

1 **Open Water Information Architecture**  
2 **System Requirements Document**  
3 **Version 2.0**

4 OWIA Technical Working Group

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# 1 Introduction

This document contains the functional and technical requirements for the *Open Water Information Architecture (OWIA)* and is called the *OWIA System Requirements Document (SRD)*. It has within it an [Appendix:B Standards and Conventions](#) that contains narrative explanations that are referred to within individual requirements where appropriate. This is done because the requirements are meant to be terse, declarative, testable statements that are not overloaded with narrative exposition. There are two companion documents to the SRD: (1) the subordinate document *OWIA Standard Operating Procedures (SOPs)* and the (2) parent document *California Council for Science and Technology (CCST) Stakeholder Use Case* document.

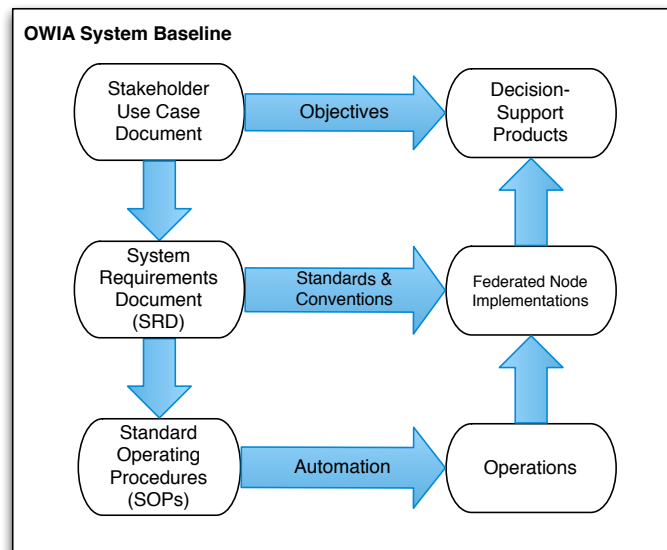
The SOPs are compliant with the requirements specified here yet written at a more detailed level of abstraction with examples of programming code or sometimes pseudo-code to exemplify the implementation details important to developers as well as precisely documenting the processing steps (i.e., [procedures](#)) used to operate on data. It is meant to be analogous to an *OWIA Programmer's Guide* and, as the OWIA implementation proceeds, there will be open-source code repositories with *minimal working examples (MWE)* for use in improvements and innovations to current procedures and applications implementing those procedures.

Each of these documents is intended for a technical audience although it is hoped that they are comprehensible to a motivated non-technical reader. There is a glossary in the back of the SRD to aid in navigating the technical language and as an effort to disambiguate some of the terms for which there may be competing and inconsistent definitions. In addition to these two, there is a third document that contains the stakeholder use cases used to develop the stakeholder objectives from each use case. These objectives are being used to define and constrain the requirements contained in the SRD and the procedures for satisfying them defined in the SOPs.

The SRD and SOPs are designed to provide a foundation for a community-based *OWIA* development of a [federated](#) set of cyberinfrastructure resources (i.e., computers, networks, data, metadata, and standards and conventions) that are interoperable and highly-automated to minimize labor as well as idiosyncratic anomalies. We therefore refer to them as the *baseline documents* (Figure 1). The objective of these baseline documents is to establish a framework for sustainable water resource management and to formalize that framework to a degree exemplified by other systems of standard methods such as those found in [7].

The federated nature of the OWIA extends to its (1) human governance structure as well as its (2) cyberinfrastructure (cf. Section 3 and Figure 3). Therefore we speak of the OWIA [federation](#) as including both these aspects and will differentiate the two parts contextually when using the term. The *open* aspect means open-access, open-source and open-architecture: encouraging innovation and automation while precluding the siloing and stove-piping that occurs when proprietary software and systems pose restrictive technology dependencies and requirements. The planning horizon is open-ended although intended to provide for a near-term operational system with an initial operating capability (IOC) within 1-2 years evolving to a final operating capability (FOC) over five (5) years that is operationally sustainable while responsive to technology innovation and risk minimization (i.e, cost, schedule, technical and operational) over its lifetime.

The approach is to follow standard system engineering practices [31] that: (1) define stakeholder ob-



**Figure 1:** Relationship between system baseline documents and operations.

185 jectives and, from these, (2) enumerate functional requirements in terms of functional components and  
186 major interfaces both of which are implementation-independent, and (3) enumerate technical requirements  
187 which specify fundamental technical features such as network transfer rates, storage capacities, reliability,  
188 maintainability and availability (RMA), interface dependencies and contingencies and similar quantitative  
189 or qualitative requirements at a level of specificity (or abstraction) that is more detailed than the functional  
190 requirements on which they are based. It is also designed to present an initial evaluation of some of the  
191 obvious design trade-studies to explicate and focus on the key risk areas related to technical, schedule, cost  
192 and operational risks.

193 This is an iterative and recursive, hierarchical design approach (Figure 2) which prioritizes *Stakeholder*  
194 *Objectives, Functional Requirements, and Technical Requirements* respectively and cross-correlates them to  
195 each other via a *traceability matrices* (Section 4) to ensure that there are no *widows or orphans* in the sense  
196 that there are no unsupported Objectives or Functional Requirements (i.e., widows) as well as no lower-  
197 level design features that are not specified in the Functional Requirements (i.e., orphans). As a development  
198 methodology, the system engineering method used here is sometimes contrasted with the agile development  
199 method. Every methodology has pros and cons and the reason we use this approach for the OWIA is because  
200 we already know a great deal about what is needed to improve access-to and reuse-of the collective set of  
201 water resource data and the OWIA focus is on the data content. This is not primarily a process of discovery  
202 and prototyping of software applications. For a broader discussion of the pros and cons of alternative  
203 software development approaches, the reader is encouraged to consider the discussions provided in [27] and  
204 [31].

205 Finally, some historical perspective is helpful. This document is meant to integrate the thinking on  
206 water resource information broadly and digital data about water resources specifically. The OWIA concept  
207 developed independently of the AB1755 legislation [1][29] that is currently, as of this writing, driving  
208 many efforts across the State of California to comply with its mandates and schedule. Fortuitously, the  
209 development of the OWIA and the activation of AB1755-related efforts overlap strongly such that AB1755  
210 requirements are a subset of the broader OWIA requirements. The implementation of the OWIA will satisfy  
211 the requirements of AB1755 and support the Sustainable Groundwater Management Act (SGMA) in such a  
212 way that we can treat AB1755 as an OWIA use-case as described in Appendix E. The OWIA concept is a  
213 reflection and integration of a wide range of on-going efforts especially those in the [UC WATER Security and](#)  
214 [Sustainability Research Initiative](#) and [CITRIS](#) [9], [California Council on Science and Technology \(CCST\)](#),  
215 the [Center for Western Weather and Water Extremes \(CW3E\)](#)[36], the [San Diego Supercomputer Center](#)  
216 [\(SDSC\)](#) [4, 16, 12, 18, 15, 39, 33, 14, 30, 5, 11, 34, 17, 6, 2, 13, 20] and the [UC Santa Barbara Bren](#)  
217 [School](#). We expect to grow this community to include private California universities, national laboratories  
218 and private sector partners as we go.

## 2 Project Management Approach

Figure 2 depicts the overall management approach used for this project and graphically summarizes it in the context of a *system engineering framework*. The system engineering framework is a set of methods and procedures for specifying design constraints to minimize the risk that a sought-after system implementation will successfully perform its intended functions. The output of this process is a system design and implementation that is *verifiably compliant with the functional and technical requirements* for the system and which can be *validated against the stakeholder objectives*.

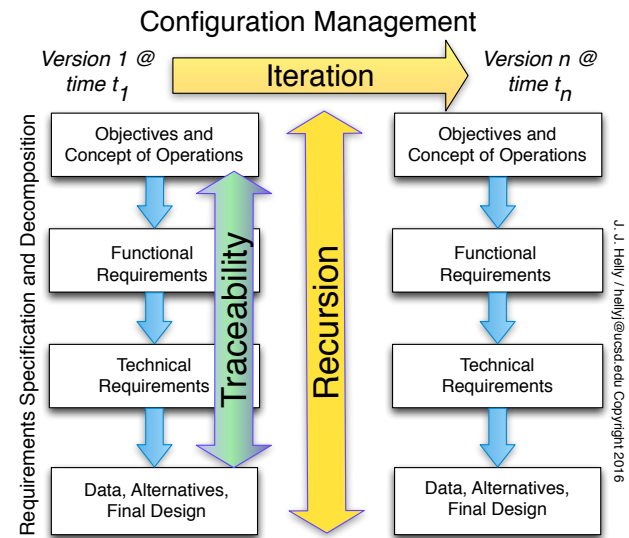
### 2.1 The Differences Between Objectives, Functional Requirements, Technical Requirements and Design Alternatives

In designing and building any type of system the first step is to describe *what it is that you want to accomplish by building the system*. These are the **objectives**. Sometimes these are called *stakeholder objectives*. They should be stated as simple declarative sentences focused on what the stakeholder wants the system to do. The language should be as non-technical as possible in order for the broadest understanding and consensus across the lay stakeholders who typically have diverse backgrounds and experience. On the other hand, the *functional requirements* are the translation of the objectives into engineering terms (i.e., functions using more precise technical language) describing how the objectives will be met. This is the first level of abstraction in specifying how the system will be implemented (Figure 2).

The articulation of objectives is often a stumbling block for stakeholders and developers alike because it poses a bit of chicken and egg or floor versus ceiling ambiguity. The way to get past this is focus on the description, often through workshops of stakeholders, of examples of usage without worrying very much whether something is an objective or a functional requirement. These can be re-factored by a *technical working group* once they are articulated. The most important thing is to articulate and document examples of how the system will be used. Once this process has an initial iteration, the system requirements document (SRD), can be maintained through configuration management of versions over time to provide accountability, via traceability tables, to the stakeholders as well as a path forward for developers and a contractually-applicable basis for acceptance testing for contract managers.

## 3 Concept of Operation

The OWIA system will be operated to produce standardized data of documented quality needed by stakeholders, as defined by the objectives, such as (1) figures, (2) tables, (3) statistics, and (4) analyses.



