

New Mexico's Data Integration and Automation Journey



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New Mexico Environment Department
Surface Water Quality Bureau



Surface Water Quality Monitoring in New Mexico

- Wide variety of data collected
 - Physical/chemical
 - Flow
 - Long-term data: thermographs, multi parameter sondes, and single parameter data loggers (DO)
 - Habitat/Geomorphic
 - Biological: fish tissue, benthic macroinvertebrates, periphyton, phytoplankton

Data Management Challenge

The variety of water quality data collected and reporting needs resulted in creation and maintenance of multiple data repositories:

- MS Access survey database (SSS)
- MS Access assessment database (ADB)
- Excel spreadsheets (long term datasets, habitat data, USGS WQ data)

Positives: focused, often high level of detail with respect to the user community for the particular data repository

Negatives: duplication of work, errors during crosswalks, redundancies, inefficient to make common assessment unit/reach revisions to both databases, instability, security concern.

Data → NMEDAS

- 2009-2012: NMED develops NMEDAS
 - Improves internal data storage and reporting
 - Streamlines chemical data upload to WQX
 - Oracle platform provides user level access limits
- Challenges:
 - Unable to house long term datasets for temperature and nutrient assessments
 - Unable to house habitat and geomorphology measurements needed for sedimentation assessments
 - Unable to house NM water quality standards or 303(d)/305(b) assessment conclusions

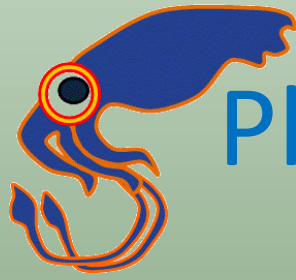
Assessment → NM ADB

- 2002-2012: NMED utilizes EPA Assessment Database (ADB)
 - CWA §303(d)/§305(b) assessment conclusions and reporting maintained MS Access version
 - Easy for non-programmer to access backend tables for simple edits and queries
- Challenges:
 - MS Access platform
 - Resided on one individual PC with no other user access
 - Unable to customize to level needed
 - Actual data being assessed resided in separate database



SOLUTION: Integrated Survey and Assessment Data Management


- 2013 (to present): NMED develops Surface water Quality Information Database (SQUID)
 - Initial and continued development funded primarily with EPA Exchange Network and CWA § 106 Supplemental grants
- Combines NMEDAS (data) and NM ADB (assessment)
 - Maintains common Assessment Units and associated stations in one Oracle platform and schema
- Used to updated station location and Assessment Unit meta data to SWQB Mapper (public and planning GIS)




Phase One → Develop SQUID

- Houses all water quality data NMED SWQB collects
- Stores all §303(d)/§305(b) attainment conclusions
 - semi-auto assessment for certain parameters such as nutrients and temperature
- Contains multiple custom survey planning and tracking, data, and assessment-related reports
- Allows for electronic reporting of:
 - assessment information to ATTAINs
 - monitoring data to WQX

Data Structure: Project → AU → Station → Sampling Activities



New Mexico
ENVIRONMENT
Department



SQUID
Surface water Quality Information

Data Management Adhoc Report **Projects**
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Project Filter

Id	Name	Description		
<input type="text" value="2011"/>	<input type="text"/>	<input type="text"/>	<input type="button" value="Apply Filter"/>	<input type="button" value="Reset Filter"/>

