



Analysis and Technical Update to the Colorado Water Plan

Technical Memorandum

Prepared for:

Colorado Water Conservation Board

Project Title:

**Identified Projects and Processes
Dataset Development**

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Prepared by: Open Water Foundation & Wilson Water Group

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Executive Summary

The State’s planning efforts, including SWSI 2010 and Basin Implementation Plans, have led to the initial development and subsequent revision of “Identified Projects and Processes” (IPP) datasets for each Basin Roundtable. These datasets reflect potential projects and processes identified by stakeholders in each basin that may be developed in the future. Due to the complexity of studies, variation by basin and number of entities involved, IPP data across basins are inconsistent in content and format. The Technical Update is reviewing and formatting IPP data to ensure that useful data products can be created and analyses can be performed consistently.

The following goals were identified in developing a consistent method for representing and using IPP datasets:

- Review existing IPP datasets from each Basin Roundtable
- Develop standard data fields that capture key IPP parameters
- Convert Basin Roundtable IPP datasets to standard format
- Create basic data visualizations (i.e. web-enabled maps and graphics) to display IPP data

IPP DATASET CONTENT STANDARDS

After a review of each Basin Roundtable’s IPP dataset, the principal recommendation for developing a standard IPP dataset for the Technical Update effort was for the datasets to exist in a flat Excel file format and implement standard dataset fields. The term “flat” means that each line (row) of data contains one record corresponding to an IPP, with columns representing data fields. Excel is a common tool and the flat format can be maintained relatively easily by many users. Additionally, Excel can be integrated with multiple software tools and geospatial programs. Standard IPP dataset fields and formatting standards are listed below.

Table 1. Standard IPP dataset fields.

Field Name	Description	Section for Detailed Discussion
Project_ID	Unique project identifier in the format of Basin-Year-Number (e.g. ARK-2015-0001) that also allows for cross-reference between datasets and use by software tools.	4.1
Project_Name	Project name only.	4.1
Project_Description	Narrative content that explains the project in greater detail.	4.2
Project_Keywords	Indicator of one or more types such as storage, ATM.	4.2
Status	Implementation phase of the project; standard terms such as Completed, Planned, Implementation Ongoing.	4.3
Lead_Proponent	Main entity proposing/leading IPP project.	4.4
Lead_Contact	Name/organization of main entity that can be contacted regarding the project and their affiliation.	4.4
Municipal_Ind_Need	% of project dedicated to municipal/industrial need.	4.5
Agricultural_Need	% of project dedicated to agricultural need.	4.5

Field Name	Description	Section for Detailed Discussion
Envr_Rec_Need	% of project dedicated to environmental/recreational need.	4.5
Admin_Need	% of project dedicated to administrative need.	4.5
Latitude	Latitude of the project's general point location in decimal degrees.	4.6
Longitude	Longitude of the project's general point location in decimal degrees.	4.6
Lat_Long_Flag	Indication of how Latitude and Longitude were determined.	4.6
County	County where project is located.	4.6
Water_District	Water District where project is located.	4.6
Estimated_Yield	Estimated amount of water the project yields (average annual volume) or amount of water kept in a stream (average flow rate), based on high-level modeling.	4.7
Yield_Units	Unit of measure for capacity; including acre-feet (AF) or cubic-feet-per-second (cfs).	4.7
Estimated_Capacity	Maximum amount of water the project stores, diverts, conveys, etc. For E&R projects, this could be linear miles of stream or area of watershed affected.	4.7
Capacity_Units	Unit of measure for capacity; including acre-feet (AF) or cubic-feet-per-second (cfs), stream length (miles), or area (acres).	4.7
Estimated_Cost	Total cost to implement the project including capital and operations and maintenance (O&M).	4.8

IPP DATASET PRODUCTS

Ultimately, two primary data products were developed through this effort: a consistent standard table reflecting the statewide IPP dataset and mapping products displaying the IPP datasets. As noted above, the original IPP datasets were inconsistent across each basin and many of the basins did not provide information that could be represented using the standard fields in Table 1. The consultant team relied on the meaning of the individual basin's IPP fields and engineering judgement to convert original IPP datasets over to the standard IPP format. As reflected in Table 2, several basins did not have data for all standard fields and those fields were left blank in the standard IPP dataset deliverable. Translation of the original data to normalized form was automated using table and spatial data processing commands of the CDSS TSTool software, to allow the process to be adjusted and repeated.

Table 2. Standard IPP data fields and presence of fields in final basin IPP datasets.

Data Field/Column	Arkansas	Colorado	Gunnison	North Platte	Rio Grande	South Platte / Metro	Southwest	Yampa / White
Project_ID	X	X	X	X	X	X	X	X
Project_Name	X	X	X	X	X	X	X	X
Project_Description	X		X	X			X	X
Project_Keywords								
Status	X	X	X				X	
Lead_Proponent	X	X	X		X	X	X	X
Lead_Contact	X		X	X		X	X	
Municipal_Ind_Need	X	X	X	X	X	X	X	X
Agricultural_Need	X	X	X	X	X		X	X
Envr_Rec_Need	X	X	X	X	X		X	X
Admin_Need					X			
Latitude	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
County	X	X	X	X	X	X	X	X
Lat_Long_Flag								
Water_District	X	X	X	X	X	X	X	X
Estimated_Yield	X	X	X			X		
Yield_Units	X	X	X			X		
Estimated_Capacity	X					X		
Capacity_Units	X					X		
Estimated_Cost	X	X	X		X	X		

Section 1: Introduction

The State’s planning efforts, including SWSI 2010 and Basin Implementation Plans, have led to the initial development and subsequent revision of “Identified Projects and Processes” (IPP) datasets for each Basin Roundtable. These datasets reflect potential projects and processes identified by stakeholders in each basin that may be developed in the future. IPP datasets for consumptive projects are typically lists of structural projects defined with varying levels of detail and may or may not include spatial data. IPP datasets for non-consumptive (i.e. environment and recreation or E&R) projects typically include a spatial component because those projects often involve stream reaches. These datasets have been updated and referenced during current and previous SWSI efforts, Basin Implementation Plans (BIPs), Colorado Water Plan (CWP) and other studies. This memorandum focuses on consumptive IPP projects, although ongoing

coordination between Technical Update contractors can consider how best to integrate updated E&R data with IPP data in the future.

Due to the complexity of studies, variation by basin and number of entities involved, IPP data across basins are inconsistent in content and format. The Technical Update is reviewing and formatting IPP data to ensure that useful data products can be created and analyses can be performed consistently. In particular, it is desirable to establish consistency in data and stewardship of data, as well as to confirm the most current IPP datasets. Improvements in data format, content and handling can benefit later phases of the Technical Update, BIP updates and other State planning efforts.

The following goals were identified in developing a consistent method for representing and using IPP datasets:

- Review existing IPP datasets from each Basin Roundtable
- Develop standard data fields that capture key IPP parameters
- Convert Basin Roundtable IPP datasets to standard format
- Create basic data visualizations (i.e. web-enabled maps and graphics) to display IPP data

Additional recommendations regarding the maintenance of the IPP datasets during future Basin Implementation Plan updates; linking IPP datasets to other analyses/data products; and integrating IPP data into the larger Technical Update modeling efforts were discussed with CWCB during this effort. These recommendations, outlined in Appendix D, may be implemented in future Technical Update planning efforts, however were not implemented during this task.

Section 2: Review of Existing IPP Datasets

Each Basin Roundtable has created one or more electronic files of IPP data with various data formats and levels of detail. The current version of the files in each basin has most recently been updated by Basin Roundtable members or consultants working for the Roundtables. A request was made to each Basin Roundtable to provide the following data and information:

- Excel workbooks, spatial dataset (geodatabase, shapefile, etc.) and other electronic files. Machine-readable files were requested since derived files, such as PDFs and Word documents, are not conducive to software processing.
- Any supporting documentation describing the IPP data that is relevant and is not otherwise included in the data files, in particular “metadata” explaining the data files.
- Information about where the original data files are maintained and are available, for example Dropbox or Roundtable website.
- Short summary of the process used to create and edit the IPP dataset. For example:
 - indicate key stakeholders at the Roundtable and consultant level (e.g., Consultant X at firm Y, Roundtable members A, B, C)
 - process used to create/update/maintain the IPP dataset (e.g., Consultant X updated the Excel file based on input from Roundtable)
 - frequency that the dataset is updated and whether an edit history is known (e.g., BIP added new projects using X process, BIP used only projects from SWSI 2010)

All Basin Roundtables’ IPP datasets exist in Excel format and some also have spatial data in Esri (ArcGIS) shapefile format. Table 3 shows the dataset files received from each basin.

Table 3. IPP dataset files received from each Basin Roundtable.

Basin	IPP Dataset Filename	Date Received	Dataset Available on Website?
Arkansas	2015 04 09 Arkansas River Basin Project Database GB update 6_13_15.xls	2017-09-12	Yes, but availability has changed over time
Colorado	Basinwide_Full_IPP_List_05_27_14.xlsx, Eagle_Region_Full_IPP_List.xlsx, Grand_Valley_Region_Full_IPP_List.xlsx, GrandCo_Full_IPP_List.xlsx, Interbasin_Reliance_Full_IPP_List_05_27_14.xlsx, MiddleCo_Region_Full_IPP_List.xlsx, Roaring_Fork_Region_Full_IPP_List.xlsx, State_Bridge_Region_Full_IPP_List.xlsx, SummitCo_Region_Full_IPP.xlsx	2017-09-26	No
Gunnison	GBIP_Simplified_Project_List_4-17-15.xlsx; GBIP_IPP_GIS.zip	2017-09-24	No
North Platte	NPBIP_IPPLists.xlsx; NPBIP_IPP_GIS.zip	2017-09-21	No
Rio Grande	Updated Tables 8-10_Project Sheet Summaries_09-11-2017.xlsx	2017-09-11	No
South Platte / Metro	Gap Analysis SPMetro HDR Phase 2.xlsx	2017-09-12	Yes, but in PDF format and incomplete
Southwest	SWBRT Draft IPP List Clean copy.xlsx; IPPs.zip	2017-09-22	Yes, but in PDF format
Yampa / White	BIP_IPPs.xlsx, IPP_Point.shp, IPP_Reach.shp	2017-10-03	No

Section 3: IPP Dataset Format

The consultant team recommended the IPP datasets exist in a flat Excel file format. The term “flat” means that each line (row) of data contains one record corresponding to an IPP, with columns representing data fields. This recommendation is made for the following reasons:

- Excel table/worksheet can be easily reviewed, filtered, edited and processed into other forms
- Excel provides:
 - commenting ability
 - color-coding and other formatting
 - support in various software
- A table representation can be represented in various forms, including:
 - Excel
 - comma-separated-value (CSV)
 - database table

- spatial data layer attribute table
 - web page table
- Allows public distribution in machine-readable electronic format, such as:
 - Excel file on a Roundtable website
 - dataset as part of a GitHub repository with version control (or other cloud platform that provides version tracking)
 - dataset on the Colorado Information Marketplace (CIM, data.colorado.gov)
 - CDSS Map Viewer
 - online electronic documents on CWCB website
 - distribution as email attachment
 - sharing on Google Drive, Dropbox, etc.
- Excel file format facilitates versioning the IPP list, as follows:
 - a worksheet (tab) can be added to the IPP dataset workbook to indicate “Date”, “Who” and “Comment” for tracking edits to the file
 - the filename can include a date as YYYYMMDD or similar to clearly indicate versions of the IPP dataset
 - versioning software such as GitHub can be used, which removes the need to add timestamp to filename and allows milestone versions to be “tagged” for retrieval

It is recognized that some IPPs could benefit from a more complex data representation, in particular when one-to-many relationships exist or there is a need to represent spatial data. For example, an IPP may involve multiple stream reaches or have multiple beneficial uses. In this case, the data can be represented by creating additional worksheets within the main dataset file that split one-to-many data into one-to-one data without making the main dataset too convoluted or difficult to understand and interpret. Using a spatial data format requires access to and skill with geographic information system (GIS) software, which may be a barrier for many.

The historical evidence is that it has been difficult to acquire basic consistent IPP data. Therefore, the approach was taken to focus on the flat Excel table representation of IPP data while allowing the option of more complex formats should they be appropriate. Future management of the IPP dataset, or integration into modeling platforms, may require a more complex data format. For this effort however, the flat Excel format is sufficient to handle the basic IPP information requested by the CWCB.

Section 4: Standard IPP Dataset Fields

This section discusses the standard IPP dataset fields used in the development of the IPP dataset. Many of the basin IPP datasets already contain some of these fields and examples from each basin are provided where appropriate. Required fields are necessary to retain basic dataset integrity and support identification and communication. Optional fields are described in the context of how they will be used, but it is recognized that optional data may be difficult to obtain, or perhaps is only available after an IPP has reached a certain phase. Some of the fields impose a new data requirement on IPP data beyond what has been asked historically. For example, each IPP needs to include a spatial coordinate that can be used to create a map representing all IPPs. This is a fundamental data element that allows basic visualization of the number and spatial distribution of IPPs. The following data fields (Table 4) are discussed in subsequent sections.

Note that an initial set of potential IPP dataset fields were provided to CWCB for review, a portion of which were intended to capture specific project components necessary for future modeling of the IPP

(e.g. project diversion location, project delivery point). As many of the IPP datasets provided by the Basin Roundtables did not contain this information and the fields would be difficult to make consistent, these data fields were not incorporated into the final dataset fields.

Table 4. IPP dataset fields.

Dataset Field	Description and Use	Section for Detailed Discussion
Project_ID	Unique project identifier in the format of Basin-Year-Number (e.g. ARK-2015-0001) that also allows for cross-reference between datasets and use by software tools.	4.1
Project_Name	Project name only.	4.1
Project_Description	Narrative content that explains the project in greater detail.	4.2
Project_Keywords	Indicator of one or more types such as storage, ATM.	4.2
Status	Implementation phase of the project; standard terms such as Completed, Planned, Implementation Ongoing.	4.3
Lead_Proponent	Main entity proposing/leading IPP project.	4.4
Lead_Contact	Name/organization of main entity that can be contacted regarding the project and their affiliation.	4.4
Municipal_Ind_Need	% of project dedicated to municipal/industrial need.	4.5
Agricultural_Need	% of project dedicated to agricultural need.	4.5
Envr_Rec_Need	% of project dedicated to environmental/recreational need.	4.5
Admin_Need	% of project dedicated to administrative need.	4.5
Latitude	Latitude of the project's general point location in decimal degrees.	4.6
Longitude	Longitude of the project's general point location in decimal degrees.	4.6
Lat_Long_Flag	Indication of how Latitude and Longitude were determined.	4.6
County	County where project is located.	4.6
Water_District	Water District where project is located.	4.6
Estimated_Yield	Estimated amount of water the project yields (average annual volume) or amount of water kept in a stream (average flow rate), based on high-level modeling.	4.7
Yield_Units	Unit of measure for estimated yield; including acre-feet (AF) or cubic-feet-per-second (cfs).	4.7
Estimated_Capacity	Maximum amount of water the project stores, diverts, conveys, etc. For E&R projects, this could be linear miles of stream or area of watershed affected.	4.7
Capacity_Units	Unit of measure for capacity; including acre-feet (AF) or cubic-feet-per-second (cfs), stream length (miles), or area (acres).	4.7
Estimated_Cost	Total cost to implement the project including capital and operations and maintenance (O&M).	4.8

4.1: PROJECT IDENTIFIERS

The use of a project identifier allows each IPP project to be uniquely identified and linked to other datasets as appropriate. Unique identifiers also minimize confusion during communication and tracking and make it easier to keep track of total number of projects in a basin. It is critical that project identifiers are added to source data because not doing so risks renumbering of projects as data are processed. A standard naming convention does not currently exist for IPP projects across basins; Table 5 shows the different formats used for each basin, if present.

Table 5. Current naming conventions for project IDs used in basin IPP datasets.