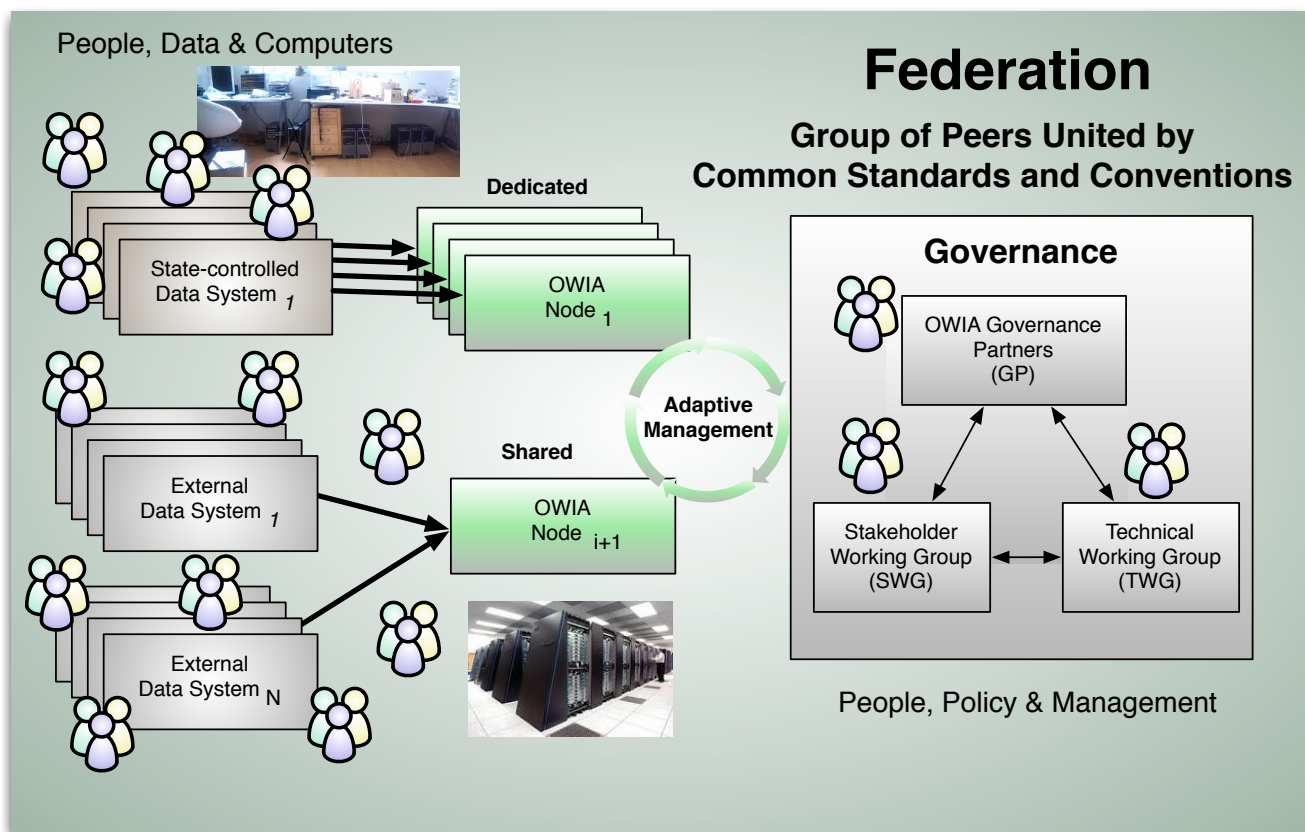
**Figure 2:** Conceptual representation of the system engineering process. *Reproduced from [19].*



### 258 3.1 Definition of the OWIA System

259 The *OWIA system* is a federated collection of data systems, cooperating through a shared governance pro-  
 260 cess, standards and conventions, standard interfaces (i.e., APIs, network protocols), and verifiable compli-  
 261 ance with requirements. The system structure supports adherence to open-data standards and principles  
 262 and guided by a set of functional requirements such as accessibility, interoperability, discoverability, and  
 263 traceability.

264 Open-data means that the data are free to use, re-use, and redistribute with no restrictions on their use  
 265 [41, 37]. A federated system does not require a central catalogue or a single interface to such a catalogue.  
 266 Rather, the federation permits the formation of one or more common catalogues (cf. Figure 4, Curated  
 267 Collections) as an implementation dependent on the requirement for standardized, published metadata.



**Figure 3:** Illustration of the OWIA federation concept with a triumvirate governance structure of partners (OWIA-GP) supported by interacting stakeholder working group (SWG) and the technical working group (TWG). The federation is comprised of dedicated OWIA system implementations to enable individual data providers to independently integrate the OWIA system into their existing methods and procedures within their operations. Shared OWIA system implementations provide the flexibility for the harvesting of non-compliant data sources into an OWIA system implementation that will support the OWIA federation without insisting that the producers be OWIA compliant.



## 268 3.2 Governance

269 The OWIA governance structure is modeled on that of the Internet Engineering Task Force (IETF) [24]. The  
270 IETF governance structure is modified to reflect the exigencies of the needs of California stakeholders and  
271 the mission agencies responsible for management leadership: the OWIA Governance Partners (OWIA-GP).

272 The OWIA-GP are responsible for the direction of the system, policy, prioritization and resourcing of  
273 work, and curation of the OWIA system baseline. This group cooperates with Stakeholder Working Group  
274 (SWG) and the Technical Working Group (TWG) to ensure that the OWIA federation.

### 275 3.2.1 Technical Working Group (TWG)

276 The *Technical Working Group (TWG)* is responsible for the identifying, adopting, approving data standards,  
277 data publication approaches, and controlling functional and technical requirements.

### 278 3.2.2 Stakeholder Working Group (SWG)

279 The *Stakeholder Working Group (SWG)* is responsible for informing the OWIA Governance Partners of the  
280 intended uses of the OWIA system, and providing iterative feedback on the effectiveness of the system to  
281 meet their requirements.

## 282 4 Functional Requirements

### 283 4.1 FR-100-100: Data Acquisition

284 Manual and automated methods shall be provided for data acquisition. Data at the acquisition stage of  
285 OWIA processing shall be referred to as *Level 0* data.

#### 286 4.1.1 FR-100-110: Manual

287 Manual data acquisition methods shall provide metadata conforming to the the OWIA minimum metadata  
288 standard.

#### 289 4.1.2 FR-100-120: Automated

290 Automated data acquisition methods shall provide metadata conforming to the OWIA minimum metadata  
291 standard.

### 292 4.2 FR-200-100: Quality Control

293 No data transformation shall require the use of proprietary software, methods or special-purpose computing  
294 platforms for data processing and transportation. Data that has received quality control processing according  
295 to OWIA standards and conventions shall be referred to as *Level 1* data.

#### 296 4.2.1 FR-200-110: Verification

297 Data verification shall be accomplished according to OWIA standards and conventions (cf. Appendix A).

298 **4.2.1.1 FR-200-120: Documentation** Documentation shall be provided according to OWIA standards  
299 and conventions (cf. Appendix A).

300 **4.2.1.2 FR-200-130: Reproducibility** All data products shall be verifiably reproducible by an anony-  
301 mous second-party from the input data, metadata and the processing methods used to produce the data  
302 product.

303 **4.2.1.3 FR-200-140: Data Traceability** All data products shall be traceable to their parent data sources  
304 to the extent that a data product composed of multiple input data sources shall be decomposable and traceable  
305 to its parents.

## 306 **4.2.2 FR-200-150: Standardization**

307 All data products shall conform to the OWIA standards and conventions (cf. Appendix A).

308 **4.2.2.1 FR-200-160: Metadata Conventions** Metadata shall be provided according to OWIA standards  
309 and conventions (cf. Appendix A).

310 **4.2.2.2 FR-200-160: File-naming Conventions** File-name shall be performed according to OWIA stan-  
311 dards and conventions (cf. Appendix A).

## 312 **4.2.3 FR-200-170: Interoperable Transformation**

313 All data transformations shall be achievable with open-source, non-proprietary software, non-proprietary  
314 data formats and commodity computers.

315 **4.2.3.1 FR-200-180: Separation of Data and Computation** Data and computation shall be separated  
316 between data files and stored procedures.

317 **4.2.3.2 FR-200-190: Data Interoperability** All data products shall be interoperable across OWIA-  
318 supported computing platforms and be able to be operated on using non-proprietary, open-source software  
319 and commodity computers and communications systems to operate on them or transport them.

320 **4.2.3.3 FR-200-200: Products or Resources** Data products shall be developed in accordance with the  
321 objectives as per section ??.

## 322 **4.3 FR-300-100: Publication**

323 Data shall be published according to OWIA standards and conventions (cf. Appendix A).

### 324 **4.3.1 FR-300-110: Cross-Referencing-Service**

325 Data objects shall be registered with a cross-referencing service.

326 **4.3.1.1 FR-300-120: Assignment of Digital Object Identifiers** A digital object identifier (DOI) shall  
327 be acquired for each Level 1 digital object according to the OWIA standards and conventions (cf. Appendix  
328 A).

### 329 **4.3.2 FR-300-130: Packaging**

330 Packaging shall conform to OWIA standards and conventions (cf. Appendix A).

331 **4.3.2.1 FR-300-140: Compression Methods** Compression methods shall be non-lossy and conform to  
332 OWIA standards and conventions (cf. Appendix A).

333 **4.3.2.2 FR-300-150: Archive File Formatting** Archive file formats shall be only those conforming with  
334 OWIA standards and conventions.

### 335 **4.3.3 FR-300-160: Archival**

336 Data shall be archived in trusted data archives with external interfaces to provide for data access and trans-  
337 portation to end-users and applications.

338 **4.3.3.1 FR-300-170: Open Access Distribution** All data products shall be accessible using OWIA stan-  
339 dard protocols or transportable external media where network transport is impossible or impractical.

## 340 **4.4 FR-400-100: Data Traceability**

341 Data traceability shall be provided according to OWIA standards and conventions (cf. Appendix A).

### 342 **4.4.1 FR-400-110: Metadata Production**

343 All data products shall have metadata provided with them sufficient to meet the OWIA minimum metadata  
344 standard.

### 345 **4.4.2 FR-400-120: Intellectual Property Rights Management**

346 Metadata shall be produced according to the OWIA standards and conventions (cf. Appendix A).

### 347 **4.4.3 FR-400-130: Public Law Compliance**

348 All data and metadata products shall comply with relevant public law requirements.

### 349 **4.4.4 FR-400-140: Licensing**

350 Licensing of data and metadata shall conform to OWIA standards and conventions (cf. Appendix A).

### 351 **4.4.5 FR-400-150: Liability**

352 Liability limitations shall be declared with each data object through the metadata in conformance with  
353 OWIA standards and conventions (cf. Appendix A).

### 354 **4.4.6 FR-400-160: Searching**

355 Minimal metadata shall be provided to meet OWIA standards and conventions for search and discovery.

356 **4.4.6.1 FR-400-170: Cross-referencing System Integration** Cross-referencing system integration shall  
357 be based on a digital objects DOI.

358 **4.4.6.2 FR-400-180: Search Engine Optimization** Search-engine optimization shall be based on the  
359 metadata associated with the DOI as a minimum.

#### 360 **4.4.7 FR-400-190: Version Control**

361 Source code, data and metadata shall be version-controlled in conformance with OWIA standards and con-  
362 ventions (cf. Appendix A).

363 **4.4.7.1 FR-400-200: Binary Data** A version control method shall be provided for binary data products  
364 in accordance with OWIA standards and conventions (cf. Appendix A).

365 **4.4.7.2 FR-400-210: Non-Binary Data** A version control method shall be provided for non-binary data  
366 products in accordance with OWIA standards and conventions.