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Projects										
Action	Project ID	Project Name	Description	WQX Upload	Project Managers	Comments	Verified	VV Initials Date	View Assessment Units	View/Add Monitoring Locations
	LRG11-12 - VVd	Lower Rio Grande Survey 2011-12	River and stream survey of the Lower Rio Grande and tributaries funded by EPA CWA 106 funds. All data vvd 10/5/2012. Data submitted to WQX 1/25/13.	✓			✗		📄 (10)	📄 (28)
	Lakes11 - VVd	Lake and Reservoir Survey 2011	Lake and reservoir survey of the Rio Puerco and Gila/SFR Watersheds funded by EPA CWA 106 funds. All data VVd 4/3/2013. Data submitted to WQX 7/23/13	✓			✗		📄 (13)	📄 (13)
	Gila/SFR11 - VVd	Gila and San Francisco River Survey 2011	River and stream survey of the Gila and San Francisco Rivers funded by EPA CWA 106 funds. All data VVd 01/09/2013. Data submitted to WQX 1/26/13.	✓	Seva Joseph		✗		📄 (30)	📄 (38)
	Puerco/LCR11 - VVd	Rio Puerco and Little Colorado Survey 2011	River and stream survey of the Rio Puerco and Little Colorado River Watersheds funded by EPA CWA 106 funds. All data VVd 02/05/2013. Data submitted to WQX 4/3/2013.	✓	Greg Huey		✗		📄 (22)	📄 (36)

Records per Page

Data Management Adhoc Report **Projects**
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[Projects](#) » [Monitoring Locations](#) » [Sampling Events](#) » Activities

Activity Filter

Project Name	ID	Sample Collection Method	After Start Date	Before End Date	
Gila and San Francisco River Survey 2011	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="button" value="Apply Filter"/> <input type="button" value="Reset Filter"/>

Assemblage: Media: Sample Collection Equipment:

Displaying 1 - 10 of 10

Activities for Monitoring Location (San Francisco River at Upper Box - 80SanFra1242) and for Project (Gila and San Francisco River Survey 2011)											
ID	Assemblage	Media	Analyte Suite	Start Date	Ship Date	Sample Collection Method	Sample Collection Equipment	Details	WQX Upload	WQX Status	Results
2385344		Water	Gross Alpha and Beta Activity + SWQB Seq.	04-15-2011 11:45 AM		Chemistry - Sample	Water Bottle		✓	✓	📄 (4)
2447611		Water	TDS & TSS	04-15-2011 11:45 AM		Chemistry - Sample	Water Bottle		✓	✓	📄 (2)
2447612		Water	SWQB Total Nutrients	04-15-2011 11:45 AM		Chemistry - Sample	Water Bottle		✓	✓	📄 (4)
2447613		Water	SWQB E Coli	04-15-2011 11:45 AM		Chemistry - Sample	Water Bottle		✓	✓	📄 (2)
2447614		Water	Total Mercury and Selenium + Aluminum	04-15-2011 11:45 AM		Chemistry - Sample	Water Bottle		✓	✓	📄 (3)
2447615		Water	SWQB Dissolved Metals	04-15-2011 11:45 AM		Chemistry - Sample	Water Bottle		✓	✓	📄 (23)
2447616		Water	SWQB Total Nutrients	04-15-2011 11:45 AM		Chemistry - Sample	Water Bottle		✓	✓	📄 (4)
2447617		Water	SWQB Dissolved Metals	04-15-2011 11:45 AM		Chemistry - Sample	Water Bottle		✓	✓	📄 (23)
2447618		Water	SWQB E Coli	04-15-2011 11:45 AM		Chemistry - Sample	Water Bottle		✓	✓	📄 (2)
RIVER_DATA_22Apr11_155449		Water		04-15-2011 11:45 AM					✓	✓	📄 (8)

Records per Page

SQUID Version 1.2

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Assessment Structure: AU → Designated Uses → Impairment Status (Non Support → Causes → Sources and approved TMDLs)

