

# NEW JERSEY'S AUTOMATED ASSESSMENT USING R

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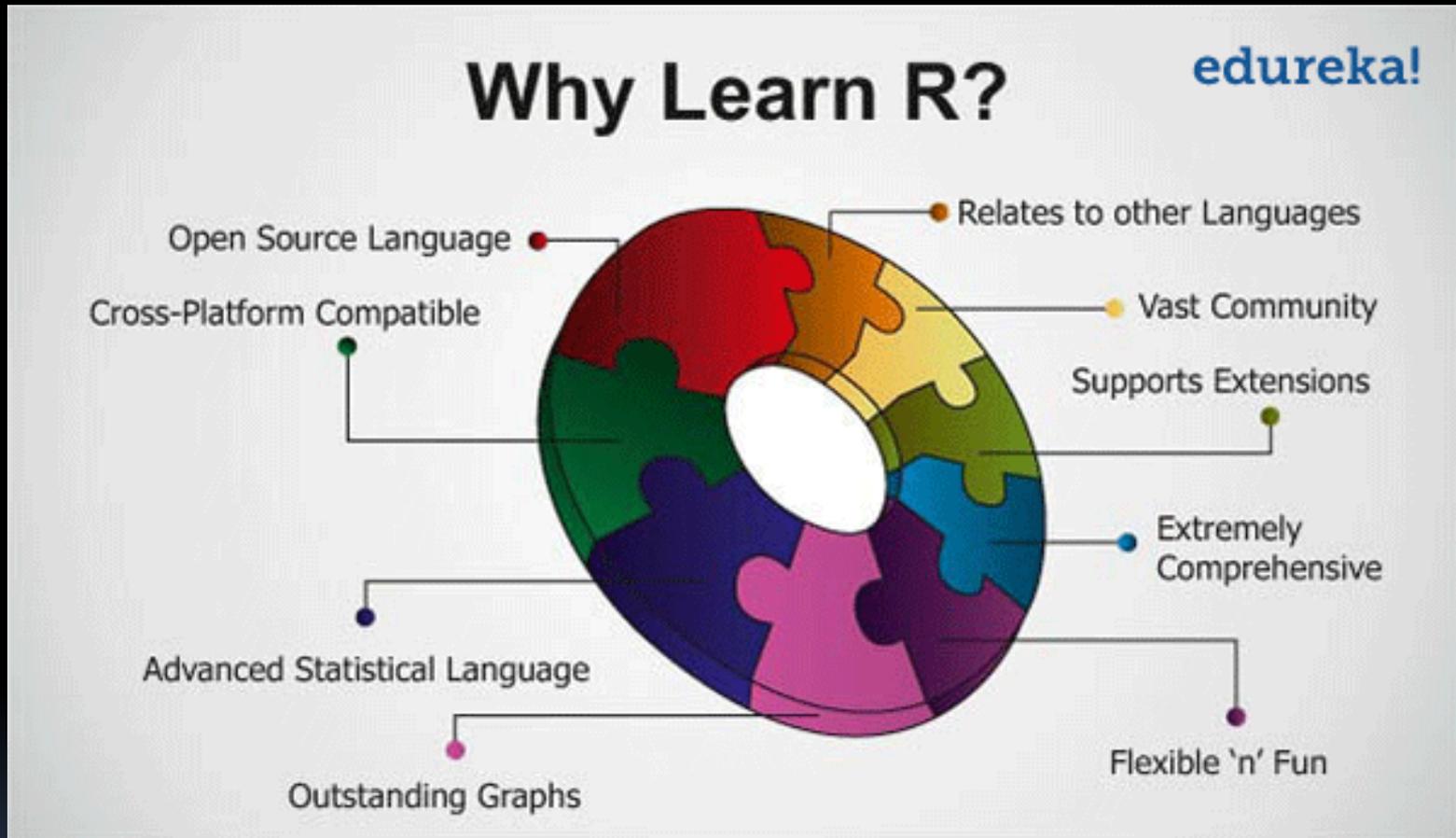
May 29, 2018