#### 367 **4.4.8 FR-400-220: Anomaly Reporting**

368 There shall be a method for reporting of anomalies detected in the data products and there shall be a method  
369 of tracking the anomalies for resolution and notification of those that have obtained the anomalous data  
370 products that an anomaly has been reported and a method for determining the resolution of the anomaly.

### 371 **4.5 FR-500-100: System Portability**

372 System portability shall be provided such that any implementation of the OWIA system is portable to other  
373 platforms in conformance with OWIA standards and conventions (cf. Appendix A).

#### 374 **4.5.1 FR-500-110: Backup and Restore**

375 Backup and restore capability shall be provided using interoperable procedures and systems according to  
376 OWIA standards and conventions (cf. Appendix A).

#### 377 **4.5.2 FR-500-120: Platform Portability**

378 Platform portability shall be provided in conformance with OWIA standards and conventions (cf. Appendix  
379 A).

### 380 **4.6 FR-600-100: External Interfaces**

381 External interfaces shall be provided for data acquisition and open-access to data products.

#### 382 **4.6.1 FR-600-110: Data and Metadata Acquisition**

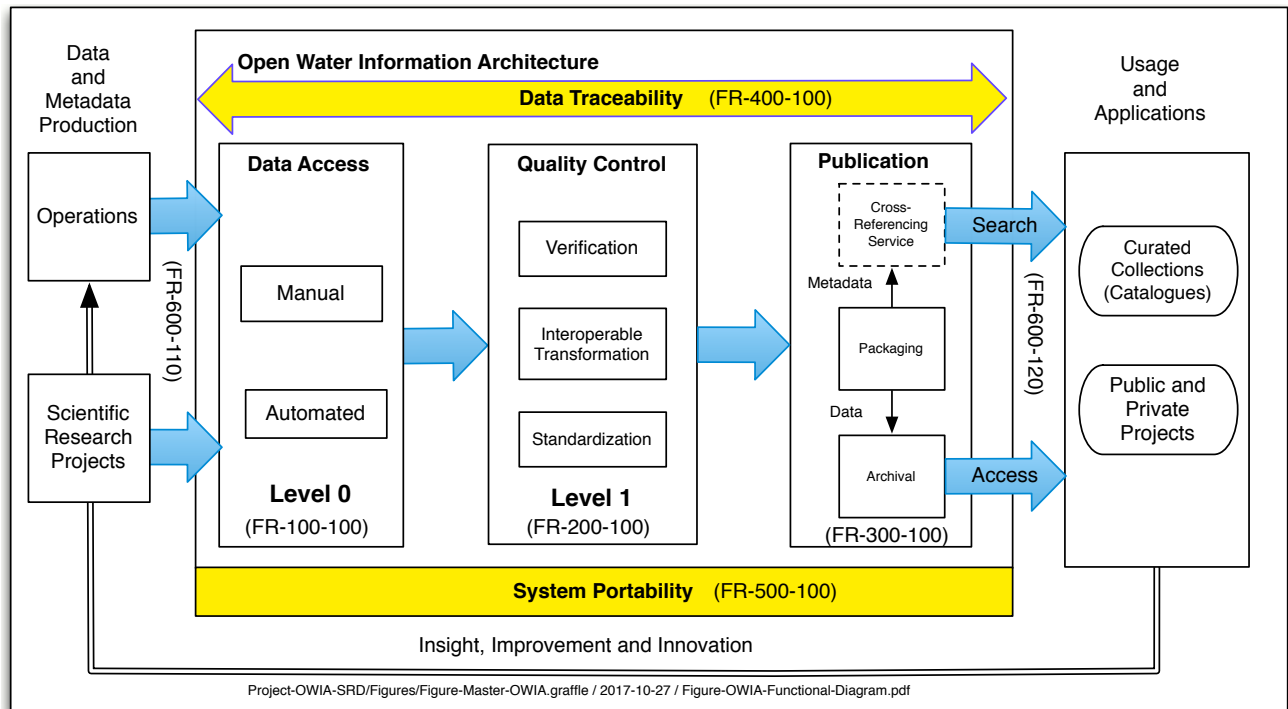
383 External interfaces shall be provided supporting the data sources in Appendix ??.

#### 384 **4.6.2 FR-600-120: Data and Metadata Distribution**

385 External interfaces to end-users and applications shall be provided supporting those listed in ??.

## 386 **5 Technical Requirements**

387 The technical requirements are subordinate and traceable to the functional requirements above and have a  
388 higher-level of engineering detail and more precise, more technical language. This is the first level suffi-  
389 ciently specific to require decision-making about engineering trade-offs and what types of hardware, soft-  
390 ware and data representations qualify to be included in an OWIA-node.



**Figure 4:** OWIA system (cf. section 3.1) functional block diagram. Parenthetical references point to the governing functional requirements.

**Table 1:** Definition of OWIA classes of datasets.

Dataset Class	Provenance	Transformation	Quality Control	Metadata	Published
Level 0	cf. Table 2	N/A	N/A	N/A	N/A
Level 1	Traceable to Level 0 parent	Interoperable	SOPs	Listing 1	DOI, Archived
Level 2	Traceable to multiple Level 1 parents (composite, decomposable)	Interoperable	SOPs	Listing 1	DOI, Archived

## 391 **5.1 TR-100-100-00100: Data Acquisition Methods**

### 392 **5.1.1 TR-200-200-00100: Data Transformation Methods**

393 All data transformations shall be accomplished with open-source, non-proprietary software and commodity  
394 computers for data processing and transportation.

### 395 **5.1.2 TR-200-300-00100: Programming Languages**

396 Data processing shall be realized through the use of stored procedures written in the [GNU programming](#)  
397 [languages](#).

### 398 **5.1.3 TR-200-400-00100: Data Interoperability**

399 All data products shall be interoperable across OWIA-supported computing platforms and be able to be  
400 operated on using non-proprietary, open-source software and commodity computers and communications  
401 systems to operate on them or transport them.

### 402 **5.1.4 TR-200-500-00100: Products (List Derived Products traceable to Objectives)**

### 403 **5.1.5 TR-300-100-00100: Data Traceability**

404 All data products shall be traceable to their parent data sources to the extent that a data product composed  
405 of multiple input data sources shall be decomposable and traceable to its parents.

### 406 **5.1.6 TR-300-100-00200: Reproducibility of Data Products**

407 All data products shall be verifiably reproducible by an anonymous second-party from the input data and  
408 the method used to produce the data product.

## 409 **5.2 TR-400-100-00100: Standardization**

### 410 **5.2.1 TR-400-100-00200: Metadata**

411 All data products shall have metadata provided with them sufficient to meet the OWIA minimum metadata  
412 standard.

413 **5.2.1.1 TR-400-100-00300: Resolution of Metadata conflicts** All conflicts in metadata standards and  
414 conventions shall be subject to the determination of the TWG.

415 **5.2.1.2 TR-400-100-00400: Controlled Vocabulary** All metadata shall be populated with controlled  
416 vocabulary drawn from the following standards.:

417 **5.2.1.3 TR-400-100-00500: Climate and Forecasting Conventions** [Climate and Forecasting conven-](#)  
418 [tions](#) shall be used when suitable.

419 **5.2.1.4 TR-400-100-00600: Federal Geographic Data Committee (FGDC) Geospatial Metadata Stan-**  
420 **ards And Guidelines** [FGDC](#) standards and guidelines shall be used when suitable.

421 **5.2.1.5 TR-400-100-00700: Open-Geospatial Consortium Standards and Guidelines** [Open-Geospatial](#)  
422 [Consortium](#) standards and guidelines shall be used when suitable.

423 **5.2.2 TR-400-100-00800: Mapping Standards**

424 **5.2.3 TR-400-100-00900: Numerical Accuracy and Precision Standards**

425 **5.2.4 TR-400-100-01000: Measures of Uncertainty**

426 **5.2.5 TR-400-100-01100: File Naming Convention**

427 **5.3 TR-600-100-00100: Data Publication**

428 **5.3.1 TR-600-100-00200: Methods**

429 **5.3.1.1 TR-600-100-00300: Assignment of Digital Object Identifiers**

430 **5.3.2 TR-600-100-00400: Metadata Production**

431 **5.3.3 TR-600-100-00500: Open Access Distribution**

432 **5.3.4 TR-600-100-00600: Intellectual Property Rights Management**

433 All data products shall be accessible using OWIA standard protocols or transportable external media where  
434 network transport is impossible or impractical.

435 **5.3.4.1 TR-600-100-00700: Public Law Compliance**

436 **5.3.4.2 TR-600-100-00800: Licensing**

437 **5.3.5 TR-600-100-00900: Discovery**

438 **5.3.5.1 TR-600-100-01000: Cross-referencing System Integration**

439 **5.3.5.2 TR-600-100-01100: Search Engine Optimization**

440 **5.3.6 TR-600-100-01200: Packaging**

441 **5.3.6.1 TR-600-100-01300: Compression Methods**

442 **5.3.6.2 TR-600-100-01400: Archive File Formatting**

443 **5.3.7 TR-600-100-01500: Version Control**

444 **5.3.7.1 TR-600-100-01600: Binary Data**

445 **5.3.7.2 TR-600-100-01700: Non-Binary Data**

446 **5.3.8 TR-600-100-01800: Anomaly Reporting**

447 **5.4 TR-600-100-00100: System Interoperability**

448 **5.4.1 TR-600-100-00200: Backup and Restore**

449 **5.4.2 TR-600-100-00300: Platform Portability**



## 450 **Appendix A Standards and Conventions**

451 This document narrative descriptions of the standards and conventions referred to in the functional and  
452 technical requirements. The [Internet Engineering Task Force](#) is used as a reference and as the default for  
453 standards and conventions that are not otherwise superseded by those identified here. For the subset of  
454 standards and conventions that pertain only to web-related services and interfaces, we refer to the [World-  
455 Wide Web Consortium \(W3C\)](#) unless explicitly superseded in this Appendix.

### 456 **A.1 Operating Systems (OS)**

457 All conventional operating systems may be employed. If there is an exceptional consideration or doubt  
458 about a particular OS or version, it should be submitted as a review item for explicit consideration by the  
459 TWG.

### 460 **A.2 Metadata Schema**

461 There are many important metadata standards that bear consideration. Examples include:

- 462 1. Ecological Metadata Language ([22], [30]),
- 463 2. Open Geospatial Metadata
- 464 3. FGDC

465 For that reason, the metadata schema recommended here is referred to as a multilateral metadata convention  
466 that supports the production of arbitrary metadata files to support compliance with the current and future  
467 complement of metadata interfaces: it is designed to be independent of any particular standard but compati-  
468 ble with most.

469 The metadata schema in Appendix B, Listing 1 is the default schema. It may be augmented. It is  
470 intended to be the basis of all metadata interoperability schemas derived from it for integration purposes  
471 as required to integrate with other systems and catalogues. This metadata schema is dependent on the  
472 controlled vocabulary standard described in section A.3.