Basin	Example Naming Convention for IPP Project ID	Comment
Arkansas	ARK-2015-0001	Clear; would need to describe the significance of the year such as year when first articulated as a project.
Colorado	No ID	
Gunnison	1	Sequential, but may just be the Excel row number
North Platte	1	Sequential, but may just be the Excel row number
Rio Grande	1	Sequential, but may just be the Excel row number
South Platte / Metro	ClearCreek_UIPP_FIB	Appears to reflect county/ municipality and SWSI 2010 IPP type.
Southwest	1-SJ, 1-DM (Numbered by sub-basin)	Southwest Basin is a collection of other basins so "SJ" indicates San Juan. If this is required, perhaps use "SW-SJ" at the front.
Yampa / White	1	Sequential, but may just be the Excel row number

Other examples of project identifiers include E&R projects in the South Platte BIP, which used identifiers that varied depending on the source of the basin (e.g. CWCB instream flow case number). If a third party identifier is used, then it is helpful to know the organization or scope of that identifier, such as "CWCB-theidentifier", or track in separate columns.

The following summarizes the methodology used to develop the fields used to help identify projects.

1. "Project_ID" is a required field:
 - a. Assign a unique identifier to each IPP as they are added to the IPP dataset.
 - b. The format of the identifier is set to a Basin-Year-Number, for example "ARK-2015-0001":
 - i. The basin abbreviation is ARK, CO, GUN, MET, NP, RG, SP, SW, YW.
 - ii. The year is the 4-digit year when the IPP was added to the IPP list or originally identified in the BIP.
 - iii. The project number is sequential and accommodates up to 9999 projects.

2. **“Project_Name”** is a required field:
 - a. Name should be a short descriptive name, based on existing data.

4.2: PROJECT DESCRIPTION

The project description includes additional information to describe the project, such as a narrative that is longer than the name. There may be large variability in this data from one basin to another. The following summarizes the methodology used to develop the fields used to help describe and search for projects.

1. **“Project_Description”** is a required field:
 - a. Short description of the project.
 - b. As descriptions are revised in the future, consider common descriptors such as “storage”, “transbasin diversion”, “agricultural transfer”, etc. to allow for filtering of datasets.
2. **“Project_Keywords”** is a required field:
 - a. Include keywords used to indicate whether the project includes storage, ATM, etc. Keywords need to be relevant to CWCB and Basin Roundtable uses of the data. Although required in the dataset, the keywords were not populated during data review because of the wide variety of terminology that was previously used. “Project_Keywords” is a placeholder for future use.
 - b. Consider future incorporation of type of document/file that describes the project (e.g., a planning document, URL).

4.3: PROJECT STATUS

An IPP project’s status is an indication of how far along the project implementation may be (e.g. concept phase, planned and detailed with a start year for the project). This data field is present in some of the basin IPP datasets but standard terminology needs to be developed to maintain consistency across datasets. Table 6 shows the terminology used in each basin, if available.

Table 6. Project status information provided in basin IPP datasets.

Basin	Example Naming Conventions for Status	Comment
Arkansas	Concept, Planned, Implementation Ongoing, Completed, Obsolete	Consistent use of categories
Colorado	Conceptual idea, Under Study, Study in Progress, Beginning stages of design/permitting, Water court application filed, Diligence filed, Money not yet allocated, Needs to be brought into compliance, In development, In Progress, Status pending, Off-line, Deferred, Ongoing, Issued, In use, Underway, Trial Run completed, Feasibility Studies Completed, Completed, Decreed, Existing	Inconsistent use of categories; should be simplified
Gunnison	None	Status indicated by worksheet name (“Planned Projects”, “Completed_Ongoing”); need to add within datasheet for each IPP

Basin	Example Naming Conventions for Status	Comment
North Platte	None	
Rio Grande	None	
South Platte / Metro	None	
Southwest	Investigating, Ongoing, Not Complete, Construction Completed	
Yampa / White	None	

The Arkansas River Basin provided a concise set of project status descriptors, therefore these were adopted for the standard IPP dataset. Note that IPPs listed as “Completed” or “Obsolete” may need to be removed from IPP datasets in the future, however “Completed” or “Obsolete” projects will remain in the standard IPP dataset for tracking purposes. The following summarizes the dataset fields used to help describe project status.

1. **“Status”** is a required field:
 - a. Apply a standard set of terminology to include: Concept, Planned, Implementation Ongoing, Completed, Obsolete.
 - b. For basins with a more robust list of status terminology, use judgment to convert them over to the standard terminology. For example, the term “Existing” would be converted over to “Completed”.

4.4: PROJECT PROPONENTS AND CONTACT

Documenting and tracking project proponents and contacts over the life of a project is critical, particularly as questions arise regarding the project. Experience working with IPP data, however, has shown that it can be difficult to track who brought forth a project and who can answer questions about a project and its status. The people behind a project will vary depending on its phase and various processes that are occurring, and will inevitably change over time. The goal of the following project contact data fields is to capture the current proponent and contact and provide a standard field to revise the information as the contact information changes.

1. **“Lead_Proponent”** is a required field:
 - a. Indicate the main entity that is the proponent or sponsor of the project.
 - b. Many projects have multiple proponents; this field captures the lead or prime entity.
 - c. Use of standard organization names would facilitate data management.
 - d. Other contact information, such as phone or email address, was excluded because the contact will generally be someone that is known to the Roundtable and because this would require greater upkeep of the dataset.
2. **“Lead_Contact”** is a required field:
 - a. Indicate a name of a person and their affiliated organization that can be contacted to provide information about the project.
 - b. Use of standard organization names would facilitate data management.
 - c. Other contact information, such as phone or email address, was excluded because the contact will generally be someone that is known to the Roundtable and because this would require greater upkeep of the dataset.

4.5: PROJECT NEED BASED ON CWP NEEDS

Project need refers to the general categories of needs as described in the CWP: Municipal & Industrial, Agricultural, and Environmental & Recreational. As some IPPs are processes (as opposed to projects), there is also an Administrative Need category. These are projects developed in conjunction with the Division of Water Resources or other state agencies that deal more with administration or operations as opposed to a specific project. Categorizing an IPP based on project type allows for a simple way to filter IPPs and can also be useful in mapping applications as a way to symbolize data. Table 7 indicates which basins have this data.

Table 7. Project need information provided in basin IPP datasets.

Basin	Example Naming Convention for Project Need	Comment
Arkansas	Municipal & Industrial; Agricultural; Environmental; Recreational	Each need is in its own column; an IPP that meets the need is indicated with an “X”
Colorado	Munic.; Irrig.; Dom; instream flows; nonconsumptive; recreational; consumptive; etc.	Needs are not separated into multiple columns. Format should be standardized; need is not clearly indicated but can be inferred from other data columns
Gunnison	M&I; AG; NC;	Needs are not separated into multiple columns. Format should be standardized
North Platte	None	Contains “CU Projects” and “NCNA_ER Projects” worksheets but each IPP is not clearly labeled as such
Rio Grande	Ag; M&I; Env/Rec	Each need is in its own column; an IPP that meets the need is indicated with an “X”
South Platte / Metro	None	Only M&I IPPs have been provided; uses categories such as Agricultural Transfer or Grow into Existing Supply
Southwest	NC; C; B (Both); “Need Addressed” column may contain Agriculture, Municipal, Aquatic habitat, Fisheries, etc.	Needs are not separated into multiple columns. Format should be standardized
Yampa / White	None	Contains “Consumptive” and “Nonconsumptive” worksheets but each IPP is not clearly labeled as such

Many IPPs will meet a variety of needs (termed multi-use projects), therefore it is necessary to develop the field in such a way that documents the multiple needs and, as requested by CWCB, provides an estimate of the project dedicated to meet that need. For example, a project could be constructed to provide primarily municipal supplies, but also have a small component to meet agricultural or E&R needs. As such, the amount of each type of need met by the IPP is defined as a percentage, totaling up to 100 percent across the four need types. Based on the information provided in the original IPP datasets and the needs defined by the Colorado Water Plan, the following data fields were developed:

1. Project need types is a required field and is formatted as follows:

- a. Project need fields include:
 - i. "Municipal_Ind_Need"
 - ii. "Agricultural_Need"
 - iii. "Envr_Rec_Need"
 - iv. "Admin_Need"
- b. Project need fields will be filled in with the percentage of the IPP that meets this need type; the sum of need fields for each IPP must sum to 100%.
- c. The need percentages will be auto-generated based on the number and type of needs met by each IPP in the original IPP datasets. These values will need to be revised by Basin Roundtable members.

4.6: SPATIAL DATA

Ideally, each IPP project provided by the Basin Roundtables has a general location, such as latitude and longitude coordinates of the project. Coordinate data is particularly useful in any mapping application. If this information was not provided or cannot be determined, more general location information can be used, such as county, water district or hydrologic unit code (HUC). However, what may seem like an easing-off of data requirements (county rather than coordinates) often results in more work later and limits usefulness of the data for spatial purposes. Therefore, a general location field is set as a required field in the standard IPP dataset. Table 8 shows the level of spatial data provided in each basin IPP dataset.

Table 8. Spatial data provided in basin IPP datasets.

Basin	Level of Spatial Data Provided	Comment
Arkansas	Latitude/Longitude coordinates, HUC, Water District, County	Coordinates are in the Excel file; no spatial files provided
Colorado	None; datasets split by "region"	
Gunnison	Points representing both consumptive and nonconsumptive IPPs; Water District	Data are in shapefiles and can be converted to Lat/Long
North Platte	Points and lines representing both consumptive and nonconsumptive IPPs	Data are in shapefiles and can be converted to Lat/Long
Rio Grande	Points representing IPPs	Data are in a .kmz file and Lat/Long can be extracted
South Platte / Metro	County	A map of IPPs summarized by county was included in the BIP but no shapefile exists
Southwest	Points and lines representing both consumptive and nonconsumptive IPPs; County	Data are in shapefiles and can be converted to Lat/Long
Yampa / White	Points and lines representing both consumptive and nonconsumptive IPPs	Data are in shapefiles and can be converted to Lat/Long

If a municipal/industrial or agricultural (i.e., consumptive) IPP did not have location information provided, the location was estimated for this effort. Refer to Appendix B for more information on how locations were estimated for mapping products. Additionally, the IPPs were also assigned to a county and water district to aid in future aggregation of results by the CWCB.

1. **“Latitude”** is a required field for the general point location for the IPP, generally corresponding to the water source, centroid of project components, or regional centroid (such as for county-level project):
 - a. Units should be decimal degrees.
 - b. Use a flag column if necessary to indicate how location was determined.
2. **“Longitude”** is a required field for the general point location for the IPP, generally corresponding to the water source, centroid of project components, or regional centroid (such as for county-level project):
 - a. Units should be decimal degrees.
 - b. Use a flag column if necessary to indicate how location was determined.
3. **“Lat_Long_Flag”** is a required field:
 - a. Indicates the method by which spatial coordinates were determined.
 - b. See **Appendix B** for details on methodology and values used.
4. **“County”** is a required field:
 - a. Reflects county name.
 - b. Assigned using a spatial analysis based on the Latitude/Longitude.
5. **“Water District”** is a required field:
 - a. Reflects standard DWR Water District number.
 - b. Assigned using a spatial analysis based on the Latitude/Longitude.

4.7: PROJECT YIELD

If available, documenting the estimated average annual yield of an IPP project is very helpful in basin-wide planning efforts. A project’s yield is uncertain given potential competition for the same water, hydrologic variability, and potential climate change impacts; however, a high-level yield estimate is useful to understand the amount of water the project may be able to supply and can be used to estimate a project’s unit cost of water. An initial yield estimate may be omitted but should be provided once sufficient evaluation has occurred, including, for example, modeling in support of a BIP. Most municipal/industrial IPPs list yield in acre-feet; some projects, however, have yield estimates in other units. As such, it is necessary to have another field to distinguish yield units and to ensure that the yield field only contains numeric data (e.g., the “Yield” column’s values should be something like “200” and not “200 AF”). This field is somewhat contingent upon the project’s status: IPPs that are only in the concept phase are less likely to have information on yield. Table 9 provides naming conventions for yield and the percent of IPPs that contain yield data by basin.

Table 9. Yield information provided in basin IPP datasets.

Basin	Example Naming Convention for Yield	Percent of IPPs with Yield Data	Comment
Arkansas	36960	7	Consistent format used
Colorado	1,680 AF	17	Format should be standardized
Gunnison	146; 1,000-2,000 per yr.; 200-300	13	Format should be standardized
North Platte	None	0	
Rio Grande	None	0	

Basin	Example Naming Convention for Yield	Percent of IPPs with Yield Data	Comment
South Platte / Metro	2081	70	Consistent format used
Southwest	None	0	
Yampa / White	None	0	

Currently, yield is focused on consumptive IPPs. Environmental and recreational IPPs tend to consider “yield” in terms of cubic feet per second (cfs) remaining in stream and this amount can vary seasonally. The Environment and Recreation Methodology Development memo, part of the Technical Update, recommends that additional data fields related to flow should be added to the Environment and Recreation Database (E&Rdb), a database that houses E&R projects. These fields will detail if the project is flow-based or has a flow component and if flows have been identified and/or quantified. The memo states that the fields will be populated where possible as part of the Technical Update but that it is likely that the majority of the information will be added in the next round of BIPs.

It should be noted that yield is different than a project’s capacity, particularly for storage projects. As one of the stated goals of the Colorado Water Plan is to increase storage by 400,000 acre-feet by 2050, capacity is also an important piece of information to capture. Similar to the fields designed to document project yield, a field is included to capture a project’s capacity and the units associated with that capacity value. This may be particularly useful in the future for E&R projects that may impact an area or stream length, but do not necessarily have a water yield. As such, the capacity fields can be used to document these impact areas.

1. **“Estimated_Yield”** is a required field to indicate average annual yield, in particular for consumptive uses:
 - a. Values should consist only of numbers and not contain ranges of numbers.
 - b. Yield values should be based on the water supply analyses and not just reflect the full capacity of a project.
2. **“Yield_Units”** is a required field:
 - a. Reflects a standard unit of measure, including acre-feet (AF), cubic feet per second (CFS), million gallons (MG), million gallons per day (MGD).
3. **“Estimated_Capacity”** is a required field to indicate the maximum capacity of a project, or maximum impact area for E&R projects:
 - a. Values should consist only of numbers and not contain ranges of numbers.
 - b. Ideally based on high-level design or impact studies.
4. **“Capacity_Units”** is a required field:
 - a. Reflects a standard unit of measure, including acre-feet (AF), cubic feet per second (CFS), million gallons (MG), million gallons per day (MGD), area (acreage), stream length (miles).

4.8: PROJECT COST

The cost of the IPP project should be estimated based on capital cost plus the cost of operation and maintenance (O&M). As with yield, this field is contingent upon the project’s status in that IPPs that are only in the concept phase do not tend to have a cost estimate. Cost coupled with yield provides an indication of unit cost of water supply.

Table 10 provides the naming conventions for cost and the percent of IPPs that contain cost data by basin.

Table 10. Cost information provided in basin IPP datasets.

Basin	Example Convention for Cost	Percent of IPPs with Cost Data	Comment
Arkansas	\$6.0M; \$300K; 14500000	4	Format should be standardized
Colorado	\$5000/AF; \$200M	2	Format should be standardized
Gunnison	50,000,000; 125,000-205,000	28	Format should be standardized
North Platte	None	0	
Rio Grande	\$19,500	50	Consistent format used
South Platte / Metro	261000000; \$122,479,600	22	Format should be standardized
Southwest	None	0	
Yampa / White	None	0	

As part of the Technical Update, the Finance Methodologies Technical Memorandum describes the development of a Water Finance Tool that will allow planners of IPP projects to estimate the cost of a project using a uniform methodology so that all projects can be compared on an “apples to apples” basis. This tool has several modules for estimating a project’s costs based on the type of project, including modules for reservoir construction, pipeline construction, stream restoration and irrigation ditch improvements, among others. It is anticipated that IPP project costs will be estimated or re-evaluated once the Water Finance Tool is available for use. However, the tool may only be applied to a subset of IPPs, in particular those that are well-defined. It is recommended that further coordination occur related to how the Water Finance Tool and the IPP database will integrate. The following summarizes the field used to capture IPP cost information.

