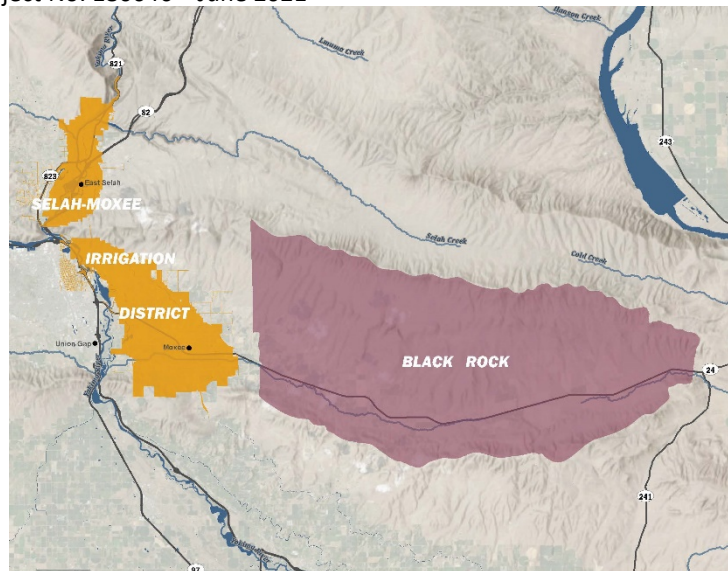


WATER MARKETING STRATEGY GROUNDWATER STUDY East Moxee (Black Rock) Area

Prepared for: Selah Moxee Irrigation District

Project No. 180646 • June 2021





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Project No. 180646 • June 2021 DRAFT

Aspect Consulting, LLC with Jacobs Engineering Group, Inc.
and Geosyntec Consultants

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Contents

Executive Summary	ES-1
1 Project Description	1
2 Prior East Moxee Area Studies	3
2.1.1 Black Rock – Moxee Valley Groundwater Study (Ecology, 1993)	3
2.1.2 U.S. Bureau of Reclamation Black Rock Storage Report, 2004	3
2.1.3 Ecology Groundwater Quality Study, 2007	4
2.1.4 Hydrogeologic Framework of the Yakima River Basin Aquifer System (USGS, 2009).....	4
2.1.5 USGS Declining Groundwater Report, 2010	4
2.1.6 Yakima Basin Integrated Plan Programmatic Environmental Impact Statement, 2012	5
2.1.7 SMID Feasibility Investigation Report, 2015.....	5
3 Project Area Summary	6
3.1 Geography	6
3.2 Geology	7
3.2.1 Geologic Setting	7
3.2.2 Hydrogeologic Units.....	8
3.2.3 Groundwater Flow	9
3.2.4 Groundwater Declines	11
3.3 Water Use Demographics and Demand	13
3.4 Water Rights.....	14
3.4.1 Black Rock Water Rights	14
3.4.2 SMID Water Rights	15
4 Physical Supply Options	17
4.1 Conservation	17
4.2 Large In-Basin Storage.....	19
4.3 Small In-Basin Storage.....	19
4.4 Underground Storage	19
4.5 Out-of-Basin Supplies.....	21
4.6 SMID Infrastructure supply options.....	22
4.6.1 Design Capacity	22
4.6.2 Demand Assumptions.....	22
4.6.3 Available vs. Required Water.....	23
4.6.4 Pump Station	23
4.6.5 Piping and Turnouts.....	24
4.6.6 Design Cost Estimate	24

5	Water Marketing	25
5.1	Water Bank Establishment	25
5.2	Comparing Water Banks	28
5.2.1	Water Bank Formation	28
5.2.2	Water Bank Structures	30
5.2.3	Public	30
5.2.4	Quasi-Government / Nongovernmental Organizations (NGO)	31
5.2.5	Private	31
5.3	Water Bank Pricing Summary	32
6	Communication Plan and Outreach Strategy	35
6.1	Outreach Plan	35
6.2	Water User Survey Description and Results	37
6.3	Willingness to Pay for New Water Source	38
7	Legal / Operational Challenges	39
8	Selection of a Preferred Alternative	42
9	Project Financing	43
9.1	2021-2023 Biennium Funding Strategy	43
9.2	Proposed 2021-2023 Schedule	44
9.3	2023-2031 Biennium Funding Strategy	46
10	References	47
11	Limitations	48

List of Tables

1	Project Area Summary of Average Rate and Total Rate of Groundwater Decline	13
2	SMID Water Right Authorizations	16
3	Outreach Plan	36
4	East Moxee Area Water Users Survey Response Summary (16 Respondents)	37
5	Willing to Pay for New Water Source: Surface Water and Domestic.	38
6	Proposed Schedule for Water Marketing Tasks, 2021-2023.....	45

List of Figures

1	Site Location (<i>attached</i>)	
2	Project Area Principal Aquifer Units (Stratigraphically; Source: Adapted from Kirk and Mackie, 1993)	8
3	Conceptual Cross-Section of Groundwater Divide in Project Area (Source: Kirk and Mackie, 1993)	10
4	Project Area Groundwater Recharge and Flow (Source: Kirk and Mackie, 1993)	11
5	1984 – 2009 Groundwater Decline in Wanapum and Grande Ronde Aquifers.....	12
6	East Moxee Water Right Types	15
7	East Moxee Irrigation Owners and SMID Service Extension (<i>attached</i>)	
8	East Moxee Demand and SMID Conveyance Capacity	23
9	Water Banking Activity.....	26
10	Washington State Water Banking Process	27
11	Water Banking Formation Process.....	29
12	Kittitas County Water Banks, Price & Volume Trends (2010 – 2018) ..	33

List of Appendices

- A July 2020 East Moxee Infrastructure Needs and Cost Evaluation, Jacobs Engineering
- B Communication Plan
- C Summary of 2019-2020 Public Outreach Documents

Acronyms

Aspect	Aspect Consulting, LLC
CWCP	Comprehensive Water Conservation Plan
Ecology	Washington State of Department of Ecology
Geosyntec Consultants	Geosyntec
Jacobs	Jacobs Engineering Group
gpm	gallons per minute
mg/L	milligrams per liter
OCR	Office of Columbia River
RCW	Revised Code of Washington
SMID	Selah Moxee Irrigation District
USBR	US Bureau of Reclamation
USGS	US Geological Survey
WDNR	Washington Department of Natural Resources
WRIA	Water Resource Inventory Area
YBIP	Yakima Basin Integrated Plan

Executive Summary

Groundwater in the East Moxee (also known as the Black Rock area) area east of Yakima has been declining by as much as 13 feet per year for the last several decades (see Figure ES-1). Home to over 7,400 acres of prime irrigated farmland, dairies, a federal research facility, commercial businesses, and hundreds of people, this water-supply challenge creates significant economic and public health risks.

Having already conserved water, implemented crop change, fallowed lands, and investigated large storage from the Columbia River, the East Moxee area's most likely remaining option is to import water from the nearby Yakima River basin and develop a water market to distribute that new supply. While feasible, this option is not without its challenges.

- The Yakima River basin is over-appropriated and future plans for surplus spring supply is being actively evaluated to meet the goals of the Yakima Basin Integrated Plan (YBIP).
- The effort requires a conveyance system to be extended, with Selah-Moxee Irrigation District (SMID) and Roza Irrigation District being the likely potential purveyors.
- The disparate interests in the East Moxee basin would need to band together and participate financially to help develop a solution that works for their needs.
- A champion is needed to steward the planning effort and project and run a water market.

SMID has emerged as a potential champion for this effort. SMID has a 7,740-acre service area immediately to the west of the East Moxee area. SMID has experienced urbanization and conservation over the last 20 years by its members, and recently created a 9,000-acre-foot water bank. With infrastructure and surplus water potentially available, SMID agreed to study solutions to this effort including whether a market for water exists.

Key findings of this study that shape the Preferred Alternative include:

1. Demand ranged from a low of 9,600 acre-feet to a high of 60,000 acre-feet for the East Moxee Area, when considering current irrigation, water right authority, crop changes, residential and commercial uses, and other factors. For the purposes of this report, we focused on 4,390 acres and a demand of 14,800 acre-feet, which is the subset of existing irrigators that expressed interest in a water supply solution, and using the highest water duty to provide a factor of safety in the event additional users are interested in the future.
2. Conservation within the East Moxee area can only have modest additional reductions in use, on the order of 1,500 acre-feet, or about 10 percent of planned demand.
3. Extending surface water infrastructure is an alternative to declining groundwater to supplement remaining demand currently met by groundwater.

4. Water supply capacity in the SMID system is only partially available during the irrigation season, with the majority available in the spring and fall.
 - a. Farmers could rely partly on existing wells and partly on new surface water when available; or
 - b. Farmers could construct on-farm storage or centralized medium-sized regional storage to retime water to the irrigation season.
5. The total capital cost of a project consisting of approximately 10 miles of pipeline, a single pump station, and a single 3,500-acre-feet reservoir was estimated at approximately \$84M in 2020 dollars.
6. Over half (4,390 acres) of the irrigated farmers expressed an interest in receiving and paying for water with assessments on the order of \$140 to \$280 . This could generate revenue on the order of \$9 million dollars over 20 years. If additional support matures over time from other irrigators that didn't respond to the survey (as of this report, those who didn't respond represent approximately 3,000 acres irrigated in 2020) or owners of land with potentially valid rights in the area (18,000 acres in Ecology files), this number could increase.
7. Five of the largest farmers have agreed to a cost-share commitment of \$5,000 to support further study if additional grant funding can be secured. SMID plans to coordinate with Ecology's Office of Columbia River, Reclamation WaterSmart (the funder of this study), YBIP, and local legislators to develop an integrated funding plan.
8. Under a Preferred Alternative, SMID remains interested in coordinating the delivery of water to the East Moxee Area. While SMID is about to launch an existing water bank, it recognizes that Yakima County and Ecology both have more water banking expertise and could potentially run an East Moxee Area water bank more efficiently. SMID remains open to the appropriate market champion through further study.

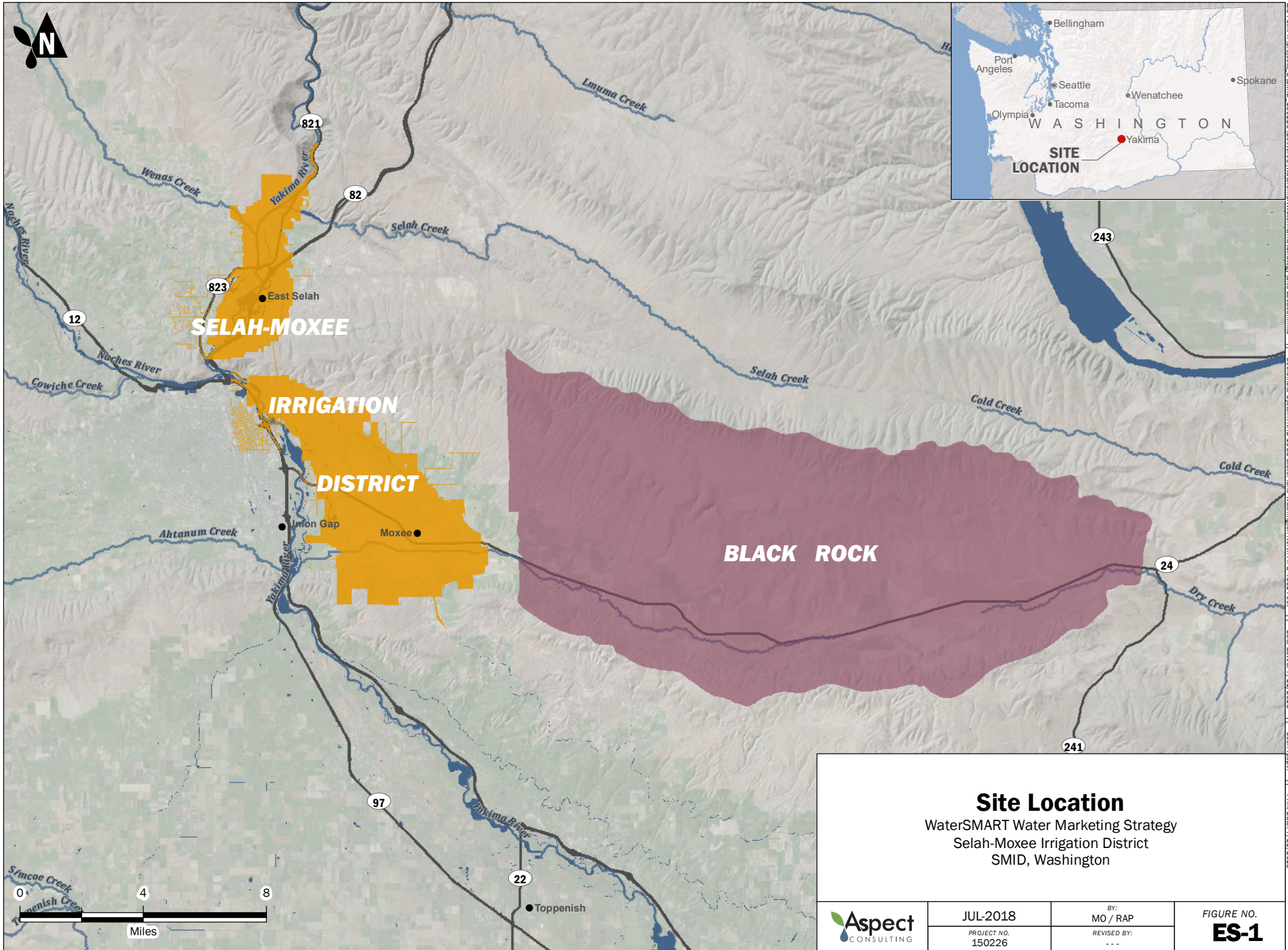
Implementation of a solution to declining groundwater in the East Moxee area will require funding for future studies, environmental review, capital projects, project operation and maintenance, and water bank implementation. The likely funding needs based on the eight critical path estimated as follows, inclusive of project and grant management needs and regulatory coordination:

- Landowner outreach (\$50,000)
- Groundwater Model and Safe Sustaining Yield Study (\$250,000)
- Out-of-Basin Supply Coordination (\$100,000)
- Project EIS (\$750,000)
- Economic Study (\$100,000)
- Easement / Access Study (\$50,000)
- Water Banking Interlocal Agreement (\$50,000)
- Design to 10% Level (\$400,000)
- **Total (\$1.75 million, 2020 Dollars)**

In spring/summer 2021, SMID applied to several funding opportunities to advance the next phase of the project including:

- USBR's WaterSmart Water Marketing grant funding program to continue its water market work (award notice pending in late summer 2021).
- Washington State legislative funding sponsored by the office of Senator Jim Honeyford (\$300,000, grant award notice received, funding available after July 2021).
- United States legislative funding sponsored by the offices of Senators Patty Murray and Maria Cantwell (application submitted).

At the end of the next phase of the project, a final project champion will be selected, environmental review conducted, 10% design completed, final landowner participation identified, and the implications that an alternative supply will have relative to the long-term capacity of the aquifer will be known.



Site Location

WatersSMART Water Marketing Strategy
Selah-Moxee Irrigation District
SMID, Washington

	JUL-2018	BY: MO / RAP	FIGURE NO. ES-1
	PROJECT NO. 150226	REVISED BY: ---	

1 Project Description

The Selah Moxee Irrigation District (SMID or District) is investigating water market options within and around its 7,740-acre service area. The U.S. Bureau of Reclamation (USBR) funded SMID's first grant effort to market a water bank concept to local water users in 2018-2020 that are experiencing significant groundwater declines.

SMID operates three canals to service its lands:

1. The Selah-Moxee Canal
2. The Moxee Canal
3. The Hubbard Canal

SMID has experienced urbanization and conservation over the last 20 years by its members and is exploring opportunities to serve new lands east of their current service area in the East Moxee (also known as Black Rock) area (hereafter referred to as the East Moxee area; see Figure 1).

The East Moxee area does not have perennial surface water. Water users in this area rely on groundwater, which comes at substantial pumping costs and is currently declining by as much as 13 feet per year for the last several decades (USGS, 2010). Within the East Moxee area, the primary water use is agricultural, with hops, orchards, vegetable crops, and dairy use within the area.

The District is investigating developing a water supply and market strategy, that could be supplied with SMID's Yakima River water rights or other acquired water rights to provide service to the East Moxee area. In collaboration with Aspect Consulting, LLC (Aspect), Jacobs Engineering Group (Jacobs), and Geosyntec Consultants (Geosyntec), SMID pursued this investigation to evaluate the following factors:

- Demand for surface water service in the East Moxee area
- Potential market barriers
- Willingness-to-pay and costs of implementing a water market program
- Regulatory framework for water markets in the region, including institutional requirements and potential water market strategies
- Water right permitting requirements and mechanisms
- Engineering requirements to leverage existing infrastructure to serve new areas currently irrigated with groundwater
- Surface and groundwater flow from potential new service area to Yakima River to ensure water budget neutrality

- Opportunities to coordinate this work with overall Yakima Basin Integrated Plan¹ water supply development goals

The goal is to select a Preferred Alternative that will allow a water bank to be created to provide reliable water service to the East Moxee area. This Water Marketing Strategy Groundwater Study Report (Report) summarizes SMID's work towards their goal to ensure reliable current and future water supply for current users and stakeholders.

Several foundational background studies and ongoing related work help inform this report. A summary of each of these key documents is provided in the following sections.

- Section 2 summarizes prior East Moxee area studies.
- Section 3 summarizes important crop, water use, geographic, and geologic information for the East Moxee area.
- Section 4 summarizes physical supply solutions.
- Section 5 summarizes market-based solutions to declining groundwater in the East Moxee area.
- Section 6 describes the communication and outreach strategy employed in this report.
- Section 7 summarizes legal or operational challenges moving forward.
- Section 8 proposes next steps for further study and options for financing.
- Section 9 contains a complete reference list.

¹ <https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-supply-projects-EW/Yakima-River-Basin-projects/Yakima-integrated-plan>

2 Prior East Moxee Area Studies

This section summarizes the key scientific studies evaluating the state of the geologic and hydrogeologic environment and infrastructure in the East Moxee area over the last several decades. In summary, groundwater declines in the East Moxee area are well-documented, long-standing, and will result in water shortages in the future. However, when that future shortage will occur is not certain.

2.1.1 Black Rock – Moxee Valley Groundwater Study (Ecology, 1993)

In 1993, Ecology’s Water Resource Department conducted a groundwater study in the East Moxee area (and eastern Moxee Valley) following recurring observations of groundwater declines in the area. The report described the hydrogeologic character of the area, noting four aquifers (all basalt formations) from shallow to deep:

- Upper and Lower Saddle Mountain (the two uppermost) aquifers
- Wanapum aquifer
- The Grand Ronde aquifer (the deepest of the four)

The rates of groundwater decline at the time of the report were highest in the area east of the Bird Canyon fault. The declines were observed in wells in the Grand Ronde aquifer (13 feet per year decline) and the Wanapum (12 feet per year decline) over a period of years. The Upper and Lower Saddle Mountain aquifers saw lesser declines, averaging 2.5 – 6 feet per year.

2.1.2 U.S. Bureau of Reclamation Black Rock Storage Report, 2004

In 2004, the USBR conducted an appraisal-level assessment of water supply storage in the East Moxee area, as part of a larger Yakima Basin Water Storage evaluation. (USBR, 2004).

The USBR evaluated an East Moxee area storage project that would pump water from the Columbia River, when water was available in excess of current instream flow targets. Stored water would be released to an outflow conveyance system running to the west to the lower Yakima Valley and provided to some lower Yakima Valley irrigation entities to receive exchange water into their existing, or modified, distribution systems.

The Yakima River water used by the potential participating exchange irrigation entities would not be diverted by those entities (and was referred to in this 2004 report as “freed-up Yakima River water”) and would instead be used to meet the larger Yakima Basin Storage Study goals. Other Yakima Valley irrigators with junior proratable water rights, but not physically located in the East Moxee area, would also potentially benefit in dry years by receiving a portion of the freed-up Yakima River water.

In summary, the USBR found that, though the project was conceptually feasible, there were sufficient concerns that it did not move forward as part of YBIP. These included lack of broad stakeholder support, project area seismology concerns, hydrologic challenges related to potential reservoir leakage, and overall costs estimated at \$2.5 to 2.7 billion (June 2004 price levels).

2.1.3 Ecology Groundwater Quality Study, 2007

In 2006, Ecology conducted a screening-level assessment of groundwater quality in the Moxee area, sampling 26 domestic wells for field parameters, common nutrients, bacteria, and selected metals (Ecology, 2007). In three wells, nitrate concentration were higher than the 10 milligram per liter (mg/L) federal drinking water standard. Five wells exceeded the primary drinking water standard for total coliform.

