

# SDWIS Modernization Alternatives Analysis

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Michael Plastino, EPA Infrastructure Branch Chief

Adam Haas-GDIT



OFFICE OF GROUND WATER  
AND DRINKING WATER

# Overview



- Background and SDWIS Modernization Board Overview (Michael Plastino)
- SDWIS Modernization Alternatives Analysis (Adam Haas)
- Next Steps (Michael Plastino)

# Background



- July 2019 – EPA suspended SDWIS Prime development due to database issues
- Sept 2019 through January 2020
  - SDWIS State 3.4 developed to address IT security issues, cross browser compatibility
  - GDIT completed assessment of SDWIS Prime database issues and reusability of the SDWIS Prime Business Rules Engine

# Background



## February 2020 through Present

- SDWIS Prime Lessons Learned (GDIT)
- SDWIS Modernization Alternatives Analysis (GDIT)
- SDWIS Modernization Board (GDIT / Ross Strategic)
- Contractor Support for SDWIS Development and O&M
  - o Completed in March – Transition of Compliance Monitoring Data Portal support to Systalex (Systalex is the lead vendor on the SDWIS State / SDWIS Fed support contract)
  - o New Drinking Water Program IT Mission Support Contract – Procurement in Progress (Support for Developing / Implementing selected option from Alternatives Analysis and range of ongoing SDWIS support)

# SDWIS Modernization Board - Overview

- November 2019 – Discussion in E-Enterprise Leadership Council on Applying the [Digital Strategy](#) to SDWIS Modernization (Initial Focus: Stakeholder Engagement)
- January 2020 – Formation of SDWIS Modernization Board
  - [Announcement](#) - Board Membership and Charter
  - Membership - EPA & State Drinking Water & Information Management Programs
  - Charter – Defines expectations for Board Member participation, along with expectations for Board Recommendations and EPA Option Selection

"Modernization Board members will review the final Alternatives Analysis and be prepared to identify preferred options. If a consensus is not reached by the Board this should be noted to EPA with the recommendation, with reasoning from the dissenting members why they didn't agree with the majority opinion."

# SDWIS Modernization Board - Overview



"... the recommendations that are decided upon by the Board are given to EPA with the expectation that EPA is going to follow that recommendation. Ultimately, however, EPA does retain final decision-making power. In the case that EPA does not follow the Board's recommendation, EPA will report back to the board in an open and transparent way their reasoning behind not following the Board's recommendation."

## Biweekly Meetings for Input into SDWIS Modernization Alternatives Analysis:

- Definition of Criteria to Evaluate Options
- Setting of Weights for Each Criteria
- Definition of Options
- State and EPA IT Environment Considerations

# SDWIS Modernization Alternatives Analysis



- EPA task order request to GDIT: Conduct an alternatives analysis to define and assess options for developing a long-term replacement for SDWIS State
- Initial Assumptions and Constraints
  - Each option in the alternatives analysis will be defined to account for the need for Primacy Agencies to run compliance on the Lead and Copper Rule Revisions (LCRR)
  - With the LCRR expected to be finalized in Summer of 2020, each option must be defined such that functionality will be available for Primacy Agencies to begin using within 3 years of the rule finalization (by Summer 2023)
  - In order for options' replacement functionality to be available for Primacy Agencies to begin using by Summer 2023, options need to be defined such that development and testing is completed by Spring of 2022, to allow for transition to using the option



**QUESTIONS?**



# Alternatives Analysis Process



1. Define evaluation criteria
2. Rate evaluation criteria
3. Define and refine options
4. Conduct capabilities analysis scoring
5. Develop cost estimates

## Define Criteria, Ratings, and Options

- Developed an initial set of evaluation criteria, which was refined through working sessions with the Board.
  - 42 criteria covering data quality, user experience and workflows, business rule flexibility and adaptability, compliance determination, state control of user administration, data exchange, support, alerts and notifications, enforcement tracking, auditing, data schema, reporting, document management, data standards and security
- These criteria are high-level requirements
- Additional working sessions narrowed the criteria to 37