### 473 **A.3 Controlled Vocabulary**

474 Controlled vocabulary is referenced to existing community standards where they exist. The OWIA will  
475 conform to the community standards listed here and these will be superseded by the OWIA Controlled  
476 Vocabulary when there is a conflict.

- 477 (1) [CF Conventions and Metadata: Standard Names](#),
- 478 (2) [World Meteorological Organization Practices](#),
- 479 (3) [Open Geospatial Consortium WaterML 2.0](#),
- 480 (4) OWIA Standard Names (TBD).

### 481 **A.4 Georeferencing**

482 Most data within the OWIA federation will require georeferencing. The default reference for definitions of  
483 map projections, use of datums and related geospatial standards and conventions will be [38]. Snyder and  
484 EPSG, PROJ.4, GDAL.

### 485 **A.5 Intellectual Property Rights**

486 Data published by the OWIA federation is governed by at least one of the following licensing mechanisms:

- 487 (1) GNU Public License

488 (2) Creative Commons

## 489 **A.6 Trusted Archives**

490 Trusted archives are digital object repositories where data published within the OWIA community can be  
491 reliably found. These may not be the only locations but they are considered to be the primary authoritative  
492 sources of copies of digital objects. The criteria used to determine trusted archive status are those of the

493 (1) [USGS Acceptable Digital Repositories for USGS Scientific Publications and Data](#),

494 (2) [CoreTrustSeal](#),

495 (3) [DIN 31644 Information and documentation - Criteria for trustworthy digital archives](#), and

496 (4) [ISO 16363:2012 Space data and information transfer systems - Audit and certification of trustworthy  
497 digital repositories](#).

498 OWIA trusted archives include:

499 (1) University of California (in discussion),

500 (2) California Department of Water Resources (TBD).

## 501 **A.7 Digital Objects**

502 Digital objects are anything that can be stored and retrieved from within the file system of an operating  
503 system. Streaming data presented to a display device are not considered to be digital objects since the data  
504 contained in the stream is not stored and cannot be directly used in reproducible analyses or unambiguously  
505 referred to or re-used. A suggested approach to employing data of this type is to checkpoint the stream into  
506 a file which can be used as a stored digital object.

## 507 **A.8 File Formats and Data Encodings**

508 Recommended file formats and data encodings are summarized in Table 2. The default standard for character  
509 encodings is UTF-8 [25] with extended ASCII as a secondary alternative.

**Table 2:** Classification of file formats, content and related interoperability features. References are supplied in brackets and listed in the bibliography.

OWIA Class	File Type	Structure	Encoding	Georeferencing	Controlled Vocabulary	Interoperability Tools	
<b>Level 1</b>	Comma-separated Values (*.csv)	Record-oriented, Scalar (Integer, Float), Text	ASCII, UTF-8	EPSG [21], DAU-County, HUC10/12 [44]	OWIA, CF [3]	Any	
	Spread-sheet (*.ods [43])	Record-oriented, Scalar (Integer, Float), Text	ASCII, UTF-8	EPSG	OWIA, CF	Any	
	Geospatial (GDAL-supported)	Raster		Binary	EPSG	OWIA, CF	GDAL
		Vector		Any	EPSG	OWIA, CF	GDAL [8], ogr2ogr, QGIS [35], GRASS [10], GMT [45]
	NetCDF [42]	Multi-dimensional, self-documenting		Binary	EPSG [21], DAU-County, HUC10/12	OWIA, CF	NetCDF API, NCL, NCO [46], GMT
Text-processing	Rich Text Format (rtf), free-text		Binary	N/A	OWIA, CF	OpenOffice, LibreOffice, rtf2latex, rtf2html	
	TeX [40]		ASCII, UTF-8, human-readable	N/A	OWIA, CF	latex2rtf, latex2html, tex4ht	
<b>Level 0</b>	Microsoft Excel Spreadsheets (*.xlsx, *.xls)	Cell, Worksheet	Binary	No	No	OpenOffice [32], LibreOffice [28]	
	Microsoft Word Documents (*.docx, *.doc)	Free-text	Binary	No	No	OpenOffice, LibreOffice	
	DBMS Export	Human-readable	ASCII, UTF-8 (*.txt)	No	No	None	
	ESRI Geodatabase	Proprietary	Binary	No	No	QGIS (GDAL-enabled)	
	NetCDF	Multi-dimensional, self-documenting		Binary	Any	Any	NetCDF API, NCL, NCO, GMT
<b>Inadmissible DBMS</b>		Database Structure and Schema	Any	Any	Any	None	
	Proprietary w/o Interoperability Tools	Proprietary	Any	Any	Any	None	

510 **A.9 Cross-referencing Services**

511 Cross-referencing services are used to support global searching for digital objects published using the OWIA  
512 standards and conventions. The default system is the University of California's [EZID](#) service.

513 **A.10 Commercial Search Services**

514 Commercial search services using the WWW are typified by Google.

515 **Appendix B Metadata Schema****Listing 1: The current metadata schema.**

```

516 # #####
517 # Canonical Collection
518 # #####
519 OWIA_CanonicalCollection_ArchivistEmail,"VARCHAR(50000)","Required","1","OWIA","Manager Email"
520 OWIA_CanonicalCollection_ArchivistInstitution,"VARCHAR(50000)","Required","1","OWIA","Manager Institution"
521 OWIA_CanonicalCollection_ArchivistName,"VARCHAR(50000)","Required","1","OWIA","Manager Name"
522 OWIA_CanonicalCollection_ArchivistPhone,"VARCHAR(50000)","Required","1","OWIA","Manager Phone"
523 OWIA_CanonicalCollection_CollectionIdentifier,"VARCHAR(50000)","Required","1","OWIA","Collection Identifier"
524 OWIA_CanonicalCollection_ControlledVocabulary,"VARCHAR(50000)","Required","1","OWIA","Controlled Vocabulary"
525 OWIA_CanonicalCollection_Creator,"VARCHAR(50000)","Required","1","OWIA","Creator of collection"
526 OWIA_CanonicalCollection_Description,"VARCHAR(50000)","Required","1","OWIA","Thorough Description of collection"
527 OWIA_CanonicalCollection_Language,"VARCHAR(50000)","Required","1","OWIA","Language"
528 OWIA_CanonicalCollection_MTFVersion,"VARCHAR(50000)","Required","1","OWIA","MTFVersion"
529 OWIA_CanonicalCollection_Ontology,"VARCHAR(50000)","Required","1","OWIA","Ontology"
530 OWIA_CanonicalCollection_Publisher,"VARCHAR(50000)","Required","1","OWIA","Publisher of collection"
531 OWIA_CanonicalCollection_Subject,"VARCHAR(50000)","Required","1","OWIA","General Subject area of collection"
532 OWIA_CanonicalCollection_Title,"VARCHAR(50000)","Required","1","OWIA","Specific Title of collection"
533 # #####
534 # Canonical ADO
535 # #####
536 OWIA_CanonicalADO_ADOIdentifier,"VARCHAR(50000)","Required","1","OWIA","ADO Identifier"
537 OWIA_CanonicalADO_ADOVersion,"VARCHAR(50000)","Required","1","OWIA","ADO Version"
538 OWIA_CanonicalADO_AccessControl,"VARCHAR(50000)","Required","1","OWIA","Access Control for this object"
539 OWIA_CanonicalADO_Author,"VARCHAR(50000)","Required","1","OWIA","Author"
540 OWIA_CanonicalADO_BlockTypes,"VARCHAR(50000)","Required","1","OWIA","Major data block types"
541 OWIA_CanonicalADO_Children,"VARCHAR(50000)","Required","1","OWIA","Children"
542 OWIA_CanonicalADO_CollectionIdentifier,"VARCHAR(50000)","Required","1","OWIA","Collection Identifier"
543 OWIA_CanonicalADO_ContentFileNames,"VARCHAR(50000)","Required","1","OWIA","Content FileNames"
544 OWIA_CanonicalADO_Contributor,"VARCHAR(50000)","Required","1","OWIA","Contributor of this upload"
545 OWIA_CanonicalADO_ControlledVocabulary,"VARCHAR(50000)","Required","1","OWIA","Controlled Vocabulary"
546 OWIA_CanonicalADO_Coverage,"VARCHAR(50000)","Required","1","OWIA","Coverage min max lat lon"
547 OWIA_CanonicalADO_Creator,"VARCHAR(50000)","Required","1","OWIA","Original creator of object"
548 OWIA_CanonicalADO_DOI,"VARCHAR(50000)","Required","1","OWIA","Digital Object Identifier"
549 OWIA_CanonicalADO_Date,"DATE","Required","1","OWIA","Date of publication into collection"
550 OWIA_CanonicalADO_Description,"VARCHAR(50000)","Required","1","OWIA","Description including importance"
551 OWIA_CanonicalADO_ExpertLevel,"VARCHAR(50000)","Required","1","OWIA","Expert Level"
552 OWIA_CanonicalADO_Filesize,"NUMERIC","Required","1","OWIA","Filesize"
553 OWIA_CanonicalADO_Format,"VARCHAR(50000)","Required","1","OWIA","Format MIME type"
554 OWIA_CanonicalADO_Keywords,"VARCHAR(50000)","Required","1","OWIA","Keywords"
555 OWIA_CanonicalADO_Language,"VARCHAR(50000)","Required","1","OWIA","Language"
556 OWIA_CanonicalADO_LatitudeEnd,"REAL","Required","1","OWIA","Latitude End"
557 OWIA_CanonicalADO_LatitudeNorth,"REAL","Required","1","OWIA","Latitude Northernmost"
558 OWIA_CanonicalADO_LatitudeSouth,"REAL","Required","1","OWIA","Latitude Southernmost"
559 OWIA_CanonicalADO_LatitudeStart,"REAL","Required","1","OWIA","Latitude at Start of object"
560 OWIA_CanonicalADO_LongitudeEast,"REAL","Required","1","OWIA","Longitude Easternmost"
561 OWIA_CanonicalADO_LongitudeEnd,"REAL","Required","1","OWIA","Longitude at End of object"
562 OWIA_CanonicalADO_LongitudeStart,"REAL","Required","1","OWIA","Longitude at Start of object"
563 OWIA_CanonicalADO_LongitudeWest,"REAL","Required","1","OWIA","Longitude Westernmost"
564 OWIA_CanonicalADO_MD5SUM,"VARCHAR(50000)","Required","1","OWIA","Verifier (md5sum)"
565 OWIA_CanonicalADO_MIFVersion,"VARCHAR(50000)","Required","1","OWIA","Meta Data Content Version"
566 OWIA_CanonicalADO_MTFVersion,"VARCHAR(50000)","Required","1","OWIA","Meta Data Template File Version"
567 OWIA_CanonicalADO_Ontology,"VARCHAR(50000)","Required","1","OWIA","Ontology"
568 OWIA_CanonicalADO_Parent,"VARCHAR(50000)","Required","1","OWIA","Parent"
569 OWIA_CanonicalADO_PhysicalStorageLocation,"VARCHAR(50000)","Required","1","OWIA","Physical storage location"
570 OWIA_CanonicalADO_Publisher,"VARCHAR(50000)","Required","1","OWIA","Publisher"
571 OWIA_CanonicalADO_Relation,"VARCHAR(50000)","Required","1","OWIA","Relation"
572 OWIA_CanonicalADO_Rights,"VARCHAR(50000)","Required","1","OWIA","Link to rights statement"
573 OWIA_CanonicalADO_Siblings,"VARCHAR(50000)","Required","1","OWIA","Siblings"
574 OWIA_CanonicalADO_Source,"VARCHAR(50000)","Required","1","OWIA","Source of object for Dublin Core"
575 OWIA_CanonicalADO_SourceFileName,"VARCHAR(50000)","Required","1","OWIA","Source File Name"
576 OWIA_CanonicalADO_Subject,"VARCHAR(50000)","Required","1","OWIA","Subject area of object"
577 OWIA_CanonicalADO_TimeEnd,"DATE","Required","1","OWIA","End Date Time of object"
578 OWIA_CanonicalADO_TimeStart,"DATE","Required","1","OWIA","Start Date Time of object"