1. “Estimated_Cost” is a required field:
 - a. Reflect the total cost of the project, including the capital cost and O&M in total dollars. Do not convert total cost to millions or thousands.
 - b. Values should consist only of numbers and not contain ranges of numbers.
 - c. This field may not be able to be populated until the Water Finance Tool is released, or the tool may create parallel data that needs to be joined to the IPP list during data processing.
 - d. In the future, definition for cost needs to be determined, such as normalized to a specific year, year of a study, etc.

Section 5: Uses of the IPP Dataset

The availability of the required data fields will support several uses of IPP datasets; the following summarizes the uses of this data as scoped under this effort. It is anticipated the standard IPP dataset will

be used to develop information for future Colorado Water Plan updates and serve as one of the foundational pieces of data for the Data Dissemination task.

5.1: FILTERED LISTS

It will be possible to create filtered, customized datasets and provide as maps, Excel files, and other formats for use in analysis and visualizations. For example, the IPP dataset can be filtered by basin, project need, status, etc. Filtered datasets can be created as new derived datasets, or the full dataset can be made available and filtering can occur using tools, such as a website or desktop software tools. IPPs with limited data can be filtered out to remove “noise” or can be the focus of evaluation to understand the extent of incomplete data.

5.2: MAPS

The addition of general location coordinate data for each IPP allows for all IPPs to be easily located on maps. Then, a user interested in a particular basin or region can quickly determine the IPPs in that area and find more information. Another advantage of mapping IPPs is that IPPs can be symbolized in different ways. For example, IPPs could be color-coded based on project need (municipal, environmental, etc.), status, or whether the project includes an ATM component. The following standard set of maps (Figures 1 through 9) were developed for this effort as examples of map products; however the standard IPP dataset can support many other mapping products. In the examples “multi-purpose” uses the “Municipal_Ind_Need”, “Agricultural_Need”, “Envr_Rec_Need”, and “Admin_Need” dataset fields to categorize projects.