# Define Criteria, Ratings, and Options



- Each member of the board was requested to rate the criteria 1-4, with limits to the number assigned
- Review of evaluation criteria scoring occurred during a collaborative working session to ensure the following:
  - An adequate number of responses is received
  - Identify and resolve where a large variance in scoring has occurred (Lots of 4's and Lots of 1's) in order to both gain an understanding on reasoning and obtain a general agreement on the tier to place
- The final scores were divided into tiers based on the average score of each criterion
  - The 17 highest scored criterion were placed in the top-tier and assigned a value of 4
  - The next 13 highest scoring were placed in the middle-upper tier and assigned a value of 3
  - The next 8 highest scoring were placed in the middle-lower tier and assigned a value of 2
  - The last 4 were placed in the lower-tier and assigned a value of 1

# Define Criteria, Ratings, and Options

- Options were developed based on the evaluation criteria
- Three main components
  - Database
  - Business Rules Engine (BRE)
  - User Interface (UI)
- Options were characterized by development requirements, hosting responsibilities, and support
- Options involving EPA hosting at NCC were eliminated

# Capabilities Analysis Scoring

- Each of the options were analyzed and scored to determine the capability to which the option meets the Evaluation Criteria.
  - 3: Fully meets the criterion with out of box, minimal level of configuration
  - 2: Partially meets the criterion with moderate level of configuration
  - 1: Minimally meets the criterion and/or requires high level of configuration
  - 0: Does not meet the criterion
- Based on the rating assigned to each of the criterion, a criterion score was determined.

**Criteria Weight x Option Rating = Criteria Score**

# Capabilities Analysis Scoring Example

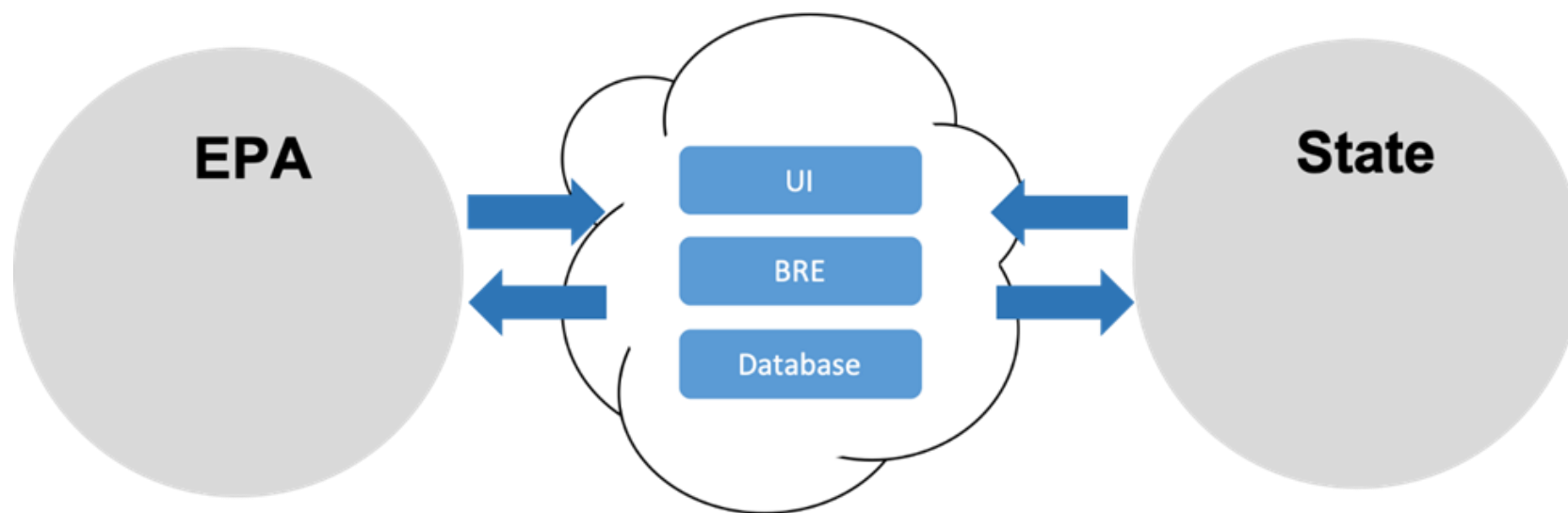


<b>Criterion</b>	<b>Category</b>	<b>Assigned Weight/ Tier</b>	<b>Analysis Score</b>	<b>Criterion Score (Assigned Tier x Analysis Score)</b>
Criterion A	Data Quality	4	3	12
Criterion B	Data Quality	3	3	9
Criterion C	Data Security	3	1	3
Criterion D	Data Security	4	2	8
Total Capability Score				32

