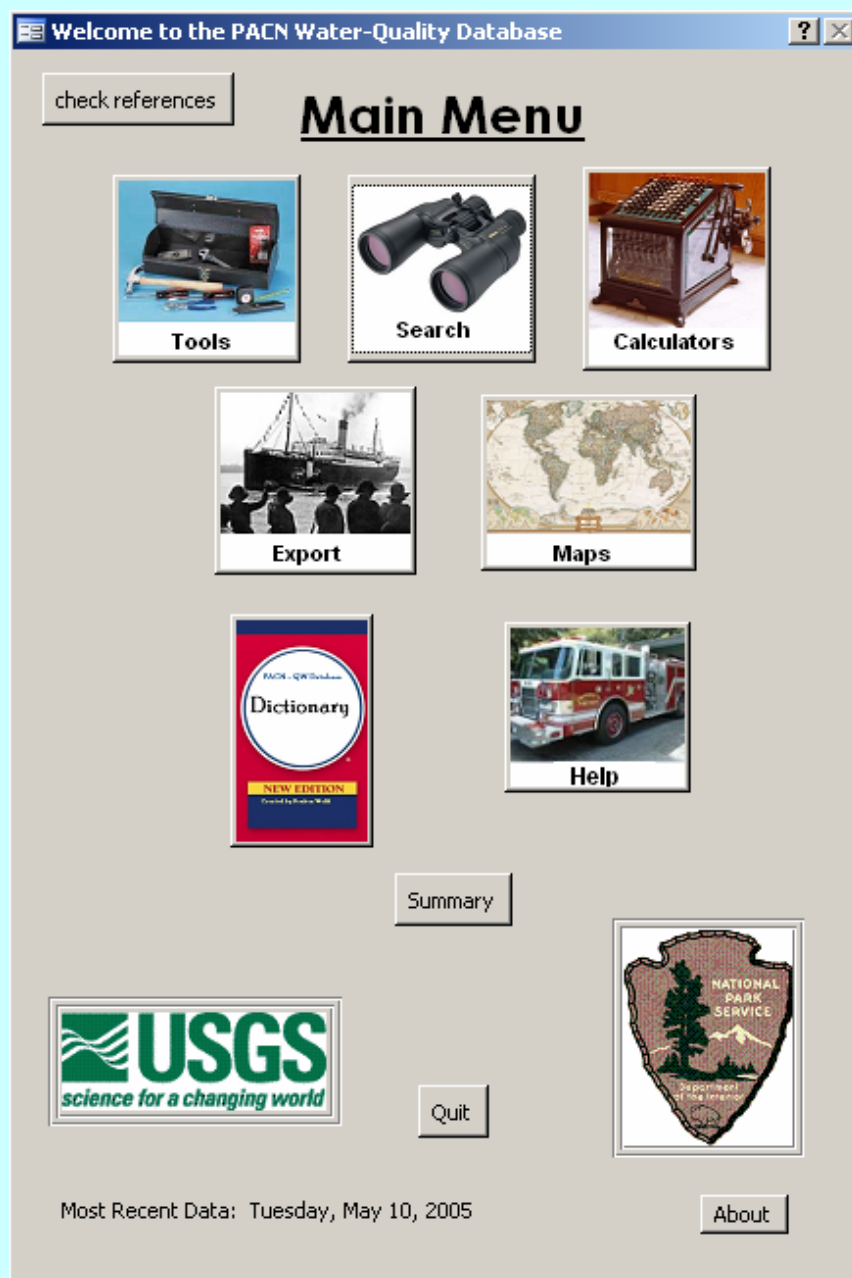


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Water-Quality Database (Version 1.2) and Documentation, National Park Service — Pacific Island Network



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Water-Quality Database (Version 1.2) and Documentation, National Park Service — Pacific Island Network

By Reuben H. Wolff

Administrative Report

**U.S. Department of the Interior
U.S. Geological Survey
Pacific Islands Water Science Center**

U.S. Department of the Interior
DIRK KEMPTHORNE, Secretary

U.S. Geological Survey
Mark D. Myers, Director

U.S. Geological Survey, Reston, Virginia: 2007

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Conversion Factors

Multiply	By	To obtain
Length		
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
mile, nautical (nmi)	1.852	kilometer (km)
yard (yd)	0.9144	meter (m)
Volume		
ounce, fluid (fl. oz)	0.02957	liter (L)
pint (pt)	0.4732	liter (L)
quart (qt)	0.9464	liter (L)
gallon (gal)	3.785	liter (L)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$^{\circ}\text{F}=(1.8\times^{\circ}\text{C})+32$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$^{\circ}\text{C}=(^{\circ}\text{F}-32)/1.8$$

Abstract

Historical water-quality data available in and near the National Park Service Pacific Island Network (PACN) park units have been compiled in a relational water-quality database. Data were compiled from three national databases: U.S. Environmental Protection Agency (USEPA) Legacy STORET (Legacy) and Modern STORET (Modern) databases and the U.S. Geological Survey (USGS) National Water Information System (NWIS) database. If maintained, this database can serve as a dynamic tool for the network's long-term water-quality monitoring and analysis needs. This report provides documentation for understanding the data compilation process, database design, data post-processing activities, as well as giving an overview of the utility of the PACN Water-Quality Database. Basic user instructions for the various components of the databases and a data dictionary are included. User instructions are included with the database by accessing the Help menu from within the database. It is highly recommended that no changes be made to the database unless performed by an advanced user of Microsoft® Access.

Introduction

The National Park Service (NPS) is developing a long-term water-quality monitoring plan for a network of park units in the Pacific to assess status and trends in water resources that include streams, lakes, wetlands, fish ponds, anchialine pools, tide pools, coastal, and interstitial waters (DeVerse and DiDonato, 2005). The Pacific Island Network (PACN) is one of 32 networks nationwide and is composed of 11 park units in the State of Hawaii, Commonwealth of the Northern Mariana Islands, and Territories of American Samoa and Guam.

All of the PACN parks are concerned about adjacent land uses and their impact on water resources. Listed below are brief summaries of water resources and issues within each of the PACN parks (DeVerse and DiDonato, 2005). Maps of each park and sampling sites are included in appendix A.

- **USS Arizona Memorial (USAR)** consists of a visitor center, a parking lot, and joint jurisdiction with the U.S. Navy over two submerged vessels: the USS *Arizona* and the USS *Utah*. This jurisdiction does not extend to the surrounding marine area of Pearl Harbor, which is a heavily altered embayment as a result of extensive and long-standing Naval operations and increasing urban development. There are several hundred thousand gallons of Bunker C fuel-oil encased in the hull of the USS *Arizona* — potentially catastrophic if released.
- **Haleakala National Park (HALE)** boundary ends at the high tide line but has extensive and somewhat isolated intertidal regions, coastal springs, and pristine isolated streams. Stream diversion and encroaching development are the main threats to water quality in this park.
- **Kalaupapa National Historical Park (KALA)** legislative boundary extends a quarter mile offshore and

encompasses relatively pristine marine resources and two offshore islands. Threatened and endangered sea turtles forage within the park, and endangered monk seals use the beaches. Coral reefs are threatened by sedimentation and agricultural runoff. The primary concerns for freshwater resources of this park are invasive species, erosion, and diversion of streams to supply upland development. This park boasts a crater lake with unique water-quality characteristics.

- **Puukohola Heiau National Historical Site (PUHE)** administrative boundary stops at the high tide line, although the enabling legislation intended that it extend into the marine area of Pelekane Bay. The park has an ephemeral brackish water pond located in an otherwise dry gulch that is impacted by flood events during periods of high rainfall upslope. Upland development and ranching contribute to erosion, runoff, and associated sedimentation of Pelekane Bay. Consequently, this bay is now listed as an impaired water body by the Hawaii Department of Health. Kawaihae Harbor is adjacent to the park and is slated for expansion, which may increase nearshore sedimentation and restrict water flow.
- **Kaloko-Honokohau National Historical Park (KAHO)** contains approximately 10 percent of the anchialine pools on the island of Hawaii. In addition, there are three fishponds, and a large embayment downslope from a growing industrial area. Adjacent land use may contribute to contamination and nutrient loading of the ground water that feeds the wetlands, anchialine pools, and subsequently the marine waters. These aquatic resources are affected ecologically when introduced species alter the environment. A small-boat harbor is located between park units and is a source of petroleum, heavy metals, and other contaminants.
- **Puuhonua O Honaunau National Historical Park (PUHO)** boundary ends at the high tide line. Urban development upslope from the park and the high level of tourism can have an impact on the water quality (sediment, nutrients, and contaminants) of springs, fishponds, anchialine pools, and the nearshore marine environment. Sedimentation and the introduction of alien fish in the fishponds and anchialine pools have contributed to their decline. Island subsidence, combined with rising sea level due to global climate change, may eventually lead to flooding of this low coastal park.
- **Hawaii Volcanoes National Park (HAVO)** boundary ends at the high tide line, limiting its aquatic resources to coastal intertidal areas, anchialine pools, and bogs in the upland rainforest. No known streams or lakes exist in this park, which is primarily made up of relatively young volcanic flows. Although the coastal area is large, the threat of runoff from paved areas is limited by the volcanic activity, the main agent of change in this park.
- **War in the Pacific National Historical Park (WAPA)** contains more than 1,000 acres of marine area, a wetland, and numerous streams within the park's boundary. Sedimentation, intense fishing, sewage, litter, and the presence of relic WWII military equipment, including

large numbers of unexploded ordnance, are some of the water-quality concerns for this park.

- **American Memorial Park (AMME)** has no submerged lands within its boundary but contains an extensive wetland with native mangroves. The wetland area has been severely impacted by historical land uses. Streams on AMME's boundaries receive stormwater runoff and brine discharged from private drinking water facilities. In addition to threats associated with terrestrial runoff, areas offshore of AMME may be impacted by contaminants from a closed landfill adjacent to the park. Sea level rise is also a concern to this low-lying park.
- **National Park of American Samoa (NPSA)** contains extensive coral reefs and pristine streams that may be impacted by rapid population growth in the region. Water quality at NPSA is affected by non-point source pollution, ground water withdrawal, bacteria, and nutrients from human and animal wastes, as well as other contaminants. Global climate change and the subsequent increase in water temperature are also of concern.
- **Ala Kahakai National Historic Trail (ALKA)** is a 175-mile trail corridor traversing the west Hawaii coast from the northern Upolu Point south to Ka Lae, and continuing up the eastern side of the island of Hawaii along the coast of Hawaii Volcanoes National Park. The water quality issues for ALKA vary with the changing land uses on the island. Although this trail system does not officially include the nearshore marine areas, harbor operations, runoff, and ground-water quality are concerns for the coastal waters in developed areas.

The overall goal of the NPS water quality monitoring is to gather data that will advance scientific understanding of PACN water resources and to better inform resource management decisions (DeVerse and DiDonato, 2005). Preliminary steps include compiling available data and assessing the data for status of resource condition. The NPS has started this process by compiling available data from the U.S. Environmental Protection Agency (USEPA) Legacy STORET (STORage and RETrieval) database and other sources. These summaries of data (Horizon reports) are available at <http://www.nature.nps.gov/water/horizon.htm>.

The U.S. Geological Survey (USGS) Pacific Islands Water Science Center (PIWSC) has been actively monitoring water resources in the Pacific for many years, including areas of interest to the PACN. However, not all of the USGS monitoring data are included in the Horizon reports because USGS does not currently use the STORET database as a repository. In addition, ground-water data and various local-project study data were not included in the Horizon reports. These data are important to review and understand before designing the PACN water-quality monitoring plan.

As part of an Interagency Agreement, the NPS and the USGS cooperated in the acquisition, organization, management, and synthesis of existing water-quality data related to all of the PACN parks, except for ALKA. As part of this agreement, the USGS incorporated water-quality data from the USEPA Legacy STORET and Modern STORET

databases, the USGS NWIS (National Water Information System) database, and selected additional datasets into a PACN Water-Quality Database (Microsoft® Access). Various tasks, including data compilation and post-processing, were completed in consultation with Fritz Klasner, NPS Pacific Island Network ecologist, to ensure that the database would meet PACN data-analysis objectives. The PACN Water-Quality Database provides a static "snapshot" of available data for waters in and surrounding the PACN parks; however, with periodic updates, this database can serve as a dynamic tool for the network's long-term water-quality monitoring and analysis needs.

Purpose and Scope

The purpose of this document is to provide information necessary for users to understand, utilize, and update the PACN Water-Quality Database. An explanation of the database design, data compilation process, and data post-processing activities is provided. In addition, an overview of the utility of the PACN Water-Quality Database is provided. User instructions for the various components of the database are included in the Help menu of the PACN Water-Quality Database. This report is intended to complement the accompanying version of the database and serves several functions by providing:

- an explanation of the databases including data compilation, database design, post-processing of data, and database utility;
- basic user instructions for using the databases; and
- a data dictionary for understanding the contents of the databases.

This report is not intended to teach the user how to use the underlying software program, Microsoft® Access, and it is written with the assumption that the user understands the basic functions and operation of that program.

Acknowledgements

This project was made possible with the assistance of the National Park Service, Pacific Island Network. We especially would like to thank Julianne Brown and Kirby Wynn of the USGS Colorado Water Science Center, who developed water-quality databases for the Southern and Northern Colorado Plateau Networks. Ms. Brown contributed greatly to the technical development of the PACN Water-Quality Database. Some functions and Visual Basic code used in the PACN Water-Quality Database were borrowed from their original designs.

Water-Quality Database

Historical water-quality data available in and near the PACN park units were compiled in a relational water-quality database. Various tasks, including compilation and data pre- and post-processing, were completed in order to

develop a database that could meet the PACN data-analysis objectives. Data were compiled from three national databases: USEPA Legacy STORET (Legacy) and Modern STORET (Modern) databases and the USGS NWIS database. If maintained, this database can serve as a dynamic tool for the network's long-term water-quality monitoring and analysis needs. However, for the purpose of the development of the water-quality vital signs monitoring plan, this database was used as a static "snapshot" of the historical water-quality of the waters in and around the PACN park units.

Database Design

The PACN Water-Quality Database design was built in Microsoft® Office Access 2000 (Access), a relational database, where data are divided into multiple tables with the subsequent linkages (established with 'primary keys') and relationships defined during the database creation. The relationships and structure of the project database are explained herein. Selected Access database terms are explained in table 1 to assist with understanding the PACN Water-Quality Database design and structure. This database has the added feature of user-friendly forms that enable the user to retrieve the information with limited knowledge of how to use Access. The user-friendly forms were designed to perform data filtering, data reviewing, and data export by selecting variables from drop-down list controls and by clicking command buttons. Visual Basic and SQL (Structured Query Language) codes were written by the author to automate the data filtering and retrieval processes.

Data Compilation

The PACN data-compilation process involved the selection of sites and sample results to be included in the database and the building of the Access database as specified in the Interagency Agreement. Available water-quality data were retrieved from three national databases: USEPA Legacy STORET (Legacy) and Modern STORET (Modern) databases and the USGS NWIS database.

Site Selection Criteria

A GIS approach was used to select the sites and sample results to be included in the PACN Water-Quality Database. Data were retrieved via the Internet at <http://www.epa.gov/storet/dbtop.html> (last accessed on November 11, 2004) from Legacy STORET ftp site: <ftp://ftp.epa.gov/storet/exports/>, by each geographic region (island, county, or state), via a compressed self-extracting flat tab-delimited file(s), and from Modern STORET by applicable geographic regions (island). Data were retrieved from NWIS by applicable station identifiers. NWIS data were retrieved directly from the USGS Pacific Islands Water Science Center NWIS database.

