



# Water-Related Land Use Inventories

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UTAH

## Jordan River Basin 2014 Inventory



**A WATER-RELATED LAND USE INVENTORY REPORT OF THE JORDAN RIVER BASIN**

**PREPARED BY**

**UTAH DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATER RESOURCES**

**COMPILED MARCH 2015**

**ACKNOWLEDGMENTS**

This report was prepared by Aaron Austin, GIS Analyst. The land use data summarized in this report were gathered under the direction of Todd Adams, Deputy Director, and supervised by John Holman, Section Chief, Technical Services, Utah Division of Water Resources.

The Technical Services Staff was chiefly responsible for the collection, preparation and analyses of the data. The data were summarized by Adam Clark, GIS Analyst. Additionally, select members of the Planning and Development Staffs assisted with the collection of the data.

This report was reviewed by

Todd Adams, Deputy Director

Eric Klotz, Section Chief, Water Conservation and Education

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## **Authority**

In the 1963 general session, the Utah State Legislature charged the Division of Water Resources with the responsibility of developing a State Water Plan. This plan is to coordinate and direct the activities of state and federal agencies concerned with Utah's water resources. As a part of this objective, the Division of Water Resources collects water-related land use data for the entire state. This data includes the types and extent of irrigated crops as well as information concerning phreatophytes, wet/open water areas, dry land agriculture and urban areas.

The data produced by the water-related land use program are used for various planning purposes. Some of these include: determining cropland water use, evaluating irrigated land losses and conversion to urban uses, planning for new water development, estimating irrigated acreages for any area, and developing water budgets. Additionally, the data are used by many other state and federal agencies.

## **Previous Methods**

The land use inventory methods used by the division in conducting water-related land use studies have varied with regard to the procedures used and the precision obtained. During the 1960s and 70s, inventories were prepared using large format vertical-aerial photographs supplemented with field surveys to label boundaries, vegetation types, and other water use information.

After identifying crops and labeling photographs, the information was transferred onto a base map and then planimetered or "dot-counted" to determine the acreage. Tables for individual townships and ranges were prepared showing the amount of land in each land use category within each section. Data were then available for use in preparing water budgets.

In the early 1980s, the division began updating its methodology for collecting water-related land use data to take advantage of the rapidly growing fields of Remote Sensing and computerized Geographic Information Systems (GIS).

For several years during the early 1980's, the division contracted with the University of Utah Research Institute, Center for Remote Sensing and Cartography (CRSC), to prepare water-related land use inventories. During this period, water-related land use data was obtained by using high altitude color infrared photography and laboratory interpretation, with field checking.

In March 1984, several division staff members visited the California Department of Water Resources to observe its methodology for collecting water-related land use data for state water planning purposes.

Based on its review of the California methodology and its own experience, the division developed a water-related land use inventory program. This program included the use of 35mm slides, United States Geological Survey (USGS) 7-1/2 minute quadrangle maps, field-mapping using base maps produced from the 35mm photography and a computerized GIS to process, store and retrieve land use data.

Areas for survey were first identified from previous land use studies and any other available information. The identified areas were then photographed using an aircraft carrying a high quality 35mm single lens reflex camera mounted to focus along a vertical axis to the earth. Photos were taken between 6,000 and 6,500 feet above the ground using a 24mm lens. This procedure allowed each slide to cover a little more than one square mile with approximately 30 percent overlap on the wide side of the slide and 5 percent on the slide's narrow side.

The slides were then indexed according to a flight-line number, slide number, latitude and longitude. All 35mm slides were stored in files at the division offices and cataloged according to township, range and section, and quadrangle map location.

Water-related land use areas were then transferred from the slide to USGS 7-1/2 minute quadrangle maps using a standard slide projector with a 100-200mm zoom lens. This step allowed the technician to project the slide onto the back of a quadrangle map. The image showing through the map was adjusted to the map scale with the zoom lens. Field boundaries and other water-use boundaries were then traced on the 7-1/2 minute quadrangle map.