# Cost Estimate Methodology

- Notional cost over a three-year period
- Key factors are resources and time:
  - Base resource rate of \$180
  - Low estimate: 9 months
  - Medium estimate: 12 months
  - High estimate: 15 months
- Cloud hosting costs (AWS cost calculator)
  - Low estimate: This is the proof-of-concept phase (POC). The assumption is that roughly 5%-10% of the states will be using the public cloud.
  - Medium estimate: Production-grade intermediate stage with 20%-25% of the states having embraced the public cloud.
  - High estimate: This is a full cloud adoption with room for future growth and burst activity.
- States were treated equally and assumed the states had a data center where applicable

# Option 1: Centralized EPA Cloud Hosting





# Option 1: Key Elements

- EPA develops the Business Rules Engine (BRE), User Interface (UI) Application and the database.
- The BRE, UI and database are hosted in a cloud (e.g., Amazon Web Services, Microsoft Azure).
- EPA manages core components of the cloud instance.
- EPA provides user support.
- States manage functionality that is the result of state-specific configuration options.
- Standardized API between UI, BRE, and database.
- Limited configuration of database fields by states.

# Option 1 Capability Score: 234

## Positive factors influencing capability scoring:

- Enforcement case management capabilities using low-code solution as meets use cases and offers rapid development.
- Data standards, and security scored favorably due to EPA managing hosting.
- Leveraging federal resources to develop helps to alleviate concerns with primacy agency resource / IT constraints.

## Negative factors influencing capability scoring:

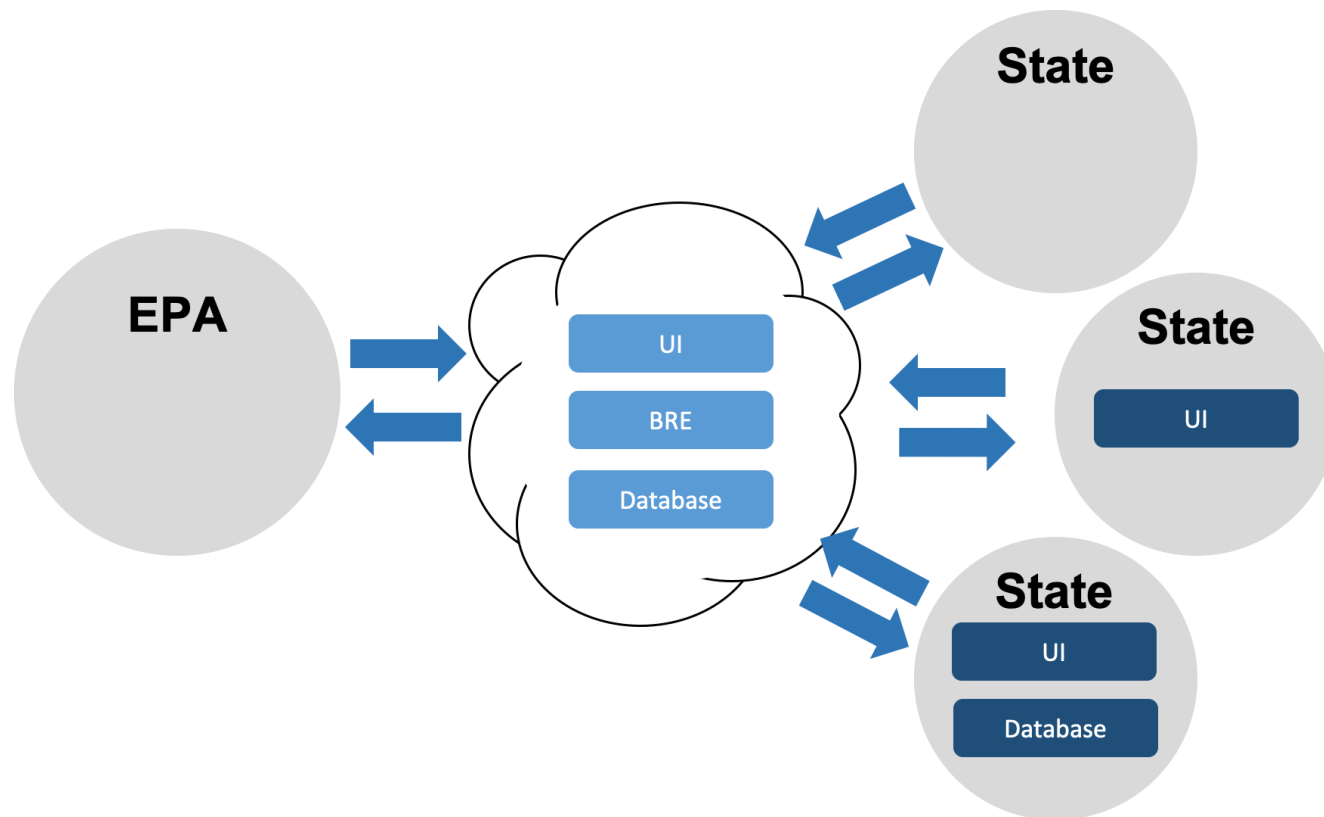
- Scoring negatively affected in the areas of data quality, workflow tailoring, state control of user administration as it would encounter limits in configurability to meet all Primacy agency unique needs.