Assessment Unit Information

AU ID	NM-2106.A_30	NM defined Category	5A
AU Name	Rio Guadalupe (Jemez River to confl with Rio Cebolla)	IR Category	5
Waterbody Type	PERENNIAL STREAM	HUC Eight	13020202 - Jemez
AU Size	12.6 MILES	Location Description	13020202 - Jemez
WQS Reference	20.6.4.108	Cycle Last Assessed	2016
IR Cycle Date	2018	AU Comments	TMDL for Al chronic (2003), turbidity, and SBD (1999) (sedimentation/siltation); de-list letter for total phosphorus. De-listed for sedimentation/siltation in 2008. A TMDL was prepared for temperature (2009).
Exclude from IR	<input type="checkbox"/>	Data Needs (if any)	
Monitoring Scheduled Date	2021		
ROD (current cycle)			
Monitoring Locations	<div style="border: 1px solid #ccc; padding: 5px;"> Rio Guadalupe above Jemez River - 31RGuada000.1 Rio Guadalupe at Deer Creek Landing - 31RGuada010.0 Rio Guadalupe at Porter Landing - 31RGuada019.7 </div>		

Edit Add Uses Update Assessment Dates

Uses for NM-2106.A_30 - Rio Guadalupe (Jemez River to confl with Rio Cebolla)

Action	Use	Use Support	Assessment Date
	Domestic Water Supply	Fully Supporting	12/8/2015
	Fish Culture	Not Assessed	
	High Quality Coldwater Aquatic Life	Not Supporting	12/8/2015
	Irrigation	Fully Supporting	12/8/2015
	Livestock Watering	Fully Supporting	12/8/2015
	Primary Contact	Fully Supporting	12/8/2015
	Wildlife Habitat	Fully Supporting	12/8/2015

Add causes to use - High Quality Coldwater Aquatic Life

Causes for High Quality Coldwater Aquatic Life - NM-2106.A_30 - Rio Guadalupe (Jemez River to confl with Rio Cebolla)

Cause	Cycle First Listed	IR Category	Pollutant	Sources	TMDL Estimate Date	TMDL Name
Nutrient/Eutrophication	2016	5	Yes	Source Unknown	2016	
Specific conductance	2016	5	Yes	Source Unknown	2016	
Temperature	2008	4A	Yes	Loss of Riparian Habitat	2009	RIO GUADALUPE 2106.A_30 TEMPERATURE TMDL
Turbidity	2016	5	Yes	Source Unknown	2016	

Integrated List with ROD

2014 - 2016 State of New Mexico Clean Water Act §303(d) List and Supporting ROD Information.					
Tularosa River (San Francisco R to Apache Creek)			IR CATEGORY	LOCATION DESCRIPTION	
			5/5A	15040004 - San Francisco	
AU ID	WQS REF	WATER TYPE	SIZE	ASSESSED	MONITORING SCHEDULE
NM-2603.A_40	20.6.4.603	PERENNIAL STREAM	21.97 MILES	2002	2019
USE	ATTAINMENT	CAUSE(S)	FIRST LISTED	TMDL DATE	PROBABLE SOURCE(S)
LW	Fully Supporting				• Source Unknown
WH	Fully Supporting				
FC	Not Assessed				
DWS	Fully Supporting				
PC	Not Supporting	E. coli	2014	2014 (est.)	
IRR	Fully Supporting				
HQColdWAL	Not Supporting	Turbidity Temperature	2014 2014	2014 (est.) 2014 (est.)	

AU Comment: TMDL for specific conductance.

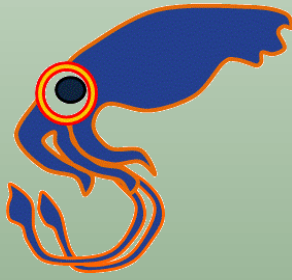
1996 Action: Previously listed for temperature, pH, fecal coliform, total ammonia, total phosphorus and turbidity. There are two sampling stations on this reach; all data are from 1990, 1992 and 1995 surveys. Temperature had a cumulative exceedance ratio of 7/22 samples. pH had a cumulative exceedance ratio of 7/22. Fecal coliform samples had an exceedance ratio of 2/6. The criterion for total ammonia was exceeded 3/22 times. The total phosphorus criterion was exceeded 6/22 times. Turbidity had a cumulative exceedance ratio of 3/22. For temperature, stations SFR603.004035 and SFR603.004025 are partially supported their designated use. For pH, station SFR603.004035 is fully supporting its designated use, while station SFR603.004025 is Not Supporting its designated use. For fecal coliform, station SFR603.004035 is full supporting, impacts observed, while station SFR603.004025 is fully supporting its designated use. For total ammonia, stations SFR603.004035 and SFR603.004025 are fully support, impacts observed. For total phosphorus, station SFR603.004035 is Full Support, Impacts Observed, while station SFR603.004025 is fully supporting its designated use. For turbidity, station SFR603.004035 is partially supported, while station SFR603.004025 is fully supporting its designated use.