# Overview

- Why R?
- Key Automation Steps
- Challenges and Lessons Learned
- Demonstration



# Advantages of Using R Language

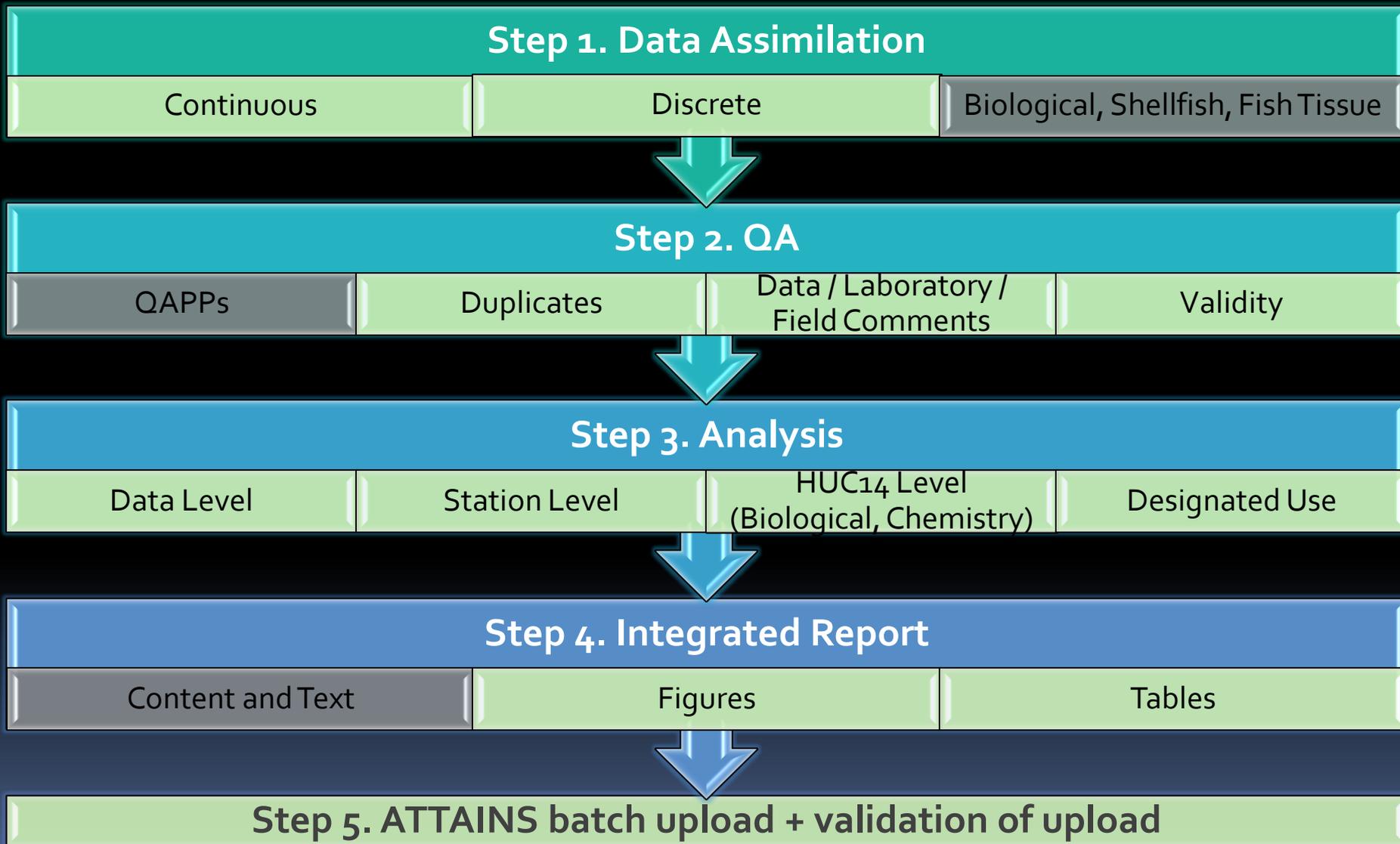


- SCDHEC leadership in Using R

### Challenges with automation:

- Programming Skills & Time
- Validation & QA : requires scientific staff verification