# Option 1 Medium Costs



Task	Year 1	Year 2	Year 3
Development (Medium) - UI, BRE, Database	\$3,351,600	n/a	n/a
Hosting	\$30,374	\$54,683	\$54,683
O&M – EPA	n/a	\$352,800	\$352,800
O&M – Aggregate of 67 primacy agencies based on \$137,200 per agency.	n/a	\$9,192,400	\$9,192,400
<b>Total</b>	<b>\$3,381,975</b>	<b>\$9,599,883</b>	<b>\$9,599,883</b>

## Option 2: Hybrid system



## Option 2: Key elements

- BRE hosted in the cloud is available to all states
- States can utilize the cloud UI Application or host and manage their own
- States can utilize the cloud database or host and manage their own
- All interactions on the Internet take place via REST API calls
- EPA manages core components of the hosted instance.
- EPA provides user support for the hosted instance.
- States manage and support the instances they host.
- Standardized API between UI, BRE, and database.
- Standard database schema.
- States can customize UI and database that they host assuming adherence to core APIs and database schema elements.

# Option 2 Capability Score: 243



## Positive factors influencing capability scoring:

- Enforcement case management capabilities using low-code solution as meets use cases and offers rapid development
- Scoring positively affected in the areas of data quality, workflow tailoring, state control of user administration for those primacy agencies electing to host UI and database.
- Leveraging federal resources to provide baseline development activities helps to alleviate concerns with primacy agency resource / IT constraints.

## Negative factors influencing capability scoring:

- Scoring is negatively impacted due to the numerous hosting options provided to primacy agencies. With a centralized IT environment in many of the primacy agencies, resource constraints and agency policy provide an increased level of complexity.
- Primacy agencies would realize additional abilities to configure but would require the ability to allocate the needed resources to execute development and support activities.

# Option 2 Medium Costs (Central Application)



Task	Year 1	Year 2	Year 3
Development (medium) - UI, BRE, Database	\$3,351,600	n/a	n/a
Hosting	\$30,374	\$54,683	\$186,901
O&M – EPA	n/a	\$352,800	\$352,800
O&M – Aggregate of 67 primacy agencies based on \$137,200 per agency.	n/a	\$9,192,400	\$9,192,400
<b>Total</b>	<b>\$3,381,974</b>	<b>\$9,599,883</b>	<b>\$9,732,101</b>