The highest nitrate concentrations (18.2 mg/L) occurred in the lower valley near Moxee on the eastern edge of the project area, where wells generally exhibited elevated concentrations of total persulfate nitrogen, total phosphorous, total dissolved solids, and conductivity. Wells in the upper valley contained elevated iron and manganese concentrations but little measurable nitrate or total persulfate nitrogen. Wells in the upper valley also exhibited generally lower total phosphorus, chloride, total dissolved solids, and conductivity values than wells in the lower valley.

2.1.4 Hydrogeologic Framework of the Yakima River Basin Aquifer System (USGS, 2009)

A 2009 USGS hydrogeologic study of the Yakima River Basin aquifer system (USGS, 2009) observed that groundwater occurred in hydrogeologic units primarily from rainfall, snowmelt, and irrigation recharge. Groundwater moves through the aquifers from the uplands (high land-surface altitude—topographic highs) to surface drainage features in the lowlands, principally to the Naches and Yakima Rivers and to the Columbia River in the eastern part of the extended study area.

About 312,000 acre-feet of groundwater was pumped in 2000 for multiple uses, about 60 percent of which was for irrigation. Authorized irrigated acreage from groundwater rights was estimated at 130,000 acres. Groundwater declines on the order of 21 to 300 feet have occurred in some areas in the basin, including the Project Area, due to pumpage. The largest declines have been in the basalt aquifers.

2.1.5 USGS Declining Groundwater Report, 2010

In spring 2009, groundwater elevations in three basalt units and one unconsolidated hydrogeologic unit in the Columbia Plateau Regional Aquifer System were measured and evaluated to provide a regional overview of groundwater conditions (USGS, 2010). Water levels for the Saddle Mountains unit, the Wanapum unit, the Grande Ronde unit, and for the overlying Overburden unit were measured in 1,752 wells during spring 2009 by the USGS and 10 other Federal, State, Tribal, and local agencies, including 66 wells located and measured by the USGS specifically for this study.

Water-level change maps were constructed for the three basalt hydrogeologic units and the Overburden (unconsolidated) unit. Groundwater levels measured in spring 1984 and 2009 in 470 wells were compared. Small to moderate groundwater-level declines were measured in most wells, although declines greater than 100 ft and as great as 300 ft were measured in many wells. Of the wells measured in 1984 and 2009, water levels declined in 83 percent of the wells, and declines greater than 25 feet were measured in 29 percent of all wells. The groundwater-level changes were greatest in the deeper hydrogeologic units. Mean groundwater-level changes ranged from a 7 feet decline for the Overburden unit to a 51 feet decline for the Grande Ronde unit. The average annual rates of groundwater-level

change for the 25-year period ranged from a 0.3 ft/yr decline for the Overburden unit to a 2.0 ft/yr decline for the Grande Ronde unit.

Groundwater level declines were identified throughout the Columbia Plateau, but areas with large and widespread declines were located in the central northern part of the study area, including the Yakima River basin in Washington. These declines are in areas known to rely heavily on groundwater for irrigation and other uses.

2.1.6 Yakima Basin Integrated Plan Programmatic Environmental Impact Statement, 2012

In 2012, the USBR and Ecology, with other stakeholders in the Yakima River Basin, evaluated a range of water supply and resource options to enhance aquatic resource demands for fish and wildlife habitat, dry-year irrigation demands, and municipal water supply (USBR and Ecology, 2012). One of the alternative concepts was an extensively modeled and analyzed East Moxee Area reservoir (aka “Black Rock”) and other potential storage facilities in the Yakima River basin.

Though the “Black Rock” reservoir was not implemented, the PEIS saw the need for an integrated list of projects that would have the following major benefits:

- Add storage capacity to the basin
- Supply proratable irrigation water supplies with a minimum of 70 percent in all years
- Meet municipal water supply needs
- Increase streamflows in the Yakima River in all seasons
- Improve fish passage

2.1.7 SMID Feasibility Investigation Report, 2015

In 1995, SMID evaluated its facilities and operations in a Comprehensive Water Conservation Plan (CWCP), which went through several updates (one in 2004 and then again in 2015). The USBR/Ecology/SMID-funded 2015 Update(CH2MHill, 2015; FS) to the CWCP, performed by CH2M (now Jacobs), updated water conservation data, re-evaluated the feasibility of constructing SMID’s proposed conservation measures, and provided a foundation for design of the proposed water conservation measures.

The 2015 FS evaluated a range of measures including a variety of piping and canal lining scenarios to develop a single river diversion for all three SMID canals, as well as a reregulation reservoir concept. The proposed system improvements were estimated to allow SMID to place into the trust program approximately 10,200 acre-feet in a full water supply year and at the same time improve water quantity and quality for the lower Yakima River. The estimated cost for the conservation measures were approximately \$73 Million.

3 Project Area Summary

This section summarizes the project area geography, hydrogeologic environment, and water use and water rights makeup of the District and its water users. In summary:

- The project area encompasses over 100 square miles and the predominant water uses are for irrigated agriculture.
- 7,400 irrigated acres and 280 people are served in the project area (Ecology, 2016).
- Existing domestic demand totals 125 acre-feet (based on 400 gallons per day [gpd]).
- Additional commercial, dairy, and a USDA Agricultural Research Center require several hundred acre-feet of additional demand.
- Existing irrigation demand estimates range from 16,000 to 25,000 acre-feet for 7,400 acres, depending on crop mix.
- Existing irrigation demand that responded favorably to the survey (see Section 6 for a summary on project communication plan and outreach survey results) to support an alternative supply to declining groundwater totaled approximately 9,600 to 14,800 acre-feet for 4,400 acres.
- Some demand may be characterized as “unmet” demand. This includes land that is fallowed at the time of the study, land enrolled in federal crop reserve programs, or land that is not irrigated now but for which the water right meets Washington relinquishment exceptions. Ecology estimated the total acres authorized by groundwater rights as 18,000 acres in the East Moxee area (Ecology, 2016). If valid, the upper bound of demand could be as high as 40,000 to 60,000 acre-feet.
- Area groundwater consists of three (out of four) aquifers (Saddle Mountain, Wanapum, and Grand Ronde) that have been declining at a rate of approximately 3 to 13 feet/year for the last 100 years. Generally, declines are worse moving deeper and from west to east.

3.1 Geography

The project area encompasses over 100 square miles within the Black Rock Valley. The western boundary of the project area is approximately 8 miles from the city of Yakima, while the eastern boundary is located just west of the junction of Washington State Route 24 with State Route 241. A vicinity map with key geographic features is shown on Figure 1, including SMID and Roza Irrigation District service areas.

SMID operates three canals near the East Moxee Area:

- Selah-Moxee
- Moxee
- Hubbard Canals

The Selah-Moxee Canal's diversion point is on the Yakima River at Pomona and has an approximate capacity of 100 cubic feet per second (cfs). Selah-Moxee Canal wraps its way east to East Selah, under Yakima Ridge via a tunnel, and through the Moxee Valley.

The Moxee and Hubbard Canals have historical diversion points on the Yakima River just south of Selah Gap (about 9 miles downstream of Pomona). However, in 2000, a flood destroyed the diversion, and Bonneville Power Administration (BPA)-funded withdrawal points in the Roza tailrace. Recent change applications to Ecology by SMID have added the Pomona diversion for its former Hubbard rights, as well as adding the Fowler Ditch diversion which is slightly downstream of the historic Hubbard diversion. The closest SMID canal service point to the project area is approximately 5 miles to the west.

SMID's conveyance facilities are in close proximity to the Roza Canal. The Roza service area partially overlaps the western portion of the Study area. Roza's diversion point is on the Yakima River at the Roza Dam, with an approximate capacity of 2,200 cfs.

3.2 Geology

A clear understanding of the project area geology is needed to help identify potential water supply solutions to the declining groundwater problem. Fortunately, this area has been heavily studied and is actively being monitored in some locations for further declines. The following sections summarize what is known about East Moxee area geology and aquifer conditions from previously authored reports (see Section 2). A complete set of references is provided at the end of this Study.

3.2.1 Geologic Setting

The Black Rock Valley is within the Yakima Fold Belt, a subdivision of the Columbia Plateau Province (Province). The Province encompasses an expansive area across portions of eastern Washington, northern Oregon, and western Idaho (Duncan, 2007). Resulting from tectonic compression of the earth's crust, the region is characterized by east-west trending folds, in which broad, rounded valleys (synclines²) alternate with steep, asymmetrical ridges (anticlines³). These folds are further deformed by northwest-southeast and northeast-southwest trending strike-slip faults (Kirk and Mackie, 1993). The project area is bounded by the Yakima Ridge to the north and the Rattlesnake Hills to the south.

Folding is understood to have stopped by the late Pliocene era, but the valley continued to evolve throughout the Pleistocene as it was repeatedly inundated by cataclysmic floods from the rapid draining of Glacial Lake Missoula (Sinclair and Roberts, 2007). As the floodwaters retreated south toward the Columbia River, sediments once suspended by the floods were deposited across the landscape. The sediments range in size and texture from sands and gravels (common to east-central Washington and Idaho) to fine-grained wind-deposited silt (loess) that blankets the slopes above the valley and the Palouse area of

²A term describing a geologic fold that is concave upward with the youngest strata occurring in the center of the fold axis (Press and Siever, 1978).

³A term describing a geologic fold that is concave downward with the oldest strata occurring the center of the fold axis (Press and Siever, 1978).

Washington. Streams and rivers in the valleys continue to reshape the landscape as underlying geologic material is eroded and redistributed across the valley floor.

3.2.2 Hydrogeologic Units

Complex stratigraphy and structural geology drive groundwater availability and flow in the project area. Significant resources have been devoted to understanding the hydrogeology of the Columbia Plateau aquifer system. Several studies have focused specifically on flow regimes in the eastern Moxee and Black Rock Valleys due to the unprecedented groundwater declines and water quality issues in this area (e.g. Tanaka, 1976; Kirk and Mackie, 1993; Sinclair and Roberts, 2007). Flood deposits, basalts and sedimentary interbeds have been grouped into four distinct hydrogeologic units based on geologic characteristics, water production potential (Jones et al., 2006), and rock chemical composition (Kirk and Mackie, 1993). The principal aquifer units are described below in order of increasing age and shown stratigraphically in Figure 2.

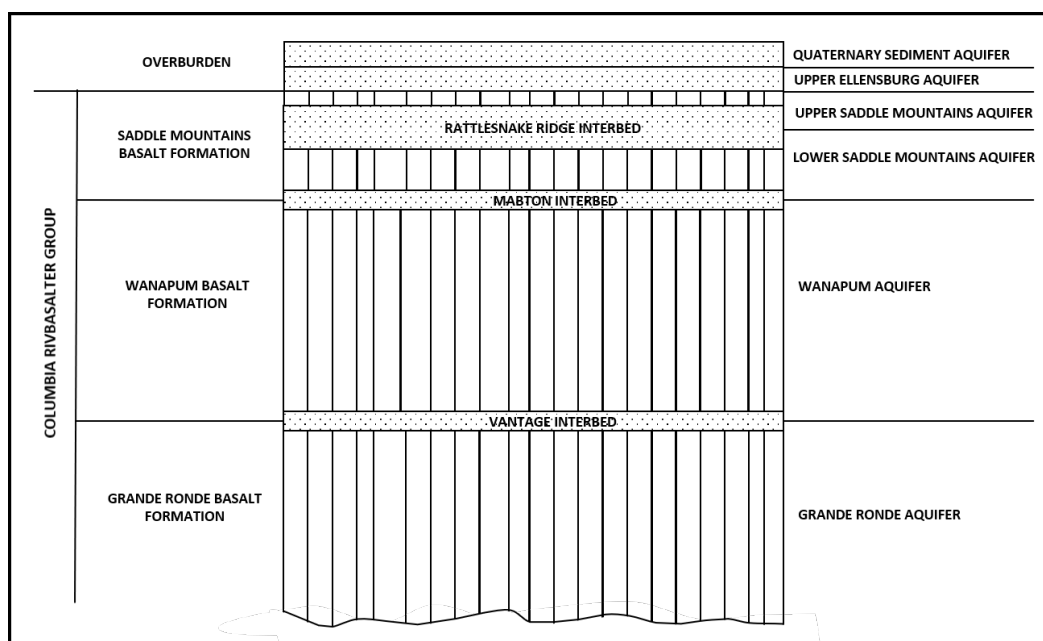


Figure 2. Project Area Principal Aquifer Units (Stratigraphically; Source: Adapted from Kirk and Mackie, 1993)

Overburden

Informally known as overburden (Drost et al., 1990), this material consists of Miocene to Holocene-aged basin-fill sediments that overlie the Columbia River Basalt units, reflecting an array of depositional processes (e.g., fluvial, glacial, eolian, lacustrine, volcanic).

Due to large variations in grain size and lithology, this unit reflects a vast range of potential to transmit water. Most wells in the project area completed in the overburden are shallow domestic wells. Groundwater recharge is driven by percolation of precipitation or irrigation return flows, leakage from unlined irrigation ditches, and upward flow from underlying basalt and sedimentary interbeds (Sinclair and Roberts, 2007).

Saddle Mountains Basalt

The youngest and least expansive of the Columbia River Basalt group, this unit ranges in thickness from 0 to 1,000 feet (USGS, 2010) and generally thins to the west and north. This unit is composed of 10 individual members but is generally divided into upper and lower aquifer units that are separated by the Rattlesnake Ridge Interbed. The interbed is composed of cemented sand and gravel or clay that functions as a hydraulic barrier to flow between the upper and lower aquifers. In each basalt unit, recharge is driven by deep percolation of precipitation and irrigation return flows.

Wanapum Basalt

The Wanapum unit directly underlies the Saddle Mountains Basalt. It is the second most voluminous of the basalt formations. Wanapum basalts were erupted between 13.5 and 14.5 million years ago (Kirk and Mackie, 1993). In the study area, this unit ranges from approximately 900 feet in the western half, to 1,100 feet in the eastern half. The unit is broken into three members, each composed of several individual basalt flows. From youngest to oldest, these members include the Priest Rapids Member, Roza Member, and Frenchman Springs Member.

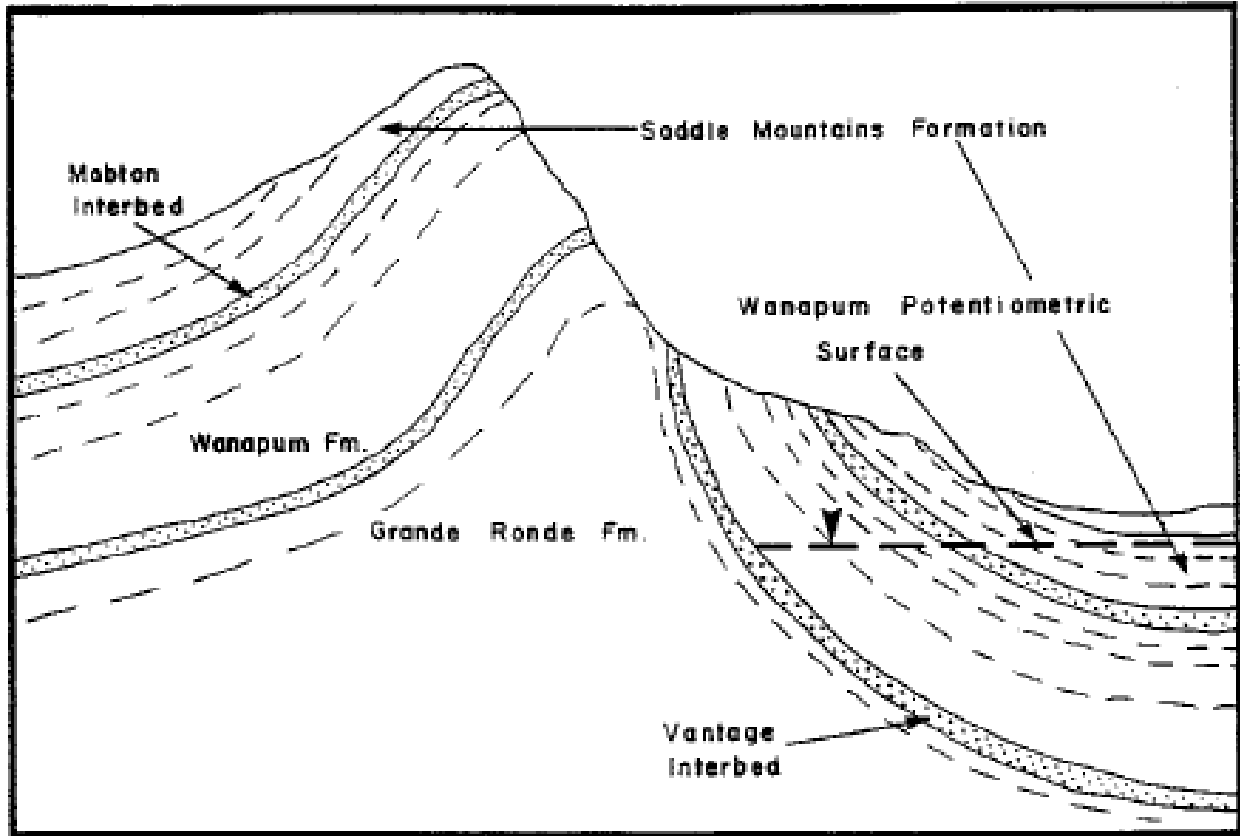
Grande Ronde Basalt

The Grande Ronde is the thickest and most expansive basalt unit within Columbia Plateau Province. The lava was extruded between 14 and 16.5 million years ago, marking the most vigorous eruptions of the greater depositional event. The thickness of this unit ranges from a few feet on the western edge of the Columbia Plateau to 3,300 feet or more in the Pasco Basin, east of the study area (Kirk and Mackie, 1993).

3.2.3 Groundwater Flow

The upper (“flow top”) portions of basalt flows act as the most direct pathway for groundwater movement in the basalt units. Previously exposed at the surface, flow tops were vulnerable to surficial weathering processes and further alteration from subsequent lava flows (USGS, 2009). Such processes enhanced porosity and permeability preservation, and most basalt wells consequently target these intervals for production (Kirk and Mackie, 1993). In contrast, groundwater flow within the basalt flow interior is complicated by variations in density, porosity, permeability, and bedding geometry.

Flow within the basalts can be further complicated by the presence of folds and faults, which can generate barriers to flow. Most notably, groundwater flow is impeded by the Bird Canyon fault, Fire Water Canyon fault, Hog Ranch-Nameum Anticline, Myers Anticline (Myers and Price, 1979), Yakima Ridge, Rattlesnake Hills, and several unnamed thrust faults that act to limit inter-basin flow and recharge (Figure 3).



**Figure 3. Conceptual Cross-Section of Groundwater Divide in Project Area
(Source: Kirk and Mackie, 1993)**

Figure 3 demonstrates the notion of structural controls on groundwater flow. In the cross-section, the anticline acts as a groundwater divide as the folding of the Vantage Interbed impedes flow between limbs of the fold. Figure 4 maps the most prominent structural features in the project area affecting groundwater recharge and flow.

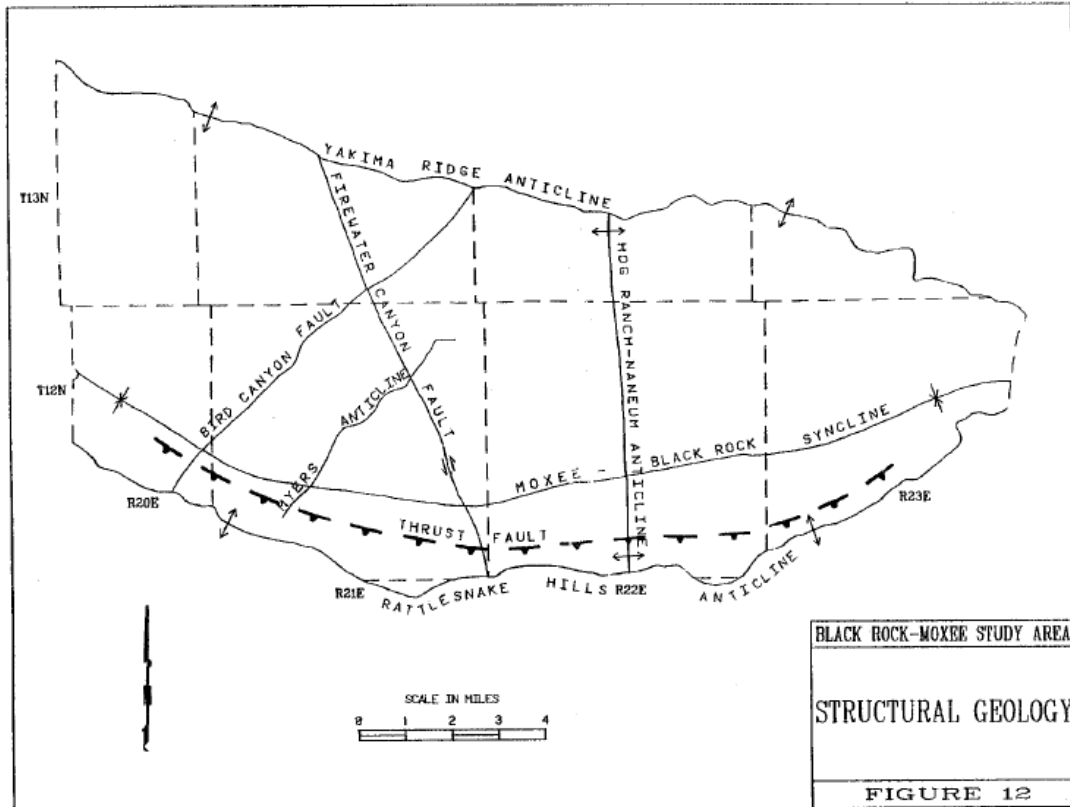


Figure 4. Project Area Groundwater Recharge and Flow (Source: Kirk and Mackie, 1993)

3.2.4 Groundwater Declines

Groundwater in the project area has been declining by as much as 13 feet per year for the last several decades. An extensive study on groundwater declines in the Columbia Plateau regional aquifer system based on monitoring well data collected between 1984 and 2009 (USGS, 2010; See Section 2.1.5). With declining levels of groundwater, issues arise relating to the (1) availability of groundwater resources for irrigation and other appropriative uses and (2) the impacts on stream temperature and water quality related to the reduction of baseflow to streams and rivers (USGS, 2010). These issues are anticipated to worsen as the effects of global climate change continue to alter recharge, baseflow and groundwater availability.