All of the site locations downloaded from each database were plotted using ESRI® ArcMap™9.1 for each island containing a park unit. Once all the available sites for each island of interest were plotted, the sites to be included

in the database were then selected using the following criteria:

- Sites from Legacy STORET, Modern STORET and NWIS that were located within a 1,000-meter buffer around each park unit Water-Quality Area Of Interest (WQAOI) boundary were selected for inclusion in the database. The park boundary and WQAOI coverages were established using ESRI® ArcGIS® (ArcGIS) and provided by PACN NPS personnel to the USGS;

Sites were excluded if:

- There were no water-quality sample results.
- The sampling site was not located within 1,000 meters of the park WQAOI and was not mentioned as a concern in available literature.

Sites were selected and subsequently checked using ArcGIS. Site consolidation was not conducted for the PACN Water-Quality Database. Site consolidation could be conducted to eliminate the occurrence of multiple datasets for a particular geographic location. (See section on data post-processing for more information on the site consolidation process.)

Pre-processing Source-Specific Datasets

Following site selection, the historic water-quality data for each site were obtained from each national database in text formats (tables 2-3). Following the data retrieval from the national databases, data were imported into source-specific (Legacy, Modern or NWIS) Access databases for pre-processing. Several processes were applied to the source-specific databases before combining them into the single PACN Water-Quality Database, including the following:

- (1) Parsing of raw data into site, sample, and results tables to facilitate processing of sites, samples and results (values) and formatting of fields to match the established database template.
- (2) Removal of obviously errant characters (for example., a " preceded selected Legacy site ids; double quote marks used in site name field were changed to single quotes because of Access formatting limits).
- (3) Formatting date and/or time, as needed, to conform to database template and assigning a default time of 2359, where time not provided for a sample.
- (4) Assigning a default depth of -999, where depth not provided for a sample.

Table 1. Explanation of selected Access database terms.

[Definitions modified from Kaufeld, 1995.]

Term	Definition
Data	The information that MS Access stores, shuffles, and stacks for you; data hangs out in fields.
Database	A collection of everything relating to a particular set of information; the database contains all of the tables, queries, reports, forms, and other things that MS Access helps you create to manage and work with the your “stuff” grouped into a single collective file of information.
Fields	The place where the data lives; one field holds one piece of data; MS Access offers eight field types to accommodate various types of data (Text, Memo, Number, Date/Time, Currency, AutoNumber, Yes/No, and OLE object).
Forms	Forms serve the function of allowing the user to have a customized view of selected data in a “user-friendly” format. Forms pull information from tables or queries.
Index	Works like an index in a book; indexes speed up queries and sorts; each field in a table can be indexed; key fields are automatically indexed; indexes slow down some processes (for example, adding records to a table with several indexes); indexes allow or prevent duplicate entries in your table depending on the selection (“Allow duplicate records” or “No duplicates”) for the specific field in the table.
Key fields (linking fields)	Both tables contain this field(s) – they are identical; the key field’s data link together matching records from different tables; usually the linking field is the primary key(s) in one of the tables.
Modules	A module is a collection of Visual Basic for Applications declarations and procedures that are stored together as a unit (Microsoft Access Help, 2002).
Queries	A query is a question about the data in your tables; queries can make lists from one or more tables, count records, and do calculations; queries can be used to update or append or delete data to/from the database; there are six types of queries available in Access: Select, Crosstab, Make-Table, Update, Append, and Delete.
Primary key(s)	A special kind of indexed field used to keep data organized; a table typically has only one primary key, although ‘multi-field keys’ can be used (you can create indexes for multiple fields); only certain types of fields can be keys (text, number, data/time, and AutoNumber); records are automatically sorted by primary key; the values in a key field must be unique.
Records	These keep fields in order; each record in a table has the exact same fields, but (probably) different data inside those fields.
Relationships	Data are split up among two or more tables but are linked by a “relationship” defined during the database creation; when two or more tables are linked together they form one of four possible relationships (one-to-one; one-to-many; many-to-one; and many-to-many); tables can only be linked that are in the same database.
Tables	A collection of records that describe similar data; all of the records in a single table contain similar data.
Object Library	A file with the .olb extension that provides information to Automation controllers (like Visual Basic) about available objects.

- (5) Assignment of sample type, based on available information.
- (6) Review of site types and reassignment as needed to conform with database template (for example, anchialine ponds coded to ANPO, whereas they were typically described in raw data source as surface water).
- (7) Formatting of latitude and longitude information to conform to the database template (for example, multiplying longitude by -1 where needed to reflect Prime Meridian = 0; Conversion to NAD83 datum, and so forth).
- (8) Coding each data record with the associated source data file, source database, and the date of the original data retrieval to allow for tracking of data once data are merged.
- (9) Assigning a 4-digit park code used by the PACN to identify individual park units.
- (10) Determining and assigning whether a site was located within the Park Unit Boundary, within the WQAOI, within 500 m of the WQAOI, or within 1,000 m of the WQAOI.
- (11) Transposing data retrieved/available “by sample” (one sample per row with multiple results by column) to “by result” (one result per row).
- (12) Quarantining selected results because critical required or primary key information was missing or illogical information was present in one of the required fields. This included missing sample fraction type (total, dissolved, or total recoverable), sample dates missing day (only providing month and/or year), missing reporting units (for example, mg/l), and/or missing reporting information (whether a nitrate result was reporting as N or as NO₃). The quarantined results are provided in the supplementary table ‘Quarantine_tbl’ in the PACN Water-Quality Database. These data results could potentially be added to the MAIN_QW_RESULT table if the source agencies and/or analyzing laboratories were contacted and the missing critical information was added to the data.

Assigning Parameter Codes

The modern STORET system does not distinguish water-quality constituents by parameter code. Data in the modern STORET system are organized by constituent characteristic name. Parameter codes (Ppcodes) had to be assigned to all results to conform to the required table relationships defined in the database. Modern STORET archives parameter information in multiple data descriptor fields as an alternative to parameter codes used in USGS NWIS and Legacy STORET. These fields (table 4) were used to match parameter codes and standardize Modern data for addition to the PACN Water-Quality Database. Using a master table of parameter codes and descriptions used by the USGS NWIS and historically used by the Environmental Protection Agency (EPA) (for Legacy STORET), a

corresponding parameter code was matched to each unique combination of the Modern parameter descriptor fields. A total of 20 different Ppcodes, from various combinations of descriptor fields, were assigned to the Modern data before appending those data to the PACN Water-Quality Database. Table 5 includes examples of the process.

Table 2. Summary of the numbers of samples and retrieval dates for each source database.

Number of Samples	Original Source Database	Retrieval Date
11,106	Legacy STORET	06/11/2005
445	Modern STORET	10/19/2004
315	Modern STORET	10/21/2004
5	Modern STORET	10/25/2004
1,433	NWIS	10/18/2004
13,408	NWIS	10/19/2004
439	NWIS	05/17/2005
2,970	NWIS	06/09/2005
4	NWIS	09/27/2005
390	NWIS	09/28/2005
2	NWIS	09/29/2005

Table 3. Summary of the numbers of results and retrieval dates for each source database.

Number of Results	Original Source Database	Retrieval Date
86,112	Legacy STORET	06/11/2005
3,491	Modern STORET	10/19/2004
2,038	Modern STORET	10/21/2004
34	Modern STORET	10/25/2004
10,511	NWIS	10/18/2004
34,966	NWIS	10/19/2004
4,087	NWIS	05/17/2005
35,393	NWIS	06/09/2005
43	NWIS	09/27/2005
2,295	NWIS	09/28/2005
58	NWIS	09/29/2005

Table 4. Modern STORET parameter descriptor fields used to assign a parameter code to results for input into PACN Water-Quality Database template.

Modern STORET Fields	Field Description
Activity Medium	Medium where field activity occurred (for example, water, sediment)
Activity Type	Type of activity (used to distinguish between field samples and field measurements/observations)
Activity Category	Descriptor used to distinguish kinds of samples, measurements, and observations
Characteristic Name	Name of characteristic as it is to be displayed on windows and reports
Sample Fraction	The portion of the sample associated with results obtained from a physically-partitioned sample (for example, dissolved, total, suspended)
Units	Unit of measure of the results
Value Type	Name that represents the process used in the determination of the result value (for example, actual, estimated, calculated)
Statistic Type	A statistic or calculation type that describes the reported result (for example, average, MPN)
Result Comment	Comments made about the result
Analytical Procedure ID	A combination of an abbreviation or acronym identifying the organization that owns the analytical procedure (for example, ASTM, USGS, EPA) and the abbreviated name or code of the analytical procedure

Table 5. Example of matching Modern STORET parameter descriptor fields to a parameter code.

[Assigned information indicated in shaded areas; deg.C, degrees Celsius; µg/L, micrograms per liter; mg/L, milligrams per liter.]

Activity Medium	Activity Type	Activity Category	Characteristic Name	Sample Fraction	Units	Analytical Proc ID	Assigned Ppcode	Assigned Parameter Name
Water	Field Msr/Obs	Routine Msr/Obs	Temperature, water	Total	deg.C	Field Measures	P00010	TEMPERATURE, WATER, DEGREES CELSIUS
Water	Sample	Routine Sample	Selenium	Total	µg/L	200.8(W)	P01147	SELENIUM, WATER, UNFILTERED, MICROGRAMS PER LITER
Water	Sample	Routine Sample	Nitrogen, Nitrite (NO ₂) + Nitrate (NO ₃)	Dissolved	mg/L	353.2	P00631	NITRITE PLUS NITRATE, WATER, FILTERED, MILLIGRAMS PER LITER AS NITROGEN
Water	Sample	Routine Sample	Sulfate	Total	mg/L	Historic	P00946	SULFATE, WATER, UNFILTERED, MILLIGRAMS PER LITER

Duplicate Data

Before merging the Legacy and Modern STORET databases, the records within each database were checked for duplicate entries. Duplicate records were identified as having identical result values for identical parameters with identical stations, dates, and times. A number of records in the Legacy STORET database were identified as being duplicate records despite minor inconsistencies in the 'Agency' or 'Depth' variables (table 6). For example, the Agency value '21HI' and the Agency value '21HISPEC' both represent the Hawaii State Department of Health. Only unique records were included into the database, and duplicate records were excluded.

Records in the Modern STORET database were identified as being exact duplicates or duplicate records with minor discrepancies in the Depth, ID, and/or Activity ID variables (table 7). Unique records were included into the database and duplicate records were excluded (Many of these records were later excluded because of redundancy with Legacy database records).

A review of the NWIS database revealed 6,184 results that were assigned temporary parameter codes associated with 'District Special' parameters that had since been reassigned a parameter code associated with a defined parameter. Duplicate records using the District Special parameters in the NWIS database were therefore excluded from the PACN Water-Quality Database.

Table 6. Number of duplicate records in the Legacy STORET database and the number of records either included in or excluded from the PACN Water-Quality Database. The records were identical except for minor discrepancies in the Agency or Sample Depth fields. For example, '21HI' and '21HISPEC' both represent the Hawaii State Department of Health.

Methods of Comparison	Number of Duplicate Records	Number of Records Excluded	Number of Records Included
Agency: 21HI or 21HISPEC	250	125	125
Sample Depth (0 or -999)	1,892	946	946
Total	2,142	1,071	1,071

Redundant Data

Before merging the source-specific databases, records from the Legacy database were cross-referenced against the records from the Modern database to check for redundant records (the same data stored in more than one database). Redundant records were identified as having identical

values for parameters determined to be identical between the Legacy and Modern database, with identical stations, dates, and times. Upon further investigation, approximately 90 percent of the records in the Modern database were redundant with records from the Legacy STORET database (table 8). These redundant records included

- exact matches;
- matching records with differing values in the 'Activity Depth' variable;
- matching records with differing values in the 'Time' variable;
- matching records with differing rounded (significant figures) Legacy result values; or
- matching records with a combination of differing rounded values and differing values in the Time variable.

Table 7. Number of duplicate records in the Modern STORET database and the number of records either included to or excluded from the PACN Water-Quality Database.

Methods of Comparison	Number of Duplicate Records	Number of Records Excluded	Number of Records Included
ID	186	93	93
ID and Activity ID	85	48	37
Sample Depth (0 or -999)	2,126	1,063	1,063
Exact Duplicate	328	164	164
Total	2,725	1,368	1,357

Upon further scrutiny of the data, it became evident that many of the characteristic names assigned to the records in the Modern database were not the parameter names of the associated parameter codes in the redundant Legacy database records. Many of these characteristic names are believed to have been assigned incorrectly, as evidenced by illogical result values (values too extreme for the given characteristic name) for these records. Upon review of these data and with a consensus of NPS PACN and USGS PIWSC scientists, all the records identified as being redundant in the Modern STORET database were excluded from the PACN Water-Quality Database. Following the additions and corrections to the source-specific databases, the remaining data were appended (merged) into the PACN Water-Quality Database. The outcome of the PACN Water-Quality Database building process, by source database, is summarized in table 9.

Table 8. Number of records identified in the Modern STORET database as being redundant (duplicated data) with records in the Legacy STORET database.

Methods of Comparison	Number of Records
Exact Match	38,352
Differed by Activity Depth	610
Differed by Time	2,266
Rounding of Result Value:	
0 decimal places	1,466
1 decimal place	648
1 decimal place and differed by Time	50
2 decimal places	6,899
2 decimal places and differed by Time	638
3 decimal places	129
Other	272
Total	51,330

Database Structure

The basic structure of the database was established at the beginning of the project and approved by the PACN before development of the PACN Water-Quality Database. The database comprises various components, which are described herein, including the following:

- Tables
- Queries
- Forms
- Libraries
- Modules
- Help
- Relationships

Table 9. Summary results of PACN Water-Quality Database building process.

Original Source Database	Number of Samples Included	Original Number of Results	Number of Results Included	Number of Erroneous Results	Number of Results Excluded and Reasoning for Exclusion
USEPA Legacy STORET	11,106	87,847	86,112	764	1,071 results were rejected due to duplicate records.
USEPA Modern STORET	765	58,633	5,563	28	51,330 results rejected due to redundancy with Legacy STORET records; 203 results rejected due to duplicate records; 1,405 records quarantined due to missing results values
USGS NWIS	18,646	91,605	87,353	10	6,184 results rejected due to District Special parameters duplicate records.
Total		238,085	177,438	802	

(1) Tables

The four main tables of the database are:

- **MAIN_SITE:** Table of site (station) information, including site id and name, park code and boundary, site type, and related location information. Each site is unique, with one or more samples linked to it.
- **MAIN_SAMPLE:** Table of sample information, including site id, date/time, source agency, sample type, sample depth, and related sample information. Each sample is unique, with one or more results linked to it.
- **MAIN_QW_RESULT:** Table of results, including values (results), value remarks, sample types, parameter codes, and related information.
- **MAIN_PARAMETER:** Table of parameters, including parameter names and codes, reporting units, sample matrices, categories, and related information. This table was generated from the USGS NWIS and EPA master files.

Although the PACN Water-Quality Database does not require the user to open the database tables, the tables can be viewed by selecting 'Tables' under the Objects menu and selecting the table of interest from the list of tables. Double-click on the table name to open it or use the 'open' icon. Descriptions of the individual table fields are provided within the database. To view the field descriptions for a particular table select the 'design view' icon for the selected table of interest. To return to the table contents view (in spreadsheet form) select the 'database' icon for the selected table of interest.

By selecting a particular field, the user can view the properties of the field (the properties of the Site_Id field are shown in figure 1). The properties reflect the nature of the data stored in the field, such as field size, whether the field is required (Site_Id is a required field as it is the primary key in the MAIN_SITE table), and whether duplicates are allowed as indicated by the "Yes (No Duplicates)" in the Indexed property description. Additional lookup tables are included in the database to provide useful reference information to database users (table 10).

(2) Queries

Queries allow the user to filter and extract specific information from the tables (or from other queries) in the database. The PACN Water-Quality Database is form driven, with automation of the underlying queries, and therefore does not require the user to run queries. If desired, the underlying queries can be viewed in the Objects menu. Double-clicking on a query runs the query. Click on the *design view* icon to view the query design. An example of a select query is shown in figure 2.