Next, a team was sent to use the map in the field to check the boundaries and current year land use field data on the 7-1/2 minute quadrangles.

The final step was to digitize and process the field data using ARC/INFO software developed by Environmental Systems Research Institute (ESRI).

Starting in 2000 with the land use survey of the Uintah Basin, the division further improved its land use program by using digital data for the purposes of outlining agricultural and other land cover boundaries. The division used satellite data, USGS Digital Orthophoto Quadrangles (DOQs), National Agricultural Imagery Program (NAIP), and other digital images in a heads-up digitizing mode for this process. This allowed the division to use multiple technicians for the digitizing process.

Digitizing was done as line and polygon files using ArcView 3.2 with a satellite image, DOQ or NAIP image as a background with other layers added for reference. Boundary files were created in logical groups so that the process of edge-matching along quad lines was eliminated and precision increased. Subsequent inventories were digitized in the ArcMap 9.x software versions.

### **Present Methodology**

Using the latest statewide NAIP Imagery and ArcGIS 10, all boundaries of individual agricultural fields, urban areas, and significant riparian areas are precisely digitized.

Once the process of boundary digitizing is done, the polygons are loaded onto tablet PCs. Field crews are then sent to field check the crop and irrigation type for each agricultural polygon and label the shapefiles accordingly. Each tablet PC is attached to a GPS unit for real-time tracking to continuously update the field crew's location during the field labeling process. This improved process has saved the division much time and money and even greater savings will be realized as the new statewide field boundaries are completed.

Once processed and quality checked, the data is filed in the State Geographic Information Database (SGID) maintained by the State Automated Geographic Reference Center (AGRC). When in the SGID, the data becomes available to the public. At this point, the data is also ready for use in preparing various planning studies.

In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Areas not inventoried are mainly desert, rangeland and forested areas.

Wet/open water areas and dry land agriculture areas are mapped if they are within or border irrigated lands. As a result, the numbers of acres of wet/open water areas and dry land agriculture reported by the division may not represent all such areas in a basin or county.

The division uses 11 hydrologic basins as the basic collection units for the land use inventories. County data is obtained from the basin data. The water-related land use data collected statewide covers more than 4.3 million acres of dry and irrigated agricultural land. This represents about 8 percent of the total land area in the state.

**Due to changes in methodology, improvements in imagery, and upgrades in software and hardware, increasingly more refined inventories have been made in each succeeding year of the Water-Related Land Use Inventory. While this improves the data we report, it also makes comparisons to past years difficult. Making comparisons between datasets is still useful; however, increases or decreases in acres reported should not be construed to represent definite trends or total amounts of change up or down. To estimate such trends or change, more analysis is required.**

### **Data Collection**

The Division inventoried water-related land use in the Jordan River Basin during the summer of 2014. Previous inventories were done in 1988, 1994, 2002 and 2008.