```

```
579 OWIA_CanonicalADO_Title,"VARCHAR(50000)","Required","1","OWIA","Title to identify object in specific detail"
580 OWIA_CanonicalADO_Type,"VARCHAR(50000)","Required","1","OWIA","Type of Dublin Core resource"
581 OWIA_CanonicalADO_URL,"VARCHAR(50000)","Required","1","OWIA","Universal Resource Locator"
582 # #####
583 # Documentation
584 # #####
585 OWIA_Documentation_MTFVersion,"VARCHAR(50000)","Required","1","OWIA","MTFVersion"
586 OWIA_Documentation_ADOIdentifier,"VARCHAR(50000)","Required","1","OWIA","ADOIdentifier"
587 OWIA_Documentation_ControlledVocabulary,"VARCHAR(50000)","Required","1","OWIA","ControlledVocabulary"
588 OWIA_Documentation_Ontology,"VARCHAR(50000)","Required","1","OWIA","Ontology"
589 OWIA_Documentation_Description,"VARCHAR(50000)","Arbitrary","1","OWIA","Document Description or Title"
590 OWIA_Documentation_Format,"VARCHAR(50000)","Arbitrary","1","OWIA","Format"
591 OWIA_Documentation_ObjectType,"VARCHAR(50000)","Required","1","OWIA","Data Object Type"
592 OWIA_Documentation_Type,"VARCHAR(50000)","Arbitrary","1","OWIA","Document Type"
593 # #####
594 # Products
595 # #####
596 OWIA_Products_MTFVersion,"VARCHAR(50000)","Required","1","OWIA","MTFVersion"
597 OWIA_Products_ADOIdentifier,"VARCHAR(50000)","Required","1","OWIA","ADOIdentifier"
598 OWIA_Products_ControlledVocabulary,"VARCHAR(50000)","Required","1","OWIA","ControlledVocabulary"
599 OWIA_Products_Ontology,"VARCHAR(50000)","Required","1","OWIA","Ontology"
600 OWIA_Products_Description,"VARCHAR(50000)","Arbitrary","1","OWIA","Data Product Description"
601 OWIA_Products_Format,"VARCHAR(50000)","Arbitrary","1","OWIA","Format"
602 OWIA_Products_Method,"VARCHAR(50000)","Arbitrary","1","OWIA","Data Production Method"
603 OWIA_Products_ObjectType,"VARCHAR(50000)","Required","1","OWIA","Data Object Type"
604 OWIA_Products_Type,"VARCHAR(50000)","Arbitrary","1","OWIA","Data Product Type"
605 # #####
606 # CKAN per Greg Smith 2017-11-01
607 # #####
608 OWIA_CKAN_MTFVersion,"VARCHAR(50000)","Required","1","OWIA","MTFVersion"
609 OWIA_CKAN_ADOIdentifier,"VARCHAR(50000)","Required","1","OWIA","ADOIdentifier"
610 OWIA_CKAN_ControlledVocabulary,"VARCHAR(50000)","Required","1","OWIA","ControlledVocabulary"
611 OWIA_CKAN_Ontology,"VARCHAR(50000)","Required","1","OWIA","Ontology"
612 OWIA_CKAN_Description,"VARCHAR(50000)","Arbitrary","1","OWIA","Data Product Description"
613 OWIA_CKAN_Format,"VARCHAR(50000)","Arbitrary","1","OWIA","Format"
614 OWIA_CKAN_Method,"VARCHAR(50000)","Arbitrary","1","OWIA","Data Production Method"
615 OWIA_CKAN_ObjectType,"VARCHAR(50000)","Required","1","OWIA","Data Object Type"
616 OWIA_CKAN_Type,"VARCHAR(50000)","Arbitrary","1","OWIA","Data Product Type"
617 OWIA_CKAN_title,"VARCHAR(50000)","Required","OWIA","Title"
618 OWIA_CKAN_description,"VARCHAR(50000)","Required","OWIA","Description"
619 OWIA_CKAN_keyword,"VARCHAR(50000)","Required","OWIA","Tags"
620 OWIA_CKAN_modified,"VARCHAR(50000)","Required","OWIA","Last Update"
621 OWIA_CKAN_publisher,"VARCHAR(50000)","Required","OWIA","Publisher"
622 OWIA_CKAN_contactPoint,"VARCHAR(50000)","Required","OWIA","Contact Name and Email"
623 OWIA_CKAN_identifier,"VARCHAR(50000)","NA","OWIA","Unique Identifier"
624 OWIA_CKAN_accessLevel,"VARCHAR(50000)","Required","OWIA","Public Access Level"
625 OWIA_CKAN_bureauCodeUSG,"VARCHAR(50000)","NA","OWIA","Bureau Code"
626 OWIA_CKAN_programCodeUSG,"VARCHAR(50000)","NA","OWIA","Program Code"
627 OWIA_CKAN_license,"VARCHAR(50000)","NA","OWIA","License"
628 OWIA_CKAN_rights,"VARCHAR(50000)","NA","OWIA","Rights"
629 OWIA_CKAN_spatial,"VARCHAR(50000)","Required","OWIA","Spatial"
630 OWIA_CKAN_temporal,"VARCHAR(50000)","Required","OWIA","Temporal"
631 OWIA_CKAN_distribution,"VARCHAR(50000)","NA","OWIA","Distribution"
632 OWIA_CKAN_@type,"VARCHAR(50000)","NA","OWIA","Metadata Type"
633 OWIA_CKAN_accrualPeriodicity,"VARCHAR(50000)","NA","OWIA","Frequency"
634 OWIA_CKAN_conformsTo,"VARCHAR(50000)","NA","OWIA","Data Standard"
635 OWIA_CKAN_dataQualityUSG,"VARCHAR(50000)","NA","OWIA","Data Quality"
636 OWIA_CKAN_describedBy,"VARCHAR(50000)","NA","OWIA","Data Dictionary"
637 OWIA_CKAN_describedByType,"VARCHAR(50000)","NA","OWIA","Data Dictionary Type"
638 OWIA_CKAN_isPartOf,"VARCHAR(50000)","NA","OWIA","Collection"
639 OWIA_CKAN_issued,"VARCHAR(50000)","NA","OWIA","Release Date"
640 OWIA_CKAN_language,"VARCHAR(50000)","NA","OWIA","Language"
641 OWIA_CKAN_landingPage,"VARCHAR(50000)","NA","OWIA","Homepage URL"
642 OWIA_CKAN_primaryITInvestmentUIIUSG,"VARCHAR(50000)","NA","OWIA","Primary IT Investment UII"
643 OWIA_CKAN_references,"VARCHAR(50000)","NA","OWIA","Related Documents"
644 OWIA_CKAN_systemOfRecordsUSG,"VARCHAR(50000)","NA","OWIA","System of Records"
645 OWIA_CKAN_theme,"VARCHAR(50000)","NA","OWIA","Category"
```

646 **Appendix C Controlled-Vocabulary**

647 [label=Table-Controlled-Vocabulary,caption=The current controlled vocabulary.]

648 Category A , Category B , Category C , Category D  
649 Agriculture ,1, Applied Water ,AG1  
650 Agriculture ,10a, Return Flow to Salt Sink ,AG10A  
651 Agriculture ,10b, Return Flow for Delta Outflow ,AG10B  
652 Agriculture ,11a, Return Flow to Developed Supply (Other DAUCO – within PA) ,AG11A  
653 Agriculture ,11b, Return Flow to Developed Supply (Other PA) ,AG11B  
654 Agriculture ,11c, Return Flow to Developed Supply (Other Region) ,AG11C  
655 Agriculture ,11d, Return Flow to Carryover Storage for Next Water Year within DAU ,AG11D  
656 Agriculture ,12, Return Flows Evaporation and Evapotranspiration ,AG12  
657 Agriculture ,13, Applied Water Use ,AWUAG  
658 Agriculture ,14, Net Water Use (Applied Water –Reuse) ,NWIAG  
659 Agriculture ,15, Net Water Use (ETAW + Flow/Salt Sink + Outflow) ,NW2AG  
660 Agriculture ,16, Depletion ,DEPAG  
661 Agriculture ,17, Conveyance Evaporation and ETAW ,AG17  
662 Agriculture ,18a, Conveyance Return Flow to Oregon ,AG18A  
663 Agriculture ,18b, Conveyance Return Flow to Nevada ,AG18B  
664 Agriculture ,18c, Conveyance Return Flow to Mexico ,AG18C  
665 Agriculture ,18d, Conveyance Deep Percolation to Oregon ,AG18D  
666 Agriculture ,18e, Conveyance Deep Percolation to Nevada ,AG18E  
667 Agriculture ,18f, Conveyance Deep Percolation to Mexico ,AG18F  
668 Agriculture ,19a, Conveyance Return Flows to Salt Sink ,AG19A  
669 Agriculture ,19b, Conveyance Return Flow for Delta Outflow ,AG19B  
670 Agriculture ,2, Applied Water – Groundwater Recharge ,AG2  
671 Agriculture ,20a, Conveyance Return Flow to Developed Supply (Other DAUCO – within PA) ,AG20A  
672 Agriculture ,20b, Conveyance Return Flow to Developed Supply (Other PA) ,AG20B  
673 Agriculture ,20c, Conveyance Return Flow to Developed Supply (Other Region) ,AG20C  
674 Agriculture ,21, Conveyance Seepage ,AG21  
675 Agriculture ,22, Conveyance Deep Percolation ,AG22  
676 Agriculture ,23, Conveyance Deep Percolation to Salt Sink ,AG23  
677 Agriculture ,24, Conveyance Applied Water Use ,AWUAGC  
678 Agriculture ,25, Conveyance Net Water Use (Applied Water –Reuse) ,NWIAGC  
679 Agriculture ,26, Conveyance Net Water Use (ETAW + Flow/Salt Sink + Outflow) ,NW2AGC  
680 Agriculture ,27, Conveyance Depletion ,DEPAGC  
681 Agriculture ,3, Evapotranspiration of Applied Water ,AG3  
682 Agriculture ,4, Evaporation and Evapotranspiration of Groundwater Recharge ,AG4  
683 Agriculture ,5, Deep Percolation of Applied Water ,AG5  
684 Agriculture ,6, Deep Percolation of Applied Water to Salt Sink ,AG6  
685 Agriculture ,7, Deep Percolation of Groundwater Recharge ,AG7  
686 Agriculture ,8, Reuse of Return Flows within DAUCO ,AG8  
687 Agriculture ,9a, Return Flow to Oregon ,AG9A  
688 Agriculture ,9b, Return Flow to Nevada ,AG9B  
689 Agriculture ,9c, Return Flow to Mexico ,AG9C  
690 Agriculture ,9d, Deep Percolation to Oregon ,AG9D  
691 Agriculture ,9e, Deep Percolation to Nevada ,AG9E  
692 Agriculture ,9f, Deep Percolation to Mexico ,AG9F  
693 Instream Flow Requirements ,1, Applied Water ,IFR1  
694 Instream Flow Requirements ,2, Reuse of Return Flows within DAUCO ,IFR2  
695 Instream Flow Requirements ,3a, Return Flow to Salt Sink ,IFR3A  
696 Instream Flow Requirements ,3b, ” Return Flow to Oregon – Mexico – Nevada” ,IFR3B  
697 Instream Flow Requirements ,3c, Return Flow for Delta Outflow ,IFR3C  
698 Instream Flow Requirements ,4a, Return Flow to Developed Supply (Other DAUCO – within PA) ,IFR4A  
699 Instream Flow Requirements ,4b, Return Flow to Developed Supply (Other PA) ,IFR4B  
700 Instream Flow Requirements ,4c, Return Flow to Developed Supply (Other Region) ,IFR4C  
701 Instream Flow Requirements ,5, Applied Water Use ,AWUIFR  
702 Instream Flow Requirements ,6, Net Water Use (Applied Water –Reuse) ,NWIIFR



