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DEPARTMENT OF
WATER RESOURCES

S. BRYCE FARRIS (ISB #5636)
RINGERT CLARK CHARTERED
455 S. Third Street
P.O. Box 2773
Boise, Idaho 83701-2773
Telephone: (208) 342-4591
Facsimile: (208) 342-4657

Attorneys for Nampa & Meridian Irrigation District

IN THE DISTRICT COURT OF THE FIFTH JUDICIAL DISTRICT OF THE
STATE OF IDAHO, IN AND FOR THE COUNTY OF TWIN FALLS

In Re SRBA	)	
	)	Subcase No. 63-27475
	)	
Case No. 39576	)	NAMPA & MERIDIAN IRRIGATION
	)	DISTRICT'S AMENDED EXPERT
	)	WITNESS DISCLOSURE

Nampa & Meridian Irrigation District (hereinafter "NMID") by and through its attorneys of record, Ringert Clark Chartered, hereby discloses the following individuals who may be called to testify as expert witnesses at the trial for this matter:

1. John P. Anderson. Mr. Anderson is the Water Superintendent for NMID. Mr. Anderson is expected to testify as both a lay witness and an expert regarding operation and maintenance of the Purdam Drain, the delivery of irrigation water to the Claimant's property by NMID, the delivery of water from the Purdam Drain to landowners of NMID which are located downstream of Claimant's point of diversion, NMID's drainage system in general and specifically related to the Purdam Drain, the source of water in the Purdam Drain, as well as any other relevant facts concerning the Purdam Drain and Claimant's use of water from the

COPY

Purdam Drain. At this time, Mr. Anderson has not reviewed any specific materials other than his own personal knowledge and observations over his twenty plus years as NMID's superintendent. Mr. Anderson is not being paid for his testimony.

2. Daren Coon. Mr. Coon is the Secretary/Treasurer for NMID and is expected to testify as a lay witness and expert regarding the history of NMID and NMID's drainage system, including the construction of the Purdam Drain for NMID, specifically including the construction of the Purdam Drain at the location of Claimant's point of diversion, any transfers of title by the Bureau of Reclamation, as well as any other relevant facts concerning the Purdam Drain and Claimant's use of the water from the Purdam Drain. At this time, Mr. Coon has not reviewed any specific materials other than his own personal knowledge and observations over his twenty plus years with NMID. Mr. Coon is not being paid for his testimony.
3. Jerry Gregg - United States Bureau of Reclamation. Mr. Gregg is expected to testify regarding the history of NMID, the development of the Boise Project, including NMID's drainage systems. Mr. Gregg is further expected to testify regarding the construction of the drainage system for NMID, including the intent and purpose of the construction of the drainage system. The documents reviewed by Mr. Gregg may include those documents attached hereto which show that the Purdam Drain, at the location of Claimant's point of diversion, was constructed in approximately 1916. Mr. Gregg is not being paid by NMID for his testimony.

4. Robert D. Schmidt. Mr. Schmidt is a hydrologist. Attached hereto is copy of Mr. Schmidt's CV. Mr. Schmidt is expected to testify regarding the source of the water in the Purdam Drain, including the fact that the source of the water in the Purdam Drain is waste and/or seepage water derived from NMID. Attached hereto is a copy of Mr. Schmidt's report. Mr. Schmidt is not being paid by NMID for his testimony.

DATED this 8th day of February, 2008.

RINGERT CLARK CHARTERED

By: 

S. Bryce Farris
Attorney for Nampa & Meridian
Irrigation District

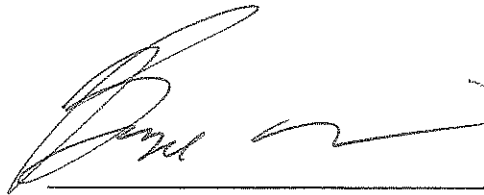
CERTIFICATE OF SERVICE

I hereby certify that on this 8th day of February, 2008, I served a true and correct copy of the foregoing document by U.S. mail, postage pre-paid to the following:

Janicek Properties, LLC
c/o Michael P. Lawrence
Givens Pursley, LLP
601 W. Bannock Street
P.O. Box 2720
Boise, ID 83701-2720