# Reporting Process - Automation



# Legwork before Automation

## Update Look-up Tables

- **Parameters**
  - Units
  - Names
  - New Criteria
- **Stations** (Continuous and Discrete)
  - Stream Classification
  - Type of waterbody
  - Colocation / station grouping
  - Representativeness
  - pH Region
- **QA Comments**
  - Any new comments which have not been addressed

Update tables + scripts (as required)



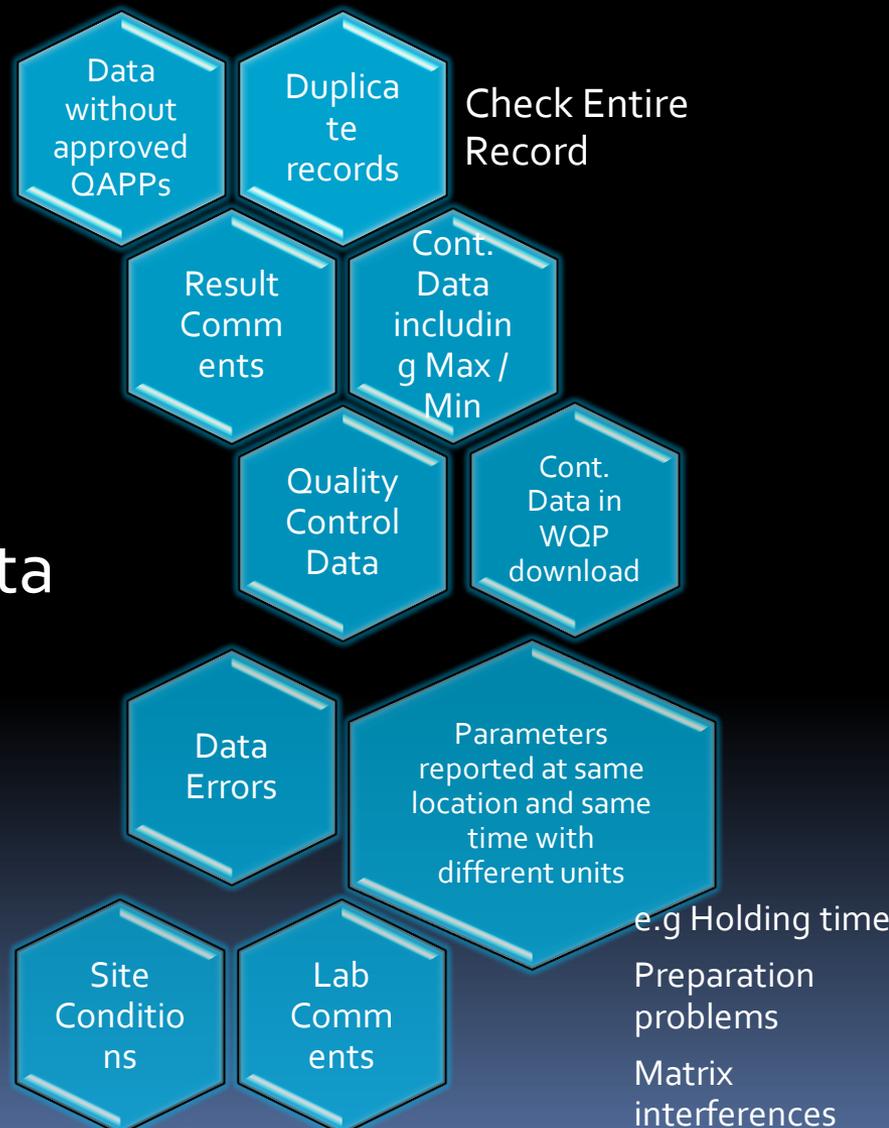
## Review QAPPs Other Data Sources

- Whether data collected can be used for the assessment
- Identify data sources not included in WQ Portal and incorporate