703 Instream Flow Requirements ,7 ,Net Water Use (ETAW + Flow/Salt Sink + Outflow) ,NW2IFR  
704 Instream Flow Requirements ,8 ,Depletion ,DEPIFR  
705 Managed Wetlands ,1 ,Applied Water ,MW1  
706 Managed Wetlands ,10 ,Return Flows Evaporation and Evapotranspiration ,MW10  
707 Managed Wetlands ,11 ,Applied Water Use ,AWUMW  
708 Managed Wetlands ,12 ,Net Water Use (Applied Water –Reuse) ,NWIMW  
709 Managed Wetlands ,13 ,Net Water Use (ETAW + Flow/Salt Sink + Outflow) ,NW2MW  
710 Managed Wetlands ,14 ,Depletion ,DEPMW  
711 Managed Wetlands ,15 ,Conveyance Evaporation and ETAW ,MW15  
712 Managed Wetlands ,16a ,Conveyance Return Flow to Oregon ,MW16A  
713 Managed Wetlands ,16b ,Conveyance Return Flow to Nevada ,MW16B  
714 Managed Wetlands ,16c ,Conveyance Return Flow to Mexico ,MW16C  
715 Managed Wetlands ,16d ,Conveyance Deep Percolation to Oregon ,MW16D  
716 Managed Wetlands ,16e ,Conveyance Deep Percolation to Nevada ,MW16E  
717 Managed Wetlands ,16f ,Conveyance Deep Percolation to Mexico ,MW16F  
718 Managed Wetlands ,17a ,Conveyance Return Flows to Salt Sink ,MW17A  
719 Managed Wetlands ,17b ,Conveyance Return Flow for Delta Outflow ,MW17B  
720 Managed Wetlands ,18a ,Conveyance Return Flow to Developed Supply (Other DAUCO – within PA) ,MW18A  
721 Managed Wetlands ,18b ,Conveyance Return Flow to Developed Supply (Other PA) ,MW18B  
722 Managed Wetlands ,18c ,Conveyance Return Flow to Developed Supply (Other Region) ,MW18C  
723 Managed Wetlands ,19 ,Conveyance Seepage ,MW19  
724 Managed Wetlands ,2 ,Evapotranspiration of Applied Water ,MW2  
725 Managed Wetlands ,20 ,Conveyance Deep Percolation ,MW20  
726 Managed Wetlands ,21 ,Conveyance Deep Percolation to Salt Sink ,MW21  
727 Managed Wetlands ,22 ,Conveyance Applied Water Use ,AWUMWC  
728 Managed Wetlands ,23 ,Conveyance Net Water Use (Applied Water –Reuse) ,NWIMWC  
729 Managed Wetlands ,24 ,Conveyance Net Water Use (ETAW + Flow/Salt Sink + Outflow) ,NW2MWC  
730 Managed Wetlands ,25 ,Conveyance Depletion ,DEPMWC  
731 Managed Wetlands ,25 ,Conveyance Depletion ,MW25  
732 Managed Wetlands ,3 ,Deep Percolation of Applied Water ,MW3  
733 Managed Wetlands ,4 ,Deep Percolation of Applied Water to Salt Sink ,MW4  
734 Managed Wetlands ,5 ,Deep Percolation of Groundwater Recharge ,MW5  
735 Managed Wetlands ,6 ,Reuse of Return Flows within DAUCO ,MW6  
736 Managed Wetlands ,7a ,Return Flow to Oregon ,MW7A  
737 Managed Wetlands ,7b ,Return Flow to Nevada ,MW7B  
738 Managed Wetlands ,7c ,Return Flow to Mexico ,MW7C  
739 Managed Wetlands ,7d ,Deep Percolation to Oregon ,MW7D  
740 Managed Wetlands ,7e ,Deep Percolation to Nevada ,MW7E  
741 Managed Wetlands ,7f ,Deep Percolation to Mexico ,MW7F  
742 Managed Wetlands ,8a ,Return Flow to Salt Sink ,MW8A  
743 Managed Wetlands ,8b ,Return Flow for Delta Outflow ,MW8B  
744 Managed Wetlands ,9a ,Return Flow to Developed Supply (Other DAUCO – within PA) ,MW9A  
745 Managed Wetlands ,9b ,Return Flow to Developed Supply (Other PA) ,MW9B  
746 Managed Wetlands ,9c ,Return Flow to Developed Supply (Other Region) ,MW9C  
747 Managed Wetlands ,9d ,Return Flow to Carryover Storage for Next Water Year within DAU ,MW9D  
748 Required Delta Outflow ,1 ,Applied Water ,RDO1  
749 Required Delta Outflow ,2 ,Return Flow for Delta Outflow ,RDO2  
750 Required Delta Outflow ,3 ,Applied Water Use ,AWURDO  
751 Required Delta Outflow ,4 ,Net Water Use (Applied Water –Reuse) ,NWIRDO  
752 Required Delta Outflow ,5 ,Net Water Use (ETAW + Flow/Salt Sink + Outflow) ,NW2RDO  
753 Required Delta Outflow ,6 ,Depletion ,DEPRDO  
754 Urban ,1 ,Applied Water – Residential – Single Family Interior ,URB1  
755 Urban ,10 ,Evapotranspiration of Applied Water ,URB10  
756 Urban ,11 ,Evaporation and Evapotranspiration of Groundwater Recharge ,URB11  
757 Urban ,12 ,Deep Percolation of Applied Water ,URB12  
758 Urban ,13 ,Deep Percolation of Applied Water to Salt Sink ,URB13  
759 Urban ,14 ,Deep Percolation of Groundwater Recharge ,URB14  
760 Urban ,15a ,Reuse of Return Flows within DAUCO ,URB15A  
761 Urban ,15b ,Urban – Wastewater Recycling ,URB15B

762 Urban,15c, Urban – Desalination ,URB15C  
763 Urban,16, Evaporation and Evapotranspiration of Wastewater ,URB16  
764 Urban,17a, Return Flow to Oregon,URB17A  
765 Urban,17b, Return Flow to Nevada,URB17B  
766 Urban,17c, Return Flow to Mexico,URB17C  
767 Urban,17d, Deep Percolation to Oregon,URB17D  
768 Urban,17e, Deep Percolation to Nevada,URB17E  
769 Urban,17f, Deep Percolation to Mexico,URB17F  
770 Urban,18a, Return Flow to Salt Sink ,URB18A  
771 Urban,18b, Return Flow for Delta Outflow ,URB18B  
772 Urban,19a, Return Flow to Developed Supply (Other DAUCO – within PA),URB19A  
773 Urban,19b, Return Flow to Developed Supply (Other PA),URB19B  
774 Urban,19c, Return Flow to Developed Supply (Other Region),URB19C  
775 Urban,19d, Return Flow to Carryover Storage for Next Water Year within DAU,URB19D  
776 Urban,2, Applied Water – Residential – Single Family Exterior ,URB2  
777 Urban,20, Return Flows Evaporation and Evapotranspiration ,URB20  
778 Urban,21, Applied Water Use ,AWUURB  
779 Urban,22, Net Water Use (Applied Water – Reuse) ,NWIURB  
780 Urban,23, Net Water Use (ETAW + Flow/Salt Sink + Outflow) ,NW2URB  
781 Urban,24, Depletion ,DEPURB  
782 Urban,25, Conveyance Evaporation and ETAW,URB25  
783 Urban,26a, Conveyance Return Flow to Oregon,URB26A  
784 Urban,26b, Conveyance Return Flow to Nevada,URB26B  
785 Urban,26c, Conveyance Return Flow to Mexico,URB26C  
786 Urban,26d, Conveyance Deep Percolation to Oregon,URB26D  
787 Urban,26e, Conveyance Deep Percolation to Nevada,URB26E  
788 Urban,26f, Conveyance Deep Percolation to Mexico,URB26F  
789 Urban,27a, Conveyance Return Flows to Salt Sink ,URB27A  
790 Urban,27b, Conveyance Return Flow for Delta Outflow ,URB27B  
791 Urban,28a, Conveyance Return Flow to Developed Supply (Other DAUCO – within PA),URB28A  
792 Urban,28b, Conveyance Return Flow to Developed Supply (Other PA),URB28B  
793 Urban,28c, Conveyance Return Flow to Developed Supply (Other Region),URB28C  
794 Urban,29, Conveyance Seepage ,URB29  
795 Urban,3, Applied Water – Residential – Multi Family Interior ,URB3  
796 Urban,30, Conveyance Deep Percolation ,URB30  
797 Urban,31, Conveyance Deep Percolation to Salt Sink ,URB31  
798 Urban,32, Conveyance Applied Water Use ,AWUURBC  
799 Urban,33, Conveyance Net Water Use (Applied Water – Reuse) ,NWIURBC  
800 Urban,34, Conveyance Net Water Use (ETAW + Flow/Salt Sink + Outflow) ,NW2URBC  
801 Urban,35, Conveyance Depletion ,DEPURBC  
802 Urban,4, Applied Water – Residential – Multi Family Exterior ,URB4  
803 Urban,5, Applied Water – Commercial Use ,URB5  
804 Urban,6, Applied Water – Industrial Use ,URB6  
805 Urban,7, Applied Water – Urban Large Landscape ,URB7  
806 Urban,8, Applied Water – Energy Production ,URB8  
807 Urban,9, Applied Water – Groundwater ,URB9  
808 Water Supplies ,10a, Desalination – Urban ,SPL10A  
809 Water Supplies ,10b, Desalination – Instream Flow Requirements ,SPL10B  
810 Water Supplies ,10c, Desalination – Wild and Scenic Flows ,SPL10C  
811 Water Supplies ,10d, Desalination – Required Delta Outflow ,SPL10D  
812 Water Supplies ,11a, Colorado River Deliveries – Agriculture ,SPL11A  
813 Water Supplies ,11b, Colorado River Deliveries – Managed Wetlands ,SPL11B  
814 Water Supplies ,11c, Colorado River Deliveries – Urban ,SPL11C  
815 Water Supplies ,11d, Colorado River Deliveries – Instream Flow Requirements ,SPL11D  
816 Water Supplies ,11e, Colorado River Deliveries – Wild and Scenic Flows ,SPL11E  
817 Water Supplies ,11f, Colorado River Deliveries – Required Delta Outflow ,SPL11F  
818 Water Supplies ,12a, State Water Project Deliveries – Agriculture ,SPL12A  
819 Water Supplies ,12b, State Water Project Deliveries – Managed Wetlands ,SPL12B  
820 Water Supplies ,12c, State Water Project Deliveries – Urban ,SPL12C