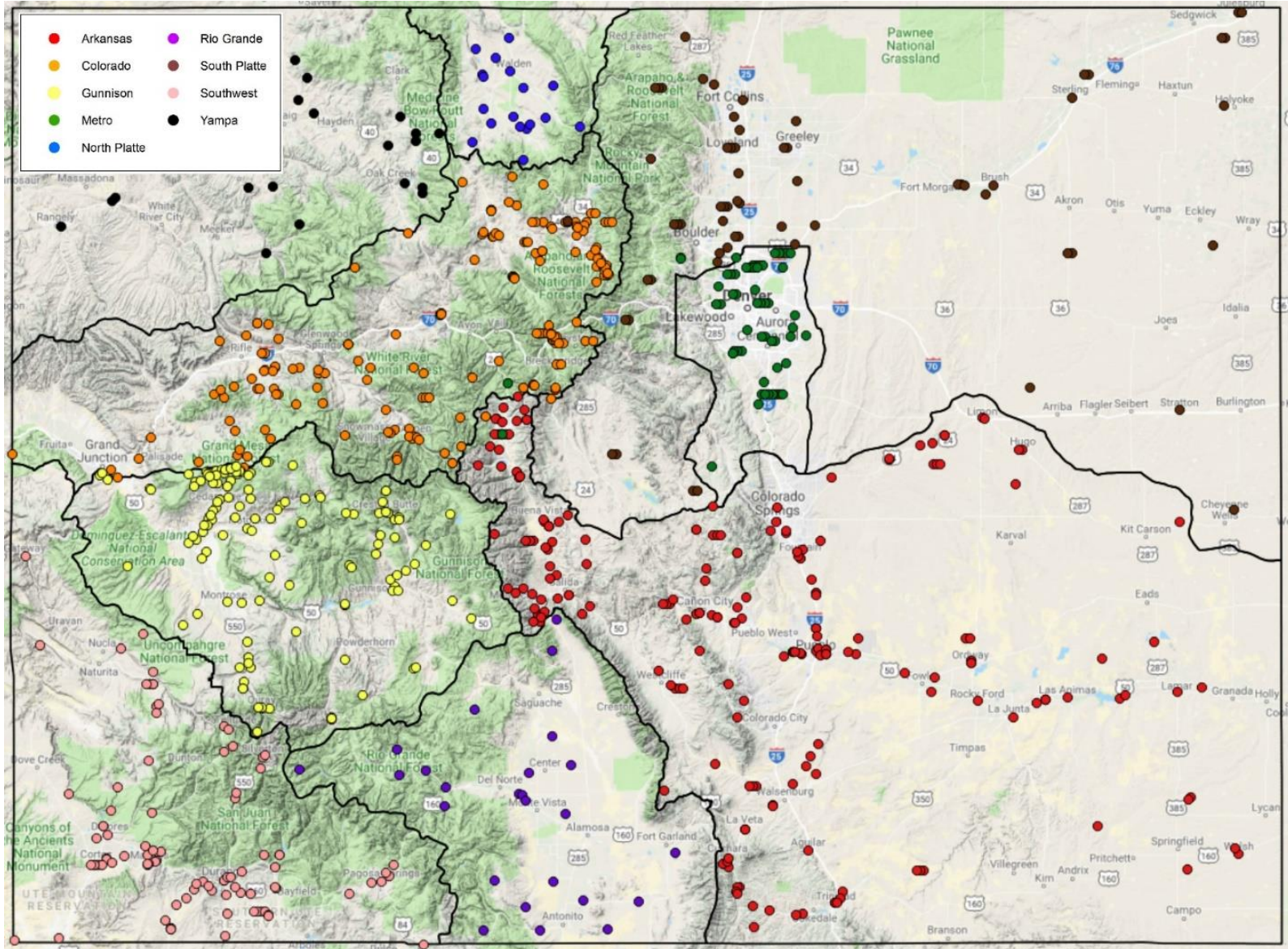


Figure 1 Statewide map of IPPs shown with basin boundaries

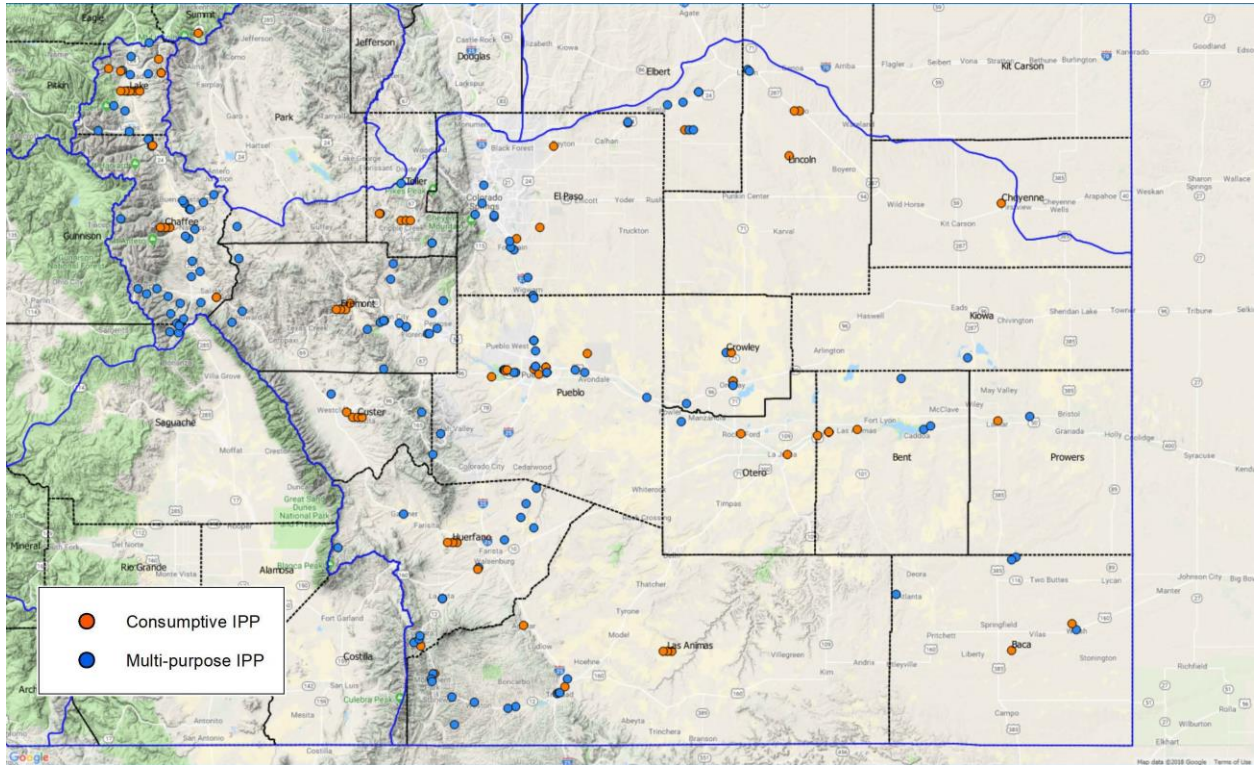


Figure 2 Arkansas Basin Consumption and Multi-Purposes/Multi-Use BIP IPPs

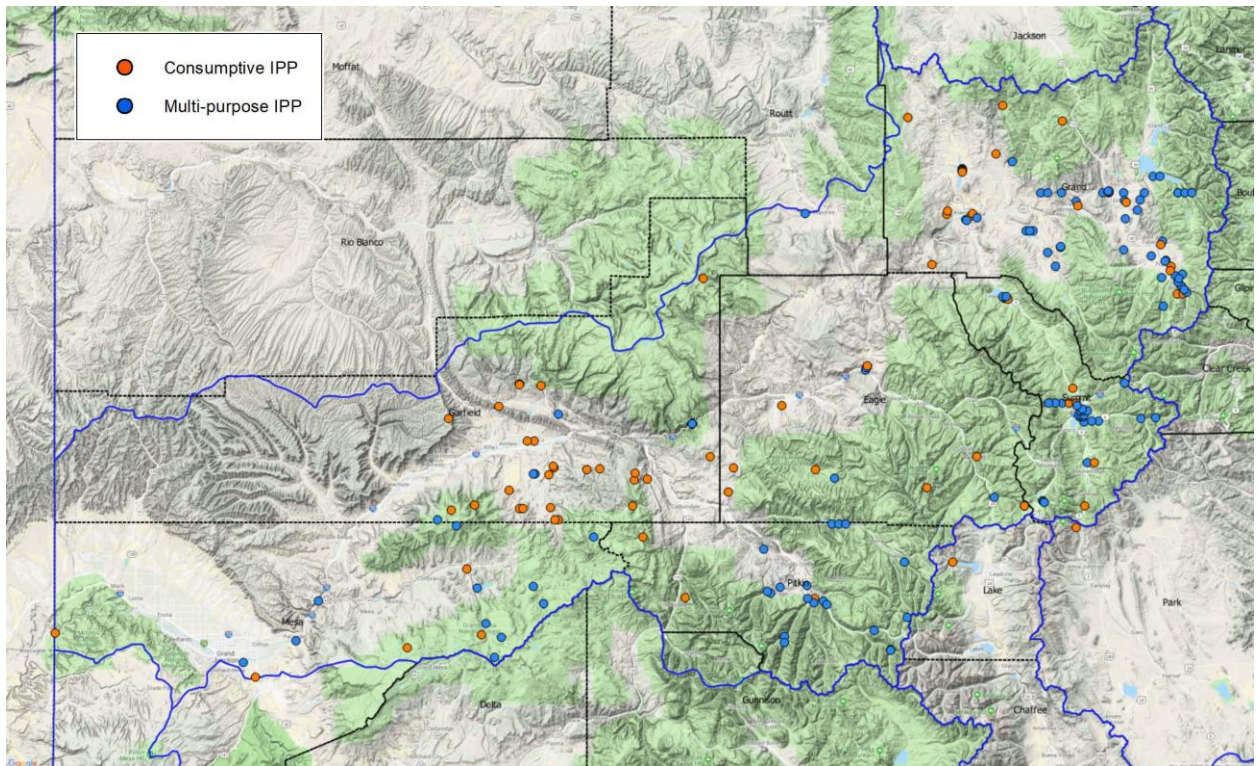


Figure 3. Colorado Basin Consumptive and Multi-Purpose/Multi-Use BIP IPPs

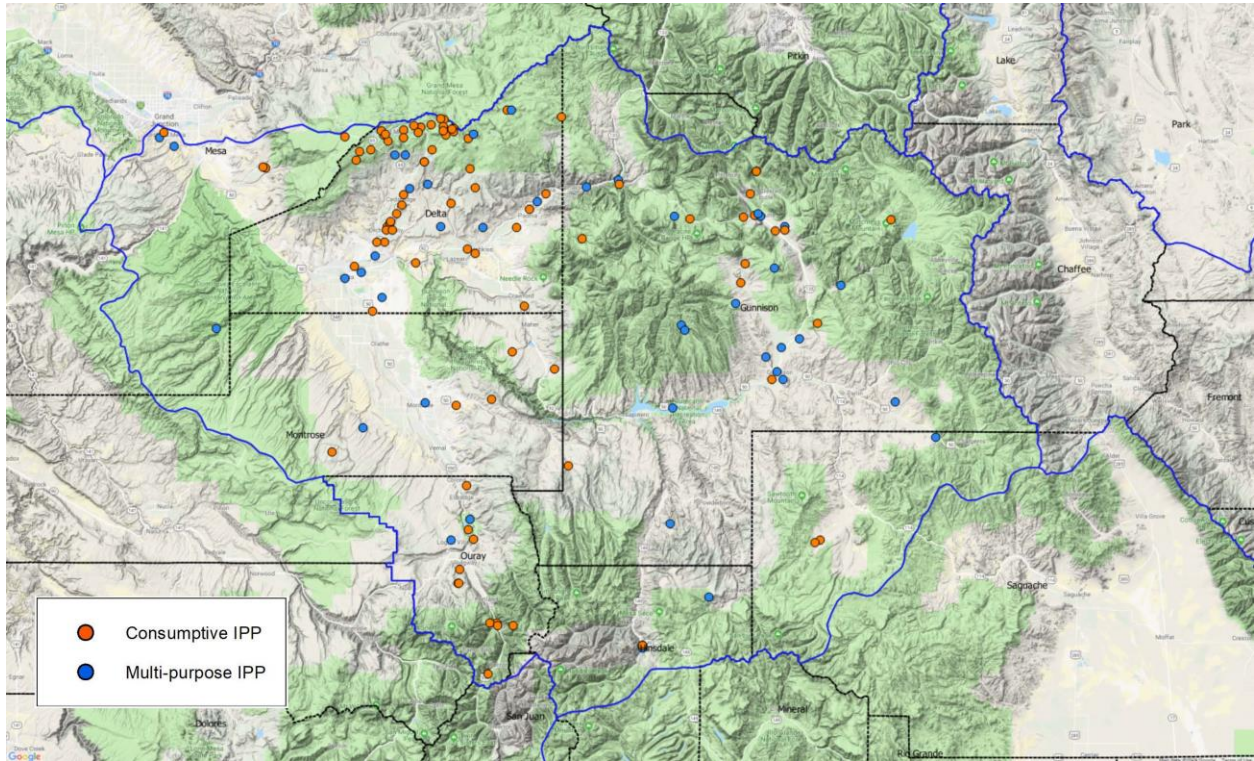


Figure 4. Gunnison Basin Consumptive and Multi-Purpose/Multi-Use BIP IPPs

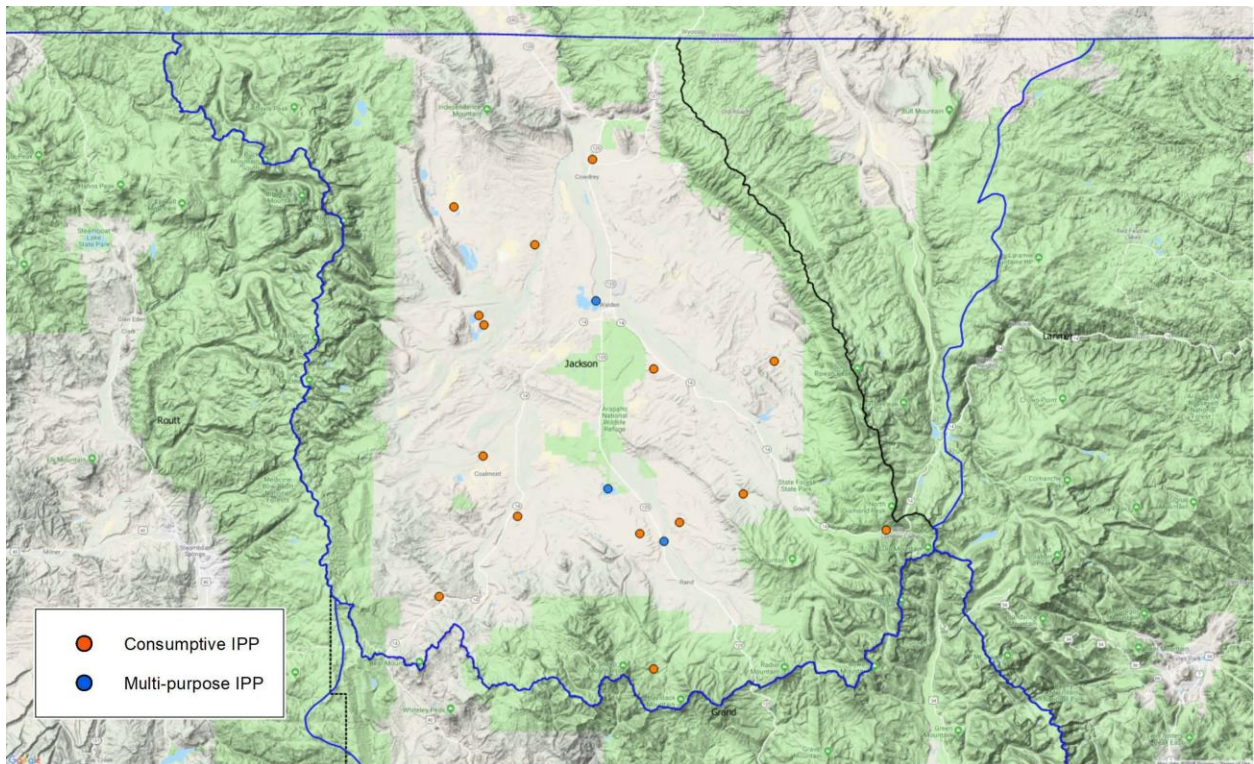


Figure 5. North Platte Basin Consumptive and Multi-Purpose/Multi-Use BIP IPPs

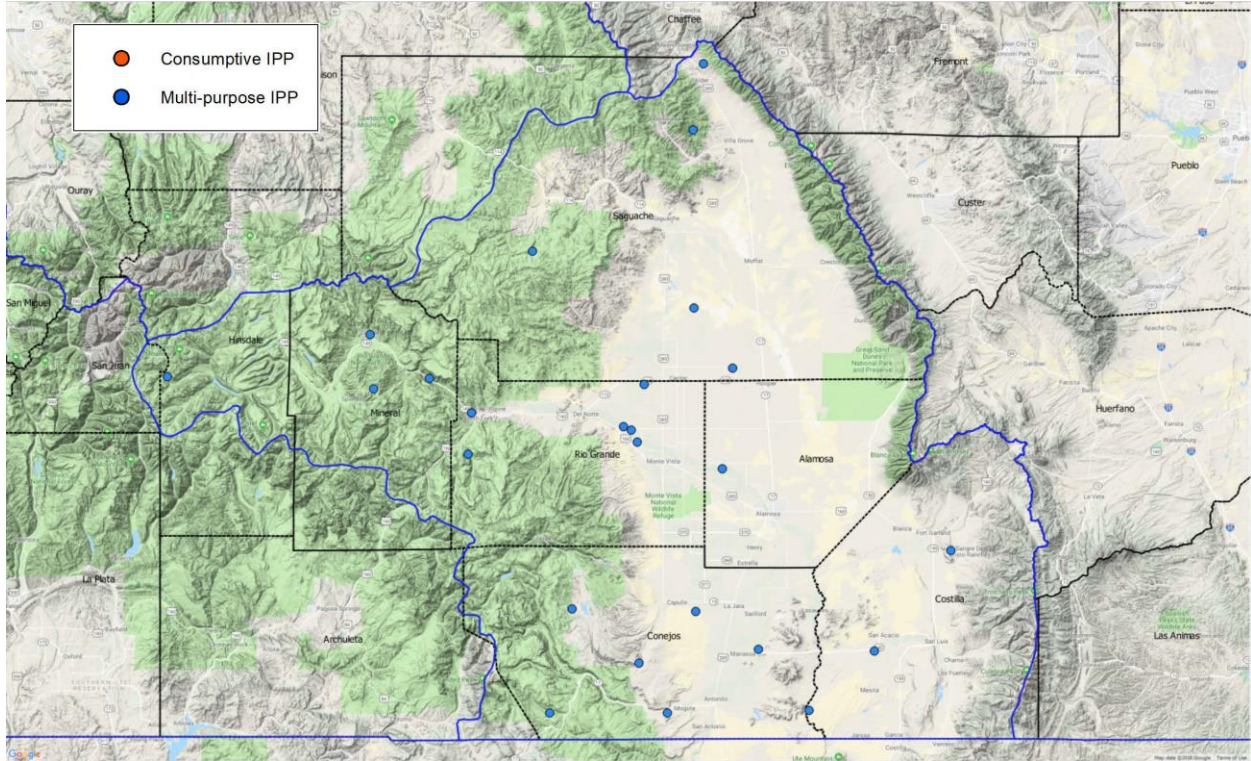


Figure 6. Rio Grande Basin Consumptive and Multi-Purpose/Multi-Use BIP IPPs

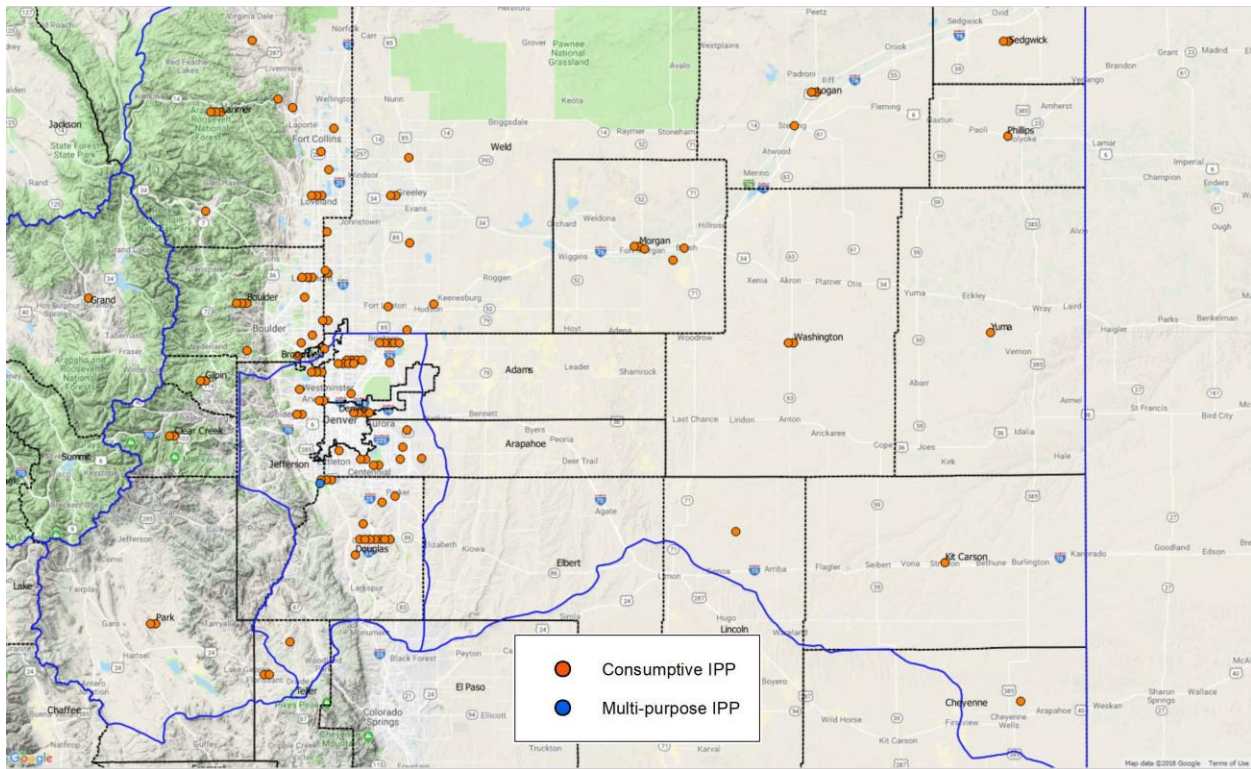


Figure 7. South Platte/Metro Basin Consumptive and Multi-Purpose/Multi-Use BIP IPPs

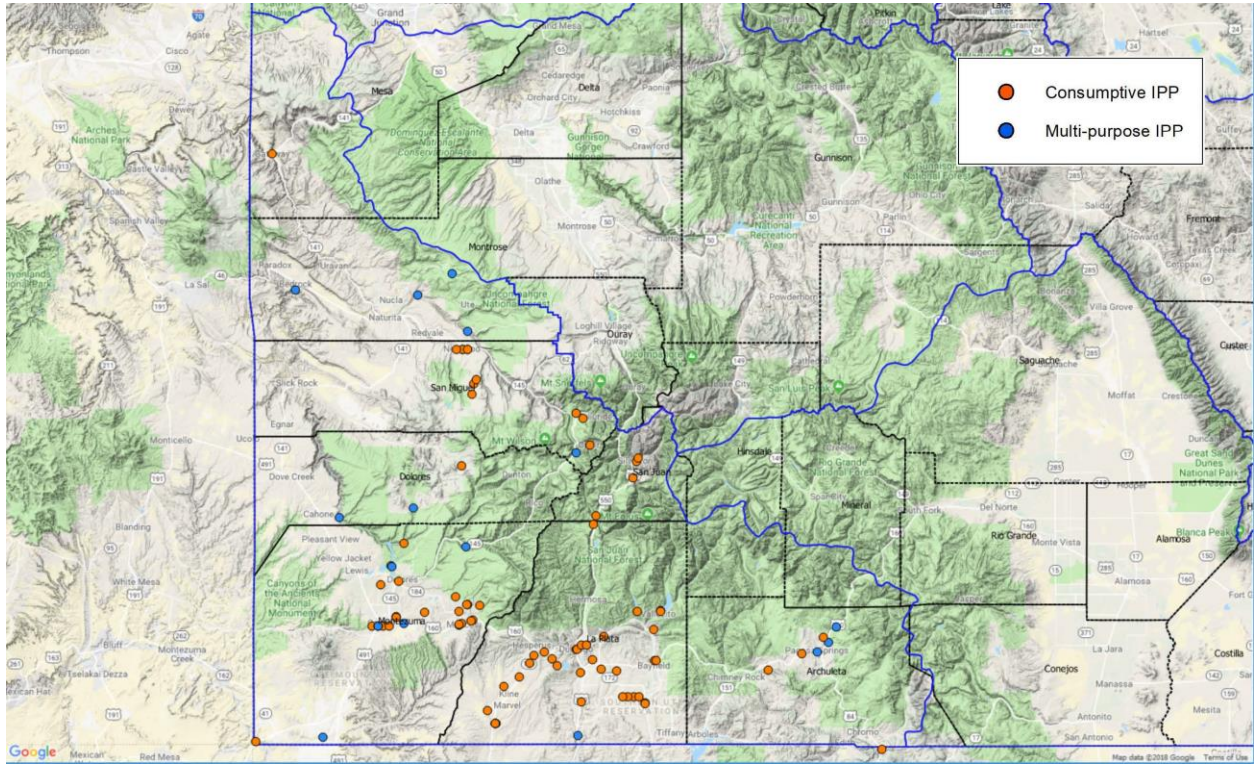


Figure 8. Southwest Basin Consumptive and Multi-Purpose/Multi-Use BIP IPPs

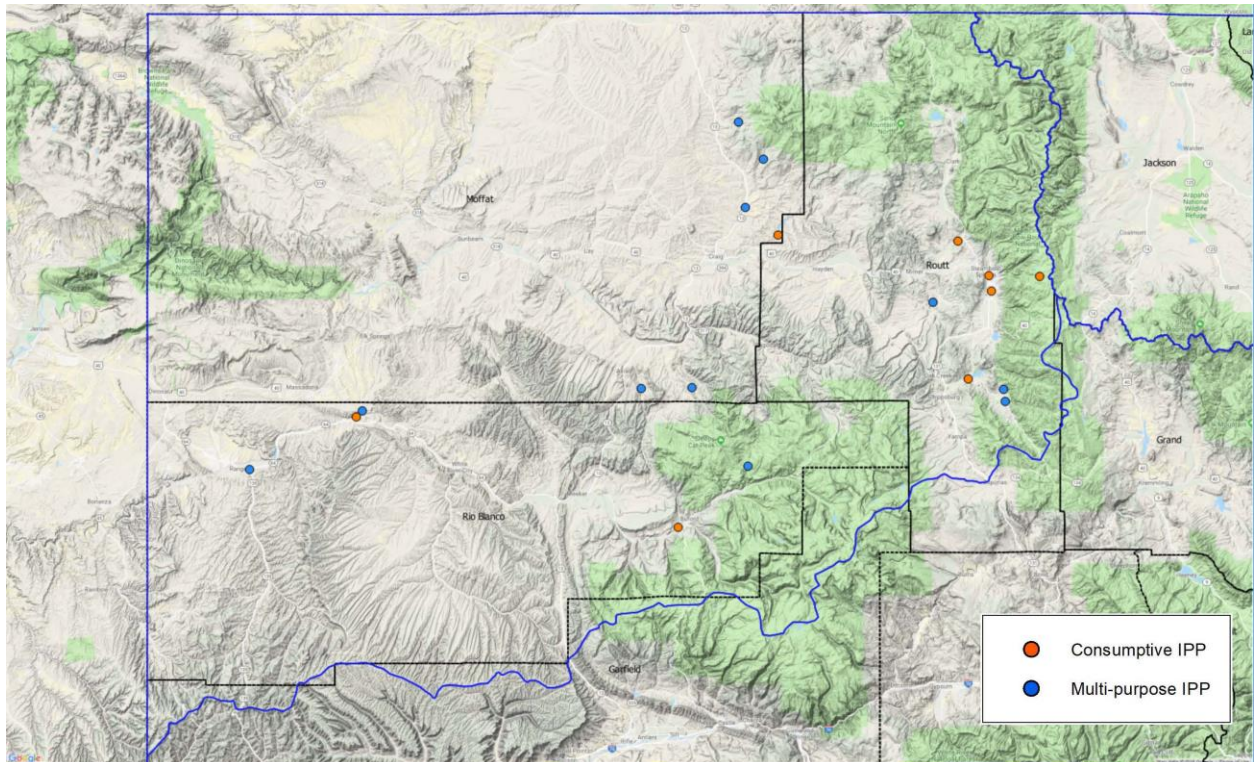


Figure 9. Yampa/White/Green Basin Consumptive and Multi-Purpose/Multi-Use BIP IPPs

Section 6: Summary of IPP Dataset Development

The standard data fields included within the standard IPP dataset are shown in Table 11. The presence of these data fields within each current basin IPP dataset is indicated, although existing column names from the Basin Roundtable IPP dataset do not correspond exactly with standard names. The exact names do not need to be matched; however the meaning of the data field should be equivalent. Software was used to rename the fields during processing.

Table 11. Standard IPP data fields and presence of fields in current basin IPP datasets.