Of the 470 wells observed in the 2010 study, groundwater declines were measured in 83 percent of the wells, and 29 percent of the wells exhibited declines in excess of 25 feet. The study cited aquifer storage to be the largest cause for groundwater declines, which is primarily a function of aquifer recharge and discharge. The smallest magnitude of change was observed in the Overburden aquifer, likely associated with the various pathways for recharge in these aquifers compared to the underlying basalt units.

A pattern of consistent annual decline was established in each basalt unit but the worst declines were observed in the Wanapum and Grande Ronde basalts in the eastern portion of the East Moxee area, which is isolated from the western portion of the area by the

northeast-southwest trending Bird Canyon Fault. Within the Wanapum unit, declines of 25 feet or greater were observed in 38 percent of the wells, with the worst declines noted in the Yakima Fold Belt and the Yakima River Basin.

Within the Grande Ronde unit alone, declines of 25 feet or greater were observed in 60 percent of the wells, many of which experienced declines on the order of 100 to 200 feet. The study attributed these declines to the compartmentalization of groundwater bodies from the large number of geologic structures present in the Yakima Fold Belt, and heavy pumping of the deeper basalt units primarily associated with irrigation. Figure 5 below summarizes groundwater declines specific to the study area.

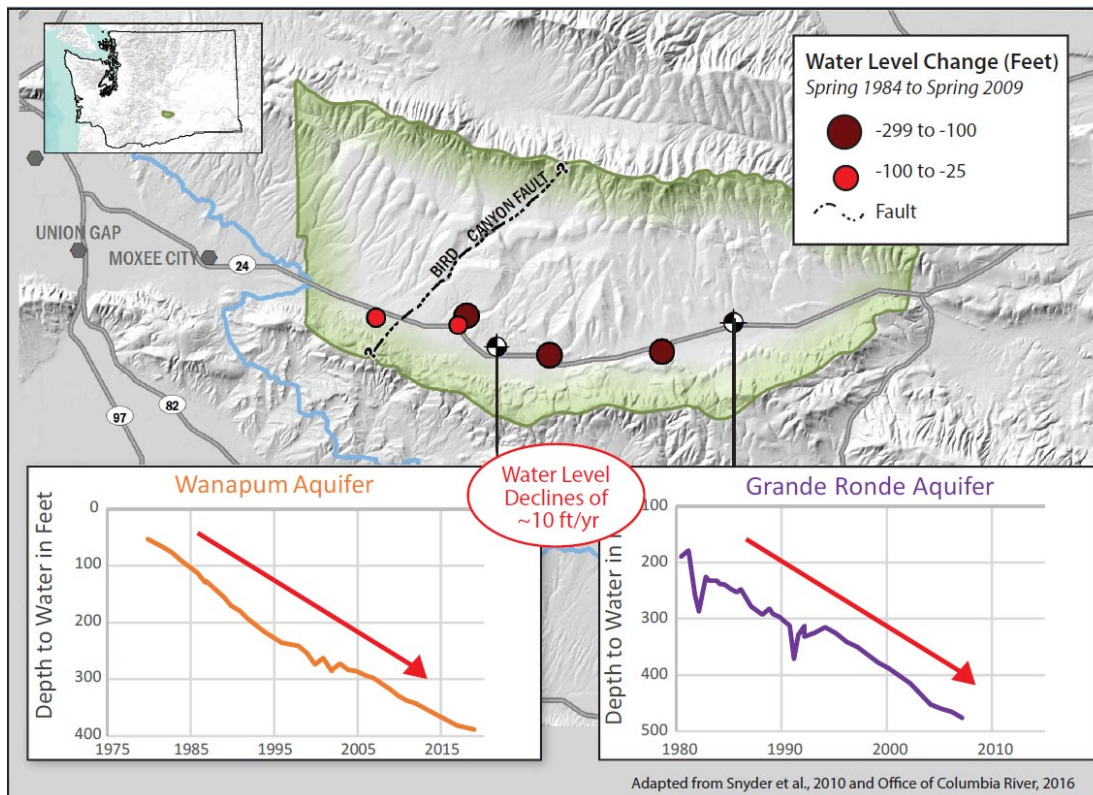


Figure 5. 1984 – 2009 Groundwater Decline in Wanapum and Grande Ronde Aquifers

Table 1. Project Area Summary of Average Rate and Total Rate of Groundwater Decline

Aquifer Unit	Aquifer Thickness (ft)	Average Rate of Decline (ft/yr)	Estimated Total Decline since 1950 (ft)
Overburden	0 - 1,300 ¹	2 ²	140
Saddle Mountains	0 - 1,000 ¹	6	420
Wanapum	988 - 1,108 ³	12	840
Grande Ronde	500 – 15,000+ ¹	13	910

Notes:¹USGS, 2010²Based on the median of declines and rises observed in wells between 1984-2009 (USGS, 2010)³Kirk and Mackie (1993)

3.3 Water Use Demographics and Demand

Water use in the East Moxee Area is used by agricultural, commercial dairy, and rural domestic users. In total, demand for reliable water supplies could exceed 60,000 acre-feet.

Estimating irrigation demand depends on whether you consider current users who may be interested in an alternative to declining groundwater (discussed further in Chapter 6), all current irrigation users, or if you also include valid water right holders not currently irrigating. For example, the number of irrigated acres for these three classes of users is 4,390 acres, 7,400 acres, and 18,000 acres, respectively.

For those acres, one must also assume a reasonable water duty. Jacobs assumed a range of water duties from 2.2 to 3.4 acre-feet per acre (Appendix A) depending on crop type. This corresponds to a low irrigation demand (low duty, low acres) of 9,600 acre-feet and a high irrigation demand of over 60,000 acre-feet.

The Washington State Department of Agriculture (WSDA) maintains a dataset of agricultural land use across the state. The GIS data was consulted to understand the portion of acres within the study area that are enrolled in the United States Department of Agriculture's (USDA) CRP or Conservation Reserve Enhancement Program (CREP). In total, CRP and CREP-enrolled land accounts for 2,687 acres within the study area. Based on the same crop assumptions, this portion of "unmet" demand that could result in future irrigation totaling up to 6,000 to 9,000 acre-feet.

Residential demand can be estimated by assigning a per capita water use to the 224 residents in the East Moxee Area. Since 2010, the population of Moxee is estimated to have risen 25 percent from 3,308 people (2010 Census) in 2010 to a projected 4,135 people in 2019 (Office of Financial Management, 2019). Applying this metric to the 2010 population of 224 people in East Moxee, the population has grown to an estimated 280 people thereby increasing the need for a reliable water source. Assuming a demand of 400 gpd, this equates to an additional 125 acre-feet per year. Commercial uses on the order of several hundred acre-feet also exist.

Although there is a broad range of demands, the East Moxee Area has a relatively stable group of users that have continued to farm and live in the project area for the last 20 years

and showed an interest in a different irrigation source. For the purposes of this report, we focused on 4,390 acres and a demand of 14,800 acre-feet, which is the subset of existing irrigators that expressed interest in a water supply solution and using the highest water duty to provide a factor of safety in the event additional users are interested in the future.

3.4 Water Rights

This section provides an overview of how water rights are created, assessed, and preserved in Washington State. A water right represents the right to use water. State-issued water rights are generally represented by three types of documents: claims, permits, or certificates.

- A claim is an assertion of use that predates the water code, which must be confirmed through the judicial system. A claim can be “tentatively determined” to be valid by Ecology through a change process.
- A permit is the first step toward securing a perfected water right. Prior to receiving a permit, an applicant must submit a water right application detailing the quantity of water needed, the source, where the water is to be used, and purpose of water use (e.g., irrigation, domestic supply, stockwater, etc.). A water right is “perfected” when all the terms and conditions associated with it have been fully accomplished: it is considered “inchoate” or “unperfected” until then.
- A permit authorizes the permit holder to start construction of a water system and begin using water on an identified “place of use.” Water right permits are personal property and may be assigned to a new property owner or owners (partial assignment to multiple owners is often called a “split”). An assignment must be filed with Ecology for the permit to remain valid and the person(s) owning it may continue to develop water use(s) on the property identified as the place of use. Water right permits remain active if they are perfected within the development schedule (or receive an extension from Ecology) or are awaiting a proof examination.
- After the permitted quantities are put to full use at the place of use, a Certified Water Right Examiner (CWRE) completes a proof examination of the water use(s) on the property. Ecology then issues a water right certificate for the fully perfected quantities. Water right certificates become part of a property’s legal record. Water right certificates remain valid as long as the perfected quantity does not go unused for more than 5 years without a qualifying statutory relinquishment exception under Revised Code of Washington (RCW) 90.14.140. After a certificate has been issued, the applicant can apply to change most attributes of the water right (e.g., location of use, source, purpose).

3.4.1 *Black Rock Water Rights*

Within the study area, 187 water rights were identified. Figure 6 below describes the relative percentages of the different types of water rights.

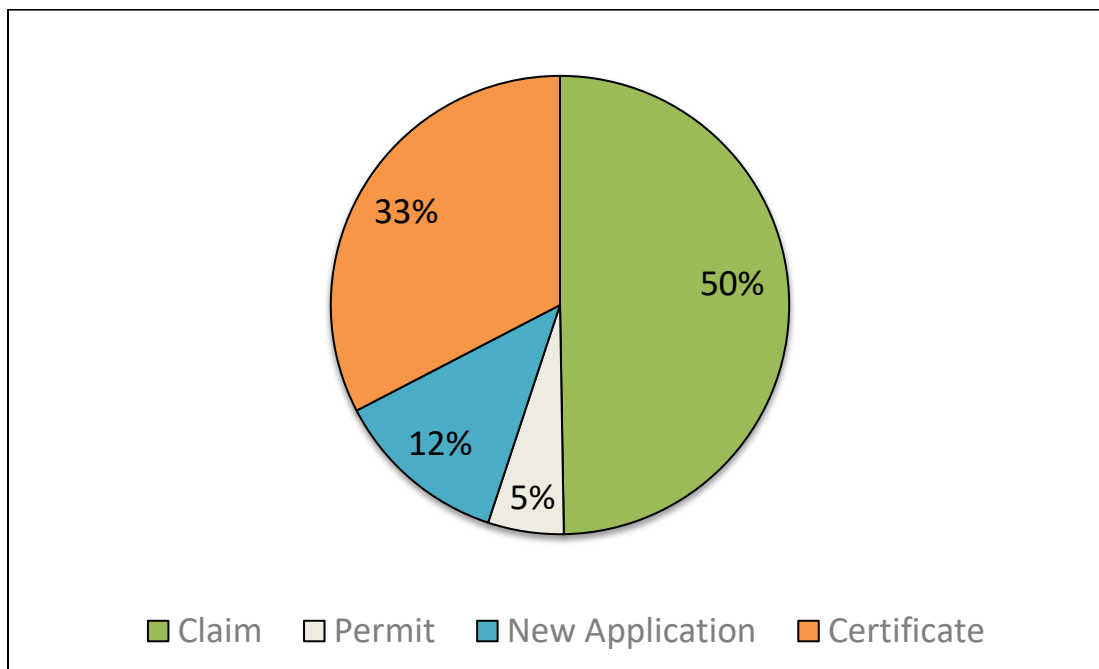


Figure 6. East Moxee Water Right Types

There is not a one-to-one correlation between the quantities authorized in Ecology’s database and the valid authorizations for numerous reasons. However, we note the following observations.

- 18,000 acres and about 60,000 acre-feet of potentially valid water rights is likely the highest ceiling of potential demand in the East Moxee Area, although actual demand is likely less.
- The actual demand expressed in New Applications is likely zero. No new “additive” water rights would ever likely be granted in the East Moxee Area under these applications.
- Two relinquishment exceptions may protect some portion of fallowed land from relinquishment, resulting in “unmet” demand. These include “unavailability of water” and enrolling in “federal crop reserve programs” under RCW 90.14.140.

3.4.2 SMID Water Rights

SMID water is diverted from the Yakima River under authorizations that were confirmed following the 42-year adjudication of the Yakima River Basin (*Ecology v. James Acquavella, et al.*). These authorizations are summarized in Table 2 below. Water right S4-33241 is the only new right that SMID applied for since the adjudication. SMID applied for this right on September 24, 2019, to align authorizations with water bank quantities, and to resolve a long-standing diversion replacement issue by authorizing three points of diversion. Water Right S4-84594-J was concurrently placed in Ecology’s Trust Water Rights Program (Trust) for the purpose of instream flow and mitigation for S4-33241.

Table 2. SMID Water Right Authorizations

Water Right No.	Priority Date	Qi* (cfs)	Qa (afy)	Purpose of use	Irrigated Acres**	Season	Point of Diversion
SMID Pomona rights							
S4-84590-J	11/9/1884	54.0	17,970.5	IR, FP, ST	5,393.63	4/1-10/31	Pomona
S4-84591-J	11/9/1900	18.0	5,990.2	IR, FP, ST	5,393.63	4/1-10/31	Pomona
S4-84592-J	5/10/1905	58.0	1,107.0	IR, FP, ST, OA	5,393.63	3/15-3/31	Pomona
S4-84593-J	5/10/1905	14.6	4,281.3	IR, DM	5,393.63	4/1-10/31	Pomona
S4-33241	9/24/2019	12.24	3,000.0	IR, FP, OA	901.00	4/1-10/31	Pomona, Fowler Ditch, Roza Wasteway
S4-84594-J	1/26/1887	38.0	13,781.0	Instream Flow	2,001.94	4/1-10/31	Old Moxee-Hubb
S4-84595-J	5/10/1905	3.1	959.4	DM, IR	345.00	4/1-10/31	Pomona, Fowler Ditch, Roza Wasteway

Notes:

FP=Frost Protection; IR=Irrigation; ST=stock water; OA=other agriculture purposes; DM=incidental domestic supply; cfs = cubic feet per second; afy= acre-feet per year; Old Moxee-Hubb is the Moxee-Hubbard diversion that was washed out during the 1996 Flood.

*Qi is peak authorized instantaneous quantity under each right. The Qi varies during the season as described in the Final Schedule of Rights for each right which is included in Ecology's file.

** Irrigated acres for four Pomona rights total 5,393.3 acres combined, with primary irrigated acres under S4-84590-J, and non-additive under S4-84591-J, S4-84592-J, and S4-84593-J. S4-33241 is additive to these authorizations.

4 Physical Supply Options

This section summarizes water supply options that have been evaluated for the East Moxee Area and summarizes the feasibility of each. Providing a firm supply for up to 14,800 acre-feet of existing demand will require a major infrastructure project. In summary:

- It is unlikely that conservation will provide much savings because the majority of demand is already highly efficient.
- In-basin, large-scale centralized surface storage has already been considered and lacked feasibility in prior studies.
- In-basin decentralized surface storage or small-scale centralized storage can help meet a portion of the water budget.
- Aquifer storage and recovery is challenging given the water quality standards required in Washington and the high treatment cost of meeting those standards for a future largely irrigation purpose.
- Importing supply (i.e., out-of-basin) via SMID canals is feasible but has some constraints based on out-of-basin legal and physical water supply availability.

All of these options would likely be combined with some form of water marketing, which is discussed in Section 5.

4.1 Conservation

Conservation is often the first water supply option considered to address demand challenges. Many basins with declining groundwater bodies have been successful in slowing the rate of decline through conservation standards. However, when demand exceeds recharge, conservation methods alone likely cannot solve declining groundwater issues of the magnitude on the Project Area.

Conservation approaches already have been and are successfully employed in the Yakima Basin, including by SMID. The following list summarizes conservation methods and potential applicability to the East Moxee area.

- **On-farm efficiency.** Changes from flood to sprinkler irrigation applications or from sprinkler to drip application can significantly reduce demand. Ecology's GUID 1210 suggests that these conversions can save up to 50 percent of the historical on-farm application of water.
 - In the East Moxee area, most of the crops are already irrigated by drip and microspray sprinklers, with efficiencies ranging from 85 to 95 percent. For the purpose of this Study, we have assumed the maximum on-farm conservation that could occur is an additional 5 percent of 14,800 acre-feet, or 740 acre-feet.
- **Canal efficiency.** SMID and many other irrigation districts in the Yakima basin with centralized canals have employed ditch lining, piping, and re-regulation reservoirs to improve transportation efficiency and reduce operational spill.

- In the East Moxee area, there is no existing centralized transmission system. While any new extension of service would be lined or piped to a very high efficiency (e.g., 90 percent or more), this option does not offer an opportunity to reduce existing demand.
- **Rural efficiency.** Rural home conservation can include plumbing upgrades (e.g., low-flow toilets and showers) and lawn watering guidance.
 - In this instance, the rural demand is the smallest fraction of existing uses in the basin (125 acre-feet). For the purpose of this Study, we have assumed an education campaign to these users would reduce water use by an additional 10 percent, or about 12 acre-feet.
- **Reduction of cover crops.** Based on the Washington Irrigation Guide (1985), cover crops (e.g., crops grown between orchard or hop rows) can consume about 1 foot of water for every acre of irrigated farmland.
 - A precise survey of cover crop savings is not yet available for the East Moxee Area. However, cover crops are typically associated with lower efficiency on-farm application methods. When drip irrigation is used, cover crop is not employed because the goal is minimizing on-farm crop use through precision application to the root zone. For the purpose of this Study, we have assumed that a 5 percent reduction in irrigation demand may be possible, or 740 acre-feet.
- **Crop change.** In some cases, crop change can reduce demand. According to the Washington Irrigation Guide and information from Washington State University (1985), wine grapes might use on the order of 18 to 24 inches in the East Moxee Area whereas orchard irrigation might use twice that amount depending on variety, spacings, and other factors.
 - The majority of the crops in the East Moxee Area are not perennial, but rather long-standing investments. For the purpose of this Study, no crop change was assumed.
- **Land fallowing.** Significant savings to the declining aquifer could come through targeted fallowing of land.
 - There is evidence that this has already occurred in the East Moxee Area. For example, 2,687 acres are enrolled in the Crop Reduction Program (CRP), presumably because the cost of supplying water to that additional acreage became cost-prohibitive. This totals 6,000 to 9,000 acre-feet of unmet demand. The difference between current irrigation and water right authorizations is on the order of 42,000 acre-feet, which could be another estimate of unmet demand. For the purpose of this Study, we did not assume any additional land fallowing would occur.

In summary, conservation savings could account for approximately 1,500 acre-feet, or 10 percent of the overall water budget relying on the declining groundwater aquifers.

4.2 Large In-Basin Storage

As discussed in more detail in Section 1.1.2, in 2004, USBR conducted an appraisal-level assessment of water supply storage in the East Moxee area, as part of a larger Yakima Basin Water Storage evaluation. (USBR, 2004).

The USBR evaluated an East Moxee area storage concept that would pump water from the Columbia River, when available in excess of current instream flow targets, for storage in an East Moxee reservoir. Stored water would be released to an outflow conveyance system running to the west to the lower Yakima Valley and provided to some lower Yakima Valley irrigation entities situated to receive exchange water into their existing, or modified, distribution systems.

The Yakima River water currently used by the participating entities would not be diverted and would instead be used to meet the larger Yakima Basin Storage Study goals. Other Yakima Valley irrigators with junior proratable water rights, but not physically located to receive exchange water from the East Moxee alternative, would also benefit in dry years by receiving a portion of the formerly diverted Yakima River water.