(3) Forms

The PACN Water-Quality Database allows the user to perform all computations, filtering, reviewing, and exporting of data using buttons and menus on user-friendly

forms and does not require the ability to write code or run queries. Similar to queries, forms can be modified by the user in the design view; however, instructions on how to modify forms are not provided in this documentation, because creating and modifying forms is an advanced Access user function.

(4) Libraries

The forms and underlying code provided in this Access database require references to object libraries (fig. 3). It is advised that you do not make any changes to the reference library until you have reviewed the procedures provided in the Help documentation available with the database. You can check and alter (if required) enabled object libraries. This process has been simplified in the PACN Water-Quality Database.

(5) Modules

A module is a collection of Visual Basic for Applications declarations and procedures that are stored together as a unit. These procedures can be called from within the database to perform functions or a series of functions. This version 1.2 of the PACN Water-Quality Database has automated the calling procedures for functions and does not require knowledge of modules to use. This database contains a number of modules containing many functions. Modules developed by the USGS Colorado Water Science Center and modified for use in the PACN

Water-Quality Database include calculators for Geometric Means, Quantiles, and Data Aggregation (Juliane B. Brown, U.S. Geological Survey, written commun., 2005). The data aggregation module is provided to aid the user in aggregating selected parameters before conducting temporal and spatial statistical analyses. Details on the aggregation procedures, conducted during the database construction, are included in the Data Post-Processing section of this document and summarized in the database by means of the associated help pages.

Instructions on how to modify the modules are not provided in this documentation, because creating and modifying modules is an advanced Access user function requiring knowledge of Visual Basic. It is highly recommended that the modules are not altered in any way.

(6) Help

The PACN Water-Quality Database includes a companion file with the extension .chm. This is a compiled help file. This file contains useful information about each form and utility included in the database. To activate this custom help file, the user can press the 'Help' button on the main menu, or press the F1 key at any time, or left-click the

'What's This?' button  at the top right corner of any form and then left-click anywhere on the form. The companion help file also includes information on installing and starting the database, a tutorial for navigating the

Field Name	Data Type	Description
SiteNo	AutoNumber	
 Site_Id	Text	Unique identifier for specific sites (default is USGS Site ID, when more than one ID available)
LatLong_Cat	Text	Concatenated DMS latitude/longitude (used for site consolidation site_ids where USGS site not available)
Site_Name	Text	Name of sample site (default is USGS Site Name, when more than one name available)
Site_Description	Text	Description of site location
Park_Code	Text	PACN 4-digit acronym for NPS units (predominant park_code will be used for sites upstream of more than one park)
Park_Boundary	Text	Identifies which sites are within the park boundaries, water quality area of interest (WQAOI), within 500 meters of the WQAOI
Latitude_DMS	Text	Latitude (in degrees, minutes, seconds)
Longitude_DMS	Text	Longitude (in degrees, minutes, seconds)
Latitude_DD	Number	Latitude (decimal degrees)
Longitude_DD	Number	Longitude (decimal degrees)
DD_datum	Text	Datum for Latitude and Longitude (decimal degrees)
UTM_x	Number	UTM NAD 1983
UTM_y	Number	UTM NAD 1983
UTM_Zone	Text	UTM Zone (limited to zones 12 or 13 for the NCPN)
UTM_Datum	Text	Datum for UTM NAD 1983
HUC	Text	Hydrologic Unit Code
Country	Text	
State	Text	State
State_code	Text	
County	Text	County (based on FIPS County Code)
County_code	Text	
Site_Type_Code	Text	Site Type Code (DV = diversion; SW = surface water (streams, rivers); GW = ground water; SP = spring; SEEP = seep; MINE =
Geologic_Unit	Text	geologic unit
Well_Depth	Number	total depth recorded for well (in feet)

Field Properties	
General	Lookup
Field Size	255
Format	
Input Mask	
Caption	Site ID
Default Value	
Validation Rule	
Validation Text	
Required	Yes
Allow Zero Length	No
Indexed	Yes (No Duplicates)
Unicode Compression	Yes
IME Mode	No Control
IME Sentence Mode	None
Smart Tags	

This property cannot be modified in linked tables.

Figure 1. Design view of the MAIN_SITE table in the PACN Water-Quality Database. The field names are listed in the first column; data types are listed in the second column; descriptions of the fields are listed in the third column. In this example, the field name 'Site_Id' is highlighted. The key image to the left of the field name indicates that this is a primary key field. The data type for this field is 'Text'. The properties for this field show that this is a required field with a unique index (no duplicate values allowed). The field size is limited to 255 characters.

Table 10. Additional lookup tables included in the database.

Table Name	Table Information
PARKS	Lookup table of park codes with associated park name and network
SOURCE_AGENCIES	Lookup table of source agency codes with associated source agency descriptions and database from where the source agency code was used
SITE_TYPES	Lookup table of site type codes and associated site type descriptions
SAMPLE_TYPES	Lookup table of sample type codes and associated sample type descriptions
VALUE_REMARKS	Lookup table of value remark codes, associated value remark descriptions, and database from where the value remark originated
COUNTY_CODES	Table of state and county FIPS codes and descriptors
QA_FLAG	Lookup table for quality assurance flags in QW_RESULT table "QA_Flag" field. See the Data Post-Processing section for details.
USGS_parmfile_master	Table of USGS parameter code master used in USGS NWIS system (useful when adding additional data to database to assign Ppcodes)
EPACODES	Table of USEPA parameter codes master used for assigning Ppcodes to Modern STORET data and other non-USGS and non-Legacy datasets.
tblCodeEquivalents	Table of Ppcode group names, prioritization order and factors used to aggregate constituents (See the Data Post-Processing section for details.)
USGS_NWIS_AppH_NegValOK	Appendix H - Parameters that allow negative values (from NWIS User Manual, last modified 7/15/2002). See the Data Post-Processing section for details.
USGS_NWIS_AppI_RecensorOK	Appendix I - Parameters that can be Recensored if Stored Value is Zero (from NWIS User's Manual, last modified 1/15/2004). See the Data Post-Processing section for details.

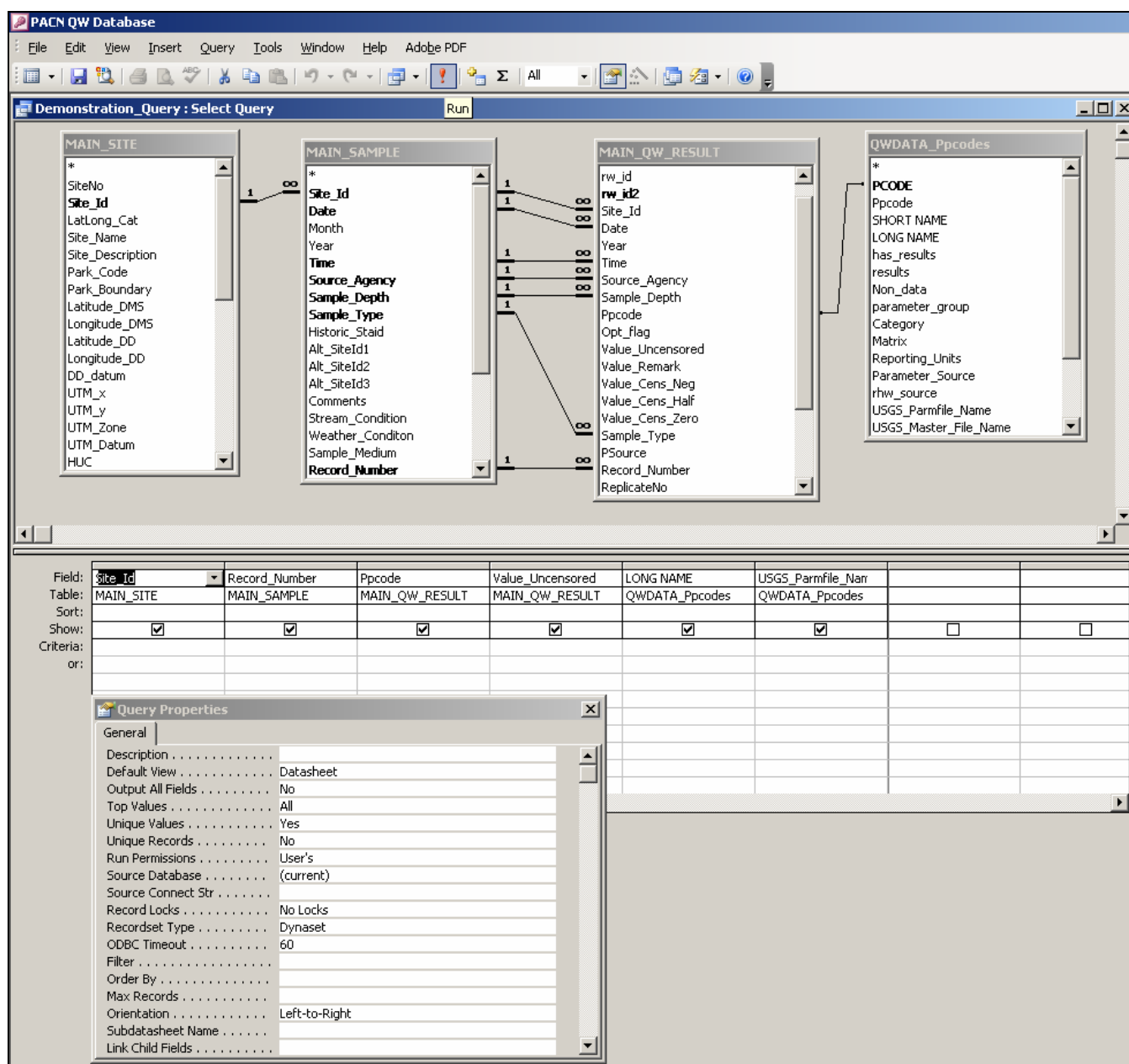


Figure 2. Example design of a select query. The relationships between the tables are shown by the lines connecting the tables. Fields selected from each table are added to the query design grid. The query can be run by clicking the toolbar button with the exclamation point icon.

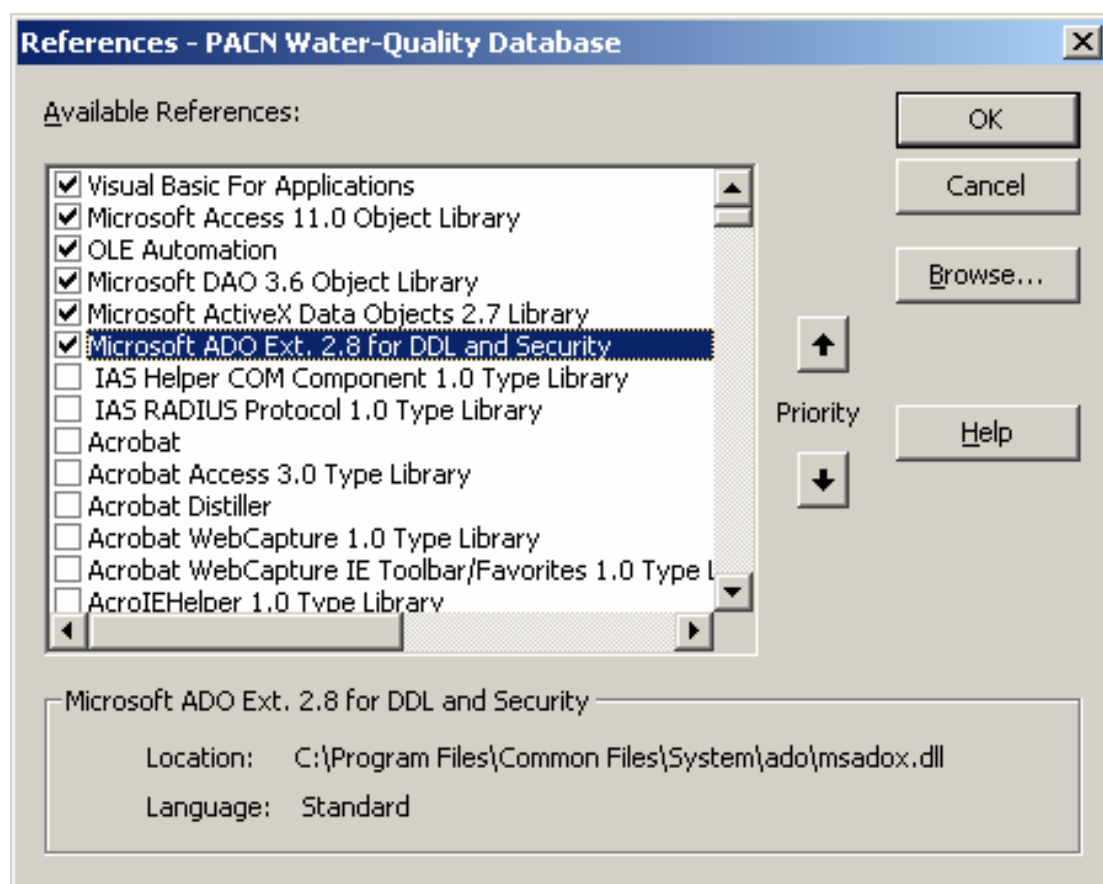


Figure 3. The PACN Water-Quality Database reference library. A reference is set to an object library by selecting the check box next to its name. This makes another application's objects available in the code.

database, and a searchable index of keywords. Important note — this file must be in the same folder as the front-end database in order to function properly. The help file will not open correctly if stored on a network drive because of security issues.

(7) Relationships

The relationships between tables in the database are indicated in figure 4. The four core tables: MAIN_SITE, MAIN_SAMPLE, MAIN_QW_RESULT, and QWDATA_Ppcodes (PARAMETERS), are linked by the primary keys (shown in bold in figure 4) and lead the user towards progressively more specific water-quality information (site–sample–result). The relational database structure provides for referential integrity through its relationships, primary keys, and linkages. For example, the deletion of a site and all associated sample and results data is facilitated by the one-to-many relationship between the SITE and SAMPLE tables and the SAMPLE and QW_RESULT tables. Alternatively, the removal of selected results and/or samples for a particular site maintains the site information in the database with the many-to-one relationship established between the QW_RESULT and SAMPLE tables. Similarly, deletion of a selected parameter code from the PARAMETER table subsequently removes all results assigned to that parameter code.

The database relationships structure should not be changed if the integrity of the database is to be maintained. If additional data are added to the database, the relationships and primary keys are designed to prevent the addition of duplicate data.

Data Post-Processing

Upon completion of the database compilation, several post-processing activities took place to clean up the database and to provide selected value-added options to aid in temporal and spatial analyses. Three primary post-processing activities occurred:

- Selected potential outliers were flagged.
- Selected data descriptors were added or adjusted.
- Selected parameters (constituents) were aggregated.

(1) Flagging of selected results

A basic quality-assessment check of results in the database was performed to identify potential outliers and nonsensical results. This assessment utilized the high and low values provided in the NPS Baseline Water Quality Inventory and Analysis (Horizon) Reports (appendix C, STORET Water Quality Control/Edit Checking, in NPS Horizon reports) to assess the ranges of selected results in the PACN Water-Quality Database (Juliane B. Brown, U.S. Geological Survey, written commun., 2005). The USGS NWIS Water Quality User Manual was also consulted for evaluating parameters that can be recensored (to detection limit, if known) if stored value is zero and parameters that allow negative values (appendices H and I in NWIS Water

Quality User Manual). These tables are provided in the PACN Water-Quality Database for reference (EPA_AppC_Qcchecks, USGS_NWIS_AppH_NegValOK, and USGS_NWIS_AppI_RecensorOK, respectively). An automated process was created to facilitate the identification of the high and low values. These values were flagged in the QW_RESULTS table, and results with nonsensical and/or extreme values were flagged and removed from the QW_RESULTS table and put into the Erroneous_results_tbl table.