821	Water Supplies ,12d, State Water Project Deliveries – Instream Flow Requirements ,SPL12D
822	Water Supplies ,12e, State Water Project Deliveries – Wild and Scenic Flows ,SPL12E
823	Water Supplies ,12f, State Water Project Deliveries – Required Delta Outflow ,SPL12F
824	Water Supplies ,13a, Central Valley Project – Base Deliveries – Agriculture ,SPL13A
825	Water Supplies ,13b, Central Valley Project – Base Deliveries – Managed Wetlands ,SPL13B
826	Water Supplies ,13c, Central Valley Project – Base Deliveries – Urban ,SPL13C
827	Water Supplies ,13d, Central Valley Project – Base Deliveries – Instream Flow Requirements ,SPL13D
828	Water Supplies ,13e, Central Valley Project – Base Deliveries – Wild and Scenic Flows ,SPL13E
829	Water Supplies ,13f, Central Valley Project – Base Deliveries – Required Delta Outflow ,SPL13F
830	Water Supplies ,14a, Central Valley Project – Project Deliveries – Agriculture ,SPL14A
831	Water Supplies ,14b, Central Valley Project – Project Deliveries – Managed Wetlands ,SPL14B
832	Water Supplies ,14c, Central Valley Project – Project Deliveries – Urban ,SPL14C
833	Water Supplies ,14d, Central Valley Project – Project Deliveries – Instream Flow Requirements ,SPL14D
834	Water Supplies ,14e, Central Valley Project – Project Deliveries – Wild and Scenic Flows ,SPL14E
835	Water Supplies ,14f, Central Valley Project – Project Deliveries – Required Delta Outflow ,SPL14F
836	Water Supplies ,15a, Other Federal Deliveries – Agriculture ,SPL15A
837	Water Supplies ,15b, Other Federal Deliveries – Managed Wetlands ,SPL15B
838	Water Supplies ,15c, Other Federal Deliveries – Urban ,SPL15C
839	Water Supplies ,15d, Other Federal Deliveries – Instream Flow Requirements ,SPL15D
840	Water Supplies ,15e, Other Federal Deliveries – Wild and Scenic Flows ,SPL15E
841	Water Supplies ,15f, Other Federal Deliveries – Required Delta Outflow ,SPL15F
842	Water Supplies ,16a, Ocean Desalination – Agriculture ,SPL16A
843	Water Supplies ,16b, Ocean Desalination – Managed Wetlands ,SPL16B
844	Water Supplies ,16c, Ocean Desalination – Urban ,SPL16C
845	Water Supplies ,16d, Ocean Desalination – Instream Flow Requirements ,SPL16D
846	Water Supplies ,16e, Ocean Desalination – Wild and Scenic Flows ,SPL16E
847	Water Supplies ,16f, Ocean Desalination – Required Delta Outflow ,SPL16F
848	Water Supplies ,17a, Water from Refineries – Agriculture ,SPL17A
849	Water Supplies ,17b, Water from Refineries – Managed Wetlands ,SPL17B
850	Water Supplies ,17c, Water from Refineries – Urban ,SPL17C
851	Water Supplies ,17d, Water from Refineries – Instream Flow Requirements ,SPL17D
852	Water Supplies ,17e, Water from Refineries – Wild and Scenic Flows ,SPL17E
853	Water Supplies ,17f, Water from Refineries – Required Delta Outflow ,SPL17F
854	Water Supplies ,18a, Water Transfers – Regional – Agriculture ,SPL18A
855	Water Supplies ,18b, Water Transfers – Regional – Managed Wetlands ,SPL18B
856	Water Supplies ,18c, Water Transfers – Regional – Urban ,SPL18C
857	Water Supplies ,18d, Water Transfers – Regional – Instream Flow Requirements ,SPL18D
858	Water Supplies ,18e, Water Transfers – Regional – Wild and Scenic Flows ,SPL18E
859	Water Supplies ,18f, Water Transfers – Regional – Required Delta Outflow ,SPL18F
860	Water Supplies ,19a, Inter-basin Water Transfers – Agriculture ,SPL19A
861	Water Supplies ,19b, Inter-basin Water Transfers – Managed Wetlands ,SPL19B
862	Water Supplies ,19c, Inter-basin Water Transfers – Urban ,SPL19C
863	Water Supplies ,19d, Inter-basin Water Transfers – Instream Flow Requirements ,SPL19D
864	Water Supplies ,19e, Inter-basin Water Transfers – Wild and Scenic Flows ,SPL19E
865	Water Supplies ,19f, Inter-basin Water Transfers – Required Delta Outflow ,SPL19F
866	Water Supplies ,1a, Local Supplies – Agriculture ,SPL1A
867	Water Supplies ,1b, Local Supplies – Managed Wetlands ,SPL1B
868	Water Supplies ,1c, Local Supplies – Urban ,SPL1C
869	Water Supplies ,1d, Local Supplies – Instream Flow Requirements ,SPL1D
870	Water Supplies ,1e, Local Supplies – Wild and Scenic Flows ,SPL1E
871	Water Supplies ,1f, Local Supplies – Required Delta Outflow ,SPL1F
872	Water Supplies ,2a1, Return Flow from Other DAUCO– within PA – Agriculture ,SPL2A1
873	Water Supplies ,2a2, Return Flow from Other DAUCO– within PA – Managed Wetlands ,SPL2A2
874	Water Supplies ,2a3, Return Flow from Other DAUCO– within PA – Urban ,SPL2A3
875	Water Supplies ,2a4, Return Flow from Other DAUCO– within PA – Instream Flow Requirements ,SPL2A4
876	Water Supplies ,2a5, Return Flow from Other DAUCO– within PA – Wild and Scenic Flows ,SPL2A5
877	Water Supplies ,2a6, Return Flow from Other DAUCO– within PA – Required Delta Outflow ,SPL2A6
878	Water Supplies ,2b1, Return Flow from Other PA – Agriculture ,SPL2B1
879	Water Supplies ,2b2, Return Flow from Other PA – Managed Wetlands ,SPL2B2

880	Water Supplies ,2b3 ,Return Flow from Other PA – Urban ,SPL2B3
881	Water Supplies ,2b4 ,Return Flow from Other PA – Instream Flow Requirements ,SPL2B4
882	Water Supplies ,2b5 ,Return Flow from Other PA – Wild and Scenic Flows ,SPL2B5
883	Water Supplies ,2b6 ,Return Flow from Other PA – Required Delta Outflow ,SPL2B6
884	Water Supplies ,2c1 ,Return Flow from Other Region – Agriculture ,SPL2C1
885	Water Supplies ,2c2 ,Return Flow from Other Region – Managed Wetlands ,SPL2C2
886	Water Supplies ,2c3 ,Return Flow from Other Region – Urban ,SPL2C3
887	Water Supplies ,2c4 ,Return Flow from Other Region – Instream Flow Requirements ,SPL2C4
888	Water Supplies ,2c5 ,Return Flow from Other Region – Wild and Scenic Flows ,SPL2C5
889	Water Supplies ,2c6 ,Return Flow from Other Region – Required Delta Outflow ,SPL2C6
890	Water Supplies ,2d1 ,Return Flow to Carryover Storage within DAU from Previous WY – Agriculture ,SPL2D1
891	Water Supplies ,2d2 ,Return Flow to Carryover Storage within DAU from Previous WY – Managed Wetlands ,SPL2D2
892	Water Supplies ,2d3 ,Return Flow to Carryover Storage within DAU from Previous WY – Urban ,SPL2D3
893	Water Supplies ,3a ,Local Imports – Agriculture ,SPL3A
894	Water Supplies ,3b ,Local Imports – Managed Wetlands ,SPL3B
895	Water Supplies ,3c ,Local Imports – Urban ,SPL3C
896	Water Supplies ,3d ,Local Imports – Instream Flow Requirements ,SPL3D
897	Water Supplies ,3e ,Local Imports – Wild and Scenic Flows ,SPL3E
898	Water Supplies ,3f ,Local Imports – Required Delta Outflow ,SPL3F
899	Water Supplies ,4a ,Groundwater Extraction – Unadjudicated – Agriculture ,SPL4A
900	Water Supplies ,4b ,Groundwater Extraction – Unadjudicated – Managed Wetlands ,SPL4B
901	Water Supplies ,4c ,Groundwater Extraction – Unadjudicated – Urban ,SPL4C
902	Water Supplies ,4d ,Groundwater Extraction – Unadjudicated – Instream Flow Requirements ,SPL4D
903	Water Supplies ,4e ,Groundwater Extraction – Unadjudicated – Wild and Scenic Flows ,SPL4E
904	Water Supplies ,4f ,Groundwater Extraction – Unadjudicated – Required Delta Outflow ,SPL4F
905	Water Supplies ,5a ,Groundwater Extraction – Adjudicated – Agriculture ,SPL5A
906	Water Supplies ,5b ,Groundwater Extraction – Adjudicated – Managed Wetlands ,SPL5B
907	Water Supplies ,5c ,Groundwater Extraction – Adjudicated – Urban ,SPL5C
908	Water Supplies ,5d ,Groundwater Extraction – Adjudicated – Instream Flow Requirements ,SPL5D
909	Water Supplies ,5e ,Groundwater Extraction – Adjudicated – Wild and Scenic Flows ,SPL5E
910	Water Supplies ,5f ,Groundwater Extraction – Adjudicated – Required Delta Outflow ,SPL5F
911	Water Supplies ,6a ,Groundwater Extraction – Banked – Agriculture ,SPL6A
912	Water Supplies ,6b ,Groundwater Extraction – Banked – Managed Wetlands ,SPL6B
913	Water Supplies ,6c ,Groundwater Extraction – Banked – Urban ,SPL6C
914	Water Supplies ,6d ,Groundwater Extraction – Banked – Instream Flow Requirements ,SPL6D
915	Water Supplies ,6e ,Groundwater Extraction – Banked – Wild and Scenic Flows ,SPL6E
916	Water Supplies ,6f ,Groundwater Extraction – Banked – Required Delta Outflow ,SPL6F
917	Wild and Scenic River ,1 ,Applied Water ,WSR1
918	Wild and Scenic River ,2 ,Reuse of Return Flows within DAUCO ,WSR2
919	Wild and Scenic River ,3a ,Return Flow to Salt Sink ,WSR3A
920	Wild and Scenic River ,3b ,”Return Flow to Oregon – Mexico – Nevada” ,WSR3B
921	Wild and Scenic River ,3c ,Return Flow for Delta Outflow ,WSR3C
922	Wild and Scenic River ,4a ,Return Flow to Developed Supply (Other DAUCO – within PA) ,WSR4A
923	Wild and Scenic River ,4b ,Return Flow to Developed Supply (Other PA) ,WSR4B
924	Wild and Scenic River ,4c ,Return Flow to Developed Supply (Other Region) ,WSR4C
925	Wild and Scenic River ,5 ,Applied Water Use ,AWUWSR
926	Wild and Scenic River ,6 ,Net Water Use (Applied Water – Reuse) ,NWIWSR
927	Wild and Scenic River ,7 ,Net Water Use (ETAW + Flow/ Salt Sink + Outflow) ,NW2WSR
928	Wild and Scenic River ,8 ,Depletion ,DEPWSR
929	Wild and Scenic Rivers ,5 ,Applied Water Use ,WSR5
930	Wild and Scenic Rivers ,6 ,Net Water Use (Applied Water – Reuse) ,WSR6
931	Wild and Scenic Rivers ,7 ,Net Water Use (ETAW + Flow/ Salt Sink + Outflow) ,WSR7
932	Wild and Scenic Rivers ,8 ,Depletion ,WSR8