1998 Action: Fecal coliform, ammonia and phosphorus were removed as causes of non-support. Temperature, pH and turbidity were retained as causes of non-support.

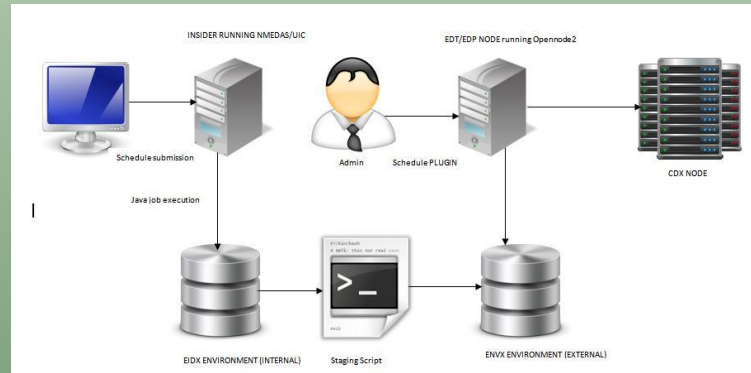
2000 Action: Data from two thermographs had 17/5,432 exceedances of the segment-specific temperature criterion of 25C. There were 0/33 exceedances of the pH criterion. Turbidity samples had 0/33 exceedances of the 10NTU criterion. Three stations were evaluated for stream bottom deposits, with a maximum observed %fines of 28.6% fines and maximum embeddedness of 58.8. Conductivity criterion was exceeded 4/33 times. Stream bottom deposits will be added to the 305(b) Report as FSIO. Conductivity will be added as a cause of non-support.

2002 Action: A TMDL was written for conductivity.

2014 Action: The AIU was sampled during the 2011 Gila survey. At station Tularosa abv San Francisco River, there were 3/8 e. coli exceedances, a max thermograph record of 29.49 degrees C, and the turbidity numeric threshold was exceeded. There were 1/9 grab SC exceedances, and the max sonde SC was 263 us/cm. Therefore, temperature, turbidity, and e.coli were added, and SC was removed.

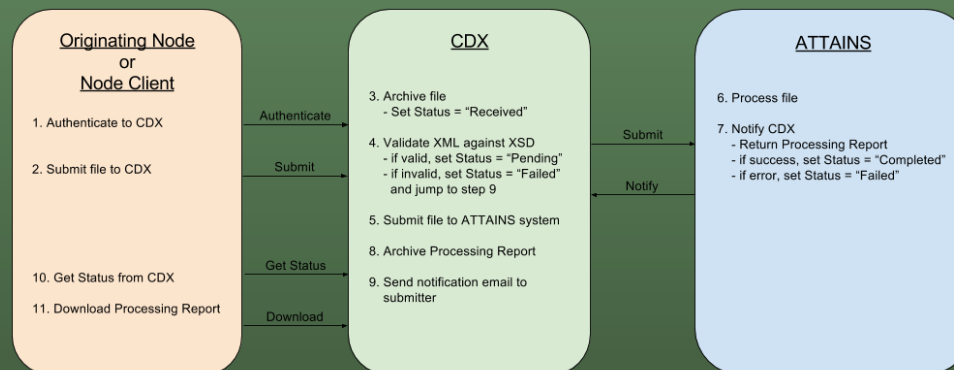


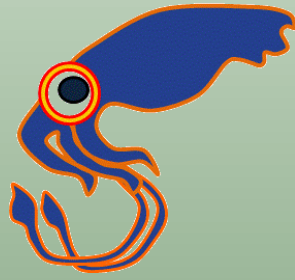
Electronic Reporting



Assessment conclusions to ATTAINs via OWIR Central Data Exchange (CDX)