To run this tool from within the database, click the 'Tools' icon on the Main Menu form and then click the 'Check for Extreme Values' button. More information about this function is provided in the associated help file. This process compares the uncensored values with the upper and lower limits from the reference tables. If a value is above the upper limit, the QA flag column will be flagged 'HIGH'. If a value is below the lower limit, it will be flagged 'LOW'. If a value is above the upper limit plus 10 percent it will be flagged 'VHIGH' and if a value is below the lower limit by more than 10 percent it will be flagged 'VLOW' (table 11). The second phase of this function removes the results flagged as either 'VHIGH' or 'VLOW' and moves them to the table named Erroneous_results_tbl. These results can be reviewed by clicking the 'Edit Extreme Values' button. If wanted, the user can then decide to append these results back into the QW_RESULTS table.

The purpose of these flags is to identify potential outliers and illogical values for the users of the database so that appropriate robust statistical techniques can be utilized to analyze data with flags attached. Parameters that were not listed were not reviewed relative to "high/low" bounds; therefore, it is recommended that additional quality-control checks for these results be established and quality assurance of the results in the database be conducted if time and resources exist. The USGS makes no statement as to the accuracy of the data in the database (and the supplementary database). Arduous attempts to quality-assure the data were made, as detailed in the Data Pre- and Post-Processing sections above; however, the users must treat the data included in the PACN Water-Quality Database with the appropriate caution that should be granted to any historical data set compiled from multiple databases and source agencies.

(2) Addition of selected data descriptors

Selected changes were made to the data after the data were added into the PACN Water-Quality Database. These included the following additions or corrections:

- Filling in missing information that could be readily obtained using available ArcGIS resources including countries, hydrologic unit codes (HUC), states, and counties.

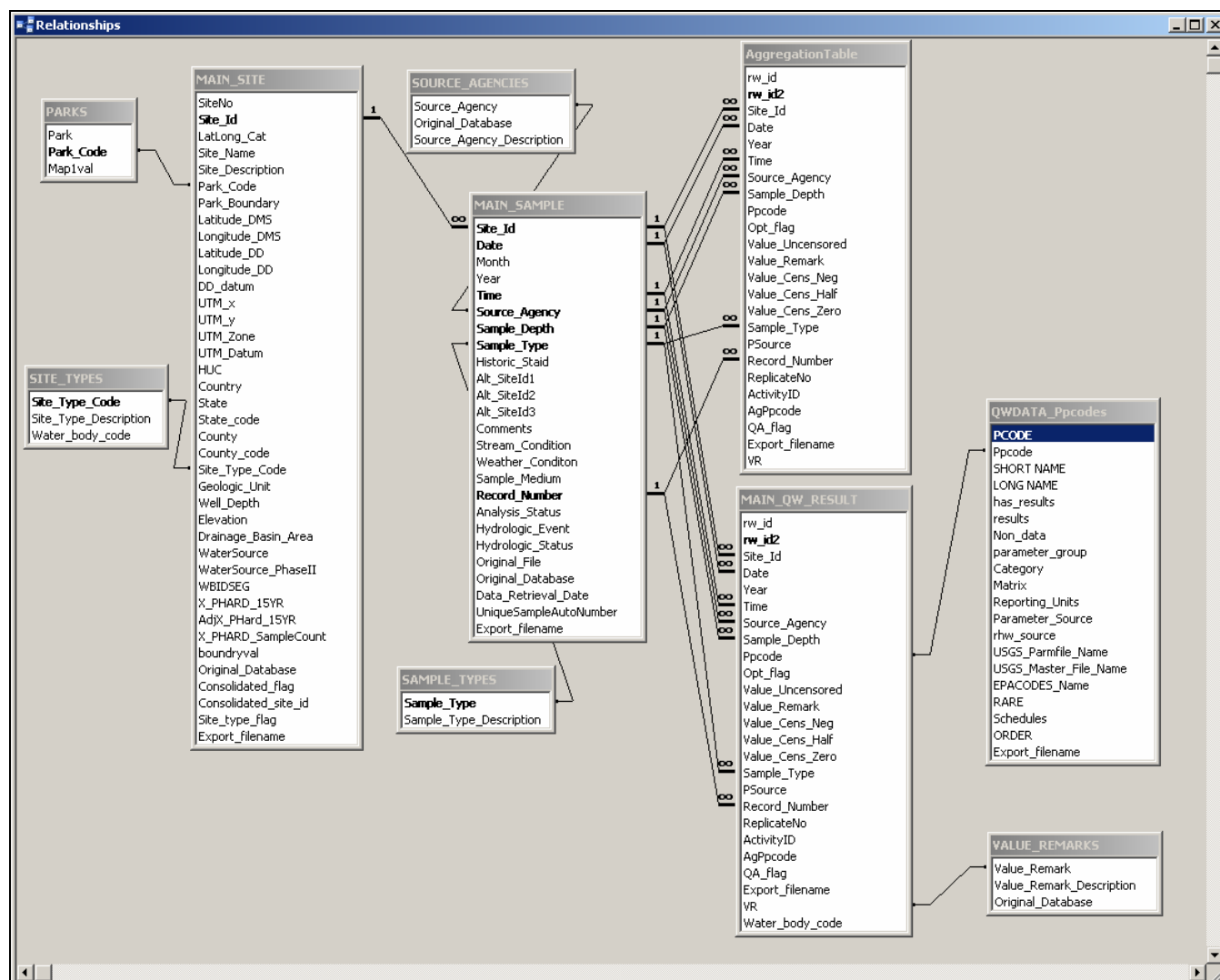


Figure 4. A display of the relationships among the various tables in the PACN Water-Quality Database. A relationship is an association that is established between common fields in two tables. A relationship can be one-to-one, one-to-many (∞), or many-to-many. The field names in highlighted in bold are primary keys. Primary keys are one or more fields whose values uniquely identify each record in a table. A primary key is used to relate a table to foreign keys in other tables.

Table 11. Post-processing quality assurance codes identifying high and/or low values.

[QA, Quality Assurance; USEPA, U.S. Environmental Protection Agency; USGS, U.S. Geological Survey]

QA_Flag	QA_Flag_Description	QA_Flag_Source	QA_Flag_Source_Description
H	Value exceeds high value used by STORET for 190 common water quality parameters used to screen or error-check data.	USEPA	"STORET Water Quality Control/Edit Checking" - Appendix C of National Park Service Baseline/Horizon Reports
L	Value is below the low value used by STORET for 190 common water quality parameters used to screen or error-check data.	USEPA	"STORET Water Quality Control/Edit Checking" - Appendix C of National Park Service Baseline/Horizon Reports
N	Parameter is allowed to be negative (or zero)	USGS	Appendix H. Parameters that Allow Negative Values. Water Quality NWIS User Manual
VHOK	High value determined acceptable		
VLOK	Low value determined acceptable		
VHIGH	Value exceeds high value plus 10 percent used by STORET for 190 common water quality parameters used to screen or error-check data.	USEPA	"STORET Water Quality Control/Edit Checking" - Appendix C of National Park Service Baseline/Horizon Reports
VLOW	Value is below the low value plus 10 percent used by STORET for 190 common water quality parameters used to screen or error-check data.	USEPA	"STORET Water Quality Control/Edit Checking" - Appendix C of National Park Service Baseline/Horizon Reports

- Corrections to the database to make the data codes or fields consistent, such as assigning a consistent site type code to all sites. For example, the abbreviation DIV and DV were both used to designate diversions, so the relevant sites were updated to DV. Similarly, some of the data used county and/or state FIPs (Federal Information Processing Standards) codes, while others used names. These fields were all updated to consistently use the county/state names, as needed.
- Corrections to obvious transcription errors (pH reported as mg/L was changed to Standard Units).
- Times were converted to military time and 2359 was used as the default time for samples with missing time data, as needed, because time is a required field and cannot be null.
- In order for sites to be plotted in ArcGIS, latitudes and longitudes were converted into decimal degrees (from degrees, minutes, and seconds), as needed. Additional location descriptors were added to the SITE table, where available. No attempt to verify, complete, or correct site locations or site location information was made as part of this effort.

(3) Aggregation of selected parameters

In order to maximize the utility of the data within the PACN Water-Quality Database, selected parameters were aggregated through a process of data conversions and combinations. Parameter aggregations were based on Mueller and others (1995). Where appropriate, similar parameters for a constituent were aggregated to create a single parameter code that could more readily be accessed for various data summary tasks (Juliane B. Brown, U.S. Geological Survey, written commun., 2005). The multiplication values were computed from atomic mass information. For example, pH was reported by various data sources using three distinct, yet similar parameters. The aggregation process generated a single pH parameter that could more readily be used to determine density of pH data and pH conditions among sites. The aggregations that were incorporated into the database, the parameters used for the aggregations (Ppcode, Parameter Name and Parameter Short Name columns), the order of aggregation (Order column), and conversion factors (Factors column) applied during the aggregation are in appendix B (from the table tblCodeEquivalents). The new parameter code assigned to each aggregated parameter is provided in the table.

The aggregation procedure has been automated in the PACN Water-Quality Database and has already been performed on the dataset. Information on how to perform this procedure on new data is described in detail in the associated help file. This process utilizes an aggregation module created to facilitate selected aggregations of results (see module modCalcBestVariables1 under the “Modules” object) (Juliane B. Brown, U.S. Geological Survey, written commun., 2005). To operate this module, the parameters to be included in the aggregation must be properly coded in the supplementary tblCodeEquivalents table, which serves as a reference table to the module to tell the program which parameters to aggregate, in what order to aggregate the parameters, and if the results should be multiplied by a numerical factor during the aggregation (note that the factor must be set to “1” if no numerical multiplication factor is required). The results of the aggregation are stored in the AggregationTable table. The PACN Water-Quality Database allows the user the option to choose the data from this table for analytical and graphical functions.

Data Post-Processing Summary

The post-processing activities led to changes affecting the results in the database.

The total number of sites, samples, and results in the database (table 12) reflects the exclusion of the “deleted” results.

The database was designed to facilitate the retrieval of information by NPS PACN and park unit personnel to address regional and/or park-specific water-quality concerns. The database provides for numerous types of retrievals and applications, such as

- descriptive statistics on selected results (quantiles, maximum value, mean);
- graphical analysis of constituents over time;
- assessment of water-quality trends over time;
- the spatial distribution of sites, sampling events, and/or concentrations of selected results.

Demonstrations of many of these applications were provided to PACN personnel.

Site Consolidation

Site Consolidation was not implemented in the PACN Water-Quality Database. If the user wants to perform this function, the methods are outlined below.

Sites with the same site type code and location could be consolidated in the database. Sites could be consolidated in order to eliminate the occurrence of multiple datasets for a particular geographic location (Juliane B. Brown, U.S. Geological Survey, written commun., 2005). The consolidation process is based on a series of queries used to find comparable site names, site types, and latitude/longitude locations as well as with visual comparisons of sites using ArcMap. Care should be taken to avoid consolidating sites that are in the same location but

whose site names and/or site ids indicate unique sites (for examples well1 and well2, though located in the same sample point location, should not be consolidated). Similarly, sites with different site types should not be consolidated (for example, x spring, x creek, though the sample points are located at the same location, should not be consolidated). The Historic_Staid field in the SAMPLE table reflects the original site id used in the raw data source; however, it is not a primary key so care must be taken when appending additional data that use these historic ids. Therefore, it is strongly advised that the historic ids be linked to any new data site ids before the data are appended to avoid duplicate results being entered into the database.

Recommendations for Future Work

There are several tasks that could enhance the analytical functionality and utility of the PACN Water-Quality Database. These include, but are not limited to, the following:

- Creating a pre-processing database that would streamline the process of adding new data to the database.
- Periodically updating the database with new data.
- Periodically updating the database with new functions as requested by the PACN.
- Creating and maintaining an associated Water-Quality Standards Database with state surface and ground water quality standards and/or incorporation of additional USEPA Human Health, Aquatic Life, Biocriteria, Nutrients, or Pathogen criteria.
- Completion of the water body segment identifications in the PACN Water-Quality Database (WBIDSEGs in SITE table), which are linked to designated beneficial uses, to include all sites in the database to allow for exceedance analyses of all sites. (This may require consultation with appropriate state contacts in Hawaii.).
- Expansion of the identified water sources in the PACN Water-Quality Database (WaterSource in SITE table) to allow for the analyses of standards exceedances at the waterbody-level on currently unidentified waters of interest to the park and/or network.
- Recomputation of mean hardness values and table value standards for applicable constituents as new data are added to the PACN Water-Quality Database.
- Completion of an outside review with the applicable state agency personnel of the assessment database structure, contents, and analysis outputs.
- Development of an exceedance report and/or form to facilitate analysis of the data relative to selected standards for nontechnical Access users.

References Cited

- DeVerse, K. and DiDonato, E., 2005. Appendix I, water quality report. *In*: HaySmith, L., Klasner, F. L., Stephens, S. H., and Dicus, G. H., Pacific Island Network Vital Signs Monitoring Plan: Phase III (draft) report: National Park Service, Pacific Island Network, Hawaii National Park, Hawaii, 111 p.
- Kaufeld, J., 1995, Access for Windows 95 for dummies: IDG Books Worldwide, Inc., 346 p.
- Mueller, D.K., Hamilton, P.A., Helsel, D.R., Hitt, K.J., and Ruddy, B.C., 1995, Nutrients in ground water and surface water of the United States — an analysis of data through 1992: U.S. Geological Survey Water-Resources Investigations Report 95-4031, 74 p.

Appendix A: Maps of the Sampling Sites in and around the PACN park units

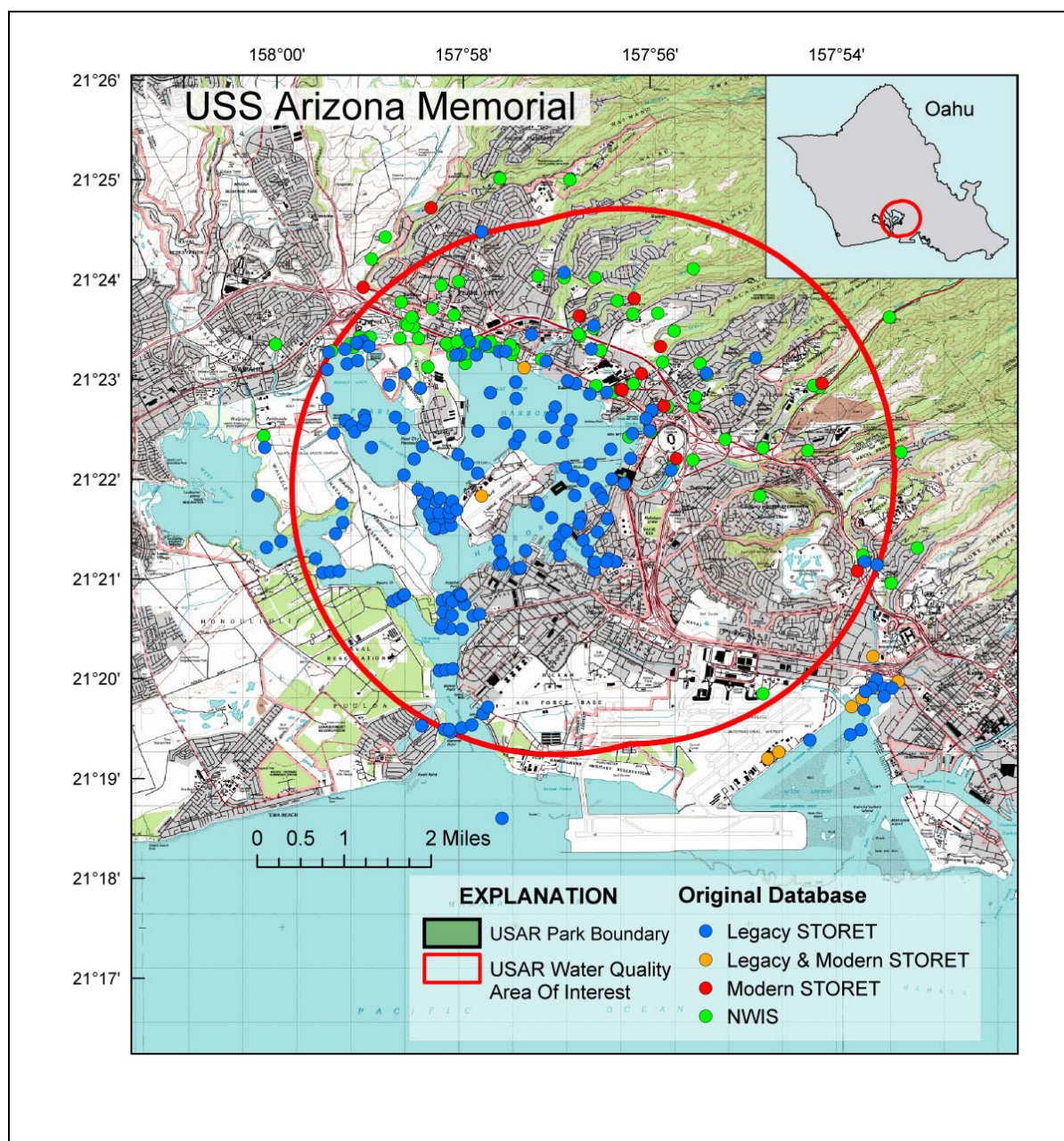


Figure A1. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the USS Arizona Memorial National Park, Oahu, Hawaii.