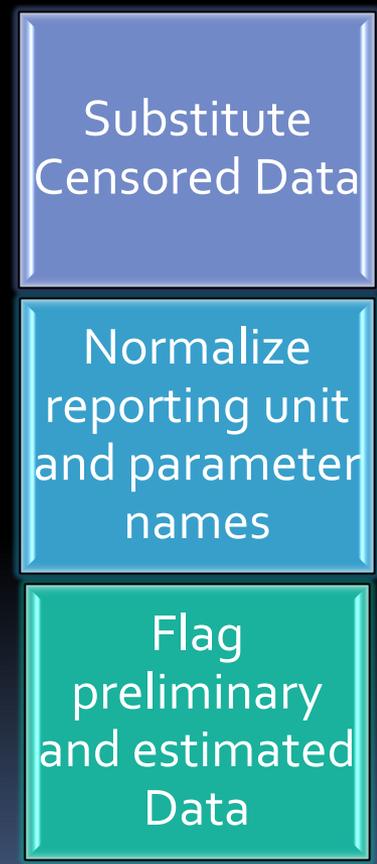


# Quality Assurance Tools

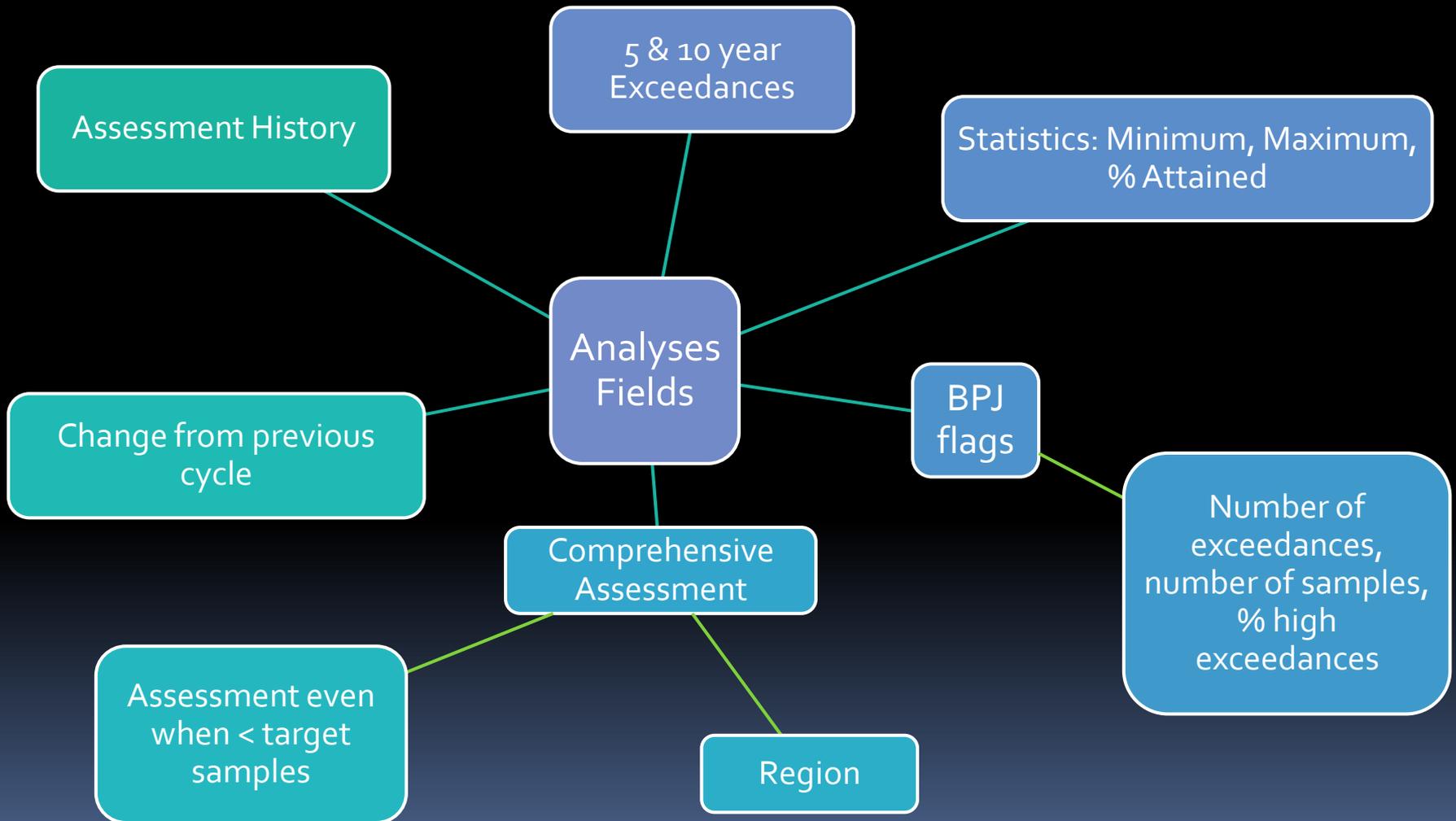
## QA Tools Remove Data



## QA Tools Substitute Record

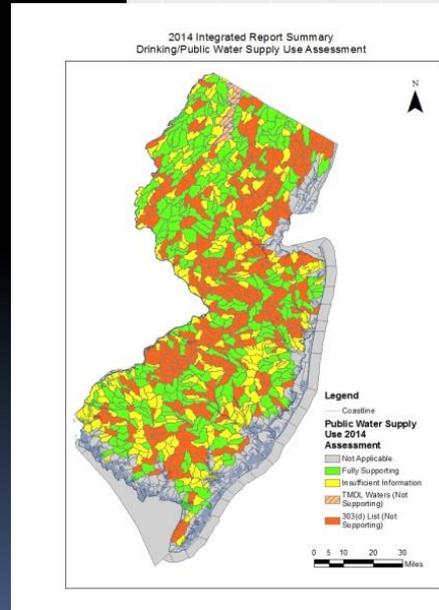