In summary, the USBR did not advance the project further due to project area seismology concerns, hydrologic challenges related to potential reservoir leakage, and overall cost. For the purpose of this Study, we did not assume that centralized storage would be a source of supply to offset declining groundwater.

4.3 Small In-Basin Storage

Construction of storage ponds on-farm is an important part of the water supply culture in the Yakima Basin, where hundreds of such ponds exist. The Legislature provided an exemption of 10 acre-feet for small irrigation impoundments (RCW 90.03.370) which is the most common size, but larger ponds are also common totaling dozens or several hundreds of acre-feet.

Visual observation of the Study area suggest numerous such ponds already exist in the basin. Because out-of-basin water supply is most likely available at times outside the peak crop demand period of July and August, small storage could be an important part of the future water supply picture.

Jacobs also suggested small storage greater than the 10 acre-foot exception but much smaller than the more ambitious large-scale surface storage could be an effective way of retiming offseason water that is available to the irrigation season. Their report (Appendix A) suggests that one or more reservoirs totaling 3,500 could be successful in retiming a significant portion of the existing irrigation demand.

4.4 Underground Storage

Based on the demonstrated underground capacity evidenced by groundwater declines, aquifer storage and recovery (ASR) or managed aquifer recharge (MAR) could present viable solutions to reduce further groundwater declines and supply existing wells in the study area, but both options have cost and feasibility challenges discussed in this section. Under these options, water would be diverted from SMID canals and conveyed to the

study area when surplus supply exists where it would be injected directly into the aquifer via existing wells (ASR) or passively infiltrated at the surface to recharge deeper aquifers (MAR) for use during peak months when the demands are greatest.

Within the state of Washington, ASR is subject to several regulations, summarized below.

- RCW 90.03.370 defines a reservoir to include “*any naturally occurring underground geological formation where water is collected and stored for subsequent use as part of an underground artificial storage and recovery project.*” Thus, this definition requires a reservoir permit for authorization of ASR projects.
- Chapter 173-157 WAC establishes a comprehensive list of standards that are considered during ASR proposal review and when evaluating mitigation strategies for adverse aquifer impacts including: (1) aquifer vulnerability and hydraulic continuity, (2) potential impairment of existing water rights, (3) geotechnical impacts and aquifer boundaries characteristics, (4) chemical compatibility of surface and groundwaters, (5) recharge and recovery treatment requirements for system operation and (6) water rights and ownership of water stored for recovery.
- Chapter 173-200 WAC requires that ASR water stored in an aquifer must meet water quality standards for groundwater in the state of Washington.
- Chapter 90.48 RCW (Water Pollution Control Act) and Chapter 173-218 WAC (Underground Injection Control Program) require registration of ASR projects with these programs.

Of these regulations, the water quality standard requirement is the primary challenge associated with this option. An ASR project would require water quality treatment prior to implementation, which would likely necessitate a large-scale surface water treatment plant treating water to drinking water quality standards (or nearly so). This would be needed for any aquifer that shared both irrigation and potable water wells.

Even if all wells in an aquifer were irrigation supply only, or if Ecology established a groundwater management area and used its overriding public interest authority to waive some portions of the more challenging water quality standards, some level of treatment would be needed to physically inject surface water underground without clogging up injection wells.

Surface water treatment is common in Washington State in municipal settings. However, it is rare in irrigation settings because the volumes of water are order of magnitude higher. For the East Moxee area, the domestic demand is 125 acre-feet while the existing irrigation demand is 14,800 acre-feet (over 100 times greater). ASR is likely prohibitively expensive compared to other alternatives that do not require treatment and was not considered further in this Study.

MAR is commonly used in Washington State and does not require costly pre-treatment. Rather, it uses natural filtration in the ground to ensure water quality standards are met in the aquifer. However, MAR installations in Washington are in alluvial settings where the target aquifer is unconfined. Aquifer recharge is generally administered to highly transmissive material (e.g., gravel pits, fields, alluvium) where it can easily infiltrate the surface to recharge deeper aquifer systems.

Local geologic conditions in the East Moxee area do not favor this solution. The study area is characterized by thick basalt sequences with confined aquifers. It is simply not feasible to infiltrate water at the ground surface and have it reach the target aquifers described in Chapter 2 in a reasonable period of time (human lifespans as opposed to geologic time). Because of the unsuitable geologic conditions in the East Moxee area, MAR was not considered further for this Study.

4.5 Out-of-Basin Supplies

One option to meet existing and unmet demand in the East Moxee Area is to import water from the mainstem Yakima basin when it is legally and physically available. This section discusses a number of options relative to an out-of-basin transfer. As the proponent of this study, focus was prioritized on SMID infrastructure options for conveyance, although numerous options exist to supply water to the canals. Options for water supply include:

1. **Transfer of private water right authority with SMID conveyance.** A market for water rights exists in the Yakima basin with wholesale transactions of hundreds of acre-feet being transferred at prices ranging from \$5,000 to \$7,500 per acre-foot. East Moxee Area farmers could purchase Yakima River basin water rights, and then use SMID conveyance infrastructure to transport that supply to their farms.
2. **Transfer of East Moxee Area water rights to the Yakima River.** Valid water rights exist in the East Moxee Area that are limited by aquifer capacity. Transfer of water rights within the same source is possible in Washington. However, based on consultation with Ecology and our review of the area geology, it is unlikely that the East Moxee aquifers and the Yakima River would be considered the same source. There may be some hydraulic connection between them on the geologic time scale, but that is likely too constrained to support a transfer that would survive a “no-impairment” threshold required under RCW 90.3.380.⁴
3. **Transfer of Seasonally Surplus Water from the Yakima River.** In some water years, water is surplus to existing rights and fisheries objectives on the Yakima River. A portion of that water could be conveyed through SMID infrastructure to the East Moxee Area. The primary challenge to this option is the Yakima Integrated Plan⁵ already seeks to make use of this water for other purposes—most notably, increases the reliability of proratable water right holders in the basin.

Currently, this East Moxee planning effort exists “outside” of the YBIP planning process. A goal of the next phase of this Study is to improve coordination with Reclamation, Ecology, and the YBIP Executive Committee to understand how this basin need can be supported by YBIP goals.

4. **Transfer of Surplus SMID Supply.** SMID is in the process of creating a water bank with approximately 9,000 afy of consumptive use. A portion of this water supply could be contracted to East Moxee Area users for outdoor irrigation. In this instance,

⁴ <https://app.leg.wa.gov/rcw/default.aspx?cite=90.03.380>

⁵ <https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-supply-projects-EW/Yakima-River-Basin-projects/Yakima-integrated-plan>

existing groundwater rights supplying those farms would be converted to standby-reserve status, similar to the process being used in the Odessa Groundwater Area in a collaborative project between USBR, Ecology, and local irrigation districts. SMID has not committed to supplying water in this manner, but is open to discussing it further. SMID's surplus water supply accounts for approximately 60 percent of the existing demand shortfall.

For any of the above water supply alternatives, transmission through existing and extended SMID canals and pipes would be required. The following sections describe conveyance options evaluated in this report.

4.6 SMID Infrastructure supply options

Jacobs evaluated potential District infrastructure needs and costs of providing water to the East Moxee area (Jacobs, 2015). This section summarizes the overall report attached in Appendix A. The Jacobs study area (Area A) focused on 4,390 acres of irrigable land, which was made up of the irrigators/parcel owners who indicated interest in the groundwater study (Figure 7; attached). The Study concluded that:

1. Some water supply and physical capacity exists in the current District system.
2. That capacity could be improved with modest infrastructure improvements.
3. A significant portion of the available supply would need to be retimed from spring and fall to coincide with peak summer demand through on-farm storage.

4.6.1 Design Capacity

The SMID canal screen and intake has a design capacity of 100 cfs; however, because of upstream canal and tunnel limitations, 90 cfs is the current maximum flow diverted to the canal system. After discussion with SMID, Jacobs focused on the area of the Walters Spills as the most reasonable location for diverting water from the SMID system to new infrastructure that would supply the East Moxee area. This portion of canal was selected for analysis because of its short length and the ease of increasing the capacity to match the canal immediately upstream.

The canal at Walters Spill has a current capacity of 49 cfs. Water is available at this location:

1. When it is spilled when supply and demand at this location are not perfectly matched
2. When demand is less than 49 cfs

A modest canal improvement project costing approximately \$100,000 could improve canal delivery capacity at this location to 54 cfs by widening the last half-mile of canal approaching Walters Spill.

4.6.2 Demand Assumptions

As described more fully in Section 2, Jacobs bookended potential irrigation demand based on high- and low-duty crops. This demand estimate ranged from about 9,600 acre-feet to 14,800 acre-feet. About half of this water is required in July and August based on the Washington Irrigation Guide (1985) when capacity in the SMID canal would be at its lowest (because of existing SMID customers).

4.6.3 Available vs. Required Water

Using the 49 cfs capacity limitation at Walters Spill and removing demand estimates by existing SMID customers, Jacobs estimated that the canals can divert 16,010 acre-feet of water to the East Moxee area from March 1 to October 31. However, the shape of that available water capacity is inverted relative to peak demand requirements. Figure 8 shows the shape of the peak demand need overlain with the shape of when water is available in the SMID canal system. As described earlier in this chapter, storage could be used to help retime supplies to match demand. Depending on the design assumptions, approximately 3,500 to 7,500 acre-feet of storage could be needed. See Figure 8 below for supply and demand curve.

If the Walters Spill were improved from 49 cfs to 54 cfs, it would provide an additional 300 acre-feet/month of surplus capacity (or 2,400 acre-feet/year).

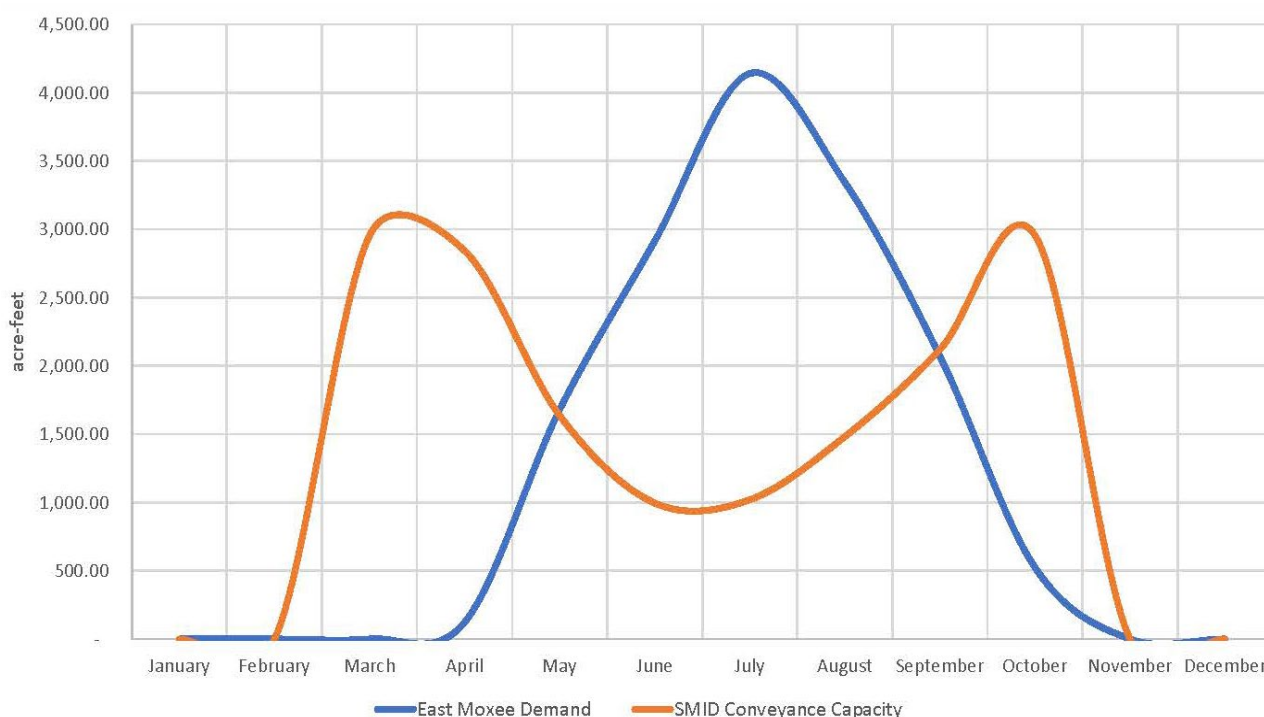


Figure 8. East Moxee Demand and SMID Conveyance Capacity

4.6.4 Pump Station

A pump station will be required to provide water to Area A because there is approximately 500 feet of elevation gained along the proposed highway route. Jacobs estimated a pump station would cost approximately \$800,000. No operation and maintenance cost was assumed for the pump station because farmers are currently paying well operation and maintenance costs that were assumed to be equal or greater than a future pump station for the purposes of this Study.

4.6.5 Piping and Turnouts

A pipeline extending from Walters Spill along an alignment adjacent to Highway 24 was assumed for this Study. Assuming a maximum of 49 cfs, Jacobs estimated a pipeline and turnout cost of \$15M to construct nearly 10 miles of pipeline.

4.6.6 Design Cost Estimate

The total capital cost of a project consisting of approximately 10 miles of pipeline, a single pump station, and a single 3,500-acre-feet reservoir was estimated at approximately \$84M in 2020 dollars (see Appendix A for detailed discussion of the pipeline cost estimate details). Additional costs would be necessary for environmental review, permitting, water authority acquisitions, and other factors. Demand estimate ranged from approximately 9,600 acre-feet to 14,800 acre-feet. At 10,000 acre-feet of demand, this equates to about \$8,500/acre-foot.

5 Water Marketing

Water markets (also known as water banks) in Washington are being used successfully to meet many water supply challenges, including regulation over exempt wells (e.g., Kittitas County, Yakima County, private banks), mitigation for streamflow impacts under the Streamflow Restoration Act (e.g., Spokane County, Chelan County, Chapter 90.94 RCW), agricultural-based banks (e.g., Oroville-Tonasket Irrigation District), and multi-purpose banks (e.g., Klickitat Public Utility District, TransAlta). SMID is creating a water bank in 2021 based on surplus water savings from urbanization, irrigation efficiency, and crop change within the District.

Water markets reallocate water use authority from those that have surpluses to those that need it. In this section, we discuss water market formation and operation, and their applicability to transfers originating both within and from outside the East Moxee area. In summary:

- Water marketing is not likely to be successful within the East Moxee area because there are no surplus water supplies in that area.
- Water marketing is likely to be successful and a key component of a water supply strategy originating from supplies outside the Study area.
- SMID has emerging expertise in water banking, but other more established local water bankers exist that could assist the East Moxee area (Yakima County, Ecology).

5.1 Water Bank Establishment

Approximately 50 water banks are in some form of study or active management in Washington (Figure 9). More water banks are being proposed each year and the SMID Water Bank is expected to be operational in time for the 2021 irrigation season.

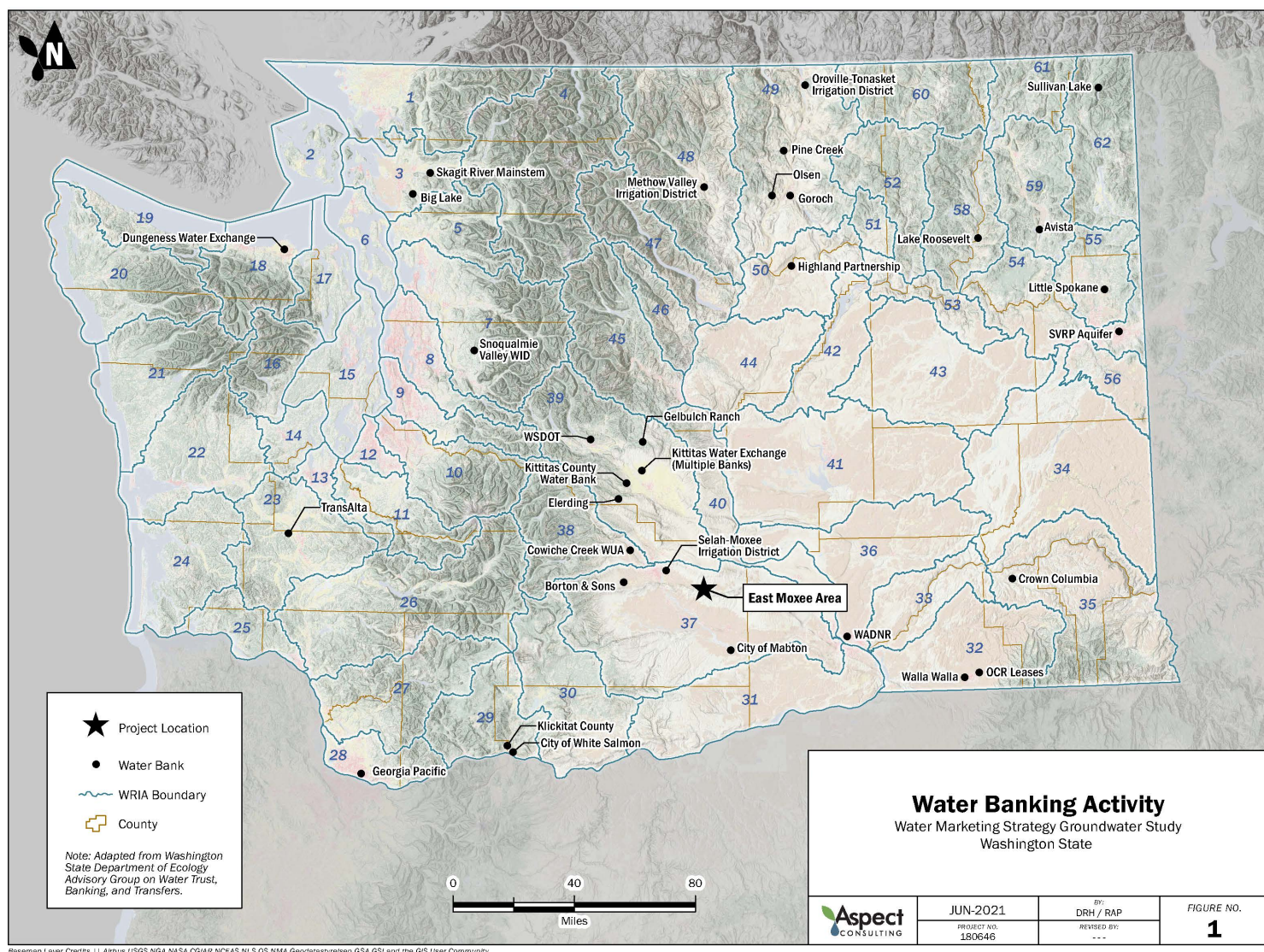


Figure 9. Water Banking Activity

Water banks reallocate water from one or more originating sources to many new sources. Water banks often work better than conventional transfers under the Water Code by streamlining one-to-many transactions. In other words, if all of a water right is going to be transferred from “Larry” to “Dan,” the original 1917 Water Code works well. However, if Larry is going to transfer fractions of the right to Dan, Isabellah, Taylor, Mike, Tyson, Emelie, Nathan, and 20 others, water banks work better.

The establishment of a water bank requires the input of some form of water right credit (bank seeding) resulting from a permitting or source development action that adds to the overall supply of the basin. Bank seeding can potentially take the form of in-kind (the most typical approach), out-of-kind, in-time, out-of-time, in-place, or out-of-place sources. These credits can potentially come in the form of:

- Retiring an existing senior water right and placing it in the State’s Trust Water Right Program (TWRP)
- Building surface or groundwater storage
- Importing water through inter-basin transfers
- Water conservation
- Reserves in instream flow rules
- Restoring habitat or wetlands that improve conditions addressing the functions and values of critical fish species or water quality
- Other watershed improvement activities

An overview of how water banking works is shown in Figure 10. A bank is seeded with water right authority, held in trust as a credit, and then new uses debit against that credit.