Data Field/Column	Arkansas	Colorado	Gunnison	North Platte	Rio Grande	South Platte / Metro	Southwest	Yampa / White
Project_ID	X		X	X	X	X	X	X
Project_Name	X	X	X	X	X	X	X	X
Project_Description	X		X	X			X	X
Project_Keywords								
Status	X	X	X				X	
Lead_Proponent	X	X	X		X	X	X	X
Lead_Contact	X		X	X		X	X	
Municipal_Ind_Need	X	X	X		X		X	
Agricultural_Need	X	X	X		X		X	
Envr_Rec_Need	X	X	X	X	X		X	X
Admin_Need					X			
Latitude	X		X	X	X		X	X
Longitude	X		X	X	X		X	X
Lat_Long_Flag								
County	X						X	
Water_District	X		X					
Estimated_Yield	X	X	X			X		
Yield_Units	X	X	X			X		
Estimated_Capacity	X					X		
Capacity_Units	X					X		
Estimated_Cost	X	X	X		X	X		

6.1: BASIN-SPECIFIC DEVELOPMENT

Excel and spatial data layer files for each basin's IPPs were reviewed to understand existing data and to identify how to update the data while minimizing Basin Roundtable effort. The following sections summarize the methods used to transition the existing IPP datasets to the recommended form.

The goal was to perform the data processing as a series of steps that are transparent and repeatable (automated). In this way, it would be apparent to the Basin Roundtables how the original datasets were converted to the standardized form. The CDSS TSTool software was used to automate processing. The TSTool software is able to read and write Excel files and represents processing steps in text "command files". While the hope had been that the data could be transformed in a straightforward process using simple commands, the reality was that a substantial portion of the data needed to be cleaned with specific "search and replace" commands. While these steps were undertaken in a repeatable way, some of the data cleaning would have gone more smoothly with software enhancements or if the original data had been checked for consistency during original data entry. A lesson from the exercise is that data will not be made software-friendly until the data are used by software to perform a task.

Future updates should seek to retain existing data and improve ability to maintain and use data for Technical Updates, BIPs and the Colorado Water Plan.

The data processing tasks performed on each basin's original data in order to create a consistent dataset are summarized below. The notes correspond to data processing commands in TSTool command files for each basin (e.g., "analysis/Arkansas-IPP-DataProcessing.TSTool"), which may be updated over time as data processing is refined. Notes are also listed in the output IPP Excel files (e.g., "data/Arkansas-IPPs.xlsx") in the "Crosswalk" worksheet.

ARKANSAS BASIN

The following changes were made to the Arkansas Basin IPP dataset:

- Used whole numbers to estimate cost of an IPP, rather than using "M" to represent millions of dollars or "K" to represent thousands of dollars. Removed dollar signs where present. All values are now numeric and without any text.
- Needs that were listed under the categories Water Quality, Watershed Health and Instream Flow were added to the Envr_Rec_Need field.
- A Yield_Units field was created and filled with AF for those projects that have values in the Estimated_Yield field.
- A Capacity_Units field was created and filled with AF for those projects that have values in the Estimated_Capacity field.
- An Admin_Need field was added and set as 0% for all projects.
- The following field was added but left blank since no data were available: Project_Keywords.

COLORADO BASIN

The following changes were made to the Colorado Basin IPP dataset:

- Created a unique identifier for each project, in the format of Basin-Year-Number.
- A Project_Description field was created but was left blank. Creating a separate description from the Project_Name field was not attempted.

- Edited the Estimated_Cost field to remove dollar signs in front of values and replaced “M” with the appropriate number of zeroes to represent values in millions of dollars. Two projects used a cost per acre-feet description; the total cost was calculated based on the Estimated_Yield. All values are now numeric and without any text.
- A Municipal_Ind_Need field was created and populated according to the following rules:
 - If the beneficiary was listed as domestic or municipal (any variation with the phrase “munic”).
 - If the Water Storage field was marked with an X.
 - If the Raise Awareness of Obstacles Facing Water Providers field was marked with an X.
 - If the Ensure Safe Drinking Water field was marked with an X.
 - If the Natural Impacts to Water Supply field was marked with an X.
 - If the Project_Name field contained any of the following words: reservoir, sanitation, water conservation plan, growth planning, storage, Windy Gap, water system or intake facility.
 - The Basin Roundtable should review this designation.
- An Agricultural_Need field was created and populated according to the following rules:
 - If the beneficiary was listed as agricultural or irrigation (any variation with the phrase “agric” or “irrig”).
 - If the Reduce Agricultural Water Shortages field was marked with an X.
 - If the Land Use Policy to Reduce ATMs field was marked with an X.
 - If the Agricultural Production Incentives field was marked with an X.
 - If the Agricultural Community Education field was marked with an X.
 - If the Agricultural Efficiency Preservation Conservation field was marked with an X.
 - If the Project_Name field contained any of the following words: ditch, canal, lateral, reservoir, agric, crop or irrigation.
 - The Basin Roundtable should review this designation.
- An Envr_Rec_Need field was created and populated according to the following rules:
 - If the beneficiary was listed as nonconsumptive, rec, wildlife, Environmental or Recreational.
 - If the Ensure Safe Drinking Water field was marked with an X.
 - If the At Risk Reaches field was marked with an X.
 - If the Protect Rivers Lakes Streams Riparian field was marked with an X.
 - If the Preserve Recreational Flows field was marked with an X.
 - If the Protect Improve Water Quality field was marked with an X.
 - If the Project_Name field contained any of the following words: habitat, restoration, reclamation, fish, stream management plan, watershed plan, wild and scenic, whitewater, TMDL or salin (as in salinity).
 - The Basin Roundtable should review this designation.
- Consolidated the number of categories used to describe project status. The following rules were used:
 - A status of Ongoing was assigned to projects that described the status as “On-going”, “ongoing”, “Ongoing”, “In Progress”, “Underway” or “Investigation/Bulkhead Design Implementation Ongoing”.
 - A status of Concept was assigned to projects that described the status as "Ongoing Study", "Conceptual", "Conceptual idea", "Concept idea", "Conceptual, Conditional Water Right", "Feasibility Studies Completed", "Feasibility Studies Completed. Diligence approved in 2013.", "Study in Progress", "Conceptual design completed", "Beginning

- stages of design/permitting", "Have ACOE Permit", "Under Study", "Needs to be brought into compliance" or "Proposed".
- A status of Completed was assigned to projects that described the status as "Existing", "Completed/Ongoing", "5th year in operation", "In use" or "Plan in draft - 2004".
- A status of Planned was assigned to projects that described the status as "Status pending", "Pumpback is pending", "In development.", "Trial Run completed", "Issued", "Decreed", "Decree issued in 10CW43", "May be constructed in fall of 2014", "Diligence filed", "Money not yet allocated", "Off-line" or "Water court application filed".
- A status of Obsolete was assigned to projects that described the status as "Deferred".
- Statuses that were listed only as years were changed to blank values.
- The Basin Roundtable should review these designations.
- Edited the Estimated_Yield field to remove units (i.e., AF) from the numbers. Created a new Yield_Units field to hold the unit type. If the Estimated_Yield was a range of values, then the value was set to the average.
- Other edits to the Estimated_Yield field were as follows: four projects listed yield in acres, which appeared to reflect acres of land, not acre-feet of water. These values were deleted. One project listed yield as a percentage, which appeared to reflect water conservation savings; this value was deleted. One project listed yield as feet of stream restored; this value was deleted. One project listed three separate yields for different entities; these were summed.
- An Admin_Need field was added and set as 0% for all projects.
- County and Water_District fields were added and populated by intersecting projects with Latitude and Longitude data with Colorado county and water district spatial data layers using geoprocessing software. For those projects without Latitude and Longitude data, these fields are blank.
- The following fields were added but left blank since no data were available: Project_Keywords, Lead_Contact, Estimated_Capacity, Capacity_Units.

GUNNISON BASIN

The following changes were made to the Gunnison Basin IPP dataset:

- Created a unique identifier for each project, in the format of Basin-Year-Number.
- Used the worksheet names ("Planned Projects", "Completed_Ongoing") to create a Status field. Data in the "Planned Projects" worksheet were given a status of Planned. Projects in the "Completed_Ongoing" worksheet were listed as Completed if the Funding Year column contained a year. If the Funding Year column was blank then the status was listed as Ongoing. Projects in the "NC Protections & Monitoring" worksheet are considered ongoing projects (BIP, p. 110), so the status was listed as Ongoing.
- Project need types (municipal, agricultural, etc.) were split into Municipal_Ind_Need, Agricultural_Need and Envr_Rec_Need fields. For projects listed in the "NC Protections & Monitoring" worksheet, the need is listed as 100% Envr_Rec_Need.
- The Estimated_Yield field was edited to remove "NA", "TBD", "per year", "Project dependent" or ranges of values. For ranges, the minimum value listed was used instead. A Yield_Units field was created and with the exception of one project, all projects with Estimated_Yield data were listed as AF. The remaining project's units were set to cfs based on the original data.
- The Estimated_Cost field was edited to remove "TBD" or ranges of values. For ranges, the maximum value listed was used instead.

- The Water_District field was edited so that a value of "All" was changed into a series of numbers (28, 40, 41, 42, 59, 60, 61, 62, 63, 68, 73).
- An Admin_Need field was added and set as 0% for all projects.
- A County field was added and populated by intersecting projects with Latitude and Longitude data with a Colorado county spatial data layer using geoprocessing software. For those projects without Latitude and Longitude data, this field is blank.
- The following fields were added but left blank since no data were available: Project_Keywords, Estimated_Capacity, Capacity_Units.

NORTH PLATTE BASIN

The following changes were made to the North Platte Basin IPP dataset:

- Created a unique identifier for each project, in the format of Basin-Year-Number.
- Added a Lead_Contact field for consumptive use projects; the field remains blank.
- An Admin_Need field was added and set as 0% for all projects.
- County and Water_District fields were added and populated by intersecting projects with Latitude and Longitude data with Colorado county and water district spatial data layers using geoprocessing software. For those projects without Latitude and Longitude data, these fields are blank.
- Used the worksheet names ("CU Projects", "NCNA_ER Projects") to create Municipal_Ind_Need, Agricultural_Need and Envr_Rec_Need data fields. Since the consumptive use projects were reservoir-related, it was assumed that the projects could be considered both agricultural and municipal/industrial and thus the percentages were set to 50% for both needs. In the original datasheet, three projects contained asterisks which indicated that the projects could also be considered non-consumptive. For these projects, the need percentages were changed to 33% for each need. The Basin Roundtable should review these designations.
- The following fields were added but left blank since no data were available: Project_Keywords, Status, Lead_Proponent, Estimated_Yield, Yield_Units, Estimated_Capacity, Capacity_Units, Estimated_Cost.

RIO GRANDE BASIN

The following changes were made to the Rio Grande Basin IPP dataset:

- Created a unique identifier for each project, in the format of Basin-Year-Number.
- County and Water_District fields were added and populated by intersecting projects with Latitude and Longitude data with Colorado county and water district spatial data layers using geoprocessing software. For those projects without Latitude and Longitude data, these fields are blank.
- The following fields were added but left blank since no data were available: Project_Description, Project_Keywords, Status, Lead_Contact, Estimated_Yield, Yield_Units, Estimated_Capacity, Capacity_Units.

SOUTH PLATTE / METRO BASINS

The following changes were made to the South Platte / Metro Basin IPP dataset:

- Created a unique identifier for each project, in the format of Basin-Year-Number.
- Created a Project_Description field. For most projects, the description is simply a copy of the Project_Name. However, some projects have a more detailed description due to OWF's previous work on the South Platte Data Platform, in which OWF was tasked with providing more detail to IPPs, such as determining general locations. The Basin Roundtable should review and update this field.
- A Municipal_Ind_Need field was created. All projects were assumed to be municipal/industrial in nature and thus the percentage was set to 100. While some of the projects may also have an agricultural need, OWF did not attempt to make this determination. The Basin Roundtable should review this designation.
- An Agricultural_Need field was created and set as 0% for all projects.
- An Envr_Rec_Need field was created and set as 0% for all projects.
- An Admin_Need field was added and set as 0% for all projects.
- County and Water_District fields were added and populated by intersecting projects with Latitude and Longitude data with Colorado county and water district spatial data layers using geoprocessing software. For those projects without Latitude and Longitude data, these fields are blank.
- A Yield_Units field was created and was set to AF for all projects that had Estimated_Yield values.
- A Capacity_Units field was created and was set to AF for all projects that had Estimated_Capacity values.
- The following fields were added but left blank since no data were available: Project_Keywords, Status.

SOUTHWEST BASIN

The following changes were made to the Southwest Basin IPP dataset:

- Created a unique identifier for each project, in the format of Basin-Year-Number. Because the original data contained IDs with a sub-basin identification, OWF conserved that portion of the ID. Therefore, the format of the Project ID is BasinSubbasin-Year-Number, as in SWDM-2015-0001, which indicates the Dolores and McElmo sub-basin. All sub-basins were given a two-letter abbreviation: MB = multi-basin, SJ = San Juan, PD = Piedra, PN = Pine, AN = Animas, LP = LaPlata, MA = Mancos, DM = Dolores & McElmo, SM = San Miguel.
- Split the Description field so that the Project_Name field could be filled in. This was done by taking the first sentence of the description and using that for the name. The Project_Description field is the original Description field.
- The original field Lead contact & Source of Info. was changed to Lead_Contact. OWF did not attempt to edit the contents of the field, thus the lead contact listed may actually only be the source of the information about the project. The Basin Roundtable should review this field.
- Used the NC/C/B (Nonconsumptive, Consumptive, Both) field to create the Municipal_Ind_Need, Agricultural_Need and Envr_Rec_Need fields. The original Need Addressed field also was used to fill in the new needs fields, as well as the Project_Description field. The following rules were used:
 - If the Need Addressed field contained the words "municipal" or "industrial" or the Project_Description field contained the words "hydropower", "water supply", "reservoir", "water right" or "metro district" then the project was considered to fulfill the Municipal_Ind_Need field.

- If the Need Addressed field contained the word “agriculture” or the Project_Description field contained the words “agriculture”, “irrigation” or “reservoir” then the project was considered to fulfill the Agricultural_Need field.
- If the NC/C/B field for a project was listed as NC or B or the Project_Description field contained the words “augmentation” or “RICD” then the project was considered to fulfill the Envr_Rec_Need field.
- Standardized the terminology used for project status. "Not Complete" and “Not completed” were replaced with "Planned". "Ongoing" was replaced with "Implementation Ongoing". “Construction Completed” was replaced with “Completed”. “Investigating” was replaced with “Concept”.
- The County field was edited so that a value of "All" was changed to list all of the counties in the basin, separated by commas.
- A Water_District field was added and populated by intersecting projects with Latitude and Longitude data with a water district spatial data layer using geoprocessing software. For those projects without Latitude and Longitude data, this field is blank.
- The following fields were added but left blank since no data were available: Project_Keywords, Estimated_Yield, Yield_Units, Estimated_Capacity, Capacity_Units, Estimated_Cost.

YAMPA / WHITE BASIN

The following changes were made to the Yampa/White Basin IPP dataset:

- Created a unique identifier for each project, in the format of Basin-Year-Number.
- Added a Project_Description field for consumptive use projects; the field remains blank.
- An Envr_Rec_Need field was added and those projects listed as Nonconsumptive were added to the Envr_Rec_Need field as 100%.
- Municipal_Ind_Need and Agricultural_Need fields were added; those projects listed as Consumptive were added to the fields as 50% for each need. Most of the consumptive use projects were related to reservoirs, so it was assumed that the need could be considered both agricultural and municipal/industrial. The Basin Roundtable should review these designations.
- An Admin_Need field was added and set as 0% for all projects.
- County and Water_District fields were added and populated by intersecting projects with Latitude and Longitude data with Colorado county and water district spatial data layers using geoprocessing software. For those projects without Latitude and Longitude data, these fields are blank.
- The following fields were added but left blank since no data were available: Project_Keywords, Status, Lead_Contact, Estimated_Yield, Yield_Units, Estimated_Capacity, Capacity_Units, Estimated_Cost.