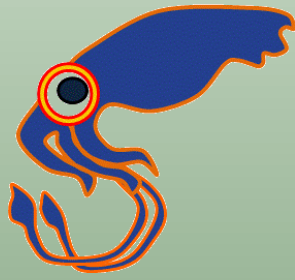
- OWIR-ATT Java plugin built in house.
- Successful OWIR-ATT test submission of 2012 IR cycle via Internal Exchange Node. Still using.





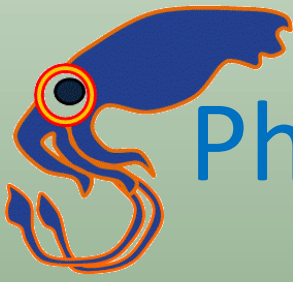
Benefits

- Improved uniformity, consistency, and data input/maintenance permission levels
- Essential tool in meeting CWA §106 grant deliverables and preparing semi-annual reports
- Allows monitoring staff to upload data that can be directly accessed by NMED assessment, permit certification, and CWA §319 restoration staff
- Spatial crosswalk errors related to station and assessment units are eliminated, saving time and resources
- **Great starting point for implementing revised Water Quality Data Framework!!**



Challenges

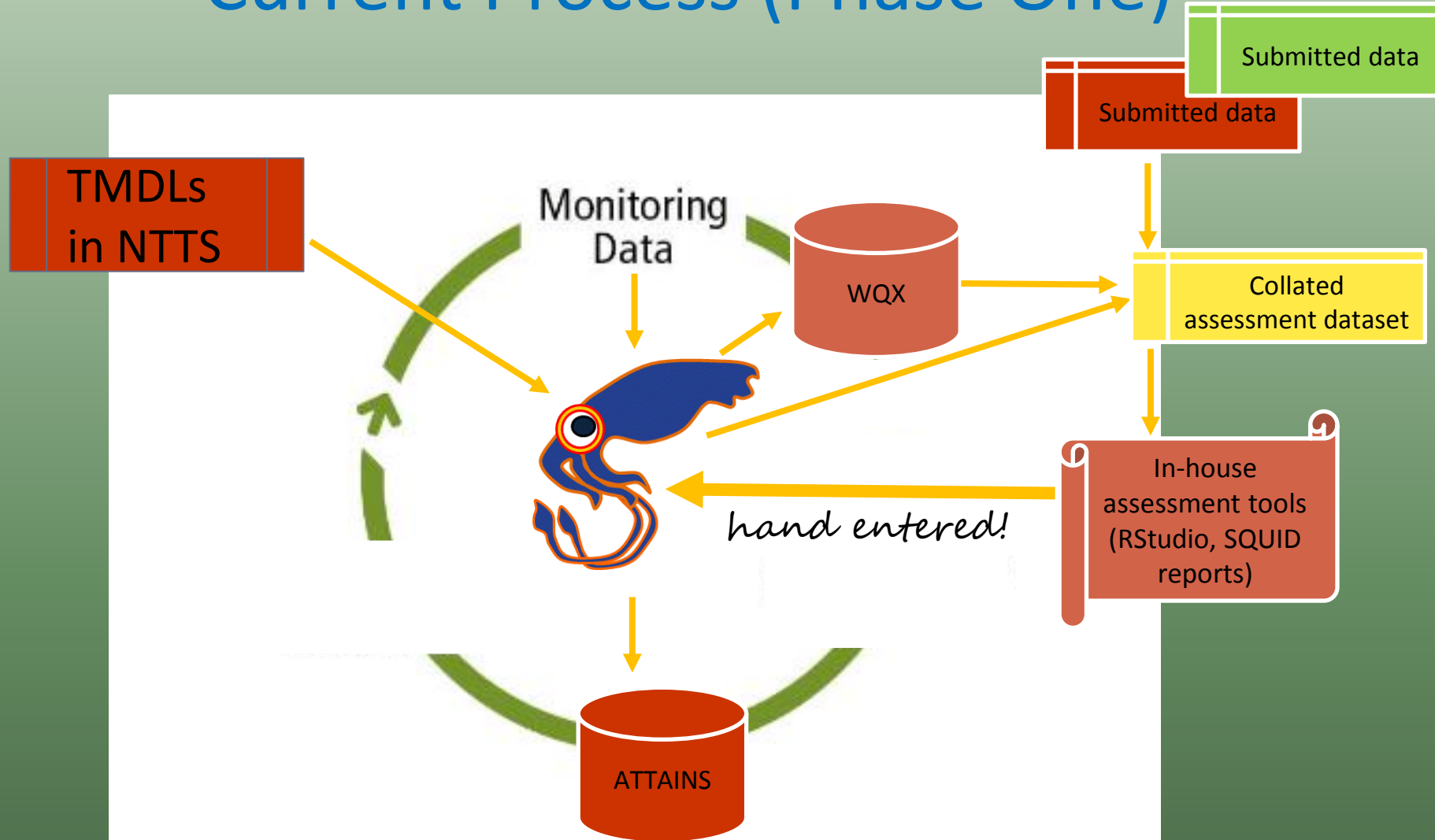
- Only data collected by NMED SWQB are allowed in SQUID so need to manually collate outside data sources
- We lose TMDL tracking data in the current user interface if the associated Cause of impairment is de-listed because of AU → Designated Uses → Impairment Status (Non Support → Causes → etc.) structure
- Still hand entering assessment conclusions into SQUID!!