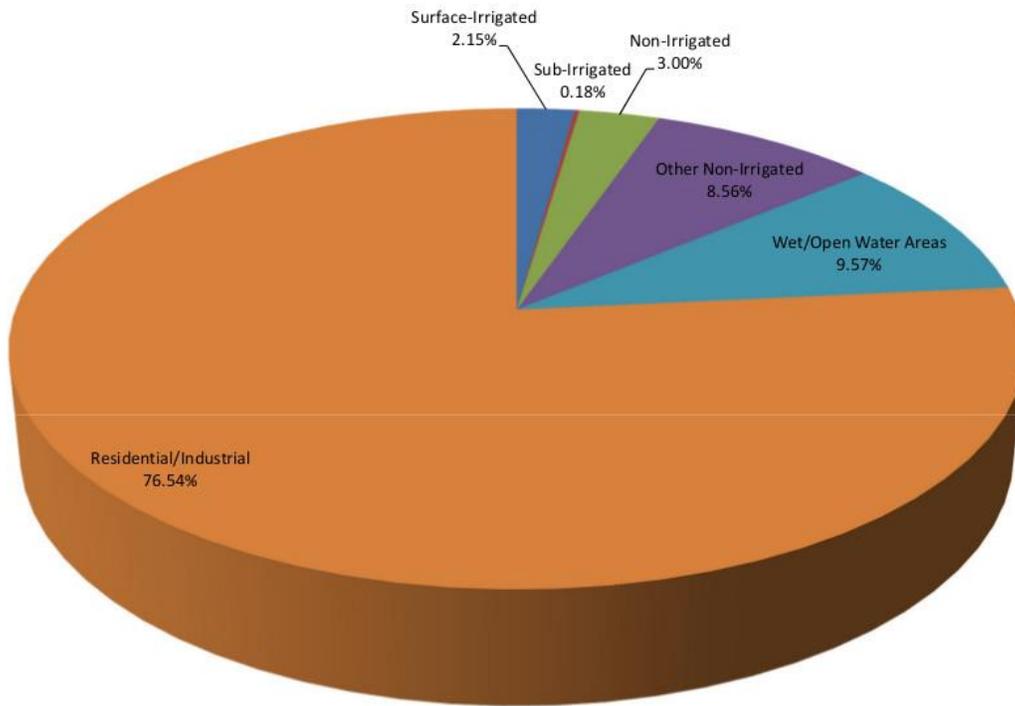
## Data Summary

**Summary Table** -Total basin acreage for irrigated lands, non-irrigated lands, wet/open water areas, and residential/industrial are presented by county. **Note: County numbers are only the basin portion of the county.**

JORDAN RIVER BASIN LAND USE 2014 (Acres)							
Category	Cover	DAVIS	MORGAN	SALT LAKE	TOOELE	UTAH	Total
<b>Surface-Irrigated</b>							
	Alfalfa	0.00	0.00	1,873.74	0.00	0.00	1,874
	Beans	0.00	0.00	8.92	0.00	0.00	9
	Corn	0.00	0.00	229.97	0.00	0.00	230
	Grain	0.00	0.00	511.10	0.00	0.00	511
	Grass Hay	0.00	0.00	259.31	0.00	0.00	259
	Melon/Pumpkin/Squash	0.00	0.00	91.08	0.00	0.00	91
	Oats	0.00	0.00	20.03	0.00	0.00	20
	Orchard	0.00	0.00	32.52	0.00	0.00	33
	Other Horticulture	0.00	0.00	11.27	0.00	0.00	11
	Other Vegetables	0.00	0.00	100.53	0.00	0.00	101
	Pasture	0.00	0.00	2,465.26	0.00	0.00	2,465
	Potatoes	0.00	0.00	11.27	0.00	0.00	11
	Tomatoes	0.00	0.00	9.23	0.00	0.00	9
	Turf Farms	0.00	0.00	30.26	0.00	0.00	30
	Vineyard	0.00	0.00	3.79	0.00	0.00	4
	<b>Irrigation Method</b>						
	<i>Drip</i>	0.00	0.00	6.79	0.00	0.00	7
	<i>Flood</i>	0.00	0.00	3,793.97	0.00	0.00	3,794
	<i>Sprinkle</i>	0.00	0.00	1,857.49	0.00	0.00	1,857
	<b>Subtotal</b>	0.00	0.00	5,658.25	0.00	0.00	5,658
<b>Sub-Irrigated</b>							
	GrassHay-subirrigated	0.00	0.00	3.29	0.00	0.00	3
	Pasture-subirrigated	0.00	0.00	462.48	0.00	0.00	462
	<b>Subtotal</b>	0.00	0.00	465.77	0.00	0.00	466
<b>Non-Irrigated</b>							
	Dry Alfalfa	0.00	0.00	607.17	0.00	0.00	607
	Dry Grain/Seeds	0.00	0.00	4,626.88	0.00	0.00	4,627
	Dry Oats	0.00	0.00	4.27	0.00	0.00	4
	Fallow-Irrigated Land	0.00	0.00	144.10	0.00	0.00	144
	Idle-Irrigated Land	0.00	0.00	1,371.17	0.00	0.00	1,371
	IdleIrrigatedPasture	0.00	0.00	1,129.91	0.00	0.00	1,130
	<b>Subtotal</b>	0.00	0.00	7,883.49	0.00	0.00	7,883
<b>Other Non-Irrigated</b>							
	Dry Land	5.76	0.00	22,442.90	0.71	65.97	22,515
<b>Wet/Open Water Areas</b>							
	Riparian	64.27	0.00	9,097.45	1.30	0.00	9,163
	Sewage Lagoon	0.00	0.00	102.09	0.00	0.00	102
	Water	116.29	0.00	11,820.59	0.61	0.24	11,938
	Wet Flats	470.14	0.00	3,505.27	0.00	0.00	3,975
	<b>Subtotal</b>	650.70	0.00	24,525.39	1.91	0.24	25,178
<b>Residential/Industrial</b>							
	Urban	12.65	0.20	192,967.88	7.93	84.40	193,073
	Urban Grass/Parks	1.15	0.00	8,226.05	0.00	1.13	8,228
	<b>Subtotal</b>	13.80	0.20	201,193.93	7.93	85.54	201,301
<b>Total Land Use/Land Cover</b>		<b>670</b>	<b>0.2</b>	<b>262,170</b>	<b>11</b>	<b>152</b>	<b>263,002</b>