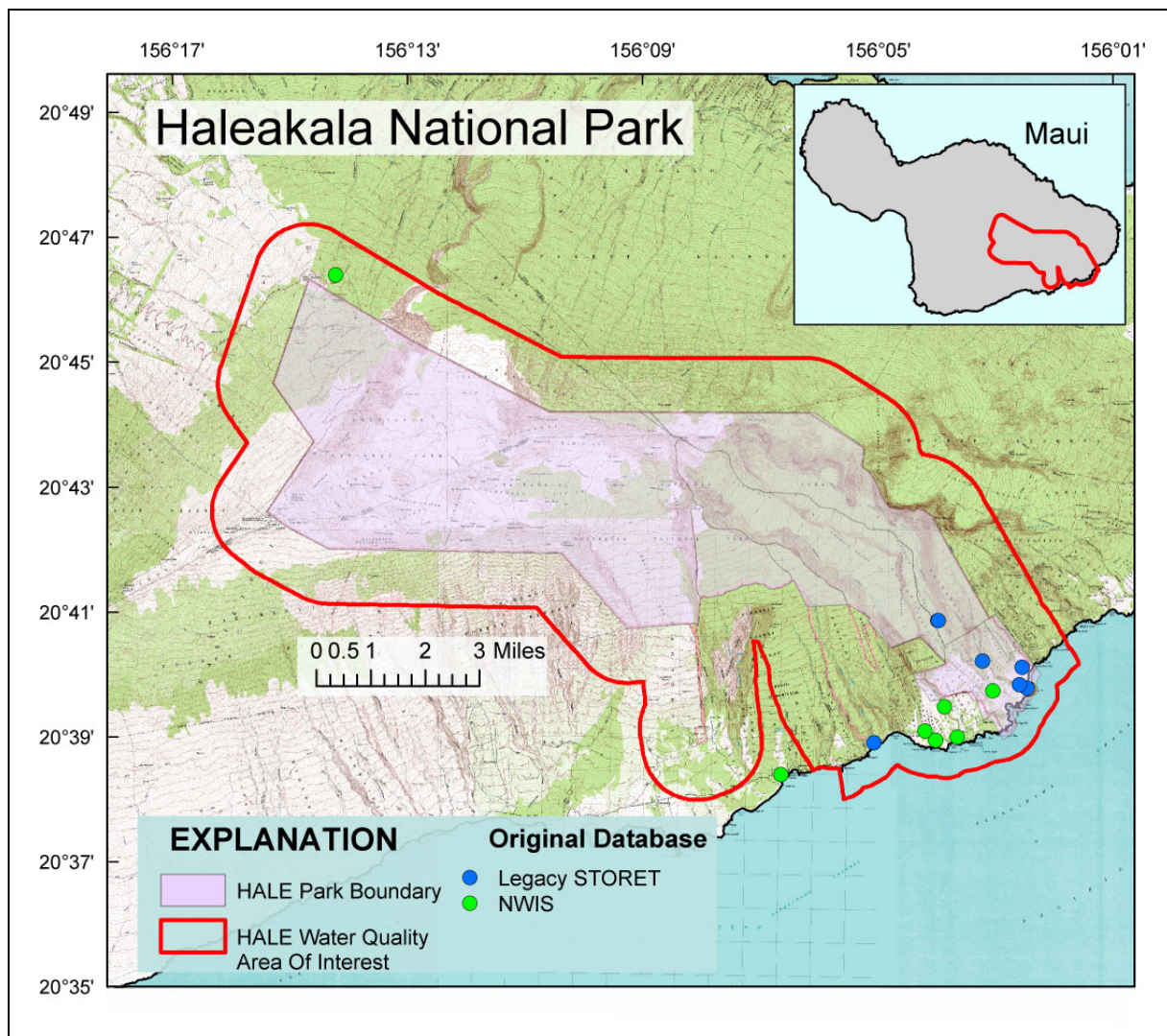


Figure A2. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the Haleakala National Park, Maui, Hawaii.

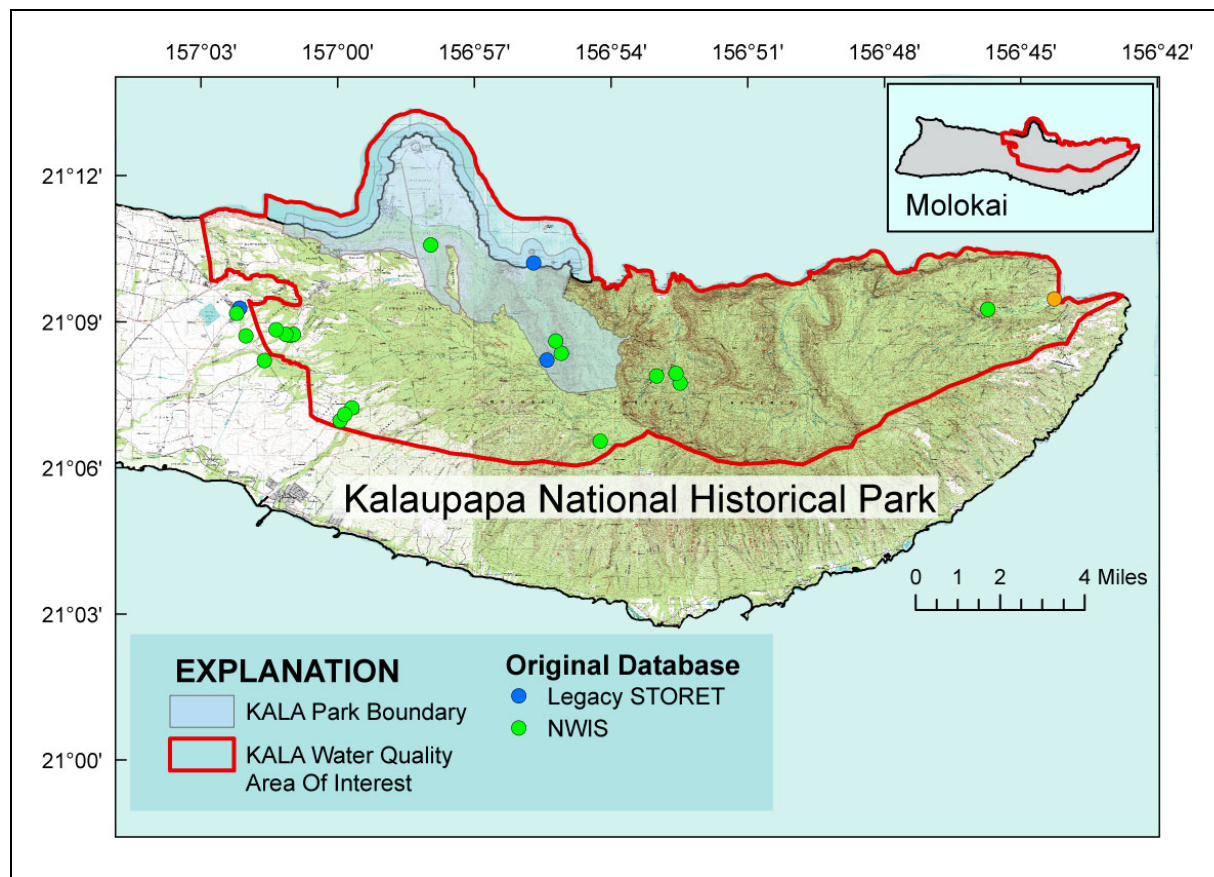


Figure A3. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the Kalaupapa National Historical Park, Molokai, Hawaii.

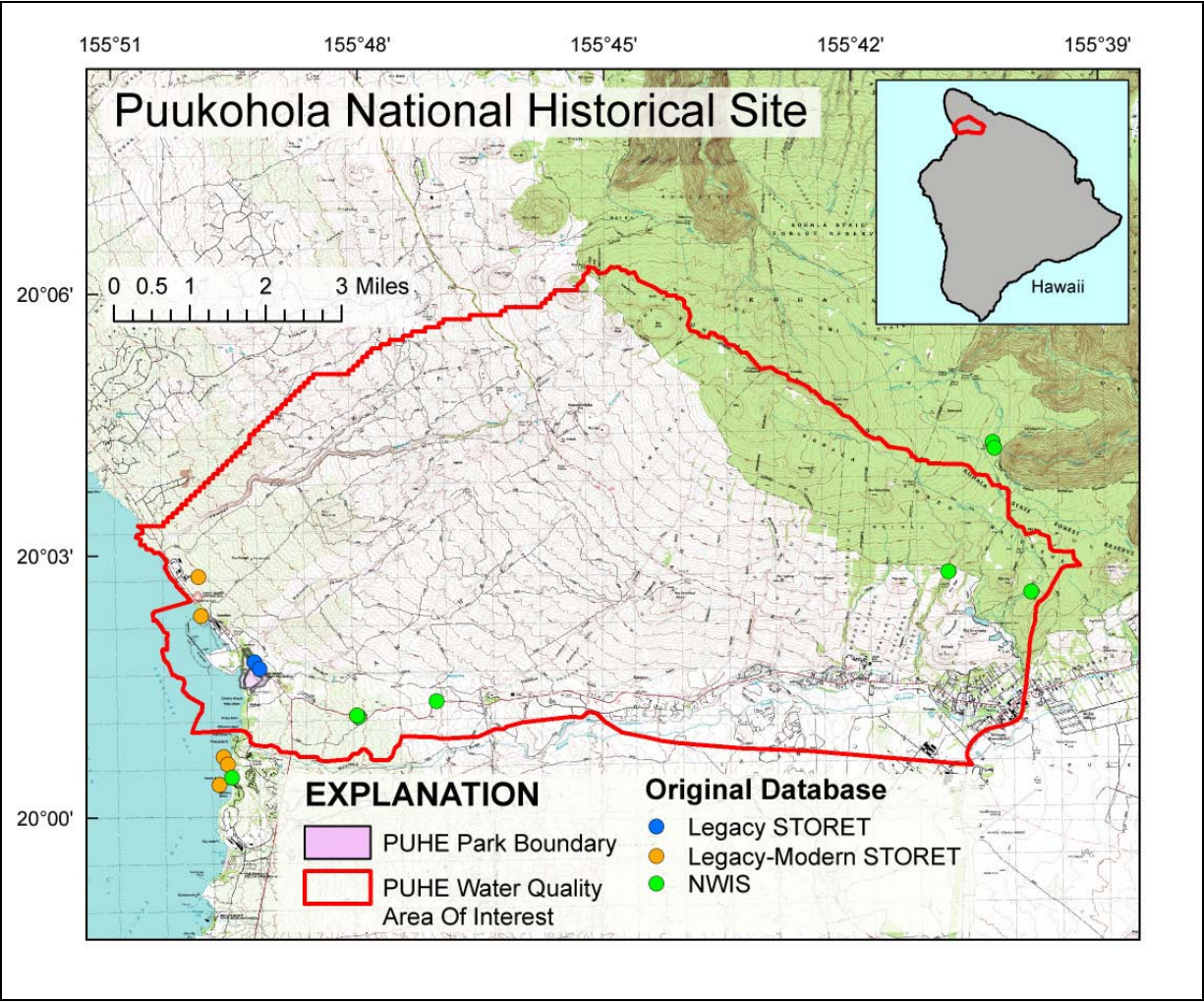


Figure A4. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the Puukohola National Historical Site, Hawaii, Hawaii.

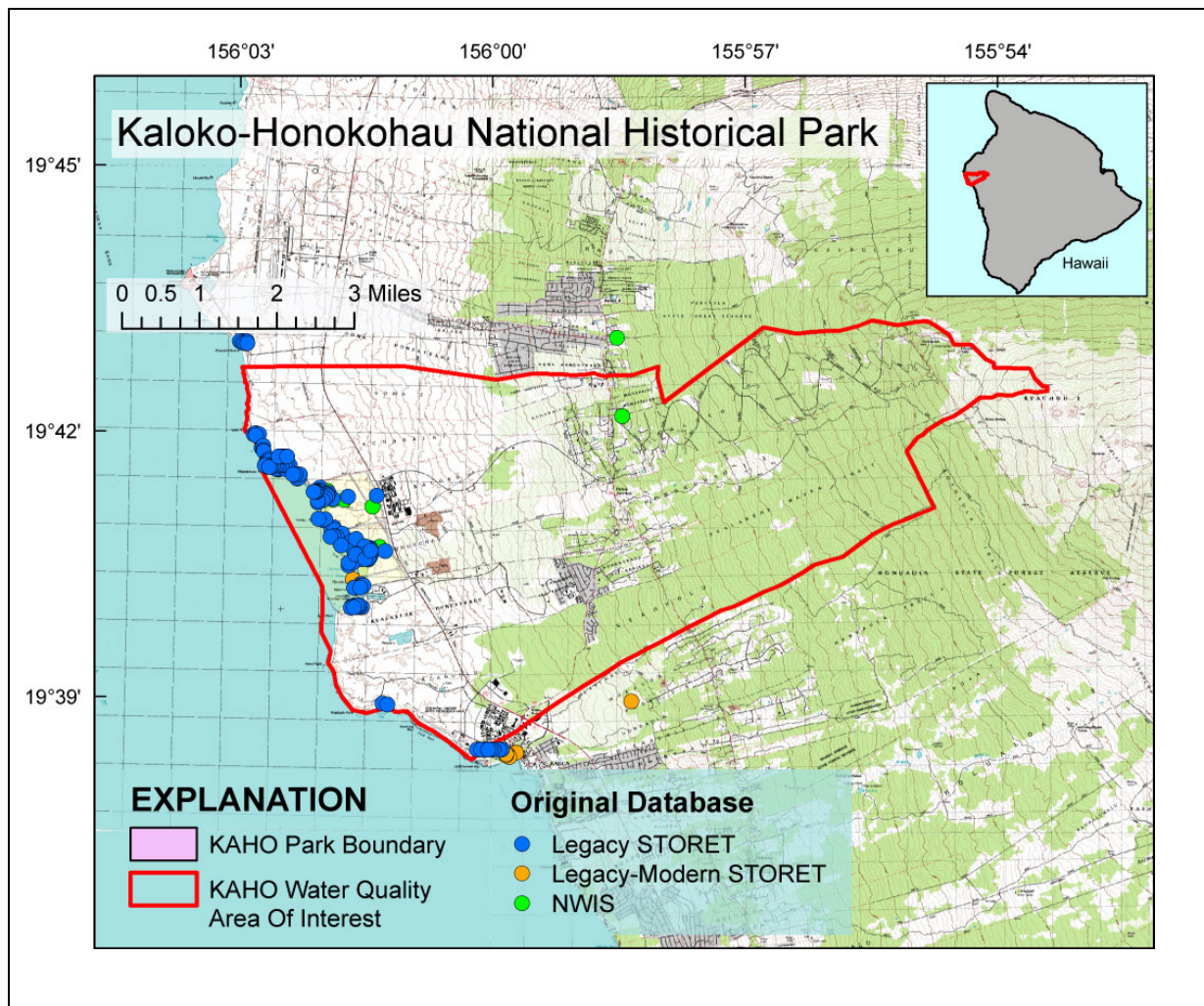


Figure A5. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the Kaloko-Honokohau National Historical Park, Hawaii, Hawaii.