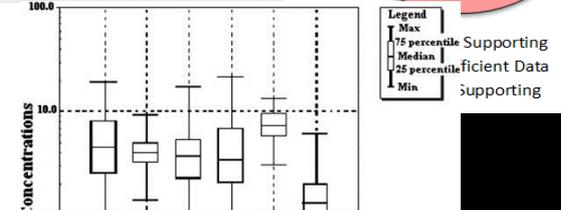
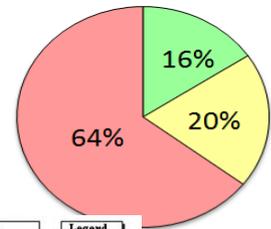
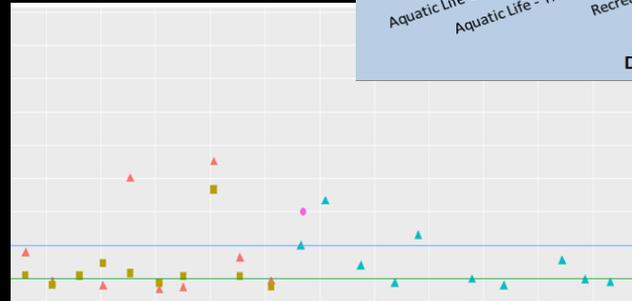
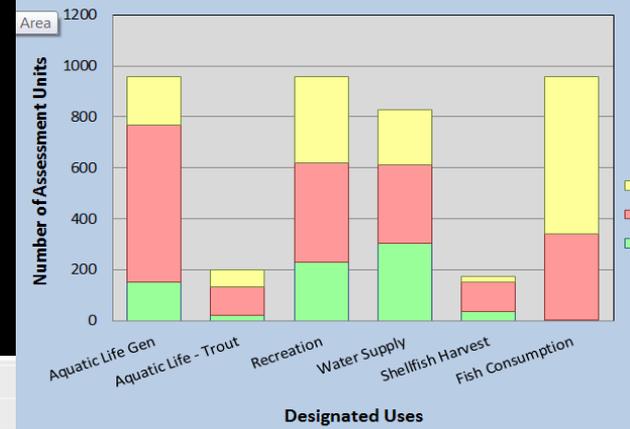