Appendix A: Current Basin IPP Dataset Formats

This appendix provides images of the Excel workbook for of each basin's IPP dataset to illustrate existing data fields in the "flat" representation of IPP data. These examples were created from the Excel files that were provided at the start of the IPP data review summarized in Section 2.

Technical Update IPP Dataset Development

	A	B	C	D	E	F	G	H
	ID	Arkansas Basin Project ID	Project Title	Need or Challenge	Project Description	Project Status	Project Proponent	Associated Waterbody
1	1	ARK-2015-0001	CSWD Cucharas River Bank Intake Structure	Municipal Water Supply Gap CSWD.	Appropriate water right, conduct permitting and construct facilities for Cucharas River bank intake.	Planned	CSWD	Cucharas River
2	2	ARK-2015-0002	Cucharas Mountain Resort Storage	Water storage for summer recreation and winter snow making at Cucharas Mountain Resort (CSWD).	Transfer water right, permitting, and construct facilities.	Planned	CMR, CSWD	Cucharas River
3	3	ARK-2015-0003	South Baker Creek Reservoir	Municipal water storage shortage Cucharas SWD.	Acquisition, construction, permitting, and adjudication of South Baker Creek Reservoir.	Planned	CSWD	Cucharas River, South Baker Creek
4	4	ARK-2015-0004	Huerfano River Futile Call Administration Model and Gages	Timely futile call administration on Huerfano and Cucharas Rivers.	Transit or futile call model development as requested by DEO and HCWCD.	Planned	DEO, HCWCD	Huerfano River, Cucharas River

	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
	Alamosa	Baca	Bent	Chaffee	Cheyenne	Costilla	Crowley	Custer	Douglas	Engle	El Paso	Elbert	Fremont	Gunnison	Huerfano	Kiowa	Kit Carson	Lake	Las Animas	Lincoln	Otero	Park	Pitkin	Provers	Pueblo	Saguache	Summit	Teller
1																												
2															X													
3															X													
4															X													

	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT
	County(s)	Validated Project (Not an Obsolete or Completed Project)	Solution	Plan of Action	MASTER NEEDS LIST	Needs Identified in BIP	Meets Min. IPP Requirements	Proponent	Intends to Meet Needs by 2050	2015 BIP IPP LIST (Yes/No)
1	Huerfano	Yes	Initiate water right application, permit, design, and construct facilities.	Authorization of activities to implement by public body.	Yes	Yes		Yes		No
2	Huerfano	Yes	Initiate water right application, permit, design, and construct facilities.	Authorization of activities to implement by public body.	Yes	Yes		Yes		No
3	Huerfano	Yes	Initiate project description.	Authorization of activities to implement by public body.	Yes	Yes		Yes		No

	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG
	Project Classification (List from Review Steps)	FUTURE TASK NOT FOR BIP	Municipal & Industrial	Agricultural	Storage	Environmental	Recreational	Water Quality	Watershed Health	Conservation / Efficiency	Instream Flow (ISF)	Multi-Benefit (to Populates)	Project Type
1	Master Needs List		X										Municipal & Industrial
2	Master Needs List		X		X	X	X					X	Municipal & Industrial; Storage; Environmental; Recreational; Multi-Benefit
3	Master Needs List		X		X	X	X		X			X	Municipal & Industrial; Storage; Environmental; Recreational; Conservation/Efficiency; Multi-Benefit

Figure A1. Screenshots of Arkansas Basin IPP dataset (2015 04 19 Arkansas River Basin Project Database GB update 6_13_15.xls, "All Input List" worksheet).

Technical Update IPP Dataset Development

BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ
Project Location: Latitude (###.#####)	Project Location: Longitude (###.#####)	Subregion	Water Conservancy District	Arkansas Basin HUC	CO Division of Water Resources District No.	Input Provided By (List or Name)	Applicant	Original Project ID (From Input Information)	Project Contact
37.332049	-105.096323		Huerfano County Water Conservancy District	110200060401	16	S. White H-P Projects			CSWCD; Art Pi
37.345076	-105.126966		Huerfano County Water Conservancy District	110200060401	16	S. White H-P Projects			CSWCD; Art Pi
37.355602	-105.105012		Huerfano County Water Conservancy District	110200060401	16	S. White H-P Projects			CSWCD; Art Pi

BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB
Contact ID	Contact Organization	Contact Phone	Contact Email	Project Website	Partners	Partners Contact	Estimated Cost	Basin Funds Requested	Statewide Funds Requested	Total Funds Requested
					CSWD		\$6.0M			
					CSWD		\$4.0M			
					CSWD		\$9.5M			

CC	CD	CE	CF	CG	CH	CI	CJ	CK
Estimated Completion Date	BRT Sponsor	CWCB Approved	Location Description	Project Category	Project Type	Basin Goals Met	Multi Basin	Attributes Identified by BRT
Est 2022	Sandy White					M1, M2		
Est 2025	Sandy White					S1, S3, M2		
Est 2018	Sandy White					S1, S3, M1, M2, NC1, NC2, NC3, NC5, NC6, NC7		

CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX
Benefit	Project Protections	Constraints and Challenges	SWSI 2010 Type	Annual Firm Yield	New Active Storage	COMID	Segment ID	Project Location ID	BNDSS IPP Category	BNDSS IPP Type	Project Note or Comment	Other
		HB1041?; 404? USFS-SUP? DEO/SEO										
		HB1041?; 404? USFS-SUP? DEO/SEO										
		HB1041?; 404? USFS-SUP? DEO/SEO										

Figure A1 continued.

Technical Update IPP Dataset Development

	A	B	C
1			
2	Projects, Policies and Process	Beneficiary	Project Sponsor
3	<p>ERMOU Project The ERMOU Joint Use Water Project (ERMOU Project) derives from the 1998 Eagle River MOU among East and West Slope water users for development of a joint use water project in the Eagle River basin that minimizes environmental impact, is cost effective, technically feasible, can be permitted by local, state and federal authorities, and provides 20,000 acre feet per year (AFY) average annual yield for East Slope use, 10,000 AFY firm dry year yield for West Slope use, and 3,000 AF of reservoir capacity for Climax Molybdenum Co. The ERMOU Project is proposed as a cooperative alternative to construction of the Homestake II Project in the Holy Cross Wilderness. The ERMOU Project will utilize conditional water rights held by the ERMOU Parties and a yet-to-be determined combination of gravity diversion, storage, pumping, and/or groundwater infrastructure to develop the contemplated project yield.</p> <p>ERMOU Parties include: Cities of Aurora and Colorado Springs; Eagle Park Reservoir Company (consisting of the Colorado River Water Conservation District, Eagle River</p>	ERMOU Parties	ERMOU Parties
4	Red Cliff Project (Iron Mountain)		CRWCD
5	Fryingpan Project		

	D	E	F	G	H	I	J	K
1	Data Sources	Region (of Project)	Proposed (AF, CFS, other)	Existing (AF, CFS, other)	Cost	Progress	Basin Importance	Nonconsumptive Benefits
2	EAGLE REGION							
3	ERMOU Parties	(Upper) Eagle Region	20,000 AFY average annual yield for Cities, 10,000 AFY firm dry year yield for the Reservoir Co., 3,000 AF storage space for Climax	2500	\$5000/AF	Ongoing	High	
4	ERMOU Project	Eagle Region	60,000 AF					
5	ERMOU Project	Eagle Region						

Figure A2. Screenshots of Colorado Basin IPP dataset (Eagle_Region_Full_IPP_List.xlsx).

	L
1	Comments (Opportunities and/or Constraints)
2	
3	Progress on the ERMOU Project has been continuous since 1998, with development and use of the Eagle Park Reservoir as a phase component of the Project, investigation of specific project configurations described in the ERMOU, investigation of alternative project configurations, and acquisition and adjudication of water rights to be used for the ERMOU Project. Currently, the Project Sponsors are continuing investigations to evaluate the "Whitney Creek" alternative, consisting of a surface diversion from the Eagle River in the area of Camp Hale with a dual purpose storage reservoir / pumping forebay on Homestake Creek to store West Slope yield, and regulate and feed East Slope yield up to Homestake Reservoir. The Project Sponsors hope to conduct field reservoir siting studies for this possible Project component during the summer of 2014. They will continue to examine additional project variations and components that will be needed to develop the full yield contemplated for the ERMOU Project.
4	
5	

	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	
1	IA - Increase Raw Water Storage	IB - Improve water court process	IC - Develop land use policy improvements	ID - Protect mainstem water rights	IE - Define potential natural impacts to water supply	IF - Raise awareness of obstacles facing water providers	IG - Ensure adequate safe drinking water	IIA - Reduce agricultural water shortages	IIB - Develop land use policy to reduce agricultural water to municipal (ATM) transfers	IIC - Identify agricultural production incentives	IID - Reduce the potential for transmountain diversions (TMDs)	IIE - Increase agriculture community education on water issues	IIF - Improve agricultural efficiency, preservation, and conservation	IIIA - Identify reaches that are at risk or will be in the future	IIIB - Protect rivers, streams, lakes and riparian areas	IIIC - Protect and improve water quality	IIID - Preserve recreational flows	
2																		
3	x						x											
4	x							x										
5	x																	

Figure A2 continued.

Ref #	Tier	Project	Project Sponsor	Water District	Sponsor Type	Use Type	Project Type	Geographic Extent	Basin Goals	Included in SWSI 2010?
1	1	Gunnison Basin Roundtable 2015 Education Action Plan Activities	Gunnison Basin Roundtable	All	SE	AG, M&I, NC	NS	MD	1, 2, 7, 9	N
2	1	Regional Conservation Partnership Program (RCPP)	CRWCD, TU, TNC, UVWUA, NFWCD, CWCD, BPWCD	40, 41	P	AG, NC	S, NS	MD	1, 2, 3, 5, 6, 7, 8	N
3	1	Inventory of Irrigation Infrastructure Improvement Needs - District 28	Upper Gunnison River Water Conservancy District	28	SE	AG, NC	NS	SD	1, 3, 5, 7, 8	N
4	1	Cole Reservoirs #4 and #5	Bill Martin	40	SE	AG	S	SD	1, 3, 8	N

Project Readiness (Feasible by 2025?)	Point of Contact: Name	Point of Contact: Email	Point of Contact: Phone Number	Purpose	Water Gained or Saved (AF)	Estimated Completion Date	Estimated Budget
Yes	George Sibley	george@gard-sibley.org		Creation and implementation of the 2015 GBRT Education Action Plan (EAP) to include such items as: active education or stewardship programs for high school students, a Basin Water Leaders program at universities in the Basin for college students to develop and deliver education programs for public K-12 schools, printed materials about "comfortable and intelligent desert living", sub-basin-specific half-day programs and printed materials for decision makers, etc.	NA	Ongoing	TBD
Yes	Cary Denison			Modernize and improve off and on farm water transmission and application infrastructure in Lower Gunnison to accurately meet ag water demands while improving flow and water quality.	TBD	Ongoing	50,000,000
Yes	Frank Kugel	fkugel@ugr-wcd.org	970-641-6065	Systematically examine and prioritize projects to restore, maintain, or modernize significant agricultural water supply infrastructure. Inventory will target proposed projects to maximize impact on meeting agricultural shortages, preserving existing uses, and in some cases meeting other purposes such as stream connectivity and flow.	NA	2018	100,000
Yes	Bill Martin	NA	970-255-7406	This project involves the repair or replacement of the main headgate diversion from Surface Creek and cleaning of the associated inlet ditch. It would preserve and restore the use of an important pre-Compact water	146	2015	50,000

Figure A3. Screenshots of Gunnison Basin IPP dataset (GBIP_Simplified_Project_List_4-17-15.xlsx, "Planned Projects", "NC Protections & Monitoring" and "Completed_Ongoing" worksheets).

Technical Update IPP Dataset Development

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Ref #	Project	Project Sponsor	Water District	Sponsor Type	Use Type	Project Type	Geographic Extent	Basin Goal	Included in SWSI 2010?	Project Readiness (Feasible by 2020?)	Point of Contact Name	Point of Contact Email	Point of Contact Phone Number	Purpose
4	1	HCCA Project		40		NC		SD		Y			Jeff, DK, Tom,		
5	2	North Fork River Improvement Association - NFRIA		40		NC		MD	5	Y					
6	3	Fish Screen & Ladder at Redlands Power Canal	RWAPA (formerly USBR & FWS)	42	P	NC	S		5	N					Fish ladder and screen allow for endangered fish migration while preventing migration by nonnative fish.
7	4	Redlands Water and Power Canal	Redlands Power and Water Company	42	SE	NC	NS		5	N					
8	5	NPS WQ, Curecanti NRA (Aspinall Reservoirs) Sites		59		NC	NS			N					NPS effort to protect aquatic life and recreational Colorado WQ standards in Curecanti NRA and Black Canyon of the Gunnison NP.
9	6	ONRW Designation -- Streams Draining West Elks (heading in and flowing within Gunnison County only) to Curecanti NRA		59		NC	NS		5	N					NPS effort to protect quality and aquatic life of Curecanti NRA.
10	7	Roaring Judy	CPW	59	SE	NC	NS		5	N					Protect autumn minimum discharge needs for upstream migration of kokanee salmon.
11															

	A	B	C	D	E
	Funding Year	Project	Description	Amount Funded	Funding Source
3	2007	Lake San Cristobal Controlled Outlet Structure (Part 1)	Hinsdale County and the Upper Gunnison River Water Conservancy District (UGRWCD) explored the feasibility of constructing a new permanent control structure at the outlet of Lake San Cristobal. The new structure allows for more controlled releases to regulate the lake level and prevent failure of the structure during flood events. The additional stored water resulting from the project will be used primarily as augmentation water within the Lake Fork of the Gunnison River. Other beneficial uses may include agriculture, recreation, and releases for instream flows.	40,000	WSRA
4	2007	Off-System Raw Water Storage Project 7 Water Authority/Uncompahgre Valley Water Users Association (Part 1)	The proposed new reservoir would be located on BLM and/or private land in the vicinity of Fairview Reservoir would have a capacity sufficient to supply P7 customers with domestic water for up to one full year. A detailed evaluation and comparative analysis of the potential sites was performed to identify the best reservoir location.	56,700	WSRA
5	2007	Orchard City Water Reservoir Project (Task 1-3)	This project involves the design of an approximately 500 acre foot off-channel reservoir to serve the municipal/domestic needs of	60,000	WSRA
6	2007	Orchard City Water Reservoir Project (Remaining Tasks)		480,000	WSRA
7	2007	Overland Reservoir Dam Expansion/Restoration (Part 1)		68,000	WSRA
8					

Figure A3 continued.