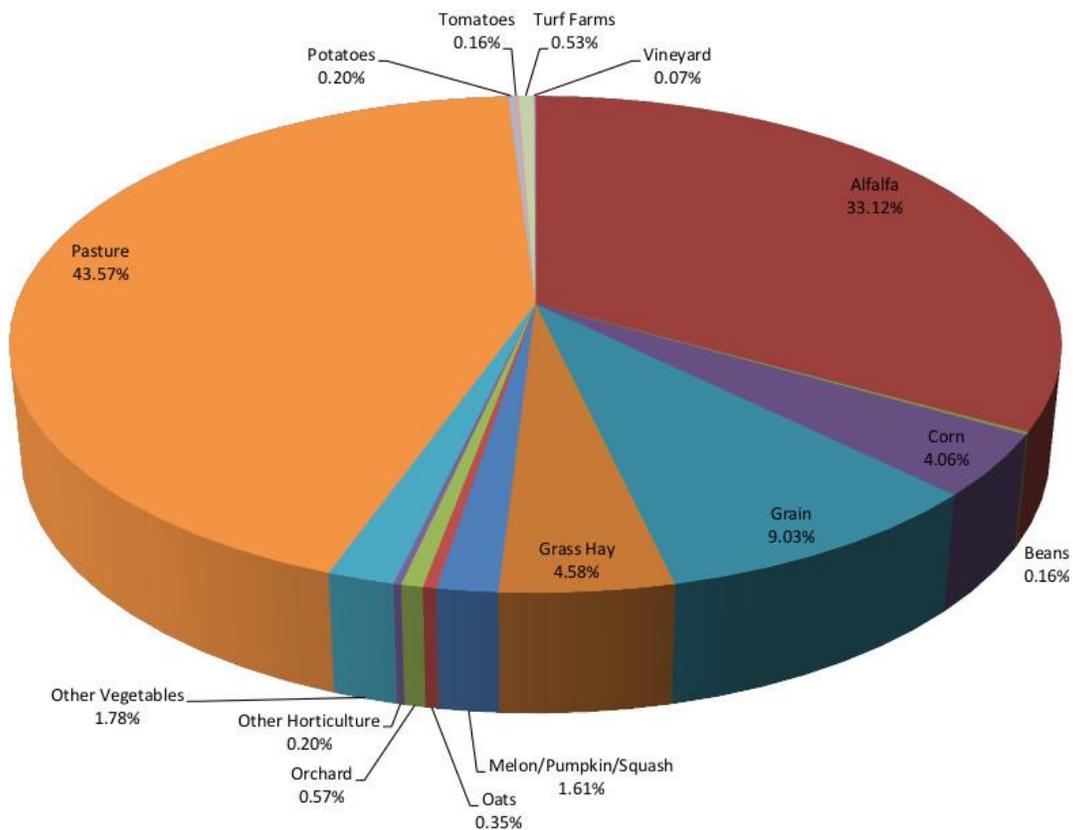
**Land Use Category Pie Chart** - Delineates six categories of water-related land use by percentage and acreage.

