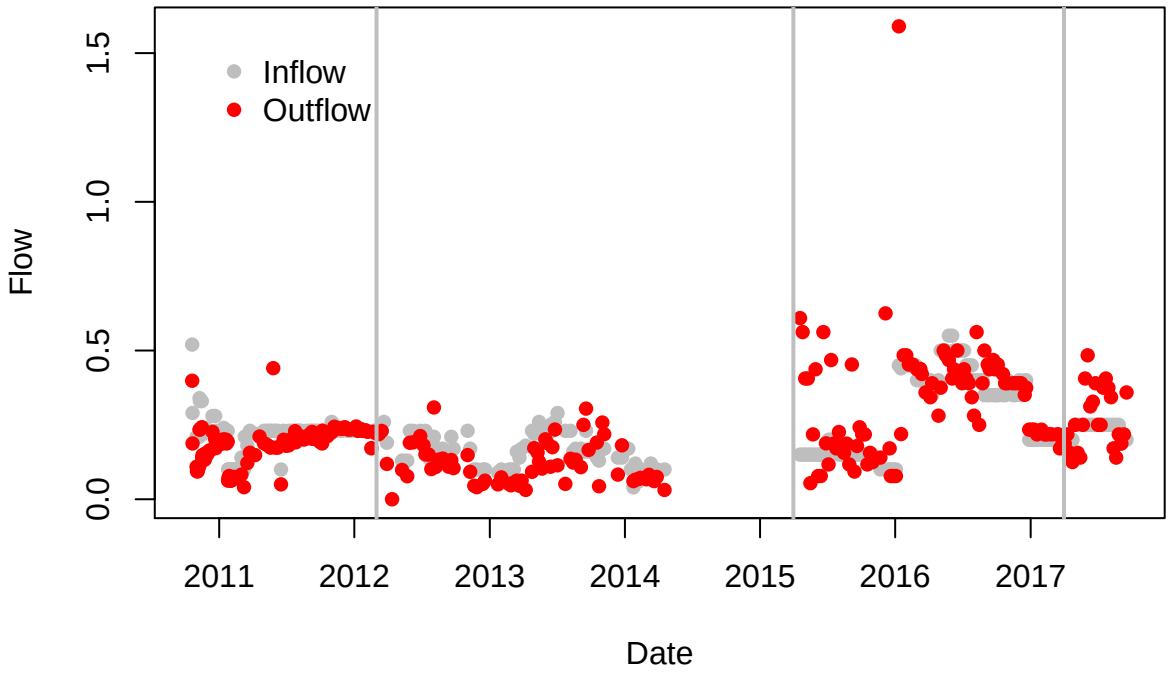
```
##                            N          mean     Std.Dev.        min          Q1
## ID                        NA            NA           NA         NA          NA
## date                      NA            NA           NA         NA          NA
## TDS                      452 8879.88938053 2.190913e+03 4840.00000 7620.000000
## Sulfate                  458 2306.99126638 5.782499e+02  752.00000 1960.000000
## Chloride                 442 3105.65610860 8.518784e+02 1900.00000 2620.000000
## Arsenic                  544    0.02176026 1.724090e-02    0.00120    0.014700
## Selenium                 539    0.01744819 1.853801e-02    0.00050    0.007025
## Chromium                 326    0.01885433 1.568020e-02    0.00224    0.005100
## Copper                   102    0.03193922 2.147596e-02    0.00950    0.013950
## Zinc                      85    0.07108882 1.157060e-01    0.00300    0.014100
## Nitrate                  516   33.02827810 2.404343e+01    0.04480    3.037500
## Nitrite                  204    0.69315049 1.475217e+00    0.00200    0.092850
## Phosphorus               368    0.41713587 1.053412e+00    0.00340    0.034950
## COD                      379  207.47493404 2.445405e+02    7.00000   40.000000
## Boron                     24    1.42291667 2.812469e-01    1.04000    1.245000
## Color                    168   34.35714286 7.057516e+01    0.00000    2.000000
## Thallium                 168    0.00000000 0.000000e+00    0.00000    0.000000
## DOC                      224    1.72078125 6.871781e+00    0.00000    0.000000
## Nitrate...Nitrite.as.N   221   40.25070226 2.267418e+01    0.02700   22.700000
## Sulfide                  181    0.08519337 4.108455e-01    0.00000    0.000000
## Conductivity.S.m        1046 1245.29533461 1.120968e+03    0.00000 1036.250000
## Conductivity.