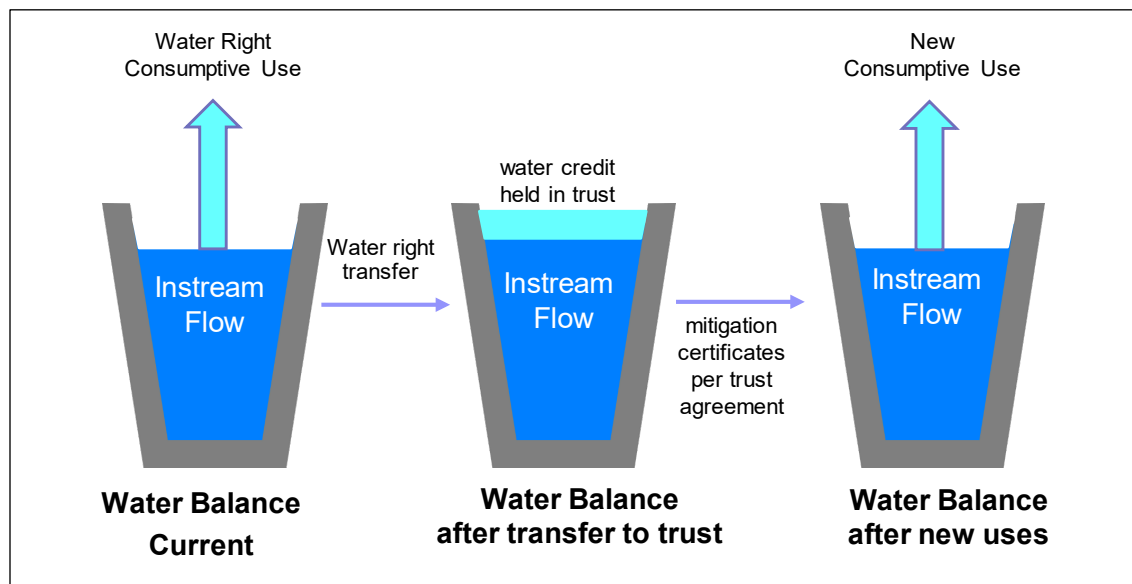


Figure 10. Washington State Water Banking Process

Utilization of the TWRP offers some common benefits applicable to all water banks. Water rights seeding a bank are validated to ensure “real” water is being used for mitigation offsets. Trust water is exempt from relinquishment providing certainty in regulation in the future. Annual reporting is typically required to make sure supply and demands are matched appropriately.

For the East Moxee area, while no supplies in-basin were identified as feasible in Section 3, several out-of-basin sources are possible that could be used to seed a water bank. Water supply could come from the SMID water bank, from purchases of rights out of the Study Area, from new rights to surplus water in some years in the Yakima basin if it can be integrated with YBIP goals, and from storage. Groundwater users in the East Moxee area could then sign up with the bank and receive authority to divert that supply in lieu of groundwater.

5.2 Comparing Water Banks

Water banks transact quantities of water for a variety of purposes, from groundwater use under the permit exemption of generally less than 1 acre-foot (i.e., indoor and outdoor domestic use for a single residence) to permitted water rights in the tens, hundreds, or thousands of acre-feet (i.e., irrigation, industrial, and municipal uses). For example: one transaction from a private water bank in Kittitas County conveyed 0.137 acre-feet per year consumptive for indoor and 500 square feet of outdoor domestic mitigation. Alternatively, one transaction from the Office of Columbia River for the Sullivan Lake Water Bank conveyed 1,100 acre-feet per year to the City of Bridgeport as a new water right permit.

It can be challenging at times to directly compare one water bank to another. Ecology and the water banker negotiate a contract called a Trust Water Agreement that specify the rules and conditions under which the bank will operate. Banks may be limited to:

1. A specific geographic area
2. A specific purpose of use
3. Certain sizes of transactions
4. Certain numbers of transactions
5. Other unique case-by-case limitations

While differences exist, the themes and their applicability to the East Moxee declining groundwater issue are important. The following sections describe some of the common water bank structures and attributes of those banks tracked by Ecology. Several recent summaries of water banks have been funded by Ecology that help inform this evaluation, including:

- Analysis of Water Banks in the Western States⁶
- 2016 Water Supply and Demand Forecast: Water Banking Module (WSU, Aspect, et al, 2016)⁷
- Water Banking and Water Marketing in Select Western States (Ebeling et al, 2019⁸)
- Ecology's Advisory Group on Water Trust, Banking, and Transfers⁹

5.2.1 Water Bank Formation

Water banks generally follow the same steps in their formation, irrespective of who the banker is, what water rights or projects are seeding the bank, or who the customers are. Every bank involves a project or water right to seed the bank and create the initial

⁶ <https://fortress.wa.gov/ecy/publications/summarypages/0411011.html>

⁷ <https://fortress.wa.gov/ecy/publications/SummaryPages/1612001.html>

⁸

<https://apps.ecology.wa.gov/docs/WaterRights/wrwebpdf/WaterBankingandWaterMarketinginSelectWesternStates.pdf>

⁹ https://www.ezview.wa.gov/site/alias__1962/37617/water_trust__transfers_advisory_group.aspx

“deposit”. Every bank uses the TWRP and Ecology’s authority to hold, manage, and protect assets via a trust water agreement. Every bank has rules of service: who can access the water, for what purpose, and for what price. See Figure 11 for summary of water banking formation process.

The most common water banks in Washington have been formed when the banker purchases and retires an existing senior water right. Because of Supreme Court cases (e.g., spanning the time period from Campbell and Gwinn in 2002¹⁰ through the Hirst case¹¹ in 2016) Counties have been on the forefront of water bank creation to mitigate for rural permit-exempt well impacts on instream flows and senior water right holders.

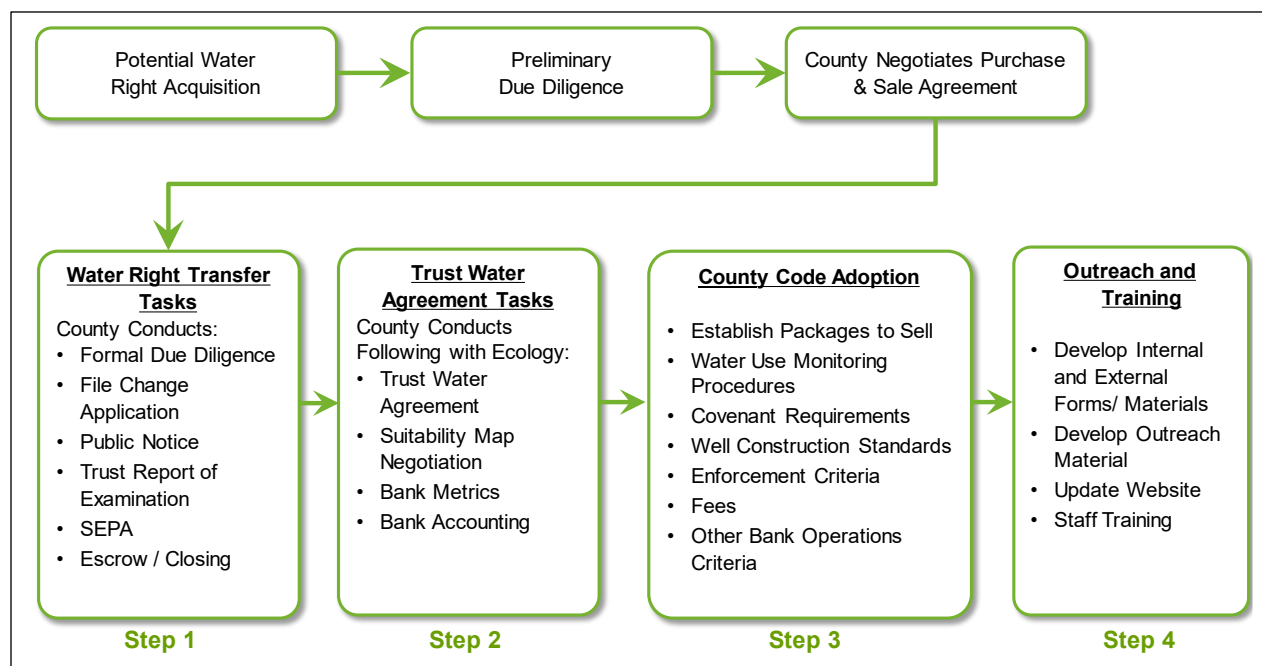


Figure 11. Water Banking Formation Process

For East Moxee Area users, the process would be similar.

1. A water banker would be identified. The most likely “champions” could be the following, although other options are discussed in the following sections:
 - a. SMID, who authored this Study, has some surplus water to market, and some local infrastructure in the area.
 - b. Ecology, who has a statutory role in regulating groundwater and water supply development.

¹⁰ <https://snohomishcountywa.gov/Archive.asp?ADID=2887>

¹¹ <https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-rights/Case-law/Hirst-decision>

- c. Yakima County, who has an interest public health and safety and economic prosperity.
2. A project from Section 3 would be selected to seed the water bank.
3. Water right permitting decisions would be issued to create the bank.
4. A Trust Water Agreement would be negotiated with Ecology (unless Ecology is the banker).
5. Business rules for the bank would be adopted (who can receive water, where will water be delivered, how much will be supplied, how much will it cost, under what terms would it be firm or interrupted).
6. Marketing of the bank would occur to potential customers.
 - a. Because of the significant cost involved, this would likely be negotiated in advance. For example, farmers who would like to participate in the bank might sign Letters of Commitment, Water Service Contracts, or other agreements that ensure that they will pay their share of the required project and receive a fixed allocation of water for their property.

5.2.2 Water Bank Structures

Water banks need a banker—a champion that operates, markets, manages, and reports on the banking activity. To date, water banks have operated under four general water bank formational, operational, and managerial structures. The operational structures include:

- Public
- Quasi-Government
- Nongovernmental Organizations (NGO)
- Private

A water bank can be formed, operated, and managed by a single entity or different entities, while achieving the goals of providing reliable and legally defensible water transfers to the customer base. The following sections summarize each of these four structures and provide pros and cons of each.

5.2.3 Public

Public entities for the purpose of this section are considered to be State, County, City, Irrigation Districts, or other local governments. Many public entities in the State operate water banks. In some cases, these are called “water banks” and in others “water exchanges”. In some cases that are named for the entities served (e.g., Cabin Owners), or by the supply that seeded the bank (Lake Roosevelt Drawdown), or for the water banker (Yakima County Water Resources Program). Regardless of whether the public entity calls it a “water bank,” it is a water bank if it uses the TWRP to convert water rights into new appropriations. However, the footprint of the public entity could range from merely their typical regulatory function to also include all formation, operation, and management functions of a water bank. When a public entity contracts with a third party to perform the non-regulatory functions, hybrid banks result.

The East Moxee area is arguably centered in the birthplace of water banking in Washington. The greater Yakima Valley has the most water banks in operation in the state and is the subject of ongoing innovation as they mature.

Most of the public (County) banks in the Yakima Valley have focused specifically on providing mitigation for small domestic well use or small surface water uses from recreational cabins. Other public water banks by Irrigation Districts were created or are in development to serve agricultural customers (e.g., Oroville-Tonasket Irrigation District, Methow Valley Irrigation District). Public banks created through Ecology's Office of Columbia River have a broader range of customers, including municipal, irrigation, commercial/industrial, interruptible users, and instream flows.

5.2.4 Quasi-Government / Nongovernmental Organizations (NGO)

Quasi-government organizations for the purpose of this section are considered to be entities formed by the legislature (i.e., Walla Walla Watershed Management Partnership) and Nongovernmental Organizations (NGO) are considered to be entities formed under IRS tax code 501c3 (i.e., Washington Water Trust). Examples of Washington quasi-government and NGO water banks include:

- Dungeness Water Exchange (hybrid with Public entity, Clallam County),¹² which has a focus on mitigation for new permit-exempt wells and restoration of Dungeness River and its tributaries.
- Walla Walla Water Exchange,¹³ which has a focus on mitigation of the outdoor irrigation component of new permit-exempt wells and Voluntary Agreements Not-To-Divert for instream flow benefit.

The universe of quasi-government or nongovernmental organizations that could have a role in championing a water bank for the East Moxee area is finite. Existing entities like Washington Water Trust, Trout Unlimited, and The Nature Conservancy all have a significant presence and missions in the area and could potentially play a role. They have typically taken on water banking or water acquisition efforts with a significant instream flow or environmental benefit, which is not the primary focus here. Like the Walla Walla Water Exchange, a specific legislative entity could also be created.

5.2.5 Private

Private entities for the purpose of this section are considered to be private for-profit corporations incorporated under State and Federal Law. Private water banks currently in operation are most commonly associated with the Yakima Basin where an Ecology Upper Kittitas County Groundwater Rule (WAC 173-539A) requires mitigation of all new groundwater uses. Other private banks that have or are negotiating trust water agreements with Ecology include Crown Columbia (a multi-purpose water bank) and Auvil Fruit (an agricultural user water bank).

¹² <http://www.washingtonwatertrust.org/water-exchange>

¹³ <https://www.wallawallawatershed.org/water-banking>

A private entity could lead an East Moxee area water bank. The most likely banker in this case would be one of the major landowners who will receive water from the bank. No entity has expressed an interest in this to-date, and none of the entities that have expressed interest in participating in receiving water from this is running any other water bank or has apparent water right institutional skills that are an immediate fit.

5.3 Water Bank Pricing Summary

When the first water banks were formed, price disclosure was not readily apparent in either public or private banks. Over time, Ecology voluntarily began posting public information for banks they managed or in which they had a significant regulatory role. By 2016, the Legislature desired even greater transparency and passed Senate Bill 6179, requiring Ecology to post and track water bank pricing on its website.¹⁴

Several important items affect water right prices in water banks, a short description of each is provided below:

1. **Banker Type:** Public banks lack a profit motive and often have access to overlapping missions for which staff funding is available. These factors typically reduce the cost of public banks over private banks.
2. **Retail or Wholesale Market:** Retail acquisitions in Washington are the most common by number and are typically measured in fractions of acre-feet. Wholesale transactions are typically in tens, hundreds, or thousands of acre-feet. Retail acquisitions are often at a premium because the value of the water is overshadowed by the value of the transaction costs of permitting, monitoring, and other ancillary costs. Additionally, the market will often bear a higher price relative to the value of the use. For example, Yakima-based markets are often charging thousands of dollars for fractions of an acre-foot, which equates to more than \$35,000/acre-foot. Figure 12 below shows a historical summary of retail water sales in nearby Kittitas County from 2012-2018 (The Water Report #183, 2019¹⁵).

¹⁴ <https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-rights/Trust-water-rights/Water-banks/Tracking-water-banks>

¹⁵ <https://www.thewaterreport.com/Issues%20181%20to%20184.html>

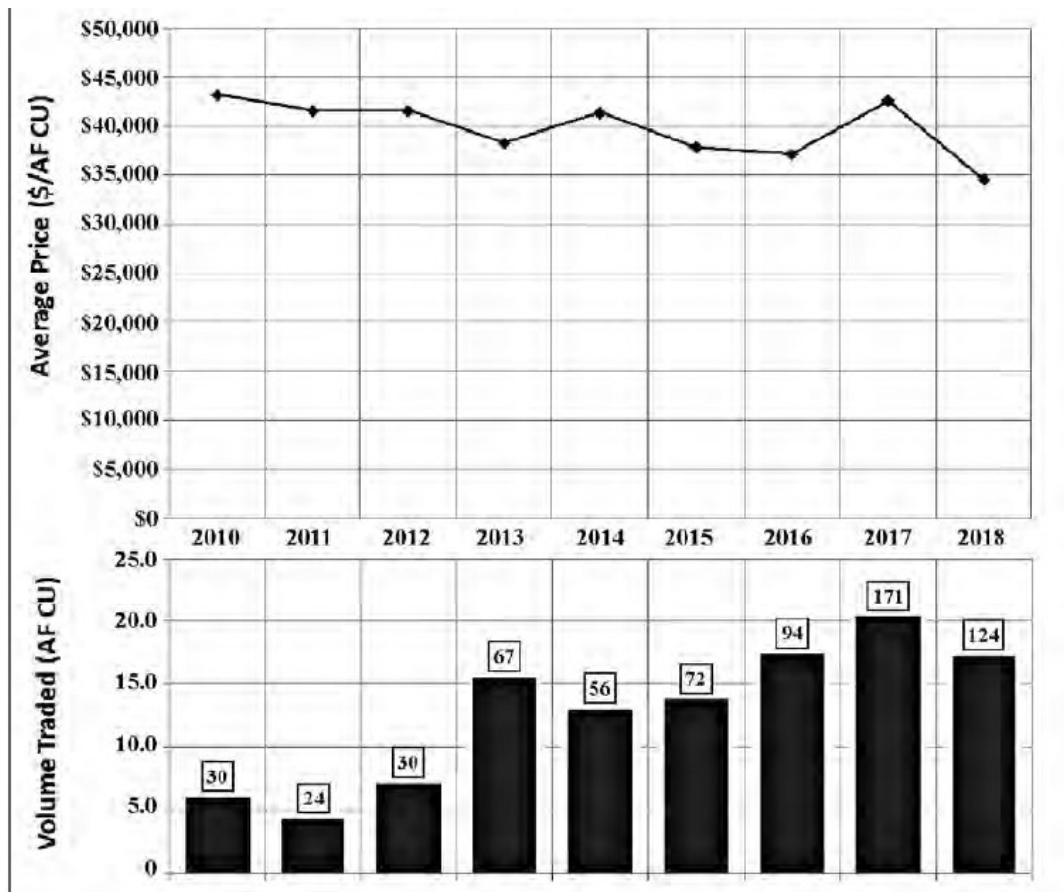


Figure 12. Kittitas County Water Banks, Price & Volume Trends (2010 – 2018)

1. **Regulatory Imperative:** For basins that lack a significant regulatory imperative (e.g., a basin closure like in Kittitas), water prices are often fairly stable and do not rapidly appreciate. However, if Ecology takes a regulatory action in a basin, or if one is anticipated, prices can climb quickly. Prices in the Yakima basin for retail (exempt well) mitigation escalated to over \$100,000 per acre-foot for a few years, before coming back down to around \$35,000 per acre-foot today. For example, if groundwater declines eventually limit a senior water right holder's ability to exercise their water right, they could request Ecology to enforce an impairment claim against junior water users in the same aquifer. Such a curtailment event could create a spike in water prices proportionate to the new demand entering the market.
2. **Individual Details:** Unlike real property transactions, water rights are often about the details. These details can significantly affect price and are often not transparent to the public. For this reason, it can be challenging to look at a water right transactions or prices in the area and draw immediate conclusions about its applicability. Factors include the price of developing the water to seed the bank, permitting costs, reporting costs for the bank, and other factors.

In this case, water bank costs will be overwhelmingly driven by the seeding cost. As an example, Jacobs estimated in Section 4 that the capital cost per acre-foot might be on the order of \$8,500 per acre-foot. If those costs were spread over 20 to 40 years, that cost would translate to about \$200 to \$400/acre-foot/year. Some portion of this would necessarily be paid for by the landowners who would receive benefit from a more reliable water supply. However, it may be possible that federal or state grants may also be accessed to pay a portion of the costs. We evaluated a number of “willingness-to-pay” scenarios in a survey that are discussed in greater detail in Section 6.

6 Communication Plan and Outreach Strategy

In 2019, working with SMID, Aspect created a communication plan (Appendix B and outreach strategy to reach SMID water users in the East Moxee region to gauge interest in moving from groundwater to surface water.

6.1 Outreach Plan

The overall outreach strategy was discussed and agreed upon with SMID and Ecology along with key project area water users and stakeholders. The outreach plan was successfully implemented between summer and fall 2019.

The overall goal of the communication strategy was to provide context and background on water banking and the potential issues regarding water supply in the Project Area; gain broad support from basin stakeholders; and obtain information to shape the Project Area Water Marketing Strategy including:

- Concerns, interests, and preferences of customers, water users in the Project Area
- Perceived market barriers
- Demand and types of potential new uses
- Willingness-to-pay for a new surface water source supplied by SMID

Key outreach materials sent to stakeholders, SMID water users, and interested parties include mailers, a press release, and a survey (these are included as Appendix C. Several meetings with Project Area stakeholders – including a public meeting in October 2019 – were also organized. The outreach plan, with dates and participants, is summarized in Table 3, followed by survey results of participants.

Table 3. Outreach Plan

Date	Outreach Task	Who	Notes
Summer 2019	Sent Newsletter requesting input on water marketing strategy	SMID Users	(see Appendix C)
Summer 2019	Contacted Ecology to input on water marketing next steps	Ecology – Central Office	
Summer 2019	SMID contacted drillers and contractors	Robinson Drilling; Akland Pump; Picatti; Foremost Pump; Blue Star	
Summer 2019	Sent mailers about fall public meeting	Stakeholders and potential East Moxee water users	(see Appendix C)
Summer 2019	Stakeholder meetings: Reached out to area stakeholders individually	Yakama Nation; Yakima County; Ecology; Roza Irrigation District	
Summer 2019	Key water users: Reached out to top area water users	• Martinez Livestock • Black Rock Ranch • Leslie Roy • Ed St. Mary • Austin Allred	Top 5+ irrigators account for ~80% acres (400 – 3,000 acres each)
October 2019	Public Meeting at (location); hosted by SMID	General public	Sent mailers to stakeholders; sent press releases to regional papers. (see Appendix C)
October 2019	Post public and stakeholder meetings survey distribution	Stakeholders and interested parties from meetings	Survey asks demographic; awareness of declining groundwater issue; and willingness to pay opinions. (see Appendix C)
Fall 2019	Presented to Water Transfer Working Group (WTWG)	Key basin interests, including USBR, Ecology, tribes, irrigators, municipalities	
Summer 2020	Key water users: Reached out to top area water users	• Martinez Livestock • Black Rock Ranch • Leslie Roy • Ed St. Mary • Austin Allred	Future funding coordination meeting

Date	Outreach Task	Who	Notes
Summer 2020	Compiled Outreach Results	Key basin interests, including USBR, Ecology, tribes, irrigators, municipalities	
Spring 2021	Finalizing Report	Key basin interests, including USBR, Ecology, tribes, irrigators, municipalities	Updated to include Spring 2021 USBR grant application notes

6.2 Water User Survey Description and Results

Sixteen respondents (out of 103 surveys mailed) replied to the survey, resulting in a 13 percent response rate. Of the 16, the top 5 irrigators – who account for more than 80 percent of the acreage in the Project Area (6,000+ of the 7,400 total acres) – responded.