### Water-Related Land Use Categories



**Irrigated Cropland Pie Chart** - Represents data from the surface irrigated and sub-irrigated cropland categories. The data are broken down into different subcategories.

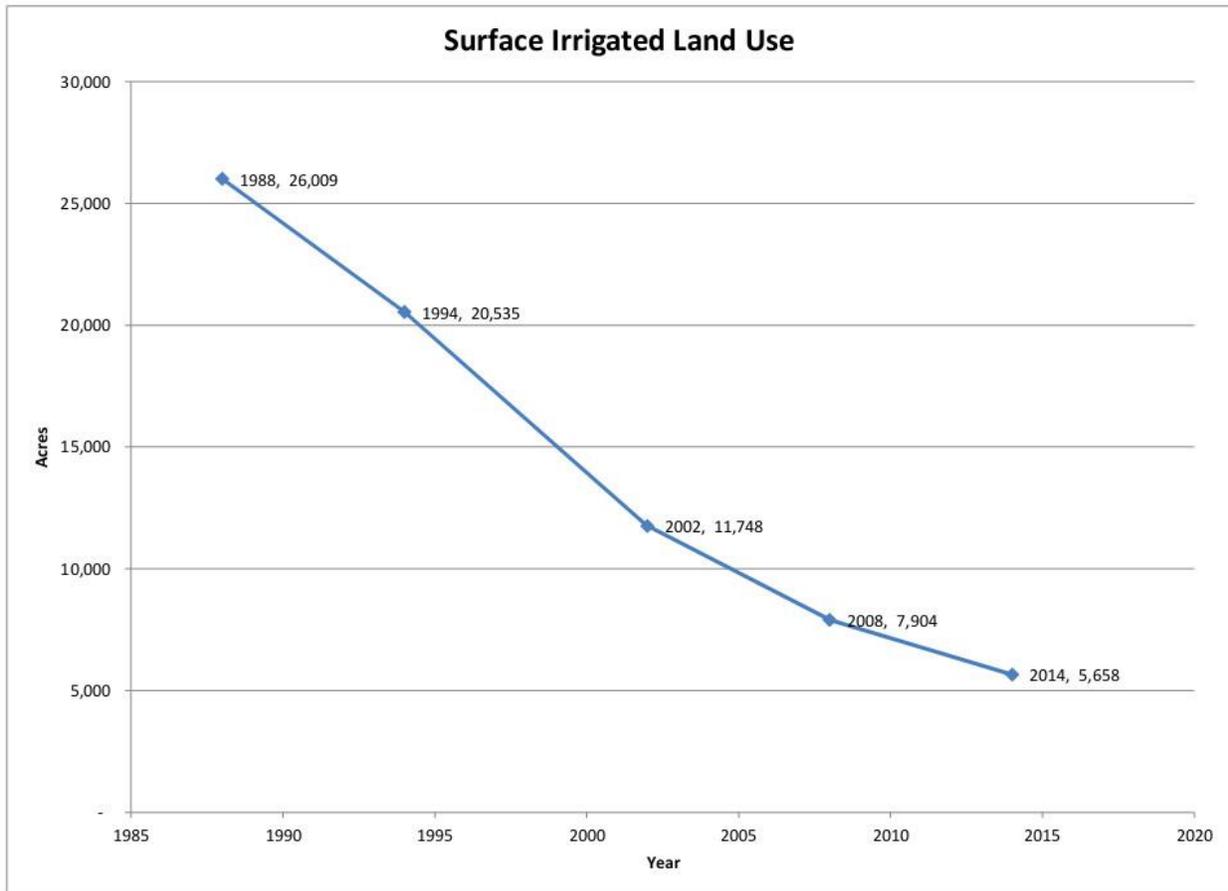
### Breakdown of Irrigated Cropland



**Inventory Comparison Table** - compares land use category acreage totals from all inventories.

<b>JORDAN RIVER BASIN LAND USE (Acres)</b>						
	<b>DAVIS</b>	<b>MORGAN</b>	<b>SALT LAKE</b>	<b>TOOELE</b>	<b>UTAH</b>	<b>Total</b>
<b>1988 Land Use Summary</b>						
Surface-Irrigated	0	0	26,009	0	0	26,009
Sub-Irrigated	0	0	950	0	0	950
Non-Irrigated	0	0	25,958	0	0	25,958
Other Non-Irrigated	0	0	0	0	0	0
Wet/Open Water Areas	0	0	43,976	0	0	43,976
Residential/Industrial	0	0	125,253	0	0	125,253
<b>Total Land Use</b>	<b>0</b>	<b>0</b>	<b>222,146</b>	<b>0</b>	<b>0</b>	<b>222,146</b>
<b>1994 Land Use Summary</b>						
Surface-Irrigated	0	0	20,535	0	0	20,535
Sub-Irrigated	0	0	77	0	0	77
Non-Irrigated	0	0	27,982	0	0	27,982
Other Non-Irrigated	0	0	0	0	0	0
Wet/Open Water Areas	0	0	43,094	0	0	43,094
Residential/Industrial	0	0	131,589	0	0	131,589
<b>Total Land Use</b>	<b>0</b>	<b>0</b>	<b>223,277</b>	<b>0</b>	<b>0</b>	<b>223,277</b>
<b>2002 Land Use Summary</b>						
Surface-Irrigated	0	0	11,748	0	0	11,748
Sub-Irrigated	0	0	611	0	0	611
Non-Irrigated	0	0	28,635	0	0	28,635