No.	Project	Project Description	GIS Shapefile
1	MacFarlane Reservoir **	Outlet work and toe drain improvements to existing reservoir (WDID 4703614)	CUProjects_Point
2	Evapotranspiration Project	Continued support of climate station operation and lysimeter data collection to develop high altitude ET	N/A
3	Walden Reservoir	Dredge reservoir bottom to increase capacity for new use (WDID 4703627)	CUProjects_Point
4	Basinwide Augmentation Plan	Develop basinwide plan to augment various uses, potentially including augmenting depletions from livestock, industrial or municipal development in the basin	N/A
5	Hanson and Wattenberg Ditch Acreage	irrigate acreage (1,612 acres) potentially served by rehabilitated Hanson and Wattenberg Ditch or new North	CUProjects_Poly
6	Proposed Streamgage Installation	Identify and potentially install new streamflow gages at key locations	N/A
7	Storage Protocol	Protocol for storage under the Equitable Apport. Decree	N/A
8	Irrigation Season Protocol	Protocol to define irrigation season in the basin	N/A
9	Irrigated Acreage Assessment Protocol	Protocol for delineating irrigation acreage under the Equitable Apport. Decree	N/A
10	Proposed Willow Creek Reservoir	New reservoir near Willow Creek crossing of Highway 125, potentially filled from Willow Creek or Illinois River	CUProjects_Point
11	Dam Ditch Headgate Improvement **	Redesign/replace existing headgate to increase capacity, ease maintenance issues and improve fish connectivity (WDID 4700582)	N/A

No.	Project or Segment	Project or method	Primary focus	To benefit:	Contact	GIS Shapefile
1	Bear Draw	Relocate trail out of wetland	Wetlands	Fishery, wetlands, amphibians	USFS	ERProjects_Point
2	BLM Water quality/quantity: Various reaches in North Platte Basin	Monitor water quality/quantity	Water quality/quantity	Fishery, wildlife, livestock, water quality	BLM	N/A
3	Boettcher Lake Rehabilitation	Rehabilitate/replace irrigation infrastructure	Improve/increase irrigated meadows	Waterfowl habitat	DU, Private Owner	ERProjects_Point
4	Boreal Toad Studies - Twisty Park/County Wide	Boreal Toad Studies	Species of concern	Amphibians	CPW	N/A
5	Brown Creek Fence	Improve water quality and riparian habitat from improved grazing management through fencing	Water quality, riparian habitat	Fishery, wetlands, amphibians	USFS	ERProjects_Point
6	Brownlee SWA- North Platte River	Brownlee SWA river channel/riparian corridor habitat/water quality improvements	Improve fishery habitat, water quality, erosion control	Fishery, riparian plant community	CPW	ERProjects_Point
7	Camp Creek	Remove fill & culverts from wetland	Wetlands, water quality, aquatic passage, stream function	Fishery, wetlands, amphibians	USFS	ERProjects_Poly
8	Camp Creek	Replace double culverts	Stream function, aquatic passage	Fishery	USFS	ERProjects_Poly

Figure A4. Screenshots of North Platte Basin IPP dataset (NPBIP_IPPLists.xlsx, “CU Projects” and “NCNA_ER Projects” worksheets).

Technical Update IPP Dataset Development

	A	B	C	D	E	F	G	H
1							Cost	
2	ID	Project	Sponsor	Total	2014	2015	2016	2017
3	1	Boatable Days Flow Evaluation	Trout Unlimited	\$19,500		\$11,167	\$4,167	\$4,167
4	2	Conejos River System Confluence Management	Conejos Water Conservancy District	\$582,000	\$193,000	\$355,000	\$34,000	
5	3	Consolidated Ditch Diversion and Headgate Rehabilitation Project	Colorado Rio Grande Restoration Foundation, NRCS, Private	\$1,500,000	\$43,450	\$173,850	\$1,258,850	\$23,850
6	4	Doppler Radar Weather Forecasting Project	RWEACT, CWCB, USFS, NWS	\$393,750	\$78,750	\$78,750	\$78,750	\$78,750
7	5	Economic Impact Statement Analysis of the Effects of Reduced Groundwater Irrigation on the Ro Grande Basin	San Luis Valley Council of Governments	\$80,364		\$38,932	\$41,432	
8	6	Groundwater Management Subdistricts	Rio Grande Water Conservation District	\$66,000,000		\$4,125,000	\$4,125,000	\$4,125,000
9	7	Hydrologic Recharge Feasibility Study for Rio Grande Basin Augmentation	San Luis Valley Irrigation Well Owners, Inc.	\$180,000	\$80,000	\$100,000		
10	8	Increasing Water Holding Capacity of Soil for Agricultural Sustainability	Rio Grande Watershed Conservation and Education Initiative	\$5,403,164	\$905,861	\$1,801,055	\$1,801,055	\$895,194

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1		Project or Method	Needs Met				Basin Goals Met													
2			Ag	M&I	Env & Rec	Water Admin	1	2	3	4	5	6	7	8	9	10	11	12	13	14
3	1	Boatable Days Flow Evaluation			x	x	✓	✓				✓	✓			✓	✓	✓	✓	✓
4	2	Conejos River System Confluence Management Project	x		x		✓	✓		✓	✓				✓	✓	✓			✓
5	3	Consolidated Ditch Diversion and Headgate Rehabilitation Project	x		x	x	✓	✓		✓	✓			✓	✓	✓	✓			✓
6	4	Closed Basin River / Creek and Wetland Water Table Study	x		x	x	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓
7	5	Doppler Radar Weather Forecasting Project	x	x	x	x	✓	✓				✓	✓			✓	✓	✓	✓	✓

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1		Project or Method Types	Needs Met				Basin Goals Met													
2			Ag	M&I	Env/Rec	Water Admin	1	2	3	4	5	6	7	8	9	10	11	12	13	14
3	1	Acquisition of Replacement Supplies for M&I Pumping Depletions	x	x	x	x		✓	✓	✓	✓	✓	✓		✓			✓		
4	2	Adaptive Management to Mitigate Climate Change Impacts	x	x	x	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	3	Alternative Agriculture Methods and Improved Irrigation Efficiency to Reduce Consumptive Use	x		x	x	✓	✓	✓	✓		✓	✓		✓					
6	4	Alternative Cropping Education and Promotion Program	x		x			✓	✓	✓	✓		✓	✓						
7	5	Basin-wide Water Public Education Program	x	x	x	x	✓	✓	✓			✓		✓		✓	✓	✓	✓	✓

Figure A5. Screenshots of Rio Grande Basin IPP dataset (Updated Tables 8-10_Project Sheet Summaries_09-11-2017.xlsx, "Budget", "Specific Project Needs Met" and "General Projects" worksheets).

Technical Update IPP Dataset Development

	A	B	C	D
8	BNDSS IPP ID	BNDSS IPP Category	Basin	Project
9	Morgan_UIPP_FIB	UIPP	South Platte	Morgan County Unspecified IPP Firming In-Basin
10	Morgan_UIPP_GIES	UIPP	South Platte	Morgan County Unspecified IPP Grow Into Existing Supply
11	ClearCreek_UIPP_FIB	UIPP	South Platte	Clear Creek County Unspecified IPP Firming In-Basin
12	ClearCreek_UIPP_GIES	UIPP	South Platte	Clear Creek County Unspecified IPP Grow Into Existing
13	FtMorganCBT&AugPlan	IPP	South Platte	Fort Morgan CBT & Augmentaion Plan
14	WindyGap	IPP	South Platte	Windy Gap Firming

	E	F	G	H	I
8	SWSI 2010 Type	BNDSS IPP Type	BNDSS Yield [Ac Ft]	BNDSS Sponsor ID	Providers
9	FIB	MDIB	2081		
10	GIES	GIES	2081		
11	FIB	MDIB	899		
12	GIES	GIES	899		
13	FIB	MDIB		FtMorgan	Fort Morgan, City of
14	FTB	TS	30000	NCWCD	Northern Colorado Water Conservancy District, Erie, Lafayette, Longmont, Louisville, Broomfield, Loveland, Greeley, Fort Lupton, Superior, Central Weld County Water District, Evans, Little Thompson Water District

	J	K	L	M	N	O	P	Q
8	Estimated Cost	Estimated Completion Date	Storage			Data Sheet Priorities - by Yield-BNDSS & Proportion of Basin Yield	Point of Contact	Email Address
9						3	Allyn Wind	wind@kci.net
10						3	Allyn Wind	wind@kci.net
11						3	Bert Weaver	bweaver@co.clear-creek.co.us
12						3	Bert Weaver	bweaver@co.clear-creek.co.us
13							Brad Curtis	bcurtis@cityoffortmorgan.com
14	261000000		90000			1	Brian Werner	bwerner@ncwcd.org

	R	S	T	U	V	W	X	Y	Z	AA
8	Comments	Date IPP Data Sheet Sent via Email	Alternate Contact Data Sheet Sent via Email		IPP Data Sheet Complete?	Condensed IPP data sheet sent via email	Condensed IPP Survey Received	Change in Yield (AFY)	Change in Estimated Year of Completion	Comment on Returned Survey
9		x			0	x				
10		x			0	x				
11		x			0	x				
12		x			0	x				
13		x			0	x				
14		x			1	x			2020	

Figure A6. Screenshots of South Platte / Metro Basin IPP dataset Gap Analysis (SPMetro HDR Phase 2.xlsx, "BNDSS IPP List" worksheet).

	A	B	C	D	E	F	G	H
3	PROPOSED IPPs							
4	ID	Date	Sub Basin	NC/C/B	Description	County	Status	Remaining Steps
5	1-A	Jul-13	Animas	C	<u>Animas-LA Plata Project</u> . Utilization of Animas-LA Plata Project water supplies for multiple purposes by Southern Ute Indian Tribe, Ute Mountain Ute Indian Tribe, Animas-LA Plata Water Conservancy District, City of Durango, LA Plata West Water Authority, Lake Durango Water Authority, Colorado Water Conservation Board, LA Plata Archuleta Water District, and others that may be entitled to ALP water. The utilization could include treatment and conveyance (pumps and pipelines) of raw or treated water.	La Plata, Archuleta, Montezuma	Not Complete	
6	2-A	Jul-13	Animas	NC	<u>Lake Nighthorse Recreation</u> . Provide boating, fishing, and swimming opportunities.	La Plata	Not Complete	
7	3-A	Oct-13	Animas	C	<u>La Plata Archuleta Water District</u> . Design and construction of a treatment plant for ALP water possibly in coordination with City of Durango. Transmission and distribution pipelines to convey treated water from the treatment plant to customers.	La Plata	Not Complete	Investigate potential partnerships, acquire land, design and construct
8	4-A	SWSI 2010	Animas (Florida)	C	<u>Florida Water Conservancy District</u> . Need for industrial, municipal, domestic, commercial, wildlife, wetlands, exchange, augmentation, hydropower, irrigation, and fire protection water within the Florida River basin. The District has initiated institutional changes by entering into a water service contract with the BOR to use decreed 114 AF water right for augmentation purposes and has obtained a 2,500 AF water right to address the aforementioned uses. Utilization of the 2,500 AF will require another water service contract with the BOR, voluntary water turn in by users, and irrigation system efficiency improvements by the Florida Mesa Ditch Companies that would firm up agricultural delivery and provide additional water supply for those other uses in Lemon Reservoir through the reduction of losses in the delivery system.	La Plata	Not Complete	Finalize water service contract with BOR and Complete additional irrigation system improvements

	I	J	K	L	M	N	O
Need Addressed	IPP Contact Information		Project vs. Process	Project ready for implementation NOW?	Does the need exist today?	Already received some WSRA funding?	
	Sponsors	Lead contact & Source of Info.					
Municipal water supply	Southern Ute Indian Tribe, Ute Mountain Ute Indian Tribe, Animas-LA Plata Water Conservancy District, City of Durango, LA Plata West Water Authority, Lake Durango Water Authority, Colorado Water Conservation Board, LA Plata Archuleta Water District, and others that may be entitled to ALP water		Both	Yes	Yes	Yes	
Recreation	Animas La Plata Water Conservancy District, Bureau of Reclamation, La Plata county, City of Durango		Project	Yes	Yes	Yes	
Municipal water supply	La Plata Archuleta Water District		Project	No	Yes	Yes	
Municipal, Industrial & Agricultural water supplies	Florida Water Conservancy District		Project	Yes	Yes	Yes	

Figure A7. Screenshot of Southwest Basin IPP dataset (SWBRT Draft IPP List Clean copy.xlsx, "Animas" worksheet).

Technical Update IPP Dataset Development

	A	B	C	D	E	F
1	ID	Name	Location	Additional Details	Proponents	GIS File
	1	Upper Yampa backwater modifications	Initial projects located within Chuck Lewis SWA and within Steamboat Springs on the south end of city limits. However, multiple sites throughout the Upper Yampa River corridor could benefit from alterations of backwater habitats. Benefits to the Upper Colorado Endangered Fish Recovery Program by implementing one element of the program's non-native fish control strategy. Also benefits other environmental attributes of the riverine ecosystem. All other elements of the nonnative fish control strategy are part of keeping the Yampa River Basin PBO in place below.	Stakeholders would develop multi-faceted projects implementing habitat modifications/restoration activities to alleviate unnatural backwater habitats to minimize non-native species recruitment and improve ecological functions of the riverine system. Multiple recreational benefits would be realized as well.		IPP_Point
2	2	Loudy Simpson access and recreational river enhancements	Yampa River at Loudy Simpson Park in Craig, Colorado.	Provide improved access to river and restoration/rebuild of riffle for non-consumptive needs specific to increasing recreational opportunities and float boating in the Yampa River at the park.	Possibly Moffat County Tourism Association	IPP_Point
3	3	Upper Elkhead Creek Stream Restoration	Stream restoration will occur on approximately 16 miles of Elkhead Creek and its tributaries from the southern end of California Park upstream to the headwaters.	Indirect benefits to consumptive uses include a reduction in sediment entering Elkhead Reservoir.	Forest Service	IPP_Reach
4						

	A	B	C
1	Map ID	Name of Project	Location
2		1 Elkhead Reservoir Enlargement Project	Yampa: Elkhead Creek
3		2 Fish Creek Direct Flow and Storage	Yampa: Fish Creek in Buffalo Pass Area
4		3 Lake Avery Enlargement	White: Expansion to Big Beaver Reservoir (Lake Avery)
5		4 Little Bear 1 Reservoir	Yampa: Fortification Creek Basin
6		5 Milk Creek Reservoir	Yampa: Milk Creek

D	E	F	G
In BIP model?	Proponents	GIS File	Description
No	Colorado River Water Conservation District	IPP_Point	pg 113
No	Mt Werner Water / City of Steamboat Springs	IPP_Point	pg 113
Yes	Yellow Jacket Water Conservancy District	IPP_Point	pg 157
Yes		IPP_Point	pg 153
Yes	Juniper Creek WCD	IPP_Point	pg 155

Figure A8. Screenshots of Yampa / White Basin IPP dataset (BIP_IPPs.xlsx, “NonConsumptive” and “Consumptive” worksheets).

Appendix B: Identified Projects and Processes Maps

This appendix provides an explanation of data availability and how locations were determined for IPPs that lacked location data.

DATA AVAILABILITY

As discussed in the main document, availability of coordinate data for IPPs varied by basin. The following describes the level of coordinate data provided to OWF by basin:

- **Arkansas Basin** – latitude and longitude coordinates were provided in the Excel file of IPPs for many, but not all, IPPs. Coordinate data were available for both consumptive and E&R projects.
- **Colorado Basin** – no coordinate data were provided; IPPs were categorized by “region” within the basin.
- **Gunnison Basin** – shapefiles of point data for both consumptive and E&R projects were provided, but not all projects were included in the shapefiles.
- **North Platte Basin** – shapefiles of point and line data for both consumptive and E&R projects were provided for most, but not all, projects.
- **Rio Grande Basin** – a .kmz file of points representing IPPs for both consumptive and E&R projects was provided, but not all projects were included.
- **South Platte and Metro Basins** – no coordinate data were provided; county designation was included in the Excel file.
- **Southwest Basin** – shapefiles of point and line data for both consumptive and E&R projects were provided, but not all projects were included in the shapefiles.
- **Yampa-White Basin** – shapefiles of point and line data for both consumptive and E&R projects were provided, and all consumptive projects were included in the shapefiles.

For basins such as the North Platte, Southwest and Yampa-White that contained both point and line data, points tended to be associated with consumptive projects, whereas lines tended to be associated with E&R projects. At this time, OWF has not attempted to convert line data into point data. If an E&R project contained a point location, then that project is included in the map. Therefore, while maps focused on consumptive IPPs, it should be understood that some E&R IPPs were also included.