The survey categories and results are summarized in Table 4. The complete survey questions and results are included in Appendix B:

Table 4. East Moxee Area Water Users Survey Response Summary (16 Respondents)

Survey Question	Total Survey Response
Demographics	
How many irrigated acres?	6,000+ acres
Number of wells?	38 wells
Domestic use vs Irrigated use vs Domestic?	Irrigated = 5,600 acres Stock – 400 acres Domestic = 1 acre
People relying on Domestic Use?	25
Power cost and cost trends required to maintain groundwater source over past 10 years?	8 of 16 responders reported a percentage power cost increase ranging from 10% to 250%
How many wells + how often did you deepen wells? (% of total)	38 wells reported on survey. Deepen Well 7 times (18%). 12 lowering of pumps (32%) of all responders.
10-year cost estimate for well or pump work?	7 of 16 responders reported costs between \$15K - \$1M for well and pump work over last decade
Awareness of Declining Groundwater Issue	
% of users aware of declining groundwater problem	15 of 16 users aware

Survey Question	Total Survey Response
If there's no water in the future: would you fallow/pick dryland vs. leave area?	8 responses, 25% stop farming in the area, 50% reduce irrigated acres, 38% would pick dryland crops. Some responses chose multiple options.
Future Plans	
% willing to accept a new source	Domestic indoor and outdoor (50% willing to pay for reliable source). Willing to pay for a new primary water source? 5/16=31%

6.3 Willingness to Pay for New Water Source

A key purpose of the water user survey was to determine East Moxee Area water user's willingness to pay for a more reliable surface water source delivery by SMID.

The survey proposed three pay scenarios to survey respondents:

- \$70 – half the current SMID assessment per irrigated acre (assumes some grant subsidy for the project)
- \$140 – the current SMID assessment per irrigated acre
- \$280 – double the current SMID assessment per irrigated acre (assumes increased delivery cost and/or less grant subsidy)

Table 5 presents a summary (based out of the 16 respondents, which included the top five irrigators in the area) of the respondents' willingness to pay results.

Table 5. Willing to Pay for New Water Source: Surface Water and Domestic

Surface Water Delivery (6 Yes)	Reliable Outdoor Domestic (8 Yes)	Reliable Indoor Domestic (7 Yes)
3/16 \$280	4/16 \$280	3/16 \$280
2/16 \$140	3/16 \$140	2/16 \$140
1/16 \$70	1/16 \$70	2/16 \$70

Notes: 16 Total Respondents; Some respondents indicated multiple choices

Although the total response rate was low, the response rate amongst the largest users was high. As a function of total water use in the East Moxee area, the survey was deemed successful. Amongst those users, a willingness to help contribute local match towards a future solution was evident. This was further explored in a follow up meeting with irrigators in September 2020. At that meeting, five users each committed \$5,000 local match to grant funding to develop a long-term reliable water supply (Appendix C).

7 Legal / Operational Challenges

The critical water supply challenge in the East Moxee Area took over 100 years to develop and will not be solved overnight. This section describes some of the legal and operational challenges that remain to be evaluated and require further study.

1. **Not all landowners are onboard.** Some landowners feel a different level of urgency on this issue than others. While participation on an acreage basis was high, participation on a user/property owner basis was low. In some cases, the project may not have seemed “real” yet. Ironically, those at the highest risk (junior domestic users) did not participate well while those at lower risk under the prior appropriation system (senior irrigators) did participate. In some cases and due to COVID issues, despite many opportunities to engage, some landowners simply may not have had the time or notice to adequately respond.
 - a. **Action Item:** A more robust outreach strategy needs to be implemented in future phases of the planning effort.
2. **The time to crisis is unknown.** Groundwater users have primarily resolved limiting supply by drilling deeper, conserving water, or voluntarily fallowing less valuable farmland. No regulation has occurred. No building permit for a house has been denied. Ecology has not issued an order turning any diversion off. However, it is unclear how long the current “peace in the valley” will last. The safe sustainable yield of the aquifer is not known.

Could the aquifer support half the existing demand if the other half was supplied by surface water? Or is the recharge so low that little to no existing demand can be supplied? The information needed to make regulatory decisions on how the basin will eventually be managed with a new demand likely comprised of priority domestic uses (that can’t be easily served by new surface water sources) and senior irrigators (first in time is first in right) will require a significant investment.

- a. **Action Item:** Refine the existing USGS groundwater model to determine safe sustaining yield and required participation in a water market to eliminate groundwater declines.
3. **Out-of-basin physical supply is limiting.** The most likely solution for a substantial amount of offset water for declining groundwater users comes from Yakima River supplies—either existing uses that are retired or opportunistic surplus water above existing objectives. Retiring existing uses is expensive and significant competition exists for any opportunistic surplus water diversions, primarily through YBIP goals that don’t include solving the East Moxee area problem.
 - a. **Action Item:** Coordinate with YBIP Leadership to determine an integration strategy for physical supply.
4. **An environmental impact statement (EIS) is likely needed.** The magnitude of environmental changes for a project like this would likely necessitate an EIS. Miles of new canal or pipeline would be constructed along with numerous laterals and turnouts

and out-of-basin supplies would likely be accessed. Some synergy with the YBIP Programmatic EIS environmental review may exist, but additional project level environmental review would be needed.

- a. **Action Item:** Coordinate to identify a SEPA (and potentially NEPA) champion for environmental review.

5. **The economic story needs to be told.** If groundwater declines result in farms or homes in the East Moxee Area being unable to withdraw water, there could be significant economic impacts in the area. In this Study, we tried to put some order of magnitude on the issues here. USDA maintains statistics on farm values for Washington and Yakima County.¹⁶ These are regional values across a wide range of circumstances.

For 2019, average irrigated farmland values in Yakima County are on the order of \$7,700 per acre. For the 4,390 acres that expressed interest in the survey, that equates to a value on the order of \$34 million dollars. If all those farmers were unable to irrigate, all of them choose to dryland farm instead, then that \$34 million dollar “loss” would be offset by dryland gains on the order of \$6 million (based on \$1,250/dryland acre). However, farmland value is only part of that story. Purchase of fuel, seed, tractors, and fertilizer by farms has indirect benefits on the economy. People working at the farms receive salaries, pay their mortgages, and spend their money in the economy, which has induced economic benefits. Finally, the risk to homes and businesses in the area has a significant economic value. A holistic evaluation of jobs, tax base, and economic impact will help us understand and compare the costs of a project solution.

- a. **Action Item:** Economic study to help inform potential impacts of the Do-Nothing alternative and to support project funding.

6. **Easements, alignments, and property owner access need to be negotiated.** The proposed project will require significant property owner coordination for new pipelines. In many cases, those property owners will be beneficiaries of water supply from the project and will likely be motivated to coordinate on access. However, some may not receive any benefit and efforts to negotiate easements or potentially condemn land may be required.

- a. **Action Item:** Create a landowner access database for likely alignments and an outreach strategy for each landowner.

7. **A water banker needs to emerge.** SMID was willing to manage this study because it has infrastructure upgrades in its system that are required in the coming years and it is developing a water bank with approximately 9,000 acre-feet of surplus water that could be made available for purchase or lease. It has not made any decision regarding whether this project is the highest and best use of any or all of that supply. SMID wanted to avoid a situation where it upgrades its canals and then five years later they are undersized to serve a regional problem that it would likely be asked to help solve. Other water bankers could also emerge, including Ecology and Yakima County.

¹⁶ https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Cash_Rents_by_County/

- a. **Action Item:** Coordinate an interlocal agreement to identify who will lead and who will support this effort if landowner participation remain high.
- 8. **Project design to the 10 percent level should be completed.** Design concepts completed to-date are conceptual. In order for a Preferred Alternative to be selected, design should be advanced to a level sufficient to rule out fatal flaws and more accurately estimate project capital and operation and maintenance costs.
 - a. **Action Item:** Fund a feasibility study resulting in 10% design and cost estimates.

These major issues will likely form the foundation of the next phase of study for this effort. Funding of the next phase of work and future capital efforts are described in Section 8.

8 Selection of a Preferred Alternative

Much work remains to develop a water market to meet the needs of water users in the East Moxee Area. Based on the analysis and feedback to-date, SMID selected the following characteristics of a Preferred Alternative. SMID proposes to further investigate and refine this effort in the next phase of work:

1. A water bank should be created to supply the East Moxee area.
2. Water for the bank should be seeded from multiple sources, inclusive of private water transfers from land owners who will benefit from water in the East Moxee area, and water supply from the Yakima River basin.
3. The water bank should be integrated and coordinated with YBIP goals and projects.
4. Yakima County or Ecology should consider implementing this water bank, although SMID remains willing to consider implementation and has proposed to remain the champion for this project for the next phase of work.
5. Supply for the water bank should be conveyed through SMID's system. However, SMID remains open to a partial conveyance of supply through the Roza Irrigation District system if that is preferred by both Roza Irrigation District and land owners who already receive water from Roza Irrigation District.
6. Costs to implement the water bank should be born by both local funding, and state and federal resources. The economic costs of losing this significant agricultural, commercial, institutional, and domestic area of Yakima County can likely be overcome only through a shared cost implementation strategy.
7. Trust water agreements (for water rights seeding the bank), interlocal agreements (between SMID and proposed water bankers if not SMID), water service contracts (between land owners and the water bank) are all needed and should be developed in the next phase of work.
8. A master funding strategy building off the elements in the next chapter should be developed to implement the bank. A sustained source of funding from OCR and/or the State legislature should be developed to ensure progress on this effort is made.
9. A broad communication strategy including a dedicated website, storymap, and outreach documents should be created to keep the public informed on the progress of this initiative.

9 Project Financing

Implementation of a solution to declining groundwater in the East Moxee Area will require funding for future studies, environmental review, capital projects, project operation and maintenance, and water bank implementation. In spring/summer 2021, SMID applied to several funding opportunities including:

- USBR’s WaterSmart Water Marketing grant funding program to continue its water market work (award notice pending in late summer 2021).
- Washington State legislative funding sponsored by the office of Senator Jim Honeyford (\$300,000, grant award notice received, funding available after July 2021).
- United States legislative funding sponsored by the offices of Senators Patty Murray and Maria Cantwell (application submitted).

As part of these funding opportunities, SMID received support from a variety of basin stakeholders. These letters of Support include:

- Yakima County
- Washington State Department of Ecology/Office of Columbia River
- City of Moxee
- Washington State Department of Commerce
- Washington State Senator Jim Honeyford (15th Legislative District, includes the Project Area)
- Roy Farms (one of Project Area’s biggest irrigators)

At the time of this writing, the outcome of some funding applications are pending, but the anchor funding of at least \$325,000 is encouraging. The following section provides an overview of funding options for these needs.

9.1 2021-2023 Biennium Funding Strategy

The likely funding needs based on the eight critical path “Next Steps” outlined in Section 6 are estimated as follows, inclusive of project and grant management needs and regulatory coordination:

- Landowner outreach (\$50,000)
- Groundwater Model and Safe Sustaining Yield Study (\$250,000)
- Out-of-Basin Supply Coordination (\$100,000)
- Project EIS (\$750,000)
- Economic Study (\$100,000)
- Easement / Access Study (\$50,000)
- Water Banking Interlocal Agreement (\$50,000)

- Design to 10% Level (\$400,000)
- **Total (\$1.75 million, 2020 Dollars)**

At the end of the next phase of the project, a final project champion will be selected, environmental review conducted, 10% design completed, final landowner participation identified, and the implications that an alternative supply will have relative to the long-term capacity of the aquifer will be known.

The following funding sources have potential to help fund the proposed next phase:

- **Landowner Participation** – Local landowner match can provide some contribution to this effort. At the time of this Study, 5 landowners have pledged matching funds of \$5,000 each as described in the Landowner Agreements in Appendix B.
- **Office of Columbia River** – The Office of Columbia River has water supply development and new water right application mandates in Chapter 90.90 RCW. OCR is also leading the YBIP effort, which is intended to address the major water supply challenges in the Yakima Basin. Solving fish issues, prorationed supplies, municipal growth, habitat, and fish passage, but not solving the major declining groundwater area in the basin would be an incomplete success.

OCR budgets for other key watershed planning efforts like the Icicle Basin and Walla Walla basin are on the order of \$1.5 to \$4 million each year. YBIP budgets are on the order of \$40 million each year. If OCR is willing to partner on helping solve this challenge, then they could be a funding partner.
- **USBR WaterSmart Grants** – USBR funded this Study and could fund later phases of work. USBR grants that address declining groundwater and include water marketing as a solution are competitive but the program includes national competition.
- **State Legislative Funding** – The Washington State Legislature has the ability to appropriate direct funding through Commerce Grants or other funding.

9.2 Proposed 2021-2023 Schedule

At the time of this report, the next stage of USBR and state/federal funding for the SMID project is still pending. If funding is awarded as proposed, Table 6 provides a proposed schedule to perform water marketing tasks for 2021-2023.

Elements are coordinated to try and have as much outreach and work done for a mid-year 2022 Open House with affected stakeholders:

Table 6. Proposed Schedule for Water Marketing Tasks, 2021-2023

Element	Description	Start Date - End Date
Master Tasks (Applying to all 4 elements)		
0.1	Develop project workplan , including tasks and subtasks, work schedule, and roles/responsibilities	September 2021 - 2022
0.2	Quarterly Progress Updates , including outreach to internal contractors and Reclamation funders	Quarterly 2021-2023
0.3	Prepare draft technical report summarizing the East Moxee Water Marketing Strategy based on the work completed under the 4 elements	March 2023
0.4	Prepare final technical report following online review period and comment solicitation, summarizing the East Moxee Water Marketing Strategy based on the work completed under the 4 elements	July 2023
Element 1: Outreach		
1.1	Update outreach materials , including improved flyers, mailers, survey, and messaging to small users	October 2021
1.2	Develop improved mailing list and telephonic contacts , as well as radio spots, news ads, etc.	December 2021
1.3	Perform outreach efforts leading to Open House	Jan to April 2022
1.4	Open House	May 2022
1.5	Analyze survey info and document participation	June to Oct 2022
Element 2: Market Supply Evaluation		
2.1	WSDA Crop Evaluation , to determine pool of rights that could help seed the market	October to December 2021
2.2	YBIP Coordination , to determine how surplus water can be accessed without conflicting with YBIP goals	November 2021 to May 2022
2.3	Communication of Options , to East Moxee users	May 2022
2.4	Documentation of Preferred Alternative	June to Oct 2022
Element 3: Economic Evaluation		
3.1	Select qualified Economist	November 2021

Element	Description	Start Date - End Date
3.2	Develop economic data required for study	January 2022
3.3	Draft economics report,	May 2022
3.4	Integrate into marketing report	March 2023
Element 4: Water Bank Interlocal Agreement		
4.1	Key entity meetings, County, Ecology, non-profits	Spring 2022
4.2	Input from water user	May 2022
4.3	Negotiate Letter of intent or interlocal agreement	Fall 2022
4.4	Integrate into marketing report	March 2023

9.3 2023-2031 Biennium Funding Strategy

The cost of a final Preferred Alternative cannot be accurately predicted at this stage. Based on the \$84 million dollar construction cost summarized in Section 4.6.6 and discussed in detail in Appendix A, considering the need for property acquisitions for easements, inflation, and contingency, a total cost of \$100 million was assumed in this Study—this is a significant effort, but not untenable.

Similar basin-scale water resource improvement efforts in Washington state include the Walla Walla Flow Study effort (estimated at over \$300 million)¹⁷, the Icicle Strategy (on the order of \$90 million)¹⁸, and the YBIP (several billion)¹⁹. All of these have different purposes, but it is possible to capitalize that kind of investment if there is broad stakeholder support around a common alternative and if the cost of the “do-nothing” alternative is higher. Given the level of effort required, this study assumes that funding would be needed over an eight-year timeframe for completion of the work.

The same funding sources employed in Section 8.1 are likely needed for this effort, just to a greater extent. The funding source that would likely increase the most is local match. Based on the survey results described in Section 6, it appears that 10 percent of the final project could be paid by local landowners over a 20-year period.²⁰

¹⁷ <http://www.wwbwc.org/assessment/57-wwflow.html>

¹⁸ <https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-supply-projects-EW/Icicle-Creek-strategy>

¹⁹ <http://www.yakimariver.org/>

²⁰ 10 percent or approximately \$9 Million, taken from adding the cost each landowner said they would pay times the amount of acres in that category (see Section 6.3), summing them together and multiplying by 20 years.