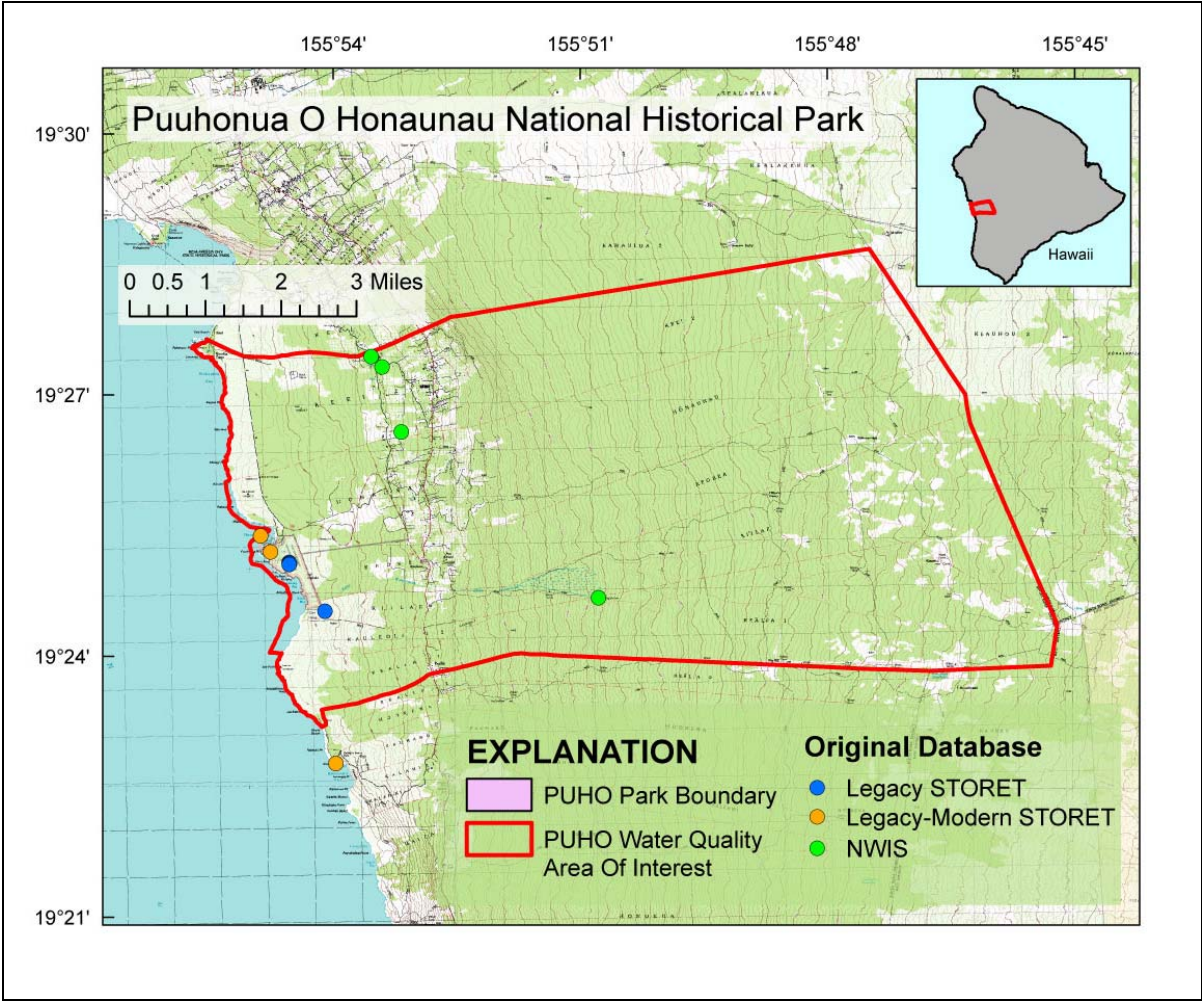


Figure A6. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the Puuhonua O Honaunau National Historical Park, Hawaii, Hawaii.

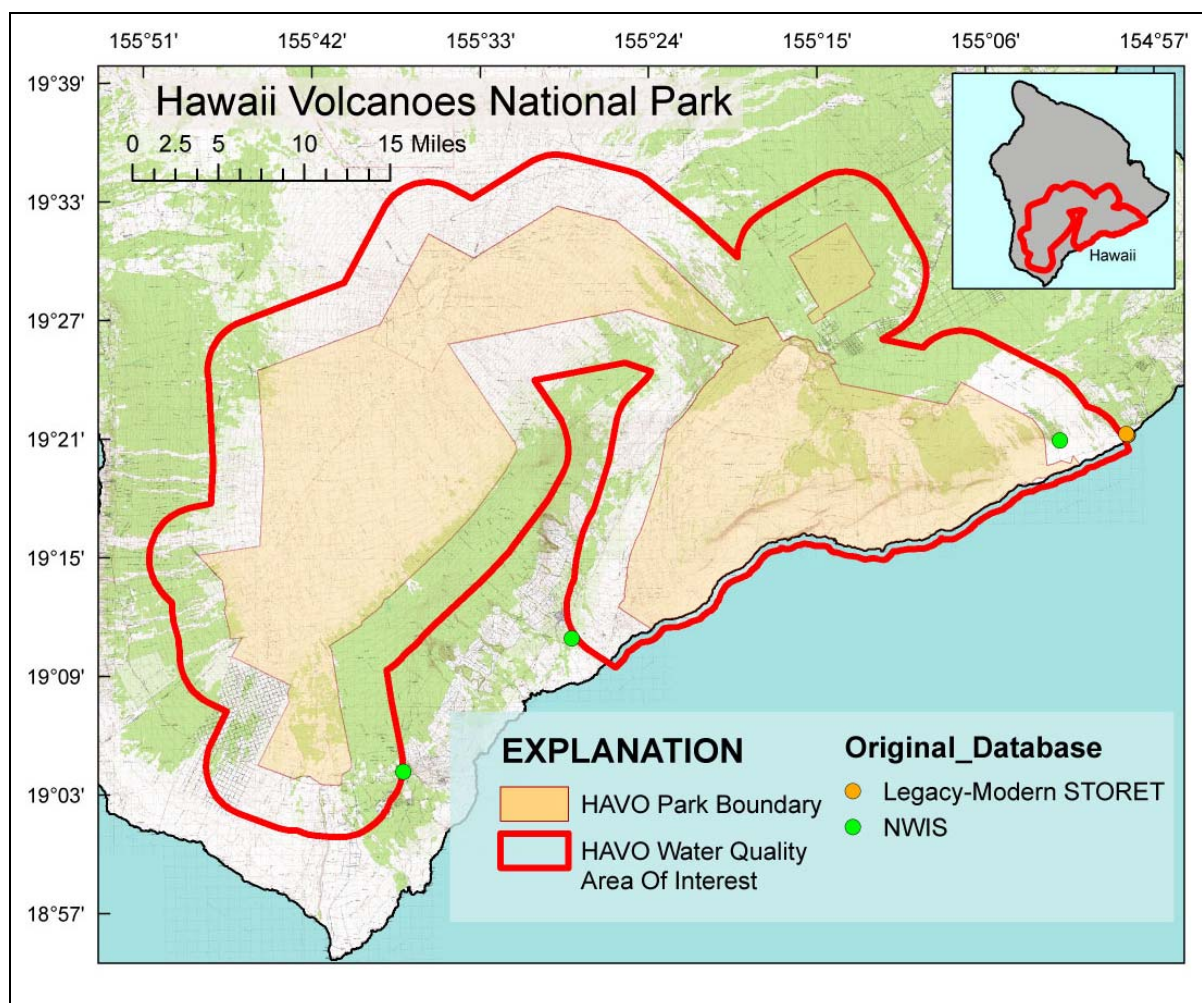


Figure A7. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around Hawaii Volcanoes National Park, Hawaii, Hawaii.

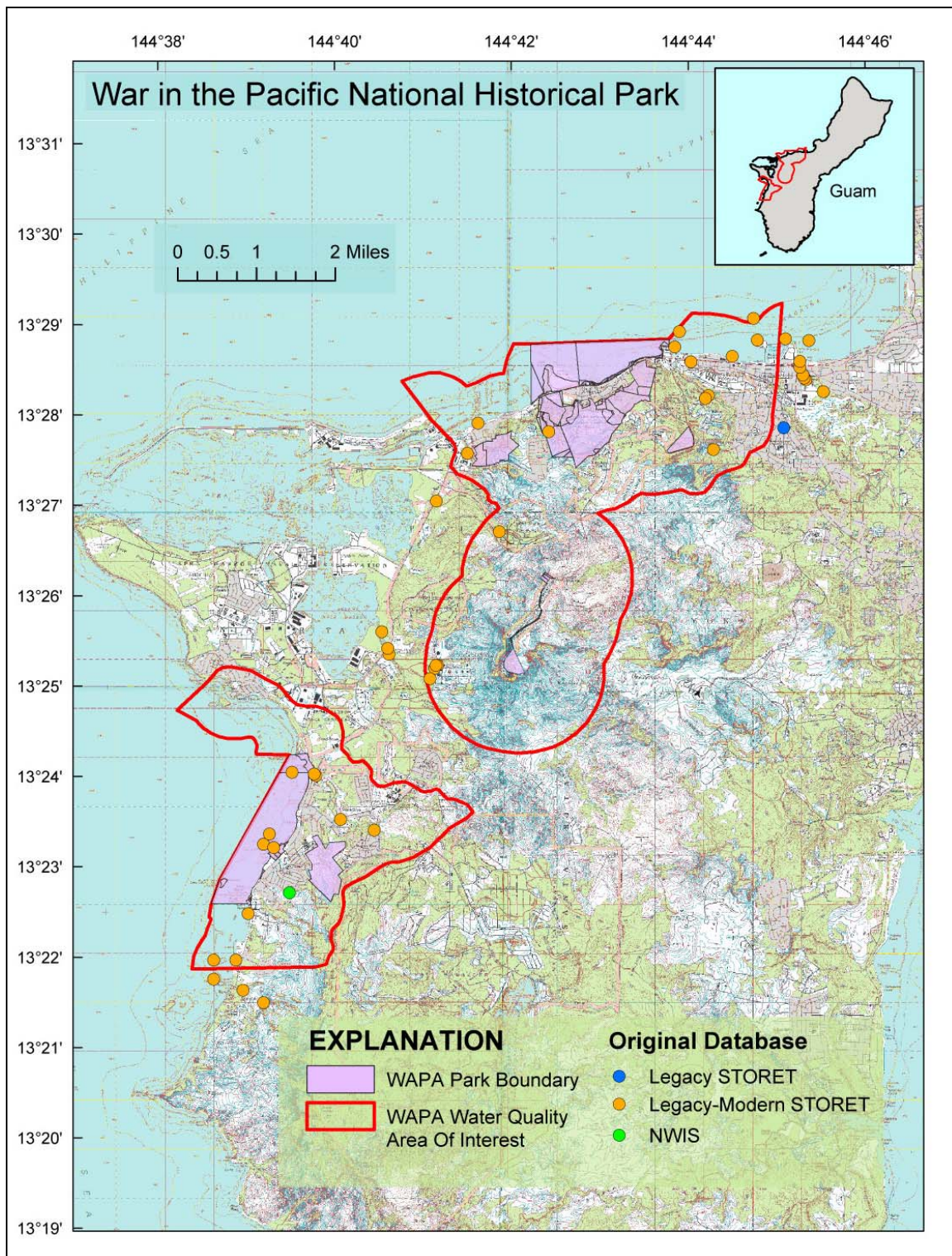


Figure A8. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the War in the Pacific National Historical Park, Guam.

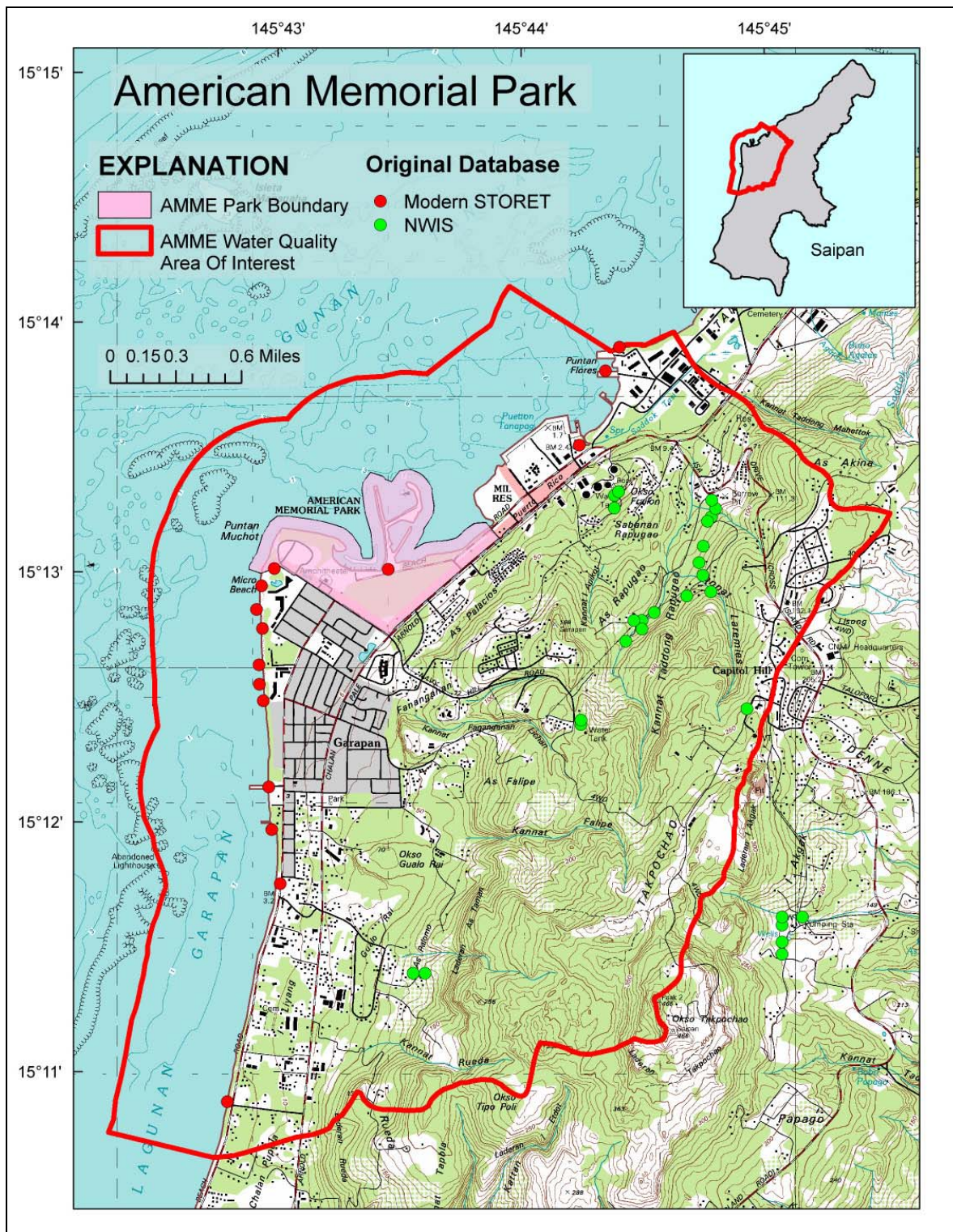


Figure A9. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the American Memorial Park, Saipan, Commonwealth of the Northern Mariana Islands.