933 **Appendix D Data Sources**

934 **Appendix E Support for AB1755**

935 The OWIA provides complete support for the open-data and transparency requirement of the AB1755 legislation. Table 4 summa-  
936 rizes the relationship between the functional requirements and the objectives stated in the AB1755 bill.

**Table 3:** Traceability of AB1755 objectives (columns) to OWIA SOPs by use case (rows).

Identifier	Name	Data Sharing	Documentation	Quality Control	Public Access	Open-source platforms and decision support tools
FR-100-100	Data Acquisition	X				
FR-100-110	*-Manual-	X				
FR-100-120	*-Automated-	X				
FR-200-100	Quality Control-*-	X		X		
FR-200-110	*-Verification-	X		X		
FR-200-120	*-*Documentation	X	X	X		
FR-200-130	*-*Reproducibility	X		X		
FR-200-140	*-*Data Traceability	X		X		
FR-200-150	*-Standardization-	X	X	X		X
FR-200-160	*-*File-naming Conventions	X	X	X		X
FR-200-170	*-Interoperable Transformation-	X		X		X
FR-200-180	*-*Separation of Data and Computation	X		X		X
FR-200-190	*-*Data Interoperability	X	X	X		X
FR-200-200	*-*Products or Resources	X		X		X
FR-300-100	Publication-*-	X	X		X	
FR-300-110	*-Cross-Referencing-Service-	X	X		X	
FR-300-120	*-*Assignment of Digital Object Identifiers	X	X		X	
FR-300-130	*-Packaging-	X			X	
FR-300-140	*-*Compression Methods	X			X	
FR-300-150	*-*Archive File Formatting	X			X	
FR-300-160	*-Archival-	X			X	
FR-300-170	*-*Open Access Distribution	X			X	
FR-400-100	Data Traceability-*-	X	X		X	
FR-400-110	*-Metadata Production-	X	X		X	
FR-400-120	*-Intellectual Property Rights Management-	X	X		X	
FR-400-130	*-Public Law Compliance-	X	X		X	
FR-400-140	*-Licensing-	X	X		X	
FR-400-150	*-Liability-	X	X		X	
FR-400-160	*-Searching-	X			X	
FR-400-170	*-*Cross-referencing System Integration	X			X	
FR-400-180	*-*Search Engine Optimization	X			X	
FR-400-190	*-Version Control-	X	X			
FR-400-200	*-*Binary Data	X	X			
FR-400-210	*-*Non-Binary Data	X	X			
FR-400-220	*-Anomaly Reporting-	X	X			
FR-500-100	System Portability-*-					X
FR-500-110	*-Backup and Restore-					X
FR-500-120	*-Platform Portability-					X
FR-600-100	External Interfaces-*-	X				X
FR-600-110	*-Data and Metadata Acquisition-	X				X
FR-600-120	*-Data and Metadata Distribution-	X				X



## 937 **Appendix F Traceability Tables**

938 The traceability tables for *stakeholder objectives to functional requirements* and functional requirements to technical requirements  
939 are listed below in Tables 4 and ??, respectively. These tables are provided to assist in the evaluation of change proposals and design  
940 approaches in order to understand more conveniently how any proposed change may ripple through the OWIA in unintended way  
941 and to provide a sound basis for engineering analysis of the interdependencies of the requirements both functional and technical as  
942 they bear upon project management and design decisions.

**Table 4:** Traceability Table: Objective O-1100-1000 to Functional Requirements. This is an example of what subordinate Technical Requirements might resolve to and is meant only to characterize what *Resolution* of Functional Requirements might look like in a Technical Proposal.

Functional Requirement	Label	Resolution
FR-100-100	Data Acquisition-*-NULL	
FR-100-110	*-Manual-NULL	Level 0: HTTP scraping (cf. Table ?? for UC001)
FR-100-120	*-Automated-NULL	Level 0: Stored procedures for updating
FR-200-100	Quality Control-*-NULL	
FR-200-110	*-Verification-NULL	Stored programs and transformation of Level 0 sources to OWIA standards, Compute checksums and version control a list of the checksums.
FR-200-120	*-Documentation	OWIA Standard Formats
FR-200-130	*-Reproducibility	Stored procedures and input data with descriptive metadata.
FR-200-140	*-Data Traceability	OWIA Level 0 metadata generation, OWIA standard Level 0 processing
FR-200-150	*-Standardization-NULL	OWIA Level 0 standard processing (verification of contents, anomaly detection, missing value coding)
FR-200-160	*-File-naming Conventions	OWIA Level 0 naming convention
FR-200-160	*-File-naming Conventions	Level 0 verification of data access and reproduction of quality control and standardization
FR-200-170	*-Interoperable Transformation-NULL	Level 0 metadata verification
FR-200-180	*-Separation of Data and Computation	
FR-200-190	*-Data Interoperability	EZID (External Interface)
FR-200-200	*-Products or Resources	(1) The water manager must identify potential source(s) of water, and for each determine the quantity and timing of water available for recharge and its cost. (2) To determine where the project should be located, the water manager must examine different options based on basin capacity and suitability of recharge areas; parcel data indicating available land and land values; and water quality implications based on current or past land use and the design of the project. (3) To determine the best method for recharge, basin characteristics such as subsurface characteristics, soil types, topography, current and planned land use, and basin capacity must be taken into account.
FR-300-100	Publication-*-NULL	Level 0 Metadata Production
FR-300-110	*-Cross-Referencing-Service-NULL	Transfer to Trusted Archive with public facing HTTPS server
FR-300-120	*-Assignment of Digital Object Identifiers	Identifier Assignment (e.g., EZID) via External Interface
FR-300-130	*-Packaging-NULL	AB1755
FR-300-140	*-Compression Methods	Lossless
FR-300-150	*-Archive File Formatting	tar.gz, zip
FR-300-160	*-Archival-NULL	Data shall be placed in a trusted archive for access and delivery using OWIA-compliant external interfaces.
FR-300-170	*-Open Access Distribution	ftp, http, rsync, scp, sftp, export
FR-400-100	Data Traceability-*-NULL	Via DOIs for parents and siblings.
FR-400-110	*-Metadata Production-NULL	Lossless
FR-400-120	*-Intellectual Property Rights Management-NULL	Attribution 4.0 International (CC BY 4.0), Attribution-NonCommercial 4.0 International (CC BY-NC 4.0)
FR-400-130	*-Public Law Compliance-NULL	AB1755
FR-400-140	*-Licensing-NULL	Compute checksums and version control a list of the checksums.
FR-400-150	*-Liability-NULL	OWIA-standard version control system
FR-400-160	*-Searching-NULL	OWIA bug tracking system
FR-400-170	*-Cross-referencing System Integration	Crossref, DataCite
FR-400-180	*-Search Engine Optimization	Google bots
FR-400-190	*-Version Control-NULL	Open-source systems verified on Linux, Windows, OSX

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FR-400-200	*-*-Binary Data	Naming convention.
FR-400-210	*-*-Non-Binary Data	ASCII-based version control systems (e.g., git, svn, mercurial)
FR-400-220	*-Anomaly Reporting-NULL	Curatorial email address
FR-500-100	System Portability-*-*NULL	Open-source operation on major operating systems.
FR-500-110	*-Backup and Restore-NULL	Rsync-based
FR-500-120	*-Platform Portability-NULL	Demonstrated operation across major platforms: Linux, OSX, Windows
FR-600-100	External Interfaces-*-*NULL	Uniquely identified per the Interface Control Appendix.
FR-600-110	*-Data and Metadata Acquisition-NULL	Compliant with OWIA standards and conventions
FR-600-120	*-Data and Metadata Distribution-NULL	Compliant with OWIA standards and conventions

## 943 Glossary

944 **federated** See [Federation 1](#)

945 **federation** A federation is a group of data providers and users using jointly agreed-upon standards of oper-  
946 ation in a collective fashion to ensure the interoperability of the resources they collectively hold and  
947 employ. The term may be used, for example, when describing the interoperation of distinct cyber-  
948 infrastructure networks with different internal structures. The term may also be used when human  
949 groups agree to collectively manage cyberinfrastructure development and operation using commonly  
950 held, and managed, requirements, standards and conventions, and operating [procedures](#) to ensure the  
951 [interoperability](#) of distinct cyberinfrastructure resources (cf. [Wikipedia Definition](#)). 1, 29

952 **Federation** See [federation 29](#)

953 **interoperability** The ability of computer systems or software to exchange and make use of data (adapted  
954 from the [Oxford English Dictionary](#)). 29

955 **procedures** An established or official way of doing something ([Oxford English Dictionary](#)). 1, 29

956 **protocol** Protocols are methods of implementing a set of objectives and requirements in a systematic way.  
957 In computing, protocols mean both specific implementations of methods such as HTTP [26] and FTP  
958 [23] and, more generally as described by the *Internet Engineering Task Force*, protocols are sequences  
959 of processing steps that are also referred to as [procedures](#) [24]. 7

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