10 References

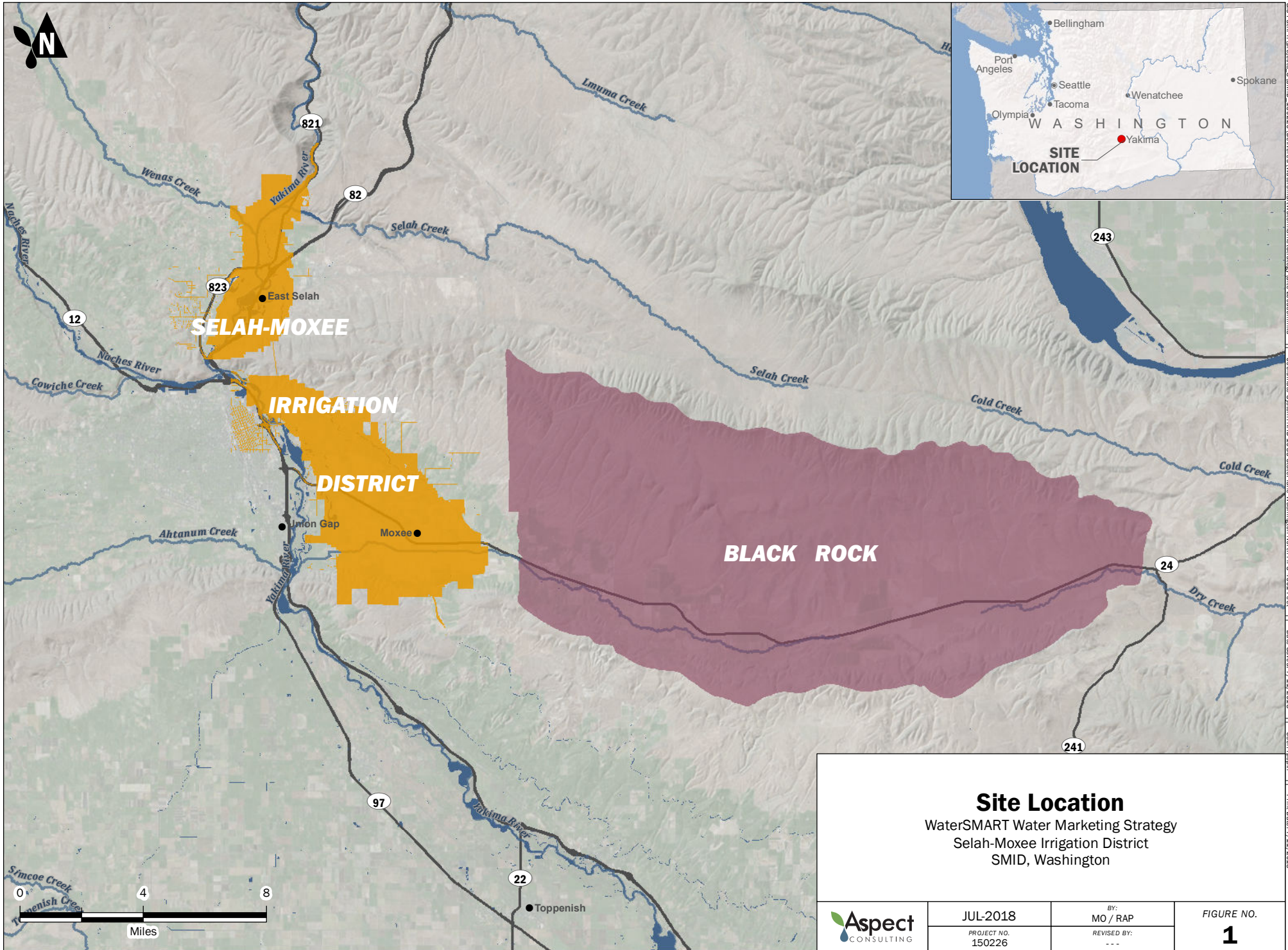
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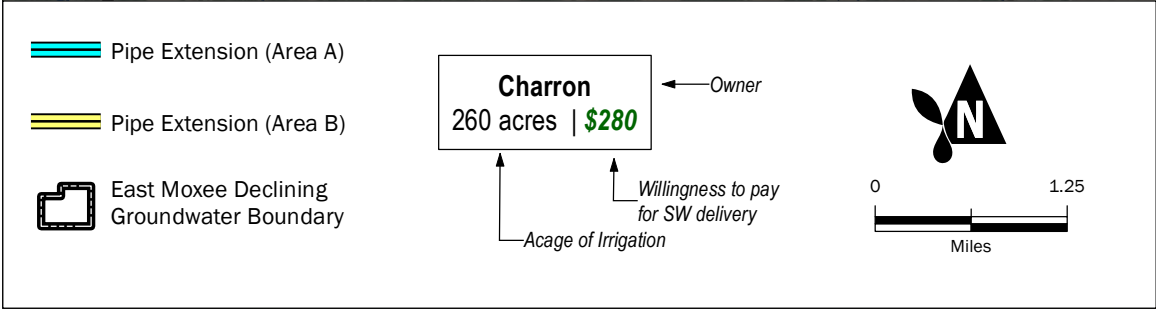
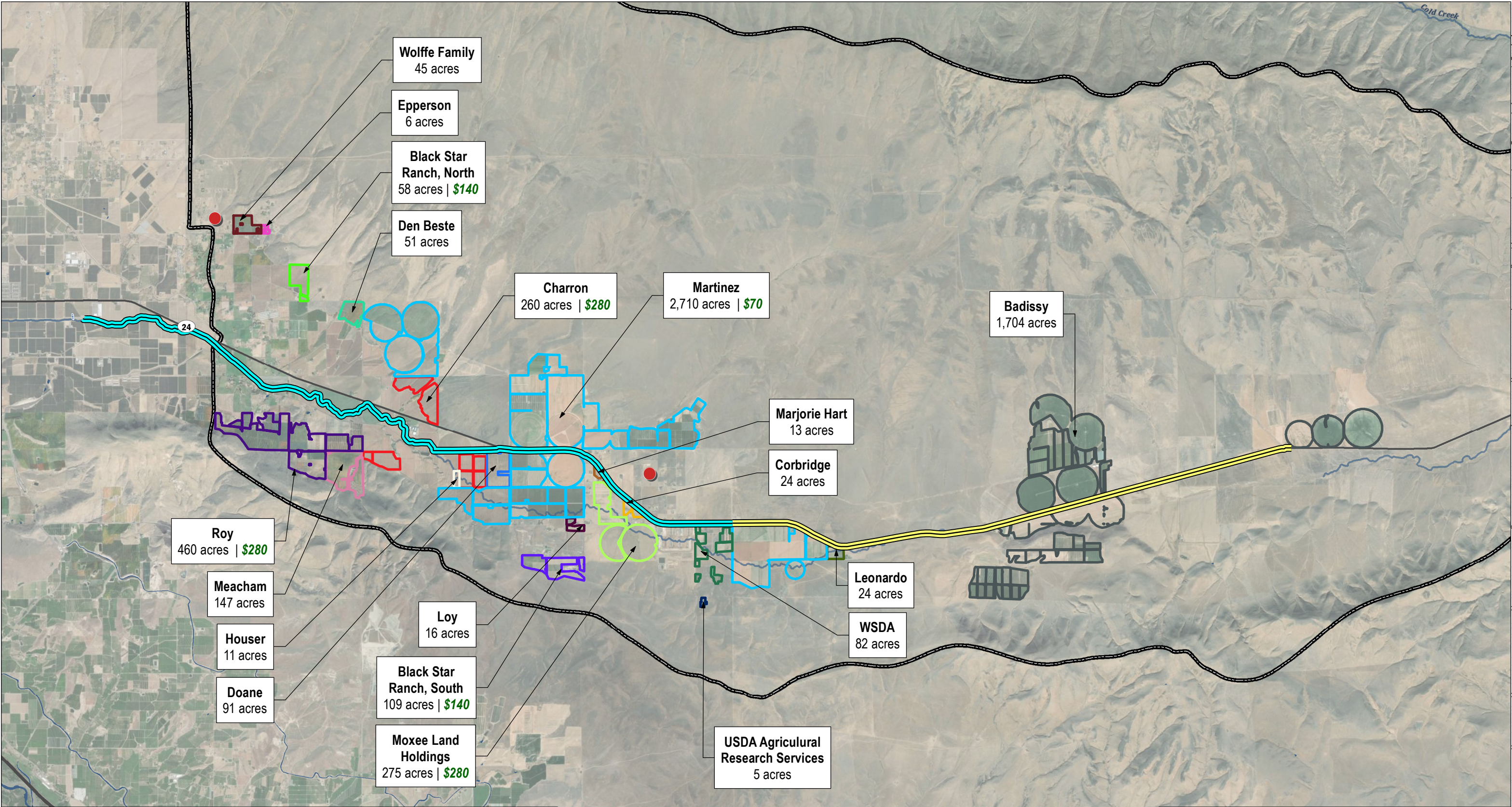
11 Limitations

Work for this project was performed for the Selah Moxee Irrigation District (Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

FIGURES





East Moxee Irrigation Owners and SMID Service Extension

Black Rock Study
Yakima County, Washington

	MAY-2020	BY: JMS / TDR	FIGURE NO. 7
	PROJECT NO. 180665	REVISED BY: ---	

APPENDIX A

July 2020 East Moxee Infrastructure Needs and Cost Evaluation, Jacobs Engineering

Subject	Infrastructure Needs and Cost Evaluation	Project Name	East Moxee (Black Rock Area Water Marketing Strategy Groundwater Study)
Attention	Dan Haller, Aspect		
From	Carrie Mauss		
Date	July 16, 2020		
Copies to	Nathan Draper, SMID; Ed Thomas, Jacobs		



Goals

- Evaluate infrastructure needs and costs of providing water to the Black Rock area and potential mechanisms of service for the different delivery options.
- Differentiate surplus water available during the irrigation season versus surplus water outside the irrigation season requiring on-farm storage.

Executive Summary

As water flows through the SMID system, irrigators are pulling from the canal system and the size of the canal decreases to accommodate decreasing water flowrate. Discussions with SMID identified the vicinity of the existing Walters Spill as a reasonable location for diverting water from the SMID system to new infrastructure that would supply Black Rock (Area A). Approximately one half mile of existing canal immediately upstream of Walters Spill can be increased to a capacity of 54 cfs for an approximate cost of \$100,000. Both the existing canal size and the improved canal size will be evaluated.

Typically, the canals in Yakima Valley run water from mid-March to mid-October. Diverting water for approximately one extra month per year as weather allows (beginning of March and end of October) would allow for more water storage for Area A outside of the traditional season. November thru February would be used for canal and system maintenance as it is not reasonable to expect the SMID canal to flow reliably during freezing winter months. This study assumes the canals can divert water to Area A storage from March 1st to October 31st, resulting in a total of 16,010 acre-feet available. A conservative estimate for total volume of water required to grow apples with a cover crop in Area A is 14,800 acre-feet.

Although the water available to divert is greater than what is required to farm Area A, the existing SMID headworks and canal capacity limit flow during peak water usage months. This results in less flow available to feed Area A since SMID is using the existing canal capacity to convey water to their existing irrigators during peak water usage months of June, July, and August. Approximately half of the water required to irrigate Area A could be provided with no improvements to the system and no storage. In

order to access enough water to irrigate for the complete season, the other half of the water volume would need to be stored during off-peak months, such as March, April and October for use during water heavy months. A large reservoir will need to store the late season and early season excess water to be used during the season peak. A single reservoir is the most cost-effective solution.

The average reservoir size required between 2014 and 2019 with no canal improvements for exclusively covered apple irrigation is 7,300 acre-feet. The average reservoir size required between 2014 and 2019 with canal improvements and using 0.01 cfs/acre peak irrigating rate is 3,600 acre-feet.

The total cost of the project, including 9.7 miles of pipeline, a single pump station and a single 3,500-acre-feet reservoir would be approximately \$84M in 2020 dollars. Connecting this cost back to **Table 1** and the conservative estimate of 14,800 acre-ft being required for Area A, the project would cost approximately \$5,700 per acre-ft.

Response

Location

The Black Rock study area has been divided into Area A and Area B based on geographical separation of parcels and owners. Area B is not included in this study because of lack of interest by irrigators who own the parcels. Area A includes 4,390 acres of irrigable land. For comparison, SMID includes approximately 7,396 acres of irrigable land.

Capacity

The fish screen at the intake of the SMID canal was designed for a maximum flow of 100 cfs. However, due to canal and tunnel limitations in the upstream half of the canal system, 90 cfs is the maximum flow diverted to the SMID canal system. The cost of increasing the canal capacity to meet the 100 cfs fish screen capacity would be very expensive to the point of being restrictive and is not evaluated in this study. The estimate of 90 cfs for the upper canal capacity is consistent with the flowrate being used for upper canal and pipeline designs currently in progress by Jacobs for SMID.

As water flows through the SMID system, irrigators are pulling from the canal system and the size of the canal decreases to accommodate decreasing water flowrate. Discussions with SMID identified the vicinity of the existing Walters Spill as a reasonable location for diverting water from the SMID system to new infrastructure that would supply Black Rock (Area A). The last approximately half mile of the SMID canal system upstream of the Walters Spill is approximately 6 feet wide, 4 feet deep, and capable of conveying 49 cfs. This portion of canal is being selected for analysis because of its short length and the ease of increasing the capacity to match the canal immediately upstream. If this last half mile was increased to 7 feet wide and 4 feet deep to match the upstream canal capacity it would be capable of carrying 54 cfs for an approximate cost of \$100,000. Both the existing canal size and the improved canal size, as shown in **Table 1**, will be evaluated.

Table 1. Canal Capacity Comparisons

Canal Capacity	
90 cfs	Headworks
49 cfs	Existing Canal Capacity at Walters Spill (6 ft wide, 4 ft deep)
54 cfs	Improved Canal Capacity at Walters Spill (7 ft wide, 4 ft deep)

Available Water

Open canal systems utilize operational spills in order to provide water to their users. This is different than a closed pipe system where operational efficiency is maximized, and water is only removed from the system at irrigation turnouts. The SMID canal system has several spills along its route that help regulate the water within the canal. For the Area A analysis, it is not feasible to capture the excess operational water from the spills, with the exception of one. The Walters Spill is near the end of the SMID canal and flows into the Moxee Drain. All water sent to the Moxee Drain via the Walters Spill could be captured and utilized to irrigate Area A.

Typically, the canals in Yakima Valley run water from mid-March to mid-October. Diverting water for approximately one extra month per year (beginning of March and end of October) would allow for more water storage for Area A outside of the traditional season. November thru February would be used for canal and system maintenance as it is not reasonable to expect the SMID canal to flow reliably during freezing winter months. The open canals freeze, the canal banks are not accessible, and the headworks freeze up. Weather patterns vary annually and may alter the operational window, which would impact water available for use at Area A. This study assumes the canals can divert water to Area A storage from March 1st to October 31st, resulting in a total of 16,010 acre-feet available as shown in **Table 2** for 2019.

Table 2 depicts the amount of water available to Area A Without Improvements. The flow measured at the headworks and flow measured at Walters Spill represent actual 2019 water flow rates in the SMID system. Water available to Area A, calculated in acre-ft, is determined by subtracting water usage from the full headworks capacity of the canal, with a maximum availability equal to the capacity of the canal at Walters Spill. Water usage is the difference between the water measured at the headworks and the water spilled at the Walters Spill. Note that in March of 2019, there was no flow measured at the headworks, and thus none was flowing through Walters Spill. Therefore, the water available to Area A is the maximum possible, 49 cfs, as shown in **Table 1** as the existing canal capacity at Walters Spill. Converted to acre-ft, the water available to Area A in the month of March in 2019 is 2,956 acre-ft. Water usage in the SMID system during any month could be a maximum of 41 cfs, which is the difference between 90 cfs (the maximum flow at the headworks) and 49 cfs (the maximum flow at Walters Spill), without affecting the flow available to Area A. However, when the existing system uses more than 41 cfs, like in April, the water available to Area A drops below 2,956 acre-ft. In April, the difference between water at the headworks and the water at Walters Spill is 42.8 cfs. That means 42.8 cfs was used in the SMID system before getting to Walters Spill. Subtracting 42.8 from the 90 cfs (the maximum flow at the headworks) leaves 47.2 cfs available to Area A which is approximately 2845 acre-ft. It is important to

note weather plays an important role in available water. For the purpose of this study, it is assumed water can be diverted from March through October, although weather conditions may not allow for water in the system in the early and late months.

Table 2. Water Available to Area A Without Improvements

2019													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Flow measured at Headworks, cfs	0	0	0	54	74.5	78	76.8	71.6	63	40.4	0	0	-
Flow measured at Walters Spill, cfs	0	0	0	11.16	11.63	4.51	3.7	6.14	8.12	5.4	0	0	-
Water Available to Area A parcels ¹ , acre-ft	0	0	2,956	2,845	1,637	996	1,020	1,481	2,119	2,956	0	0	16,010

1. Water available is determined by subtracting water usage from the full headworks capacity of the canal, with a maximum availability equal to the capacity of the canal at Walters Spill. Water usage is the difference between the water measured at the headworks and the water spilled at the Walters Spill. Table 2 assumes water fully available in March. In some years, this could be reduced by 50% or more depending on canal startup and weather conditions.

Required Water

Peak delivery provided to parcels currently utilizing the SMID canal system is 6 gallons per minute per acre. Area A will be provided a peak delivery of 5 gallons per minute per acre. Area A includes 4,390 acres of irrigable land, resulting in 49 cfs of total flow required to irrigate Area A at peak usage. Pump Station and pipeline improvements would be sized based on this flow requirement, but the volume of water required by Area A for the entire irrigation season depends on the variable monthly crop water demands which are a function of weather patterns and crops planted.

The Washington Irrigation Guide provides guidance on a monthly basis for the volume of water different crops in the Yakima area need throughout the growing season. For the purpose of this study, it is assumed all parcels in Area A will be fully irrigated. Initial calculations assumed all parcels would also be farming apples with a cover crop. This is both realistic given regional farming practices and conservative as apples with a cover crop require the largest total volume of water of all crops evaluated in the Yakima area. The total volume of water required to grow apples with a cover crop in Area A is 14,800 acre-feet. Comparatively, if all parcels in Area A produced grapes, the total volume of water required for the irrigation season would be 9,600 acre-feet. The volume of water required for Area A decreases for less water consumptive crops, but volumes shown in **Table 3** for apples and grapes provide a reasonable boundary to the water use requirements.

Table 3. Water Volume Requirements for Area A

Delivery	
5 gal/min/acre	Peak flow rate provided to irrigators
Area A	
4,390 acres	Total acreage
49 cfs	Total Flow required
14,800 acre-ft	Total volume of water required to feed Area A for covered apple irrigation season
9,600 acre-ft	Total volume of water required to feed Area A for grape irrigation season

Available vs. Required Water

For 2019, **Table 2** indicates 16,010 acre-feet of water is available and **Table 3** indicates up to 14,800 acre-feet are required. While this looks promising, the existing SMID headworks and canal capacity limit flow during peak water usage months. Less flow is available to feed Area A since SMID is using the existing canal capacity to convey water to their own irrigators during peak water usage months of June, July, and August. Approximately half of the water required to irrigate Area A could be provided with no improvements to the system and no storage. In order to access enough water to irrigate for the complete season, the other half of the water volume would need to be stored during off-peak months if weather allows, such as March, April and October for use during water heavy months.

As previously indicated, the water volume is available from SMID's existing system, but the size of a reservoir required to store the water during off peak months is costly. SMID could perform conservation improvements such as spill reduction and piping to offset some of the required reservoir storage volume. However, even piping the entire SMID system and maximizing efficiency, the headworks and tunnel still limit the flow available to Area A. Reservoir construction would still be needed. The following sections evaluate potential improvements to the SMID system.

Canal Improvement Evaluation

The water available to Area A changes minimally with the canal widening improvements just upstream of Walters Spill as discussed in the *Capacity* section of this report. For the majority of the year, water available to Area A is less than the 49 cfs capacity of the canal immediately upstream of the Walters Spill. Increasing the capacity of the canal does not make more water available during peak months since the headworks is already operating at maximum flow. During March and October, water usage is low and the canal can run at full capacity through Walters Spill if weather conditions allow. During these two months, widening the canal allows more water to be conveyed to Area A as shown in **Table 4**. In 2019, approximately 600 more acre-feet could be conveyed to Area A under covered apple irrigation assumptions. This value is fairly consistent year to year. **Table 5** shows the difference between irrigating covered apples and grapes if canal improvements were made. In other high-usage months, increasing the canal capacity at the lower end of the system doesn't offer advantages unless the headworks was capable of diverting more water.

Table 4. Monthly Water Evaluation With Canal Widening Improvements¹ vs. Without Improvements

2019												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Without Canal Improvements												
Water Available to Area A parcels, acre-ft	0	0	2,956	2,845	1,637	996	1,020	1,481	2,119	2,956	0	0
Area A needs based on irrigation usage for Covered Apples, acre-ft	0	0	0	154	1,822	2,319	4,320	3,475	2,125	571	0	0
Water Available to Area A Parcels without Storage, acre-ft	0	0	0	154	1,637	996	1,020	1,481	2,119	571	0	0
Water Available for Area A Storage, acre-ft	0	0	2,956	2,692	0	0	0	0	0	2,386	0	0
Excess/(Deficit), acre-ft	0	0	2,956	2,692	(185)	(1,323)	(3,301)	(1,995)	(7)	2,386	0	0
With Canal Improvements												
Water Available to Area A parcels, acre-ft	0	0	3,258	2,845	1,637	996	1,020	1,481	2,119	3,258	0	0
Area A needs based on irrigation usage for Covered Apples, acre-ft	0	0	0	154	1,822	2,319	4,320	3,475	2,125	571	0	0
Water Available to Area A Parcels without Storage, acre-ft	0	0	0	154	1,637	996	1,020	1,481	2,119	571	0	0
Water Available for Area A Storage, acre-ft	0	0	3,258	2,692	0	0	0	0	0	2,687	0	0
Excess/(Deficit), acre-ft	0	0	3,258	2,692	(185)	(1,323)	(3,301)	(1,995)	(7)	2,687	0	0

1. Canal widening for ½ mile upstream of Walters Spill

Table 5. Total Water Comparison Between Improvements vs. Without Improvements for Covered Apples and Grapes

2019 (Covered Apples)		2019 (Grapes)	
Without Canal Improvements		Without Canal Improvements	
Water Available to Area A parcels, acre-ft	16,010	Water Available to Area A parcels, acre-ft	16,010
Area A needs based on irrigation usage for Covered Apples, acre-ft	14,790	Area A needs based on irrigation usage for Grapes, acre-ft	9,560
Excess/(Deficit), acre-ft	1,220	Excess/(Deficit), acre-ft	6,450
With Canal Improvements		With Canal Improvements	
Water Available to Area A parcels, acre-ft	16,610	Water Available to Area A parcels, acre-ft	16,610
Area A needs based on irrigation usage for Covered Apples, acre-ft	14,790	Area A needs based on irrigation usage for Grapes, acre-ft	8,660
Excess/(Deficit), acre-ft	1,830	Excess/(Deficit), acre-ft	7,950

If the entire SMID system was piped, then water typically lost to spills, evaporation, or infiltration could be conveyed further down the system during peak water usage months, helping offset storage requirements. SMID's 2015 Feasibility Investigation indicated that piping the entire SMID system (lining the East Selah area) was estimated to cost \$65M in 2015. The Feasibility Investigation also estimated that Phase 1 conservation improvements downstream of Walters spill would save approximately 1,110 acre-feet annually. The saved water would be available at Walters Spill for feeding Area A. The estimated cost of the Phase 1 piping was \$7.2M in 2015.

Storage

The reservoirs used by farmers for frost protection are typically very small and only provide enough water to meet the peak frost protection needs for short periods of time. It is unlikely they would be able to make up for the additional demands of Area A. A large reservoir will need to store the late season and early season excess water to be used during the season peak. A single reservoir is the most cost-effective solution.