# Analysis – Station, HUC, Designated Use Levels



# Reporting Tools

- Maps
- Tables
- Piecharts,
- Bar Charts
- Scatter Plots
- Box Plots
- GIS
- Etc....



2014 New Jersey Integrated Report Appendix B: 2014 Final 303(d) List of Water Quality Limited Waters with Sublist 5 Subpart and Priority Ranking for TMDL Development NJ Department of Environmental Protection May 2017

| WMA | Assessment Unit Number | Assessment Unit Name                      | Parameter                    | Station Number                       | Cycle 1st Listed | Designated Use                     | Sublist 5 Subpart (A, R, L) | Priority Ranking for TMDL |
|-----|------------------------|---|------------------------------|--------------------------------------|------------------|------------------------------------|-----------------------------|---------------------------|
| 15  | 02040302020030-01      | Absecon Creek (AC Reservoirs) (age to SB) | Mercury in Fish Tissue       | Atlantic City Reservoir (Upper)      | 2014             | Fish Consumption                   |                             | Low                       |
| 15  | 02040302020030-01      | Absecon Creek (AC Reservoirs) (age to SB) | Mercury in Water Column      | 01410455                             | 2010             | Water Supply                       |                             | Low                       |
| 15  | 02040302020040-01      | Absecon Creek (below gage)                | Mercury in Fish Tissue       | Atlantic City Reservoir (Lower)      | 2006             | Fish Consumption                   |                             | Low                       |
| 15  | 02040302020040-01      | Absecon Creek (below gage)                | Oxygen, Dissolved            | R33, 2401                            | 2004             | Aquatic Life                       |                             | Medium                    |
| 15  | 02040302020040-01      | Absecon Creek (below gage)                | Total Coliform               | Shellfish Network                    | 2014             | Shellfish                          |                             | Medium                    |
| 15  | 02040302020010-01      | Absecon Creek NB                          | Mercury in Fish Tissue       | Atlantic City Reservoir (Lower)      | 2006             | Fish Consumption                   |                             | Low                       |
| 15  | 02040302020010-01      | Absecon Creek NB                          | gH                           | HW048639                             | 2006             | Aquatic Life                       |                             | Medium                    |
| 15  | 02040302020020-01      | Absecon Creek SB                          | Mercury in Water Column      | 01410455                             | 2006             | Water Supply                       |                             | Low                       |
| 14  | 02040301160110-01      | Albertson Brook / Gun Branch              | gH                           | 0140941020, 0140940070, NALDBRELL    | 2006             | Aquatic Life                       |                             | Medium                    |
| 11  | 02040105210010-01      | Absecon Ck (above 74d 55m)                | gH                           | 01461300                             | 2014             | Aquatic Life                       |                             | Medium                    |
| 11  | 02040105210010-01      | Absecon Ck (below 74d 55m)                | Temperature, water           | 01461300                             | 2006             | Aquatic Life - Trout               | R                           | Medium                    |
| 11  | 02040105210020-01      | Absecon Ck (below 74d 55m to 118A06)      | Arsenic                      | 01461840                             | 2012             | Water Supply                       |                             | Low                       |
| 11  | 02040105210020-01      | Absecon Ck (below 74d 55m to 118A06)      | Escherichia coli             | 01461840                             | 2012             | Recreation                         | R                           | Medium                    |
| 11  | 02040105210020-01      | Absecon Ck (below 74d 55m to 118A06)      | gH                           | 01461300                             | 2012             | Aquatic Life, Aquatic Life - Trout |                             | Medium                    |
| 11  | 02040105210020-01      | Absecon Ck (below 74d 55m to 118A06)      | Temperature, water           | 01461300                             | 2006             | Aquatic Life - Trout               | R                           | Medium                    |
| 17  | 02040206060020-01      | Alloway Ck (above Alloway-Woodstown Rd)   | Arsenic                      | 01482880                             | 2006             | Water Supply                       | A                           | Low                       |
| 17  | 02040206060020-01      | Alloway Ck (above Alloway-Woodstown Rd)   | Total Suspended Solids (TSS) | 01482880                             | 2006             | Aquatic Life                       |                             | Medium                    |
| 17  | 02040206060090-01      | Alloway Ck (below HancockBrd) to Salem S  | PCB in Fish Tissue           | Delaware River Tribs to head of Tide | 2006             | Fish Consumption                   | L                           | Low                       |
| 17  | 02040206060090-01      | Alloway Ck (below HancockBrd) to Salem S  | Total Coliform               | Shellfish Network                    | 2014             | Shellfish                          |                             | Medium                    |
| 17  | 02040206060090-01      | Alloway Ck (HancockBrd) to Newbridge      | PCB in Fish Tissue           | Delaware River Tribs to head of Tide | 2006             | Fish Consumption                   | L                           | Low                       |
| 17  | 02040206060090-01      | Alloway Ck (HancockBrd) to Newbridge      | Total Coliform               | Shellfish Network                    | 2014             | Shellfish                          |                             | Medium                    |