LATITUDE/LONGITUDE FLAG DESCRIPTIONS

In order to document and keep track of the methods used to determine coordinate locations for IPPs, OWF created a “Lat_Long_Flag” column in the IPP dataset. The flag consists of a 1- or 2-character designation; the first character is a letter and the second character is a number. The designations are as follows:

- G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles
- g = coordinates are based on an estimation technique:
 - g1 = coordinates based on centroid of county boundary
 - g2 = coordinates based on centroid of municipal boundary
 - g3 = coordinates based on centroid of water district boundary
 - g4 = coordinates based on location of reservoir
 - g5 = other; based on a location described in the IPP name, such as a school or the Shoshone Plant
 - g6 = coordinates based on centroid of county boundary, then offset by 0.02 (or 0.04, 0.06, etc.) degrees longitude to allow for visibility on map
 - g7 = coordinates based on centroid of municipal boundary, then offset by 0.02 (or 0.04, 0.06, etc.) degrees longitude to allow for visibility on map

- g8 = coordinates based on centroid of water district boundary, then offset by 0.02 (or 0.04, 0.06, etc.) degrees longitude to allow for visibility on map
- g9 = coordinates based on general location on stream
- g10 = coordinates based on address of water provider, ditch company, etc.
- g11 = coordinates based on primary diversion structure of transbasin diversion project
- g12 = coordinates based on ditch's diversion structure
- g13 = coordinates based on ditch's diversion structure, then offset to allow for visibility on map
- g14 = coordinates based on IPP-Projects layer from Colorado Mesa University's Colorado Headwaters Map (applies to Colorado Basin only)
- M = coordinates missing in original source and therefore values cannot be provided:
 - M1 = coordinates not determined because general location cannot be determined from IPP name or description
 - M2 = coordinates not determined because IPP is an E&R IPP

IPPs designated with a g6, g7, g8 or g13 flag were necessary in order to allow IPPs to be shown on the map that represented the same basic location. An effort was made to standardize how much the locations were offset, such as by 0.02 degrees longitude. An example is the numerous IPPs that were generally located within Grand County. However, IPPs associated with a reservoir did not use this offsetting technique and instead were manually located to make sure they were placed within the reservoir's boundary.

For most basins, coordinate data could not be determined for several IPPs because the name or description of the IPP was too generic, such as "Improvements to Ditch and Canal Diversion Structures". In these instances, the Lat_Long_Flag designation is M1 and the IPP could not be included in the map. Therefore, it should be understood that the IPP map does not contain the entire list of consumptive IPPs.

Appendix C: Statewide IPP Locations Estimates

This is an electronic Excel workbook file that include an exhaustive list of IPPs across the state. The appendix is organized by basin and includes flag “Lat_Long_Flag” indicating how the location (latitude/longitude) was determined. See Appendix B for additional detail.

File name: *Statewide-IPPs-locations.xlsx*

Appendix D: Future IPP Management Recommendations

This appendix provides recommendations regarding the maintenance of the IPP datasets during future Basin Implementation Plan updates; linking IPP datasets to other analyses/data products; and integrating IPP data into the larger Technical Update modeling efforts that were discussed with CWCB during this effort. These recommendations are made at a higher level than the details presented elsewhere in this documentation. Some of the recommendations have been implemented during the IPP Dataset review.

D.1 RECOMMENDATIONS FOR IPP DATASET MANAGEMENT

D.2 RECOMMENDATIONS FOR INCORPORATING WATER SOURCE AND DESTINATION INFORMATION

D.3 RECOMMENDATIONS FOR ESTABLISHING AN IMPROVED IPP DATASET MAINTAINENCE WORKFLOW

D.4 RECOMMENDATIONS TO LINK IPP DATASET TO OTHER DATASETS

D.1 RECOMMENDATIONS FOR IPP DATASET MANAGEMENT

As the consultant team was developing the standard IPP dataset, basic data management and maintenance procedures were documented to ease future use of the dataset. The following summarizes those recommendations:

1. Each Basin Roundtable should maintain an Excel workbook file containing IPPs.
2. The name of the electronic file should reflect the date of modification. Alternatively, use version-tracking software such as GitHub that allows versions of the data file to be retrieved.
3. A worksheet in the file named “ChangeLog” or “Changes” should be added indicating the date, person and notes about the change. Note that “History” is a reserved word in Excel and cannot be used for the worksheet name. An example is shown in Figure D1.
4. A worksheet in the file named “Notes” or “ReadMe” should be added with general information, such as explanation of workbook organization.
5. A worksheet in the file named “Definitions” should be added that defines data fields. It should include descriptions of how data should be formatted and/or directions for how to fill in a particular field. An example is shown in Figure D2.
6. The main IPP list should be represented in a flat table form with columns corresponding to data fields that are discussed in subsequent sections of this document. The worksheet should be named “IPPs” or similar (to be determined with CWCB review input).
7. Additional worksheets in the workbook can be added as appropriate, using the IPP identifier to cross-connect. However, additional sheets should not dilute the core data that should be included in the main IPP list. Examples of additional worksheets are:
 - a. Definitions of terms used in the dataset list (such as project type)
 - b. One-to-many data in the core dataset that include shared relationship to other worksheet(s)
 - c. History of changes
 - d. Optional data that will clutter up the main list but may be useful, such as more detailed contact information or information used by the Roundtable to conduct its business

	A	B	C	D	E	F	G
12	When	Who	What				
13	September 12, 2017	Kristin Swaim, OWF	Received current version of Rio Grande Basin IPP dataset				
14	September 15, 2017	Kristin Swaim, OWF	Added in "ID" column to dataset				
15							
16							
17							
18							
19							

Figure D1. Example of a “ChangeLog” tab within the IPP workbook to indicate data edits.

A15		
A	B	C
1	Data Field	Description
2	IPP_ID	Unique identifier for the project
3	IPP_Description	Short description of the project
4	Basin	IBCC basin location of the project
5	Capacity	Annual amount of water anticipated from the project, in acre-feet or cfs
6	Estimated_Cost	Total cost of the project
7	Latitude	Latitude location of the project
8	Longitude	Longitude location of the project
9		

Figure D2. Example of a “Definitions” tab within the IPP workbook to describe data fields.

D.2 RECOMMENDATIONS FOR INCORPORATING WATER SOURCE AND DESTINATION INFORMATION

An IPP’s water source(s) (river name, groundwater basin name, etc.) provides spatial context and a connection to water planning and administration. It is recommended to use the GNIS (Geographic Names Information System) name and identification number where possible for surface water-based IPPs. The GNIS ID was developed by the USGS and is the federal government’s official repository of domestic geographic feature names. The State of Colorado uses the GNIS ID in its Source Water Route Framework (SWRF) spatial data layer, so the addition of these data fields will allow for linking to other state datasets. An alternate location ID for groundwater-based IPPs will need to be developed.

Connected to an IPP’s water source is the destination of the water. Does the project deliver water to a municipality, does it divert water to a system of ditches, or does the water stay in the stream? Unlike water source, the destination can be more descriptive in nature. For example, the destination may be “City of Denver” or “Eagle River”. If the destination is a stream, then the official GNIS name can be used.

It should be noted that not all water bodies are in the SWRF. Potential options are to create a new ID or to use the nearest water source that does have a GNIS ID. OWF is currently not making any recommendations regarding this issue.

Table D1 shows the level of water source information provided in each basin IPP dataset. None of the basins have information about water destination at this time.

Table D1. Water source information provided in basin IPP datasets.

Basin	Example Naming Convention for Water Source	Comment
Arkansas	Cucharas River	“Associated Waterbody” field can serve as GNIS Name
Colorado	None	
Gunnison	None	
North Platte	Illinois River	A “Water Source” field exists for some IPPs within shapefiles but is not contained in the Excel datasheet
Rio Grande	None	
South Platte / Metro	None	
Southwest	00902295; Mancos River	“GNIS_ID” and “GNIS_NAME” fields exists for some IPPs within shapefiles but are not contained in the Excel datasheet
Yampa / White	00169868; North Fork Elkhead Creek	“GNIS_ID” and “GNIS_Name” fields exists for some IPPs within shapefiles but are not contained in the Excel datasheet

Recommendations:

1. **“WaterSource_GNIS_Name”** should be a required field:
 - a. GNIS Name can be found using Division of Water Resources’ Map Viewer.
 - b. The primary water source should be included. If the project has multiple water sources, a second worksheet can be populated that shows the additional sources.
2. **“WaterSource_GNIS_ID”** should be a required field:
 - a. GNIS ID can be found using Map Viewer and Source Water Route Framework layer.
 - b. The primary water source should be included. If the project has multiple water sources, a second worksheet can be populated that shows the additional sources.
3. **“WaterSource_Aquifer_ID”** and **“WaterSource_Aquifer_Name”** should be a required field for groundwater IPPs but requires additional evaluation. GNIS ID is not available for aquifers. An alternative identifier could be determined from HydroBase well permit or other data, in which case the field name should reflect the identifier type. The list of groundwater sources that are used need to be available in a published form to facilitate use. Additional evaluation is required.
4. **“WaterDestination”** should be a required field:
 - a. Values can be descriptive in nature (e.g., “City of X” or “X River”) to provide minimal context; no standard conventions are currently recommended but could be adopted based on more detailed review of IPP data.
 - b. GNIS identifiers and names could be used for water features. However, the destination may be complex to describe, with multiple infrastructure and natural feature components. The destination value may often be assumed to be the same as the “WaterSource_GNIS_Name” field, particularly for E&R projects.

D.3 RECOMMENDATIONS FOR ESTABLISHING AN IMPROVED IPP DATASET MAINTAINENCE WORKFLOW

It is important to establish an improved workflow to facilitate maintenance and access to IPP datasets, which includes identifying how to publish IPP datasets on the web to facilitate coordination and Technical Update publication. It is understood that a considerable amount of time, effort and resources have already been put toward the development of IPP lists. Rather than suggesting that each basin revamp its dataset, it is recommended that each basin add in the missing data fields but keep existing data field names as-is if that is the recommendation of the Basin Roundtable. The Notes tab can then be used to define how data fields correspond to the standardized IPP data fields. For example, the Colorado Basin may choose to continue using the data field name “Progress” to indicate the phase of an IPP. The Notes tab could then explain that these fields are interchangeable and could be indicated with a description, such as, “Progress = Status”. If the recommendations for IPP datasets are acceptable to Roundtables and the CWCB, then more substantial changes can occur to align all of the Roundtable datasets.

It will be necessary to do some additional processing of the datasets so they are in a standard (normalized) format that can be used to create statewide data products and visualizations. One option is to use TSTool software, which is able to read and write Excel files, and represents processing steps in text “command files”. Other tools could also be used and it is recommended that the workflow should consist of transparent text instructions. This will allow for data processing to be done in a series of steps that are transparent and repeatable. Data manipulation tools may need to be implemented or enhanced to perform transformations, for example to rename fields, populate fields based on keywords, remove formatting such as dollar signs, and other manipulations.

A comprehensive, standardized, statewide IPP dataset containing consistent data fields should then be published on the web using Map Viewer, CIM, static websites (see an example at: <http://data.openwaterfoundation.org/cdss-data-spatial-bybasin/index.html>) or other options. Another option that OWF has direct experience with is GitHub, which is a version control system that provides a data management system for files. In GitHub, data are stored in repositories that are cloud-hosted. GitHub is somewhat similar to Google Drive and Dropbox. Repository hosting is free for public repositories but private repositories require payment. Regardless of the approach taken, it should be consistent with the technical capabilities of each Roundtable such as considering whether a Roundtable has its own website. Greater CWCB support of Roundtables may be appropriate, such as utilizing the State’s Google Cloud Platform (GCP) to provide data-hosting website for each basin. OWF has been working with the State to utilize the GCP for a project and it would be possible, for example, to use GCP to provide data and web hosting for each Roundtable.

The workflow for IPP dataset processing might be similar to the following (Figure D3 and discussion below):

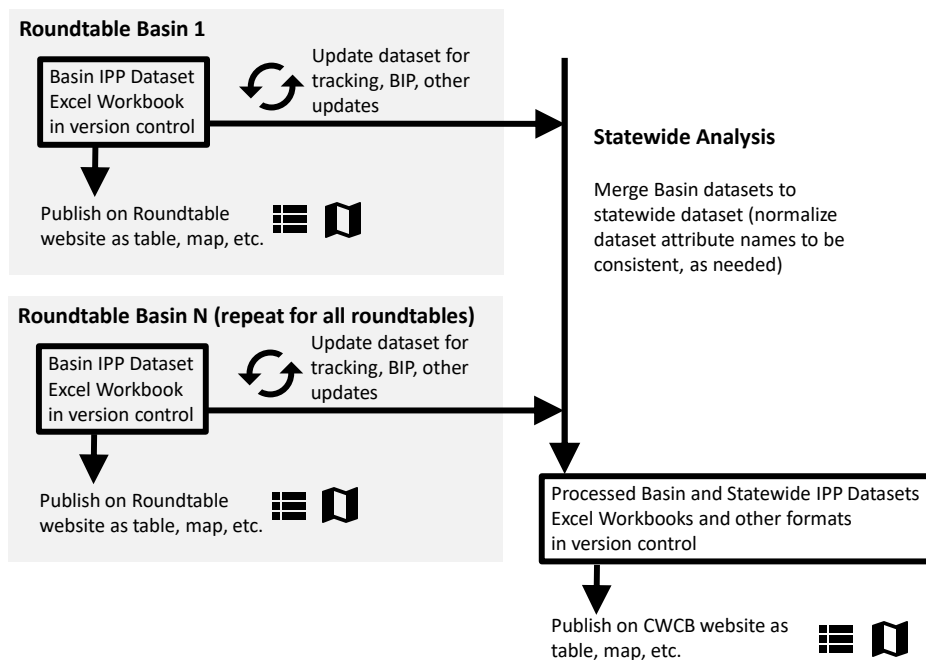


Figure D3. IPP Dataset Handling Workflow.

1. Original basin IPP datasets are published on each Basin Roundtable’s website (or the CWCB’s website or the Colorado Water Plan website) in a machine-readable format such as an Excel workbook.
2. Edits to the dataset are made and noted in the “ChangeLog” tab of the workbook. The edited dataset is then republished to the website, either replacing the original dataset or added as new file (perhaps with a timestamp) to indicate an updated version of the dataset. Keeping an archive of old versions is helpful given that such versions are referenced in specific versions of studies and analyses. OWF has been evaluating using platforms such as GitHub that track changes to electronic files and such a system could be used to track versions of the IPP dataset. Ideally, the chosen platform allows collaboration with a “gatekeeper” on edits and tracks changes and versions.
3. The dataset is processed with TSTool (or other software) to create a standardized dataset that is compatible with other basin IPP datasets. It would be possible to have a link to the TSTool command file that details how the data are processed so that the processing is transparent. The software that is used must support reading datasets from Excel worksheets, performing data manipulation such as filtering and cleaning data and outputting formats such as merged datasets and formats suitable for creating maps and tables for web publishing.
4. The standardized dataset (containing IPPs for all 9 basins) is then published to each Basin Roundtable’s website, CWCB website, Colorado Water Plan website, GitHub repository and/or the Colorado Information Marketplace website in a machine-readable format to allow for statewide analysis and visualization.
5. Visualizations such as maps that use dataset attributes can be created using the statewide dataset. Links to example visualizations that utilize the IPP dataset will be provided via one of the above-mentioned websites.

6. The above input datasets and processed products can be used by Roundtables, consultants, CWCB staff, CWCB Board and IBCC members as appropriate.

D.4 RECOMMENDATIONS TO LINK IPP DATASET TO OTHER DATASETS

The IPP dataset has the potential to be linked to other datasets, for example:

- StateMod – the Project ID can be used as the node identifier in StateMod modeling (12-character limit).
- Source Water Route Framework (SWRF) – the SWRF contains a shapefile of points representing confluences of tributaries to streams with an attribute table that provides the GNIS ID and name of the tributary and also the GNIS ID and name of the stream to which the tributary joins. Using this information, it would be possible to determine all of the IPPs associated with an entire watershed, not just a single river. This information could assist with stream management planning.
- CWCB Grant programs - WSRF and Water Plan Grant applications could be updated to contain a question that asks if there is a Project ID for the project.

Appendix E: Dataset Electronic Files

The Open Water Foundation has created a private GitHub repository for electronic files related to this memorandum. Note that a GitHub log-in is required to access the information; contact Open Water Foundation to obtain a log-in or to request the information outside of the GitHub platform.

<https://github.com/OpenWaterFoundation/swsi-data-ipp>

The README file for the repository explains files that are included in repository including original data files, TSTool command files, processed output, and documents.