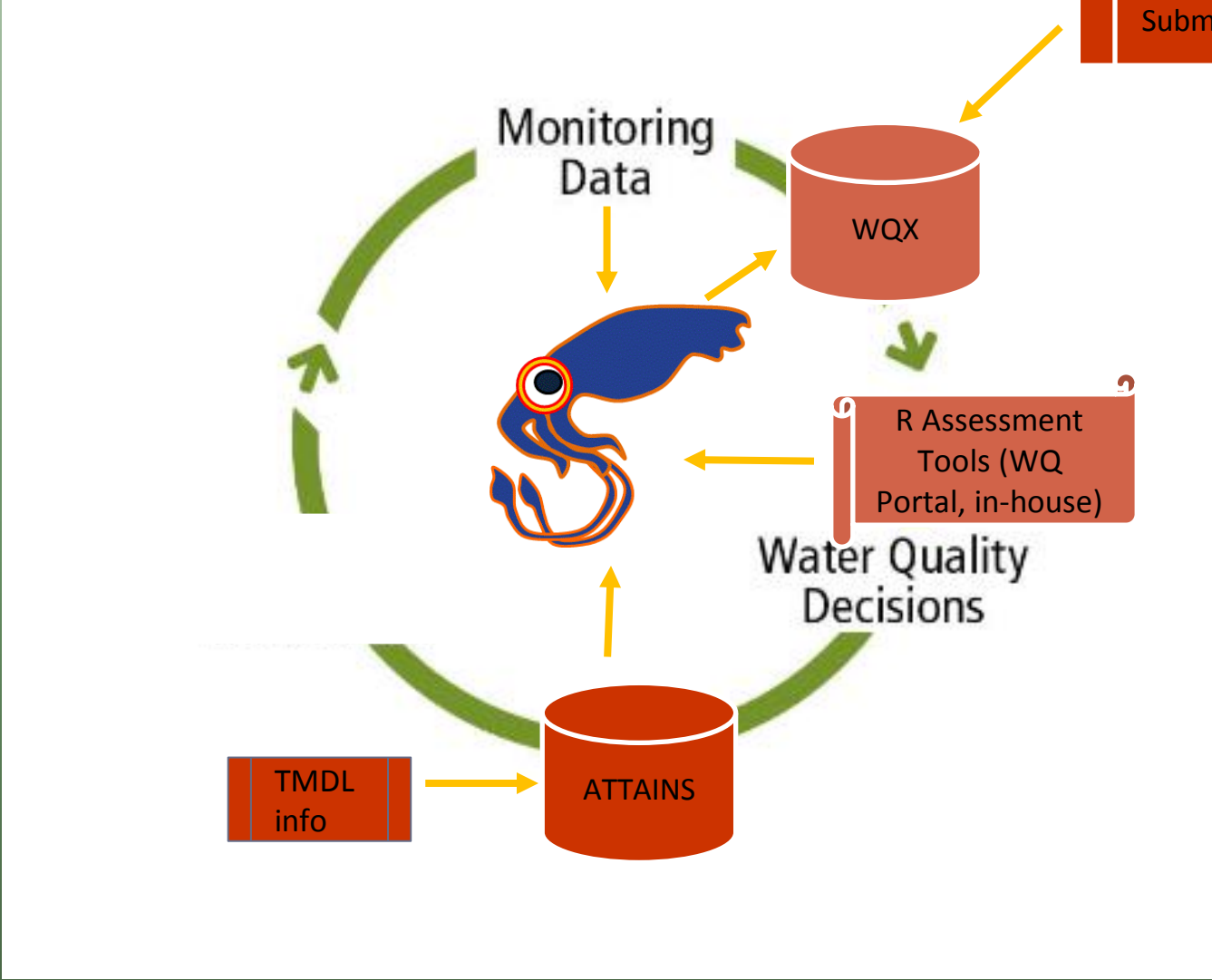
Phase Two → Update SQUID

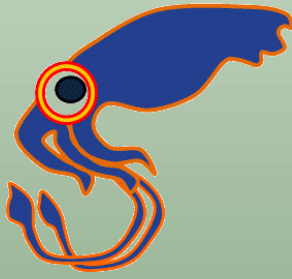
- Implement ATTAINS re-design schema and domains for continued electronic reporting via the node
- Develop ways to import TMDL data **from ATTAINS to SQUID** via additional module to our ATTAINS plug in (or ATTAINS portal REST services for Action/TMDL queries)*
- Develop assessment import processes based on ATTAINS-based **Assessment Batch Upload Template (WQ Portal compatible)***

Current Process (Phase One)



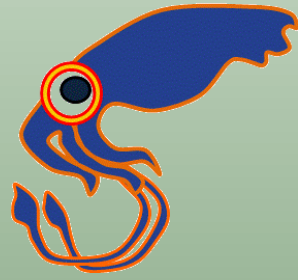
Target Process (Phase Two)





On-going Challenges

- Encouraging outside data collectors to submit data through WQX
 - WQX may not accept types of data (ex) CWA 319 projects are collecting
 - Considering starting a “State Monitoring Council” to promote consistent data entry from outside sources into WQX
- Identifying continuing funding and build institutional knowledge for custom database maintenance and enhancements
 - Pivotal IT contractor (100% grant funded)
 - Need NMED IT staff position with tech transfer from contractor
- NM’s custom assessment automation process in R not complete!
 - No improvements since 2014 IR cycle (no dedicated programmer)
 - No time to keep up with R version updates and available packages



Conclusion

- SQUID is an essential data and assessment management and reporting tool at NM's Surface Water Quality Bureau
- SQUID has been a good basis for implementing the ATTAINS revision portion of the Water Quality Data Framework
- Looking forward to incorporating WQ Portal R-based assessment automation
- Because development of SQUID was 100% federally funded, it's freely available to others!
 - Contact lynette.guevara@state.nm.us, 505-827-2904