Under the most conservative assumptions of no canal improvements for exclusively covered apple irrigating in 2014, the total water available for storage in the existing system for the months of March, April and October totals approximately 7,500 acre-feet. In the same year, 8,900 acre-feet would have been needed from the reservoir during the months of May, June, July, August and September. There was a deficit of 1,400 acre-feet of water available. As shown in **Table 6**, A reservoir would need to be 8,900 acre-feet to meet the needs of Area A in 2014, but only 7,500 acre-feet of water was available to collect.

Table 6. Water available for storage in 2014

2014 Water Storage	
Off-Peak Season ¹ Water Available for Storage, acre-ft	7,600
Peak Season ¹ Water Requirements, acre-ft	9,000
Annual Volume Excess/(Deficit), acre-ft	(1,400)

1. Off-peak season includes March, April and October. Peak season is May, June, July, August and September.
2. Irrigation season runs from March through October. Water cannot be in the canals outside of the irrigation season.

Comparatively, 2017 was a more average year. With no canal improvements for exclusively covered apple irrigation, the total water available for storage for the months of March, April, May and October totals approximately 8,200 acre-feet. In the same year, only 7,500 acre-feet would have been needed from the reservoir during the months of June, July, August and September. There was 700 acre-feet of excess water available. As shown in **Table 7**, A reservoir would only need to be sized to hold 7,500 acre-feet to meet the needs of Area A in 2017. The average reservoir size required between 2014 and 2019 with no canal improvements for exclusively covered apple irrigation is 7,300 acre-feet.

Table 7. Water available for storage in 2017

2017 Water Storage	
Off-Peak Season ¹ Water Available for Storage, acre-ft	8,200
Peak Season ¹ Water Requirements, acre-ft	7,500
Annual Volume Excess/(Deficit), acre-ft	700

1. Off-peak season includes March, April and October. Peak season is May, June, July, August and September.

2. Irrigation season runs from March through October. Water cannot be in the canals outside of the irrigation season.

The Washington Irrigation Guide is conservatively high when evaluating the need for crops by region. Arguably more realistic is using a 0.01 cfs/acre rule of thumb as a guide for peak water usage in the Yakima Valley. This rule of thumb value of 0.01 cfs/acre was accepted by the court in the Yakima River Adjudication case. Using this less conservative method in the worst-case year, 2014, the total water available for storage in the existing system for the months of March, April, May, September and October totals approximately 10,000 acre-feet. In the same year, only 4,700 acre-feet would have been needed from the reservoir during the months of June, July, and August. There was 5,300 acre-feet of excess water available. A reservoir would only need to be sized to hold 4,700 acre-feet to meet the needs of Area A in 2014 under these conditions.

Using the less conservative rule of thumb method in an average year, 2017, the total water available for storage in the existing system for the months of March, April, May, September and October totals approximately 11,000 acre-feet. In the same year, only 3,500 acre-feet would have been needed from the reservoir during the months of June, July, and August. There was 7,500 acre-feet of excess water available. A reservoir would only need to be sized to hold 3,500 acre-feet to meet the needs of Area A in 2017. The average reservoir size required between 2014 and 2019 with canal improvements with 0.01 cfs/acre peak irrigating rate is 3,600 acre-feet.

To put the storage needs in perspective, the three re-regulation reservoirs that were built on the Sunnyside Canal starting in 2010 only have a capacity of about 400 acre-feet each and cost roughly \$5M each at the time. Roza Irrigation District recently constructed a 1,600 acre-feet re-regulation reservoir for approximately \$31M.

Pump Station

A pump station will be required to provide water to Area A because there is approximately 500 feet of elevation gained along the proposed highway route. Comparable pump stations would cost approximately \$800,000.

Piping and Turnouts

Assuming a maximum of 49 cfs conveyed along the highway 24 route, it would cost approximately \$15M to construct 9.7 miles of pipeline.

Conclusions

The total cost of the project, including 9.7 miles of pipeline, a single pump station and a single 3,500-acre-feet reservoir would be approximately \$84M in 2020 dollars. Connecting this cost back to **Table 1** and the conservative estimate of 14,800 acre-ft being required for Area A, the project would cost approximately \$5,700 per acre-ft. This does not include pumping costs, which are expected to be equal or less than pumping from deep wells.

APPENDIX B

Communications Plan

2018-2019 SMID Water Marketing Communication Plan

- 1. Send newsletter to SMID users**
- 2. Contact Ecology for input**
- 3. Contact drillers and contractors**
 - Mike Poulin, Robinson Drilling, Akland Pump, consultants, others
- 4. Send mailers to Stakeholders and potential black rock water users (September)**
- 5. Stakeholder meetings: Reach out to Stakeholders individually (September-October)**
 - Yakama Nation
 - Yakima County (Joel Freudenthal)
 - Ecology (August 27th Meeting)
 - Roza Irrigation District
- 6. Water Users: Reach out to Black Rock area users:**
 - Top 5-7 irrigators account for ~90% acres (100 – 2700acres each) (September)
 - Meet in small groups or individually
- 7. Public Meeting (mid-October)**
 - Notification process: Include information in survey packet, public notice, Letter?
- 8. Send Survey: Following stakeholder meetings and after public meeting. (late October)**
 - Survey uses willingness to pay options: \$60 (half current assessment); \$120 (current assessment); \$240 (double); Urgency time frame, volumes; Delivery preference
- 9. Present to Water Transfer Working Group (WTWG)**
- 10. Compile outreach results**

APPENDIX C

Summary of 2019-2020

Public Outreach Documents

Selah-Moxee Irrigation District News Release – September 27, 2019

October 17 Public Meeting Discusses Options to Replace Declining Groundwater Supplies in Black Rock Area of Yakima Valley

Moxee, WA – The Selah-Moxee Irrigation District (SMID) is conducting a study to evaluate potential water supply options that address declining groundwater in the Black Rock area east of Moxee, Washington and is seeking feedback at a public meeting on October 17 in Yakima. The U.S. Bureau of Reclamation is funding the study, which will assess:

- Demand for surface water as an alternative source to declining groundwater
- Options for physical water supply delivery or replacement of groundwater by SMID
- Potential cost of delivery options and willingness-to-pay by existing groundwater users

For over a century, SMID has irrigated over 7,000 acres of some of the most productive agricultural land in the Yakima Basin. However, the Black Rock area east of SMID's service area has been challenged by declining groundwater for decades. SMID's mission is to support agriculture, help customers and neighbors, and be a good water steward. SMID's water delivery infrastructure extends east toward the Black Rock area, and the district is currently planning additional system upgrades including piping to improve water use efficiency. As part of infrastructure upgrades, SMID is also pursuing options that solve local water problems.

Seeking Feedback from Black Rock Area Water Users at October 17 Meeting in Yakima

SMID needs feedback from area water users and others on demand for water in the Black Rock area and preferred options for surface water supplies to users relying on declining groundwater.

- **A public meeting is scheduled for 6:00 – 8:30 p.m. on October 17, 2019, at the Yakima Arboretum located at 1401 Arboretum Drive, Yakima WA, 98901**

A survey will be sent out following the meeting to area water users. Responses and public comments are due by November 2019. The study will conclude with development of preferred actions, recommendations and next steps. A summary report with recommendations on water marketing and supply options will issue in Summer 2020. Please contact SMID with comments and questions.

Contact:

Nathan Draper
Selah-Moxee Irrigation District Office
113 East Moxee Avenue
Moxee, WA 98104
509.469.0449
smidistrict@qwestoffice.net



SELAH-MOXEE IRRIG. DIST.

Yakima, Wa.

PO Box 166, Moxee, WA 98936

ADDRESSEE

How do I get involved?

We need your feedback on demand for water in the Black Rock area and preferred options for surface water supplies to users relying on declining groundwater.

- Provide feedback at public meeting to be held on Thursday, October 17th, from 6-8:00 pm at the Yakima Area Arboretum located at 1401 Arboretum Drive, Yakima WA, 98901
- Fill out survey that will be sent out following the meeting to area water users
- Contact SMID office with comments and questions

If local interest in further study is high, what are the next steps?

- Produce a report with recommendations on water supply options and land owner interest. Copies of the report will be made available to the public.
- Apply for additional grants to support further work
- Conduct feasibility study
- Expand water level monitoring in the Black Rock area
- Negotiate Water Service Contracts for surface water through SMID

Study Schedule:

- Public Meeting followed by survey in October 2019
- Responses and public comments by November 2019
- Develop report and recommendations by Summer 2020
- Questions? Contact SMID Office at (509)469-0449 or smidistrict@qwestoffice.net

DECLINING GROUNDWATER BLACK ROCK / MOXEE

New Bureau of Reclamation Study

Reclamation is funding a study to evaluate options that address declining groundwater in the Black Rock area east of Moxee, led by Selah-Moxee Irrigation District (SMID). The Study will assess:

- Demand for surface water as an alternative source to declining groundwater
- Options for physical water supply delivery or replacement of groundwater by SMID
- Potential cost of delivery options and willingness-to-pay by existing groundwater users

The Study will conclude with development of preferred actions, recommendations and next steps

Why is Selah-Moxee Irrigation District (SMID) sponsoring the effort?

- SMID's mission is supporting agriculture, helping our neighbors, and being a good water steward. As part of our infrastructure upgrades it makes sense to consider options that solve local problems in the process.
- Through conservation upgrades, SMID has approximately 10,000 acre-feet of water available.
- SMID's water delivery infrastructure extends east toward the Black Rock area.
- The District is planning additional system upgrades including piping to improve water use efficiency.
- SMID needs to understand how extending service east to Black Rock affects the sizing of planned upgrades.

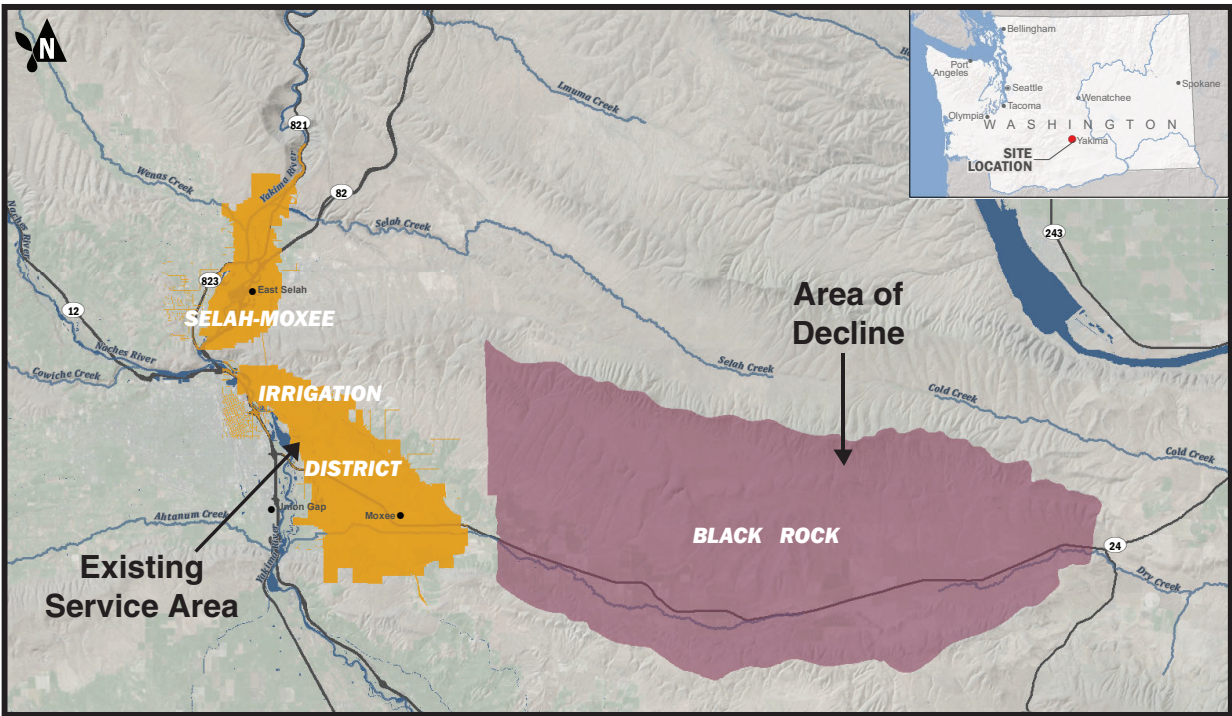


photo credit: USBR

Where are groundwater supplies declining?

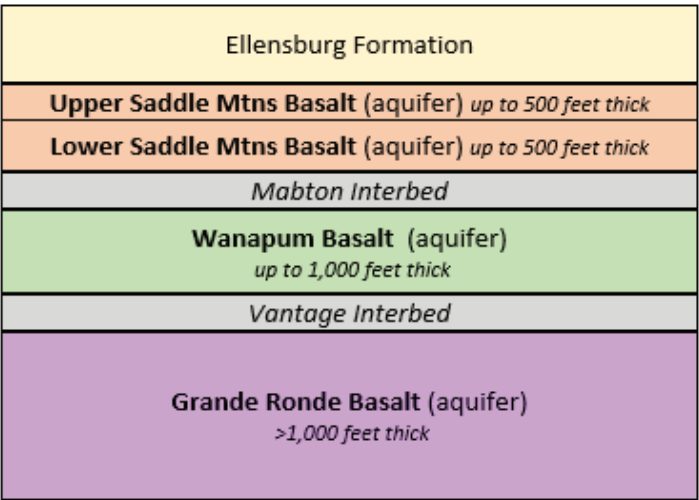
Groundwater levels have been declining steadily over the past several decades within the Black Rock area east of Moxee. The magnitude and location of decline varies and are controlled, in part, by geologic structures and pumping from wells. Generally, the largest declines are found in the central and eastern portion of the Black Rock area within the Columbia River Basalts.

The USGS and Department of Ecology have conducted studies and monitored wells in the area for several decades which are available from SMID on request. The figure below shows SMID's service area in orange near the Black Rock declining groundwater area in red.



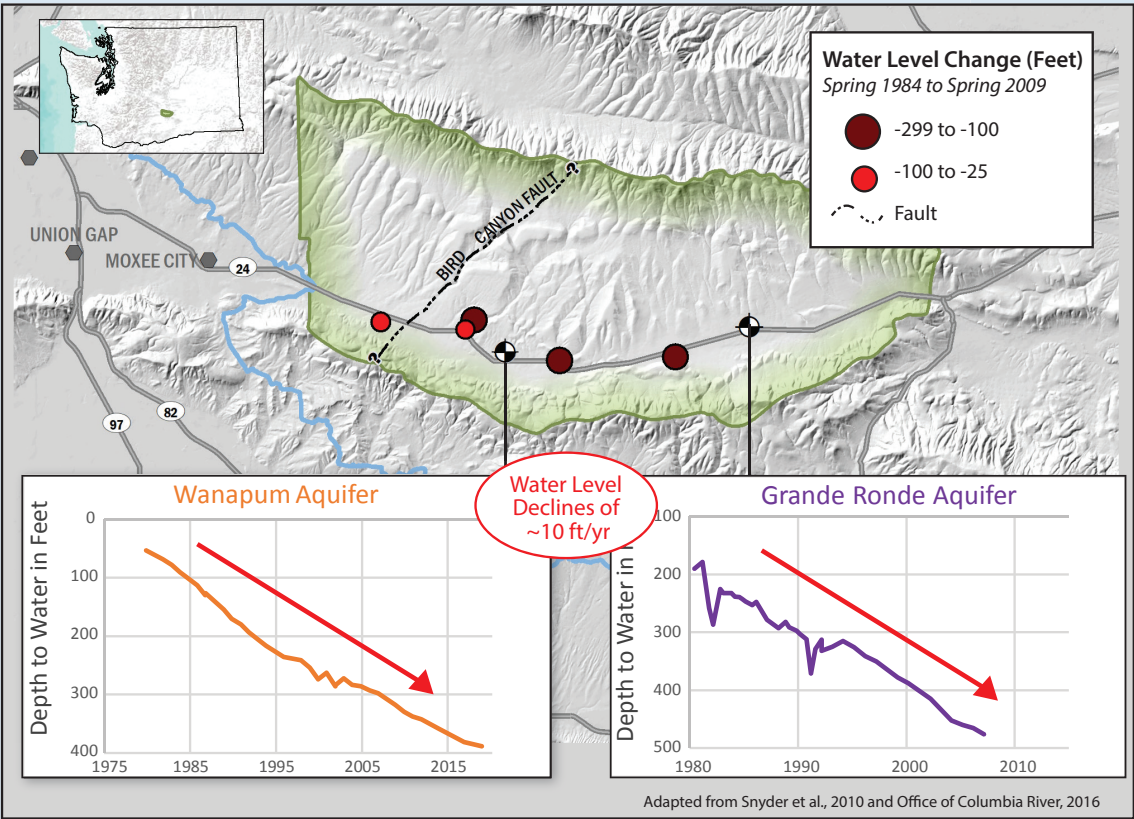
What aquifers are declining?

There are multiple basalt units that form the aquifers relied on for water supply in the area. Black Rock groundwater monitoring wells show declines in all of the major basalt aquifers. The figure to the right shows the basalt formations from deep to shallow: Grande Ronde Basalt, Wanapum Basalt, and Lower and Upper Saddle Mountains Basalts.



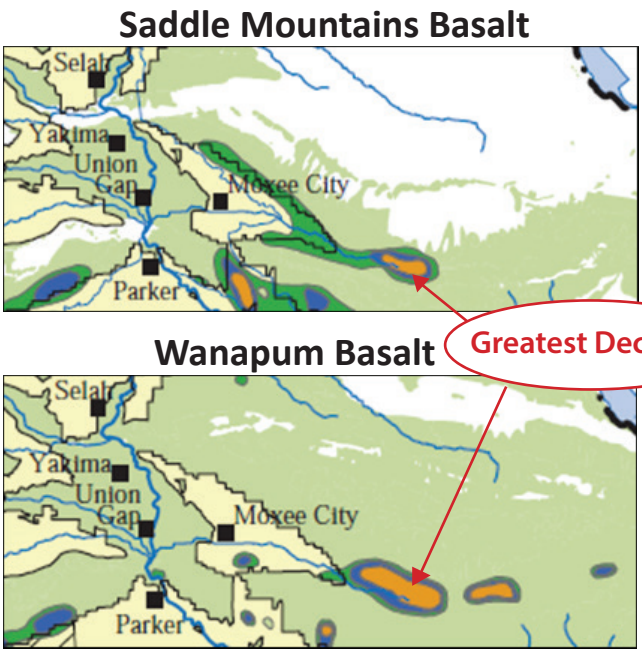
How bad are the declines?

Groundwater declines are approximately 5 feet per year in the Saddle Mountains Basalt, and greater than 10 feet per year in the Wanapum and Grande Ronde Basalt over the last 40 years. The figure below shows orange and red dots classifying the magnitude of the declines, along with time-history graphs of water levels from existing wells in specific basalt aquifers.



Greatest declines are in central Black Rock area

This figure shows the location of greatest declines in orange within specific basalt aquifers.



EXPLANATION

Irrigation Districts

Trends in Groundwater Levels, in feet, since 1985

- 21 to -75
- 76 to -150
- Greater than -150

Source: Adapted from Vacarro et al., 2009; Clipped excerpt of Figures 30 and 31

Fall 2019 East Moxee Groundwater Survey

Survey Respondents? 16 area irrigators and or domestic users.

- How many irrigated acres 6008.5 acres from survey.
- Number of wells 38 wells from survey
- Domestic use vs IR vs other Primary DOM =1acre, Primary IRR =5607.5acres, Stock =400acres
- Number of people relying on domestic use 25 from survey
- Percentage of total water users 103(postcards). 16 responded. $16/103+16=\sim 13\%$

Extent of the problem?

- Cost and cost trends required to maintain gw source over past 10 years?
 - Power cost 8 of 16 responders reported a percentage power cost increase ranging from 10% to 250%
- How many/how often deepen wells? % of total 38 wells reported on survey. Deepen Well 7 times (18%). 12 lowering of pumps (32%) of all responders.

Perception of the problem

- % aware of problem 15/16 are aware (94%)
- If no water: dryland vs. leaving area 8 responses, 25% stop farming in the area, 50% reduce irr acres, 38% dryland crops. Some responses chose multiple options.

Interest level and Willingness-to-pay?

- % willing to accept a new source DOM indoor and outdoor (50% willing to pay for reliable source). Willing to pay for a new primary water source? $5/16=31\%$
- Cost: Willing to pay in three categories

Surface Water Delivery	Reliable Outdoor Domestic	Reliable Indoor Domestic
6 responses	8 Yes	7 Yes
3/16 \$280	4/16 \$280	3/16 \$280
2/16 \$140	3/16 \$140	2/16 \$140
1/16 \$70	1/16 \$70	2/16 \$70