Figure A10. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the National Park of American Samoa, Tutuila, American Samoa.

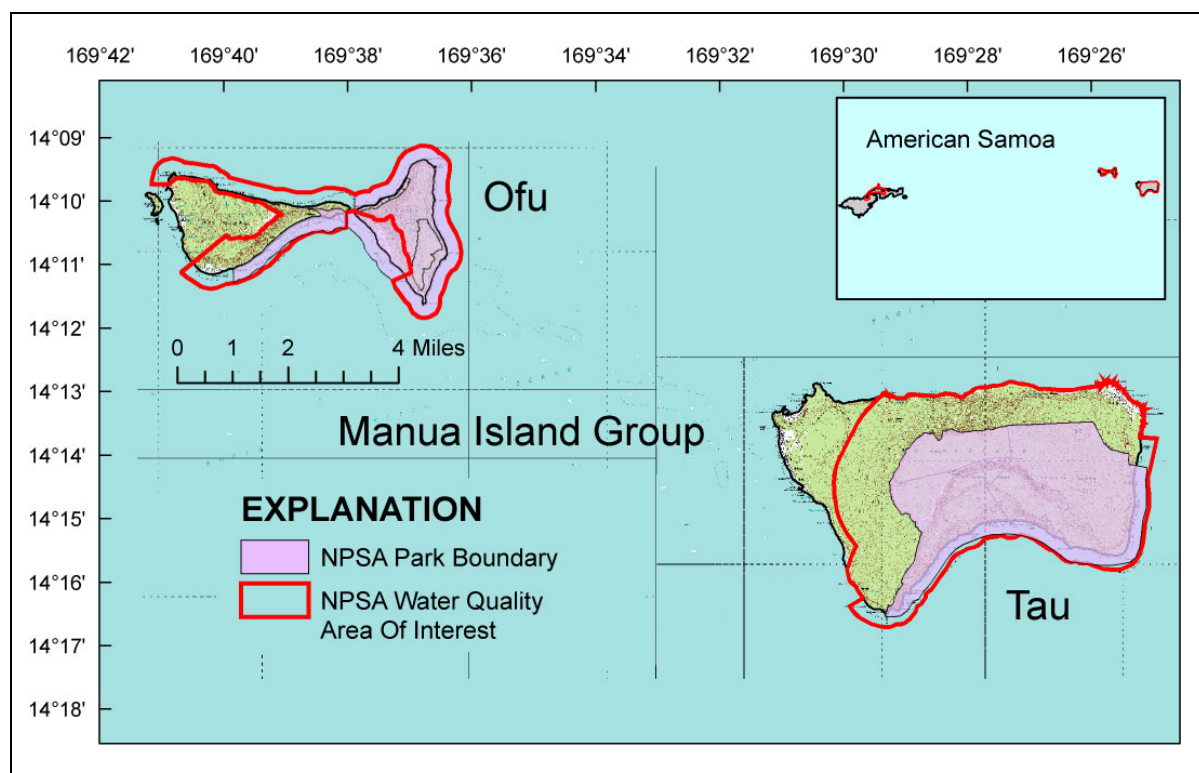


Figure A11. Map of the sampling sites within 1,000 meters (3,300 ft) of the Water Quality Area of Interest around the National Park of American Samoa, Manua Island Group, American Samoa.

Appendix B: List of Parameters used in the Aggregation Procedure

Appendix B. List of parameters used in the aggregation procedure.

[Parameter aggregations based on Mueller, et al (1995) and provided by Julianne B. Brown, U.S. Geological Survey, written commun., 2005.]

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P00010	TEMPERATURE, WATER (DEGREES CENTIGRADE)	TEMP	1	1
P00060	DISCHARGE, CUBIC FEET PER SECOND	QFlow	2	1
P00061	DISCHARGE, INSTANTANEOUS, CUBIC FEET PER SECOND	QFlow	1	1
P00070	TURBIDITY, (JACKSON CANDLE UNITS)	turby	7	1
P00076	TURBIDITY,HACH TURBIDIMETER (FORMAZIN TURB UNIT)	turby	2	1
P00094	SPECIFIC CONDUCTANCE,FIELD (μMHOS/CM @ 25C)	SpCnd	1	1
P00095	SPECIFIC CONDUCTANCE (μMHOS/CM @ 25C)	SpCnd	2	1
P00154	SULFATE (AS S) WHOLE WATER, MG/L	00SO4	4	2.996
P00299	OXYGEN, DISSOLVED, ANALYSIS BY PROBE MG/L	000DO	1	1
P00300	OXYGEN, DISSOLVED, MG/L	000DO	2	1
P00400	pH, WATER, WHOLE, FIELD, STANDARD UNITS	000pH	1	1
P00402	SPECIFIC CONDUCTANCE, NON-TEMPERATURE CORR.UMHOS/CM	SpCnd	4	1
P00403	pH, LAB, STANDARD UNITS, SU	000pH	3	1
P00406	pH, FIELD, STANDARD UNITS, SU	000pH	2	1
P00409	ACID NEUTRALIZING CAPACITY, WATER, UNFILTERED, GRAN TITRATION, MICROEQUIVALENTS PER LITER	00ANC	13	0.05
P00410	ACID NEUTRALIZING CAPACITY, WATER, UNFILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, FIELD, MG/L AS CALCIUM CARBONATE	00ANC	1	1
P00411	ACID NEUTRALIZING CAPACITY, WATER, UNFILTERED, METHYL ORANGE ENDPOINT (pH 3.1-4.4) TITRATION, MG/L AS CALCIUM CARBONATE	00ANC	11	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P00413	ALKALINITY,TOTAL,LOW LEVEL GRAN ANAL, MG/L (CACO ₃)	00ALK		1
P00415	ACID NEUTRALIZING CAPACITY, WATER, UNFILTERED, PHENOLPHTHALEIN ENDPOINT (pH 8.5-9.0) TITRATION, MG/L AS CALCIUM CARBONATE	00ANC	5	1
P00417	ACID NEUTRALIZING CAPACITY, WATER, UNFILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, LABORATORY, MG/L AS CALCIUM CARBONATE	00ANC	12	1
P00419	ACID NEUTRALIZING CAPACITY, WATER, UNFILTERED, INCREMENTAL TITRATION, FIELD, MG/L AS CALCIUM CARBONATE	00ANC	8	1
P00420	ALKALINITY, HYDROXIDE (AS CACO ₃)	00ALK	5	1
P00421	ALKALINITY, WATER, FILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, LABORATORY, MG/L AS CALCIUM CARBONATE	00ALK	7	1
P00425	BICARBONATE, WATER, UNFILTERED, MG/L AS CALCIUM CARBONATE	Bicarb	3	1.6403
P00430	CARBONATE, WATER, UNFILTERED, MG/L AS CALCIUM CARBONATE	Carb	5	1.6679
P00440	BICARBONATE, WATER, UNFILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, FIELD, MG/L	Bicarb	1	1
P00440	BICARBONATE, WATER, UNFILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, FIELD, MG/L	HCO ₃	1	0.82
P00445	CARBONATE, WATER, UNFILTERED, FIXED ENDPOINT (pH 8.3) TITRATION, FIELD, MG/L	Carb	1	1
P00447	CARBONATE, WATER, UNFILTERED, INCREMENTAL TITRATION, FIELD, MG/L	Carb	2	1
P00450	BICARBONATE, WATER, UNFILTERED, INCREMENTAL TITRATION, FIELD, MG/L	Bicarb	2	1
P00452	CARBONATE, WATER, FILTERED, INCREMENTAL TITRATION, FIELD, MG/L	Carb	6	1
P00453	BICARBONATE, WATER, FILTERED, INCREMENTAL TITRATION, FIELD, MG/L	Bicarb	6	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P00600	NITROGEN, TOTAL, (MG/L AS N	totalN	1	1
P00608	NITROGEN, AMMONIA, DISSOLVED, MG/L AS N	ammon	1	1
P00608	NITROGEN, AMMONIA, DISSOLVED, MG/L AS N	ammonds	1	1
P00610	NITROGEN, AMMONIA, TOTAL, MG/L AS N	ammon	3	1
P00612	AMMONIA, UNIONIZED, MG/L AS N	unNH3	1	1
P00613	NITRITE NITROGEN, DISSOLVED, MG/L AS N	Nitrite	1	1
P00615	NITRITE NITROGEN, TOTAL, MG/L AS N	Nitrite	3	1
P00618	NITRATE NITROGEN, DISSOLVED, MG/L AS N	Nitrate	2	1
P00619	AMMONIA, UNIONIZED (CALC FR TEMP-PH-NH ₄), MG/L	unNH3	2	0.82
P00620	NITRATE NITROGEN, TOTAL, MG/L AS N	Nitrate	5	1
P00630	NITRITE PLUS NITRATE, TOTAL 1 DET., MG/L AS N	NO3_NO2	1	1
P00631	NITRITE PLUS NITRATE, DISS. 1 DET., MG/L AS N	NO3_NO2	2	1
P00650	PHOSPHATE, TOTAL, MG/L AS PO ₄	orthoP	9	0.3261
P00653	PHOSPHATE, TOTAL SOLUBLE, MG/L	orthoP	2	0.3261
P00660	PHOSPHATE, ORTHO, MG/L AS PO ₄	orthoP	4	0.3261
P00662	PHOSPHORUS (P), WATER, TOTAL RECOVERABLE, µG/L	totalP	5	0.001
P00665	PHOSPHORUS, TOTAL, MG/L AS P	totalP	1	1
P00671	PHOSPHORUS, DISSOLVED ORTHOPHOSPHATE, MG/L AS P	orthoP	1	1
P00900	HARDNESS, WATER, UNFILTERED, MG/L AS CALCIUM CARBONATE	HARD	1	1
P00901	CARBONATE HARDNESS, WATER, UNFILTERED, MG/L AS CALCIUM CARBONATE; NO CORRESPONDING HCO ₃	00ANC	15	1
P00910	CALCIUM, WATER, UNFILTERED, MG/L AS CALCIUM CARBONATE	000Ca	5	0.4004