Other Non-Irrigated	0	0	0	0	0	0
Wet/Open Water Areas	0	0	36,900	0	0	36,900
Residential/Industrial	0	0	171,866	0	0	171,866
<b>Total Land Use</b>	<b>0</b>	<b>0</b>	<b>249,761</b>	<b>0</b>	<b>0</b>	<b>249,761</b>
<b>2008 Land Use Summary</b>						
Surface-Irrigated	0	0	7,904	0	0	7,904
Sub-Irrigated	0	0	557	0	0	557
Non-Irrigated	0	0	30,005	0	0	30,005
Other Non-Irrigated	0	0	3	0	0	3
Wet/Open Water Areas	0	0	20,978	0	0	20,978
Residential/Industrial	0	0	182,097	0	0	182,097
<b>Total Land Use</b>	<b>0</b>	<b>0</b>	<b>241,544</b>	<b>0</b>	<b>0</b>	<b>241,544</b>
<b>2014 Land Use Summary</b>						
Surface-Irrigated	0	0	5,658	0	0	5,658
Sub-Irrigated	0	0	466	0	0	466
Non-Irrigated	0	0	7,883	0	0	7,883
Other Non-Irrigated	6	0	22,443	1	66	22,515
Wet/Open Water Areas	651	0	24,525	2	0	25,178
Residential/Industrial	14	0.2	201,194	8	86	201,301
<b>Total Land Use</b>	<b>670</b>	<b>0.2</b>	<b>262,170</b>	<b>11</b>	<b>152</b>	<b>263,002</b>

**Surface Irrigated Comparison Chart** - provides a comparison of surface irrigated acreage totals by survey year.



**Data Access**

AGRC – current data

<http://gis.utah.gov/data/planning/water-related-land/>

Google Drive – Historical and Current Zipped Shapefiles by Basin

<https://drive.google.com/folderview?id=0B8agagPrSa5xQmJxMjJHNm9vekU&usp=sharing>

**Data Contact**

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