# R Automation Benefits

- Improved Efficiency
  - ~ 70% time savings for NJ
- Improved Accuracy
- Improved Validation Process
- More Time for Comprehensive Assessments
- More Information for Technical Decisions
- User Friendly Visualization Tools
- Overall Improved Transparency of Process



# Challenges and Lessons Learned

## Logistics

- Time
- Dedicated Resources (or lack thereof) – trained programmers preferred
- IT Department Approvals
- Functional knowledge / process familiarity
- Prepare thorough algorithm / flow chart of the process
- Inconsistent data standards – continued improvement required

## Technology

- Learning R
- Continuous updates / fixes / simultaneous cycles
- New features / packages / tools make a difference
- Establish initial QA/QC process – will be adaptable process
- Lookup tables – Accuracy is critical
- Document, document, document
- Use Git / Version Control (<https://git-scm.com/>)

# Future Projects

Cloud-based Rstudio Server hosted by EPA or some entity that can be accessed by multiple States' water quality regulatory agencies so that the projects can be shared and possibly others could contribute – e.g. HSPF has been improved significantly because of non-funded contributions



# Resources for R/Rstudio

- [Google](#)
- <https://stackoverflow.com/>
- [Training - www.Datacamp.com](https://www.datacamp.com)
- <https://www.rstudio.com> (online-learning, resources/cheatsheets, products/rpackages etc)
- Book - “R for Data Science” by Hadley Wickam (<http://r4ds.had.co.nz/>)
- Listserves / github ([r\\_users\\_water\\_resources@listserv.state.nj.us](mailto:r_users_water_resources@listserv.state.nj.us); <https://github.com/USGS-R>)



# Questions



## Point of Contacts:

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New Jersey Department of Environmental Protection (NJDEP)  
Division of Water Monitoring and Standards (WM&S)



# Demonstration

Integrated Report Open Network, Mapping, and  
Assessment Navigator (IRONMAN)