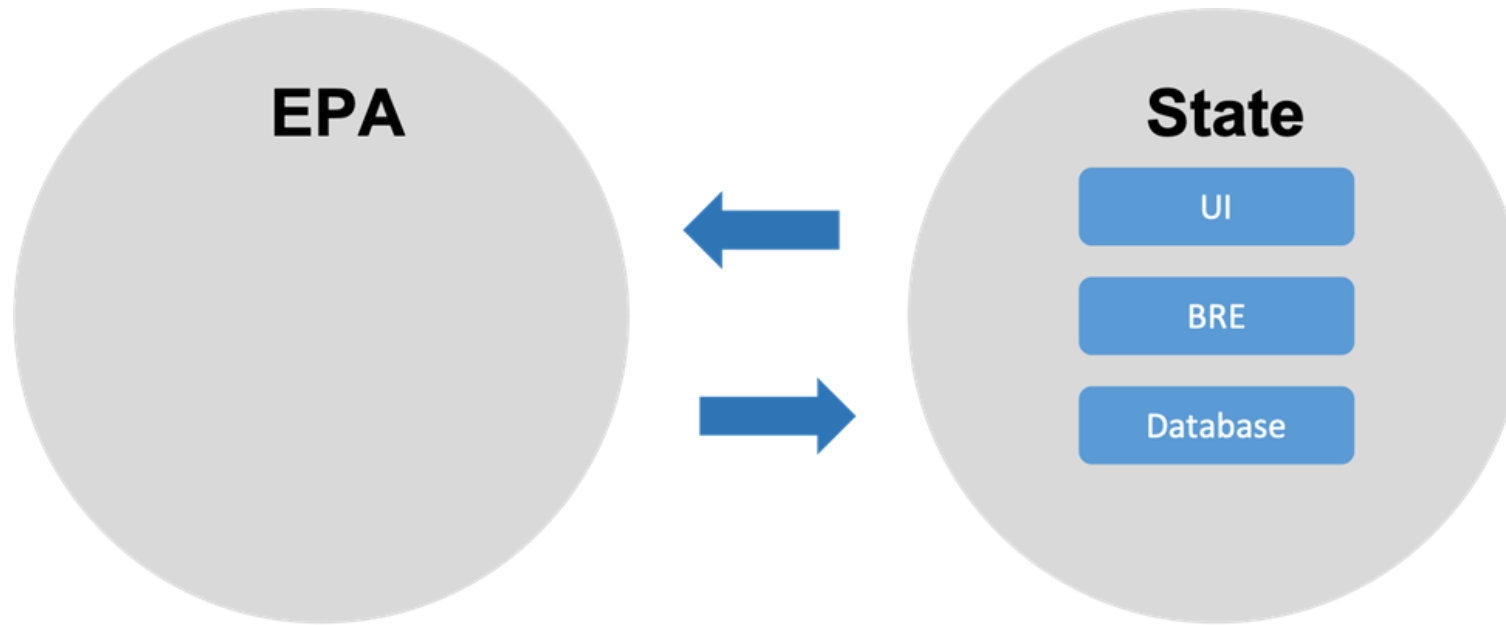
# Option 2 Medium Costs (State Hosted)



<b>Task</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>
Development - UI, Database	\$2,513,700	n/a	n/a
Hosting	\$118,000	\$118,000	\$118,000
O&M – Single State	n/a	\$137,200	\$137,200
Total	\$2,631,700	\$255,200	\$255,200



# Option 3: State Hosted (Direct SDWIS State Replacement)



# Option 3: Key Elements



- UI and BRE developed by EPA and hosted by state
- UI Application developed by EPA and hosted by state
- Database developed and hosted by state
- EPA provides user support for BRE.
- State provides user support for UI and database.
- States manage and support the instances they host.
- States can customize UI and database that they host assuming adherence to core APIs and database schema elements.

# Option 3 Capability Score: 200



## Positive factors influencing capability score:

- Enforcement case management capabilities using low-code solution as meets use cases and offers rapid development.
- Scoring positively affected in the areas of data quality, workflow tailoring, state control of user administration for those primacy agencies hosting the UI and database.