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P00915	CALCIUM, WATER, FILTERED, MG/L	000Ca	1	1
P00916	CALCIUM, WATER, UNFILTERED, RECOVERABLE, MG/L	000Ca	4	1
P00918	CALCIUM, WATER, UNFILTERED, RECOVERABLE, MG/L	000Ca	6	1
P00920	MAGNESIUM, WATER, UNFILTERED, MG/L AS CALCIUM CARBONATE	000Mg		1
P00921	MAGNESIUM, WATER, UNFILTERED, RECOVERABLE, MG/L	000Mg	5	1
P00923	SODIUM, WATER, UNFILTERED, RECOVERABLE, MG/L	000Na	3	1
P00925	MAGNESIUM, WATER, FILTERED, MG/L	000Mg	1	1
P00927	MAGNESIUM, WATER, UNFILTERED, RECOVERABLE, MG/L	000Mg	3	1
P00929	SODIUM, TOTAL, MG/L AS NA	000Na	2	1
P00930	SODIUM, DISSOLVED, MG/L AS NA	000Na	1	1
P00935	POTASSIUM, WATER, FILTERED, MG/L	0000K	1	1
P00937	POTASSIUM, WATER, UNFILTERED, RECOVERABLE, MG/L	0000K	2	1
P00939	POTASSIUM, WATER, UNFILTERED, RECOVERABLE, MG/L	0000K	3	1
P00940	CHLORIDE, WATER, FILTERED, MG/L	000Cl	1	1
P00941	CHLORIDE, DISSOLVED IN WATER MG/L	000Cl	2	1
P00945	SULFATE, WATER, FILTERED, MG/L	00SO4	1	1
P00946	SULFATE, WATER, UNFILTERED, MG/L	00SO4	3	1
P00950	FLUORIDE, WATER, FILTERED, MG/L	Fluor	1	1
P00951	FLUORIDE, WATER, UNFILTERED, MG/L	Fluor	2	1
P00955	SILICA, WATER, FILTERED, MG/L	0SiO2	1	1
P00956	SILICA, WATER, UNFILTERED, MG/L	0SiO2	4	1
P00980	IRON, TOTAL RECOVERABLE IN WATER AS FE, µG/L	FeTrec	1	1
P00981	SELENIUM, TOTAL RECOVERABLE IN WATER AS SE, µG/L	selen	3	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P00992	SILICA (SiO ₂), WATER, TOTAL RECOVERABLE, µG/L	OSiO ₂	5	0.001
P00998	BERYLLIUM, WATER, UNFILTERED, RECOVERABLE, µG/L	BeTrec	2	1
P00999	BORON, WATER, UNFILTERED, RECOVERABLE, µG/L	Boron	2	1
P01007	BARIUM, WATER, UNFILTERED, RECOVERABLE, µG/L	BaTrec	2	1
P01009	BARIUM, WATER, UNFILTERED, RECOVERABLE, µG/L	BaTrec	1	1
P01012	BERYLLIUM, WATER, UNFILTERED, RECOVERABLE, µG/L	BeTrec	1	1
P01022	BORON, WATER, UNFILTERED, RECOVERABLE, µG/L	Boron	1	1
P01032	CHROMIUM(VI), WATER, FILTERED, µG/L	Cr6ds	2	1
P01034	CHROMIUM, WATER, UNFILTERED, RECOVERABLE, µG/L	CrTrec	2	1
P01042	COPPER, WATER, UNFILTERED, RECOVERABLE, µG/L	CuTrec	2	1
P01045	IRON, WATER, UNFILTERED, RECOVERABLE, µG/L	FeTrec	2	1
P01051	LEAD, WATER, UNFILTERED, RECOVERABLE, µG/L	PbTrec	2	1
P01055	MANGANESE, WATER, UNFILTERED, RECOVERABLE, µG/L	MnTrec	2	1
P01067	NICKEL, WATER, UNFILTERED, RECOVERABLE, µG/L	NiTrec	2	1
P01070	PHOSPHORUS, TOTAL, SPECTROGRAPH METH (µG/L AS P)	totalP	4	0.001
P01074	NICKEL, WATER, UNFILTERED, RECOVERABLE, µG/L	NiTrec	1	1
P01077	SILVER, WATER, UNFILTERED, RECOVERABLE, µG/L	AgTrec	2	1
P01079	SILVER, WATER, UNFILTERED, RECOVERABLE, µG/L	AgTrec	1	1
P01090	ZINC, WATER, UNFILTERED, RECOVERABLE, µG/L	ZnTrec	1	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P01092	ZINC, WATER, UNFILTERED, RECOVERABLE, µG/L	ZnTrec	2	1
P01094	ZINC, WATER, UNFILTERED, RECOVERABLE, µG/L	ZnTrec	3	1
P01114	LEAD, WATER, UNFILTERED, RECOVERABLE, µG/L	PbTrec	1	1
P01118	CHROMIUM, WATER, UNFILTERED, RECOVERABLE, µG/L	CrTrec	1	1
P01119	COPPER, WATER, UNFILTERED, RECOVERABLE, µG/L	CuTrec	1	1
P01123	MANGANESE, WATER, UNFILTERED, RECOVERABLE, µG/L	MnTrec	1	1
P01140	SILICON, WATER, FILTERED, µG/L	0SiO2	2	0.00214
P01142	SILICON, WATER, UNFILTERED, µG/L	0SiO2	3	0.00214
P01143	SILICON, IN SILICATE, µG/L SiO_3 AS SI	0SiO2		0.00214
P01145	SELENIUM, DISSOLVED, µG/L AS SE	selen	1	1
P01147	SELENIUM, TOTAL, µG/L AS SE	selen	4	1
P01167	SELENIUM, ACID SOLUBLE, WATER, WHOLE, µG/L	selen	2	1
P01220	CHROMIUM, HEXA VALENT, DISSOLVED IN µG/L AS CR	Cr6ds	1	1
P09501	RADIUM-226, WATER, UNFILTERED, PICOCURIES PER LITER (+ P11501 (Ra228) INC. AFTER MODULE AGGREGATION)	Ra226	1	1
P09503	RADIUM-226, WATER, FILTERED, PICOCURIES PER LITER (+/- P09504 + (P81366 +/- P76000 (ERROR)) INC. AFTER MODULE AGGREGATION)	Ra226	2	1
P09511	RADIUM-226, WATER, FILTERED, RADON METHOD, PICOCURIES PER LITER (+/- P76001 + (P81366 +/- P76000 (ERROR)) INC. AFTER MODULE AGGREGATION)	Ra226	3	1
P11501	RADIUM-228, WATER, UNFILTERED, PICOCURIES PER LITER	Ra228	1	1
P13501	STRONTIUM-90, WATER, UNFILTERED, PICOCURIES PER LITER (+/- P13502 INC. AFTER MODULE AGGREGATION)	Sr90	2	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P13503	STRONTIUM-90, WATER, FILTERED, PICOCURIES PER LITER (+/- P13504 INC. AFTER MODULE AGGREGATION)	Sr90	3	1
P29801	ALKALINITY, WATER, FILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, LABORATORY, MG/L AS CALCIUM CARBONATE	00ALK	4	1
P29804	BICARBONATE, WATER, FILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, FIELD, MG/L	Bicarb	7	1
P29804	BICARBONATE, WATER, FILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, FIELD, MG/L; NO CORRESPONDING CO ₃ (AS HCO ₃)	00ALK	9	0.6096
P29806	BICARBONATE, WATER, FILTERED, INCREMENTAL TITRATION, LABORATORY, MG/L	Bicarb	8	1
P29807	CARBONATE, WATER, FILTERED, FIXED ENDPOINT (PH 8.3) TITRATION, FIELD, MG/L; NO CORRESPONDING HCO ₃ (AS CO ₃ ?)	00ALK	10	0.5996
P29807	CARBONATE, WATER, FILTERED, FIXED ENDPOINT (pH 8.3) TITRATION, FIELD, MG/L	Carb	7	1
P29809	CARBONATE, WATER, FILTERED, INCREMENTAL TITRATION, LABORATORY, MG/L	Carb	8	1
P29813	ACID NEUTRALIZING CAPACITY, WATER, UNFILTERED, GRAN TITRATION, FIELD, MG/L AS CALCIUM CARBONATE	00ANC	9	1
P31501	TOTAL COLIFORM, M-ENDO MF METHOD, IMMEDIATE, WATER, COLONIES PER 100 MILLILITERS	TColi	2	1
P31503	TOTAL COLIFORM, M-ENDO MF METHOD, DELAYED, WATER, COLONIES PER 100 MILLILITERS	TColi	3	1
P31505	TOTAL COLIFORM, BRILLIANT GREEN LACTOSE BROTH METHOD, CONFIRMED, WATER, MPN PER 100 MILLILITERS	TColi	7	1
P31506	COLIFORM, TOT, MPN, CONFIRMED TEST, TUBE CONFIG.	TColi	6	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P31507	TOTAL COLIFORM, COMPLETED TEST, WATER, MPN PER 100 MILLILITERS	TColi	4	1
P31613	FECAL COLIFORM, M-FC MF (0.7 MICRON) METHOD, WATER, COLONIES PER 100 MILLILITERS	FColi	3	1
P31614	FECAL COLIFORM,MPN,TUBE CONFIGURATION	FColi	5	1
P31615	FECAL COLIFORM, EC BROTH METHOD, WATER, MPN PER 100 MILLILITERS	FColi	4	1
P31616	FECAL COLIFORM, M-FC MF (0.45 MICRON) METHOD, WATER, COLONIES PER 100 MILLILITERS	FColi	2	1
P31625	FECAL COLIFORM, M-FC MF (0.7 MICRON) METHOD, WATER, COLONIES PER 100 MILLILITERS	FColi	1	1
P31628	TOTAL COLIFORM,MF,MFC MEDIUM,VERIFIED #/100ML	TColi	5	1
P31633	ESCHERICHIA COLI, M-TEC MF METHOD, WATER, COLONIES PER 100 MILLILITERS	EColi	1	1
P31648	ESCHERICHIA COLI, M-TEC MF METHOD, WATER, COLONIES PER 100 MILLILITERS	EColi	2	1
P34726	NITROGEN, AMMONIA, TOTAL (AS NH ₃),EFFLUENT, MG/L	ammon	5	0.8225
P39036	ALKALINITY, WATER, FILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, FIELD, MG/L AS CALCIUM CARBONATE	00ALK	3	1
P39086	ALKALINITY, WATER, FILTERED, INCREMENTAL TITRATION, FIELD, MG/L AS CALCIUM CARBONATE	00ALK	1	1
P39087	ALKALINITY, WATER, FILTERED, INCREMENTAL TITRATION, LABORATORY, MG/L AS CALCIUM CARBONATE	00ALK	8	1
P46570	HARDNESS, CA MG CALCULATED (MG/L AS CaCO ₃)	HARD	2	1
P50278	ESCHERICHIA COLI, NA-MUG MF METHOD, WATER, COLONIES PER 100 MILLILITERS	EColi	3	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P50286	MERCURY, WATER, UNFILTERED, NANOGRAMS PER LITER	HgTrec	3	0.001
P50286	MERCURY, WATER, UNFILTERED, NANOGRAMS PER LITER	HgTot	1	0.001
P50786	ORTHOPHOSPHATE AS P, WATER, MG/L	orthoP	6	1
P50787	PHOSPHATE, TOTAL AS P, WATER, MG/L	orthoP	7	1
P61028	TURBIDITY, WATER, UNFILTERED, FIELD, NEPHELOMETRIC TURBIDITY UNITS	turby	5	1
P70505	PHOSPHATE,TOTAL,COLORIMETRIC METHOD, MG/L AS P	orthoP	8	1
P70506	PHOSPHATE,TOT SOL COLORIMETRIC METH, MG/L AS P	orthoP	3	1
P70507	PHOSPHORUS,IN TOTAL ORTHOPHOSPHATE, MG/L AS P	orthoP	5	1
P71845	AMMONIA, WATER, UNFILTERED, MG/L AS NH ₄	ammon	4	0.7765
P71846	NITROGEN, AMMONIA, DISSOLVED, MG/L AS NH ₄	ammon	2	0.7765
P71846	NITROGEN, AMMONIA, DISSOLVED, MG/L AS NH ₄	ammonds	2	0.7765
P71850	NITRATE NITROGEN,TOTAL, MG/L AS NO ₃	Nitrate	6	0.2259
P71851	NITRATE NITROGEN, DISSOLVED, MG/L AS NO ₃	Nitrate	3	0.2259
P71855	NITRITE NITROGEN,TOTAL, MG/L AS NO ₂	Nitrite	4	0.30446
P71856	NITRITE NITROGEN, DISSOLVED (MG/L AS NO ₂)	Nitrite	2	0.30446
P71883	MANGANESE, WATER, UNFILTERED, µG/L	MnTrec	3	1
P71885	IRON, WATER, UNFILTERED, µG/L	FeTrec	3	1
P71886	PHOSPHORUS, TOTAL, AS PO ₄ , MG/L	totalP	3	0.3261
P71887	NITROGEN, TOTAL, MG/L AS NO ₃	totalN	2	0.2259
P71900	MERCURY, WATER, UNFILTERED, RECOVERABLE, µG/L	HgTrec	2	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P71900	MERCURY, WATER, UNFILTERED, RECOVERABLE, µG/L	HgTot	2	1
P71901	MERCURY, WATER, UNFILTERED, RECOVERABLE, µG/L	HgTot	3	1
P71901	MERCURY, WATER, UNFILTERED, RECOVERABLE, µG/L	HgTrec	1	1
P74010	IRON, WATER, UNFILTERED, MG/L (*NOT FOR WRD USE*)	FeTrec	4	1000
P76003	STRONTIUM-90 2-SIGMA COMBINED UNCERTAINTY, WATER, FILTERED, PICOCURIES PER LITER	Sr90	1	1
P81366	RADIUM-228, WATER, FILTERED, PICOCURIES PER LITER	Ra228	2	1
P82032	CALCIUM, TOTAL, µG/L AS CA	000Ca	7	0.001
P82033	MAGNESIUM, TOTAL, µG/L AS MG	000Mg	4	0.001
P82034	POTASSIUM, TOTAL, µG/L AS K	0000K	4	0.001
P82036	CALCIUM, DISSOLVED, µG/L AS CA	000Ca	2	0.001
P82037	MAGNESIUM, DISSOLVED, µG/L AS MG	000Mg	2	0.001
P82078	TURBIDITY, FIELD, NTU	turby	4	1
P82079	TURBIDITY,LAB, NTU	turby	1	1
P82233	SILICON (SI) TOTAL IN WATER, MG/L AS SiO_2	0SiO2		1
P82368	CALCIUM DISSOLVED IN WATER AS CaCO_3 , MG/L	000Ca	3	0.4004
P82537	TURBIDITY,FORWARD SCATTER JTU	turby	6	1
P90095	SPECIFIC CONDUCTANCE MICROSIEMENS/CM AT 25 DEG C	SpCnd	3	1
P90410	ACID NEUTRALIZING CAPACITY, WATER, UNFILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, LABORATORY, MG/L AS CALCIUM CARBONATE	00ANC	4	1
P90900	TOTAL COLIFORM, MI MF METHOD, WATER, COLONIES PER 100 MILLILITERS	TColi	1	1
P91001	CHLORIDE, WATER, FILTERED, µG/L	000Cl		0.001
P91002	FLUORIDE, WATER, FILTERED, µG/L	Fluor	3	0.001

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
P91005	SULFATE, WATER, FILTERED, µG/L	00SO4		0.001
P91051	CALCIUM, WATER, FILTERED, µG/L	000Ca		0.001
P91052	MAGNESIUM, WATER, FILTERED, µG/L	000Mg		0.001
P91053	SODIUM, WATER, FILTERED, µG/L	000Na		0.001
P91054	POTASSIUM, WATER, FILTERED, µG/L	0000K		0.001
P95410	ACID NEUTRALIZING CAPACITY, WATER, UNFILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, LABORATORY, MG/L AS CALCIUM CARBONATE	00ANC	14	1
P95440	BICARBONATE, WATER, UNFILTERED, FIXED ENDPOINT (pH 4.5) TITRATION, LABORATORY, MG/L	Bicarb	5	1
P99220	CHLORIDE, WATER, UNFILTERED, MG/L	000Cl	3	1
P99430	CARBONATE, WATER, UNFILTERED, INCREMENTAL TITRATION, FIELD, MG/L AS CALCIUM CARBONATE	00ANC	10	1
P99430	CARBONATE, WATER, UNFILTERED, INCREMENTAL TITRATION, FIELD, MG/L AS CALCIUM CARBONATE	Carb	3	1.6679
P99440	BICARBONATE, WATER, UNFILTERED, INCREMENTAL TITRATION, FIELD, MG/L	Bicarb	4	1
P99445	CARBONATE, WATER, UNFILTERED, INCREMENTAL TITRATION, FIELD, MG/L	Carb	4	1
P99872	TURBIDITY, WATER, UNFILTERED, LABORATORY, HACH 2100AN, NTU	turby	3	1
P99890	SULFATE, WATER, FILTERED, UNCORRECTED, MG/L	00SO4	2	1
P99891	PHOSPHORUS, TOTAL, WATER, WHOLE, MODIFIED JIRKA METHOD, TOTAL, AS P, MG/L	totalP	2	1
P99895	SILVER, WATER, UNFILTERED, EPA CONTRACT, RECOVERABLE, µG/L	AgTrec	3	1
PALKCAL1	P00453 (AS HCO ₃ CONVERTED TO CaCO ₃) + P00452 (AS CO ₃ CONVERTED TO CaCO ₃)	00ALK	2	1
PALKCAL2	P29806 (AS HCO ₃ CONVERTED TO CaCO ₃) + P29809 (AS CaCO ₃ ? CONVERTED TO CaCO ₃)	00ALK	6	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
PANCCAL1	P00400 (AS HCO ₃ CONVERTED TO CaCO ₃) + P00445 (AS CO ₃ CONVERTED TO CaCO ₃)	00ANC	2	1
PANCCAL2	P00425 (AS CaCO ₃) + P00430 (AS CaCO ₃)	00ANC	6	1
PANCCAL3	P00450 (AS HCO ₃ CONVERTED TO CaCO ₃) + P00447 (AS CO ₃ CONVERTED TO CaCO ₃)	00ANC	3	1
PANCCAL4	P99440 (AS HCO ₃ ? CONVERTED TO CaCO ₃) + P99445 (AS CO ₃ ? CONVERTED TO CaCO ₃)	00ANC	7	1
PcalcNH	AMMONIA, UNIONIZED (CALCULATED FROM AVAIL. PH, TEMP. AND AMMONIA, DISS.)	unNH3	3	1
CFSca1	CONVERTED FLOW FROM OTHER UNITS FOR AGGREGATION (FROM P82636, P50051, P74070, P74043, P00056, P00058, P00059)	QFlow	3	1
PH3wER1	TRITIUM (P07000 + P75985), UNFILTERED, ERROR ADDED, PICOCURIES PER LITER	H3	1	1
PH3wER2	TRITIUM (P07012 + P07013), UNFILTERED, ERROR ADDED, TRITIUM UNITS	H3	2	3.2
PNO3NO2	NO ₃ +NO ₂ _AGGREGATED (PNITRATE + PNITRITE)	NO3_NO2	3	1
PNO3wf	NITRATE CALCULATED (FROM P00631 - PNITRITE RESULTS) USED FOR AGGREGATION	Nitrate	1	1
PNO3wu	NITRATE CALCULATED (FROM P00630 - PNITRITE RESULTS) USED FOR AGGREGATION	Nitrate	4	1
PRa226_8	RA226+RA228 WITH ERROR ADDED (FROM P11503 + P11504)	Rad_H	1	1
PRa2268C	AGGREGATED RA226 AND RA228 (FROM MULTIPLE PARAMETERS WITH ERROR ADDED)	Rad_H	2	1
PTempC	TEMPERATURE, WATER CONVERTED FROM P00011 (DEG F) TO DEG C	TEMP	2	1
PTNCal1	TOTAL NITROGEN CALCULATED (FROM P00625 AND PNITRATE AND PNITRITE RESULTS) USED FOR AGGREGATION	totalN	3	1

Ppcode	Parameter Name	Aggregated Parameter	Aggregation Order	Multiplication Factor
PTNCal2	TOTAL NITROGEN CALCULATED (FROM P99892 AND PNITRATE AND PNITRITE RESULTS) USED FOR AGGREGATION	totalN	4	1
PTNCal3	TOTAL NITROGEN CALCULATED (FROM P00635 AND PNITRATE AND PNITRITE RESULTS) USED FOR AGGREGATION	totalN	5	1

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