µS.cm      1005 9749.77683582 3.874046e+03    0.00000 9200.000000
## DO.mg.L                 1485    3.88096970 2.496720e+00    0.00000    2.070000
## ORP                     1904  -56.58161765 1.581782e+02 -394.00000 -168.250000
## pH                      1920    7.01061458 1.292699e+00    0.00000    7.080000
## Temp..Celsius           1921   23.99814911 8.526946e+00  -17.77778   19.900000
## Inflow                  1977    0.19302606 1.323349e-01    0.00000    0.100000
## Outflow                 1934    0.19004588 3.070942e-01    0.00000    0.078000
## H2S.mg.L                1032    0.05358527 4.349730e-01    0.00000    0.000000
##                            median           Q3       max missing values
## ID                             NA           NA        NA              NA
## date                           NA           NA        NA              NA
## TDS                    8465.0000 9.447500e+03 2.210e+04            3056
## Sulfate                2180.0000 2.520000e+03 5.500e+03            3050
## Chloride               2900.0000 3.267500e+03 9.000e+03            3066
## Arsenic                   0.0200 2.350000e-02 2.120e-01            2964
## Selenium                  0.0145 1.950000e-02 1.650e-01            2969
## Chromium                  0.0150 2.500000e-02 8.430e-02            3182
## Copper                    0.0264 4.372500e-02 1.010e-01            3406
## Zinc                      0.0351 6.000000e-02 8.380e-01            3423
## Nitrate                  36.8500 5.500000e+01 9.870e+01            2992
## Nitrite                   0.2300 6.282500e-01 1.570e+01            3304
```

```
## Phosphorus                 0.1000 2.640000e-01 1.200e+01          3140
## COD                      140.0000 2.900000e+02 2.600e+03          3129
## Boron                      1.3650 1.552500e+00 2.250e+00          3484
## Color                      8.0000 2.500000e+01 4.500e+02          3340
## Thallium                   0.0000 0.000000e+00 0.000e+00          3340
## DOC                        0.0000 2.187500e-01 7.520e+01          3284
## Nitrate...Nitrite.as.N    45.2000 5.720000e+01 9.870e+01          3287
## Sulfide                    0.0000 0.000000e+00 4.000e+00          3327
## Conductivity.S.m        1113.0000 1.250750e+03 1.270e+04          2462
## Conductivity.