## Negative factors influencing capability score:

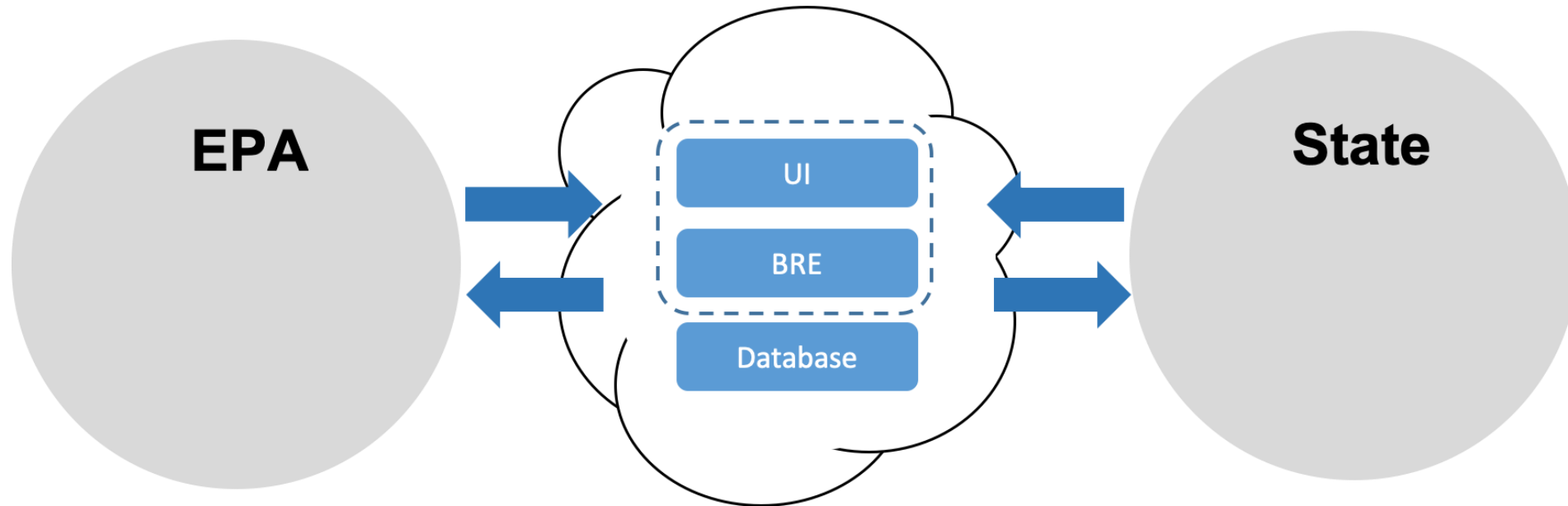
- With a centralized IT environment in many of the primacy agencies, resource constraints and agency policy provide an increased level of complexity.
- Primacy agencies would realize additional abilities to configure but would require the ability to allocate the needed resources to execute additional development or support activities.

# Option 3 Medium Costs



Task	Year 1	Year 2	Year 3
Development – BRE	\$837,900	n/a	n/a
Development - UI, Database	\$2,513,700	n/a	n/a
Hosting	\$142,000	\$142,000	\$142,000
O&M – EPA	n/a	\$352,800	\$352,800
O&M – Single State	n/a	\$137,200	\$137,200
Total (67 Primacy Agencies)	\$3,493,600	\$19,059,200	\$19,059,200

# Option 4: Modified SDWIS Prime



## Option 4: Key Elements

- SDWIS Prime UI Application, modified to reflect database changes, hosted by EPA in the cloud
- BRE is integrated into SDWIS Prime, hosted by EPA
- Database is SDWIS Prime database with new reference tables from decomposed KEY\_VALUE\_REF and hosted by EPA
- Database will be converted from Oracle to an open source RDBMS (PostgreSQL)
- EPA provides user support for UI, BRE, and database.
- Limited configuration of database fields by states.

# Option 4 Capability Score: 202



Positive factors influencing capability score:

- Data standards, and security scored favorably due to EPA managing hosting.
- Leveraging federal resources to develop helps to alleviate concerns with primacy agency resource / IT constraints.
- Reporting is positively impacted due to continued use of a SQL database. This provides a higher level of familiarity and potential for less configuration required to modify existing tooling.

Negative factors influencing capability score:

- Migrating database to PostgreSQL requires high level of configuration.
- Resource constraints in PostgreSQL knowledge.
- Scoring negatively affected in the areas of data quality, workflow tailoring, state control of user administration as it would encounter limits in configurability to meet all Primacy agency unique needs.
- Enforcement case management capabilities require high-level of configuration / custom development compared to a low-code solution.

# Option 4 High Costs (All Primacy Agencies)



Task	Year 1	Year 2	Year 3
Development - UI, BRE, Database	\$3,197,250	n/a	n/a
Hosting	\$30,374	\$54,683	\$233,626
O&M – EPA	n/a	\$352,800	\$352,800
O&M – Aggregate of 67 primacy agencies based on \$137,200 per agency.	n/a	\$9,192,400	\$9,192,400
<b>Total</b>	<b>\$3,227,624</b>	<b>\$9,599,883</b>	<b>\$9,778,826</b>



## Option 5: Commercial-off-the-shelf (COTS)

- Generally cloud-based
- Have APIs for data access
- Excellent reporting capabilities
- Score well on data quality and notifications
- Not designed for regulators
  - No enforcement tracking mechanism
  - May need to extensive customization to meet unique regulatory needs
- May not meet Federal or state security requirements out of the box.

# Option 5A: WaterTrax



- Database retains historical data for samples.
- Data can be imported to the database if it follows the WaterTrax electronic data format.
- Data can be loaded into the database from the WaterTrax mobile app (smartphone or tablet).
- The mobile WaterTrax app features real-time alerts.
- Alerts are generated from defined alerting criteria and sent by email.
- Reports and graphs are customizable and can be exported to PDF or Excel.
- WaterTrax has region-specific regulatory report templates available.
- WaterTrax is in use by another federal agency, the U.S. Geological Survey (USGS).
- External data exchange handled by REST APIs

# Option 5B: Locus



- Leverage water quality data from multiple data sources, including SCADA
- Plan and schedule sampling and configure notifications for late or missing samples or exceedances or pre-defined limits
- Streamline Consumer Confidence Reports (CCR) and routine chlorine and coliform reporting
- Use query and visualization tools to quickly view key environmental data
- Use integrated mobile app to eliminate paper forms

# Capabilities Score Comparisons

	<b>Option 1 Central EPA Host</b>	<b>Option 2 Joint Host</b>	<b>Option 3 Primacy Host</b>	<b>Option 4 Modified Prime</b>	<b>Option 5A WaterTrax</b>	<b>Option 5B Locus</b>
<b>Capability Score</b>	234	243	200	202	214	204
<b>Tier 4 (Top 40%)</b>	132	148	120	116	124	116
<b>Tier 3 (Middle - Upper 30%)</b>	72	69	54	63	66	66
<b>Tier 2 (Middle Lower 20%)</b>	24	20	20	18	18	16
<b>Tier 1 (Lower 10%)</b>	6	6	6	5	6	6

# Cost Comparisons



<b>Task</b>	<b>Low</b>	<b>Middle</b>	<b>High</b>
Option 1 - EPA Hosted	\$24,081,525	\$32,151,249	\$40,684,880
Option 2 - Hybrid	\$24,081,525	\$32,151,249	\$40,544,704
Option 3 - State Hosted	\$27,238,350	\$36,317,800	\$45,397,250
Option 4 - SDWIS Prime	\$23,486,175	\$31,357,449	\$39,692,630

# Common Features



- All options feature an API for data access
  - Interfacing applications can be configured for the new API
- Responsive browser-based application that supports computers, smartphones, and tablets
- Role-based access
- Export to multiple formats
- Data encryption at rest and in transit
- FedRAMP certified components

## Underlying Technologies

- The architecture is agnostic to the underlying technology stack
- GDIT recommends a document database, but conventional relational databases can be used
  - MongoDB, Couchbase, MarkLogic, Apache CouchDB (document database)
  - Oracle, PostgreSQL (RDBM)
- GDIT recommends a low-code UI development platform (Appian, Be Informed, K2, Medix, Zoho Creator)
- Business Rule Management (Drools, Fico Blaze Advisor, IBM WebSphere, TIBCO Business Events)
- GDIT recommends containerization (Docker)
- Feedback from forums is incorporated in the evaluation process



**QUESTIONS?**



## Next Steps

- Upcoming SDWIS Modernization Board Meetings
  - June 26 – Discussion on Final Alternatives Analysis Report
  - July 10 – State Board Members Preliminary Discussion on Recommendations to EPA
  - July 24 – Final State Board Member Recommendations to EPA
- Following State Board Member Recommendations to EPA
  - Potential for supplemental, rapid information gathering
  - EPA selection of option
  - Procurement of option support
  - Work with SDWIS Modernization Board on prep for option implementation



**QUESTIONS?**