µS.cm     10180.0000 1.134000e+04 2.850e+04          2503
## DO.mg.L                    4.2400 5.600000e+00 4.000e+01          2023
## ORP                      -58.7000 5.600000e+01 2.940e+02          1604
## pH                         7.2800 7.430000e+00 8.100e+00          1588
## Temp..Celsius             25.7000 2.880000e+01 2.286e+02          1587
## Inflow                     0.1700 2.300000e-01 2.500e+00          1531
## Outflow                    0.1400 2.296875e-01 6.800e+00          1574
## H2S.mg.L                   0.0000 0.000000e+00 1.050e+01          2476
```

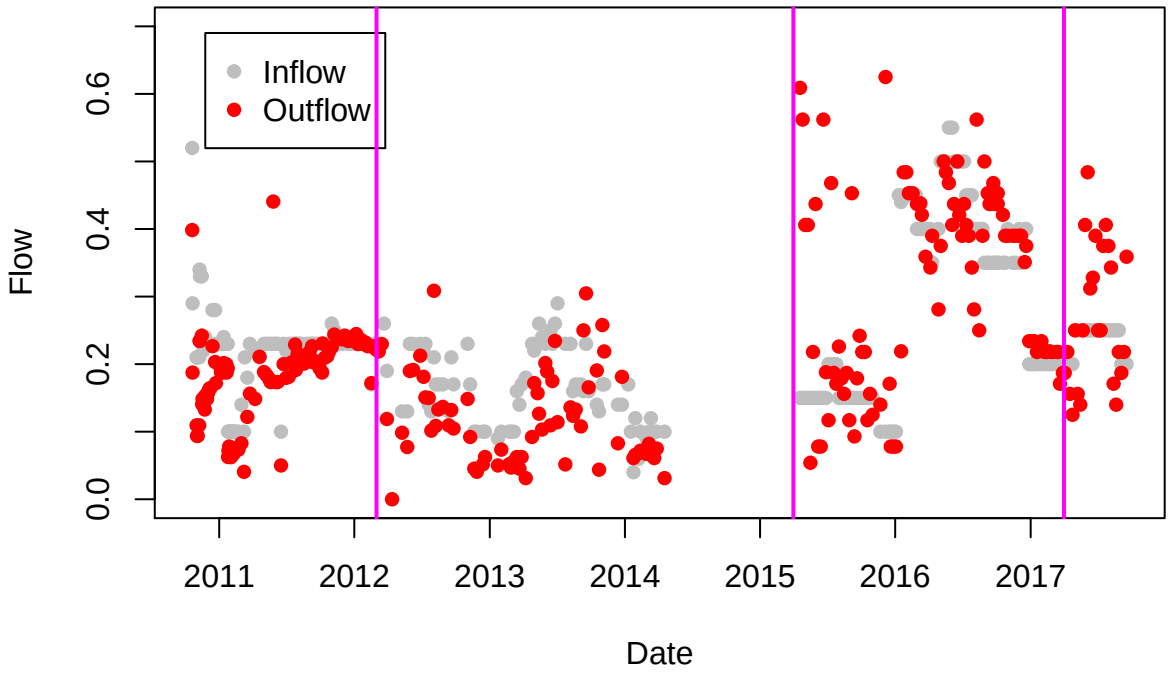
```
# Selenium across different treatments
# could also use ggplot or lattice to make this
colTab<- alpha( c(  "magenta", viridis(7)), .4)
plot(goodyear$date,
     goodyear$Selenium,
     col=colTab[goodyear$ID], pch=16,
     xlab="Date", ylab="Selenium")

IDNames<- unique(goodyear$ID)
legend("topleft",
       pch=16, col = colTab,
       legend = IDNames
      , inset=c( .05,.05) , ncol=2 )
title("Selenium by treatment")
```




```
periods<- ymd( c("2012-03-01", "2015-04-01", "2017-04-01" ) )

matplot( Bin1$date, Bin1[,c("Inflow", "Outflow") ],
         col=c("grey", "red"), type="p", pch=16,
         xlab="Date", ylab="Flow"
         )
abline( v= periods, col="grey", lwd=2)

legend("topleft",
       pch=16, col =c("grey", "red") ,
       legend =  c("Inflow", "Outflow")
       , inset=c( .05,.05), bty="n" )
title( "Bin1 flow measurments")
```




```
matplot( Bin1$date, Bin1[,c("Inflow", "Outflow") ],
         col=c("grey", "red"), type="p", pch=16,
         xlab="Date", ylab="Flow",
         ylim=c(0,.7)
)
legend("topleft",
       pch=16, col =c("grey", "red") ,
       legend =  c("Inflow", "Outflow")
       , inset=c( .05,.05) )
title( "Bin1 flow measurments w/o outlier")
abline( v= periods, col="magenta", lwd=2)
```




```
 temp<- subset( goodyear, goodyear$ID=="Bin1")
 plot( temp$date, temp$TDS,xlab="date", ylab="TDS",pch=16)
 temp2<-  subset( goodyear, goodyear$ID=="brine")
 points( temp2$date, temp2$TDS, col="red", pch=16)
 legend("topleft",
        pch=16, col =c("black", "red") ,
        legend =  c("Inflow", "Outflow")
        , inset=c( .05,.05) )
title( "Figure 17 --  Bin1 TDS ")
abline( v= periods, col="magenta", lwd=2)
```

Figure 17 −− Bin1 TDS