USDI Bureau of Reclamation
Represented by:
US Department of Justice
Environment & Natural Resources
550 West Fort Street, MSC 033
Boise, Idaho 83724

Director of IDWR
P.O. Box 83720
Boise, Idaho 83720-0098



S. Bryce Farris

A N N U A L
P R O J E C T H I S T O R Y

of

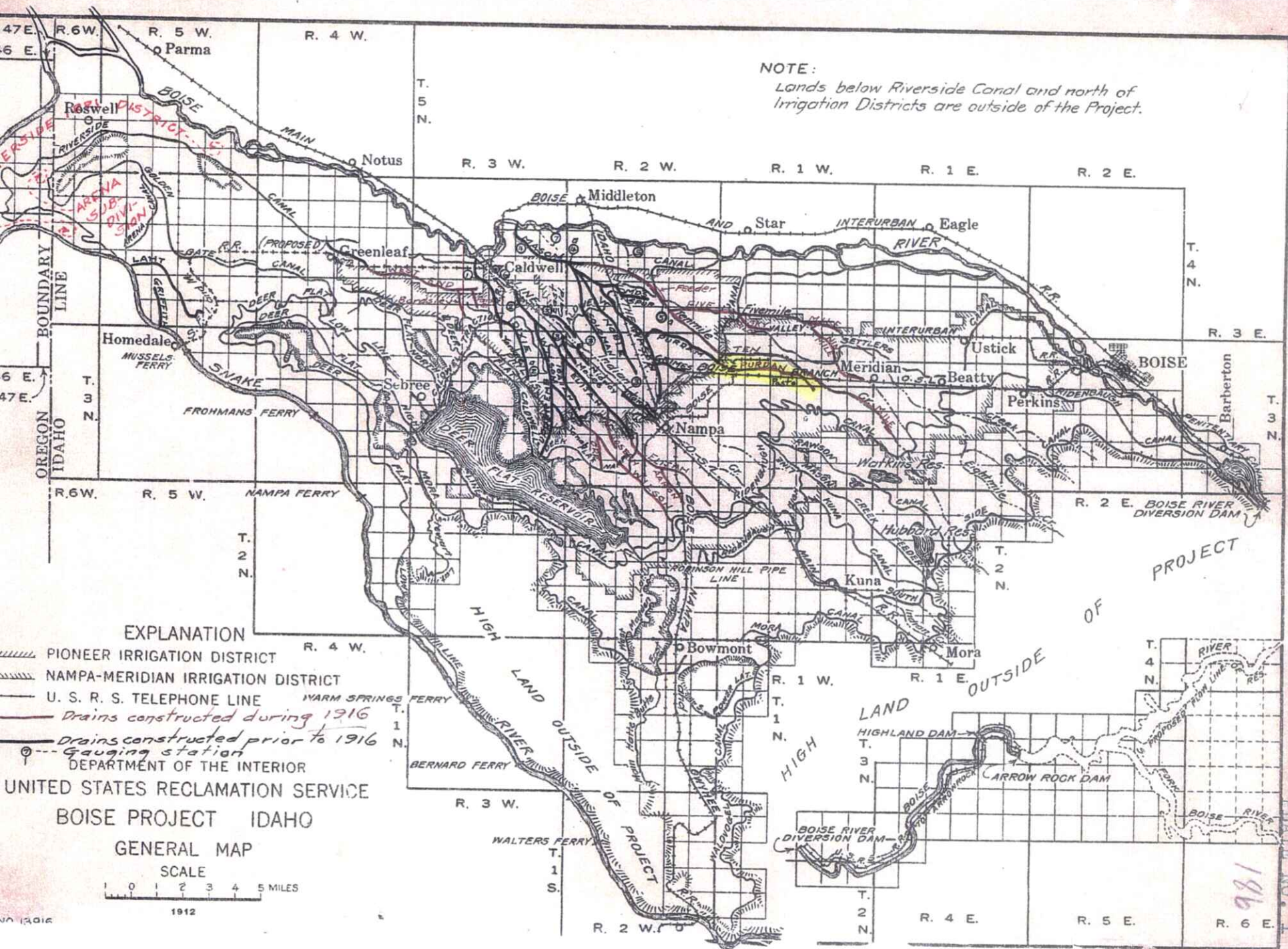
BOISE PROJECT

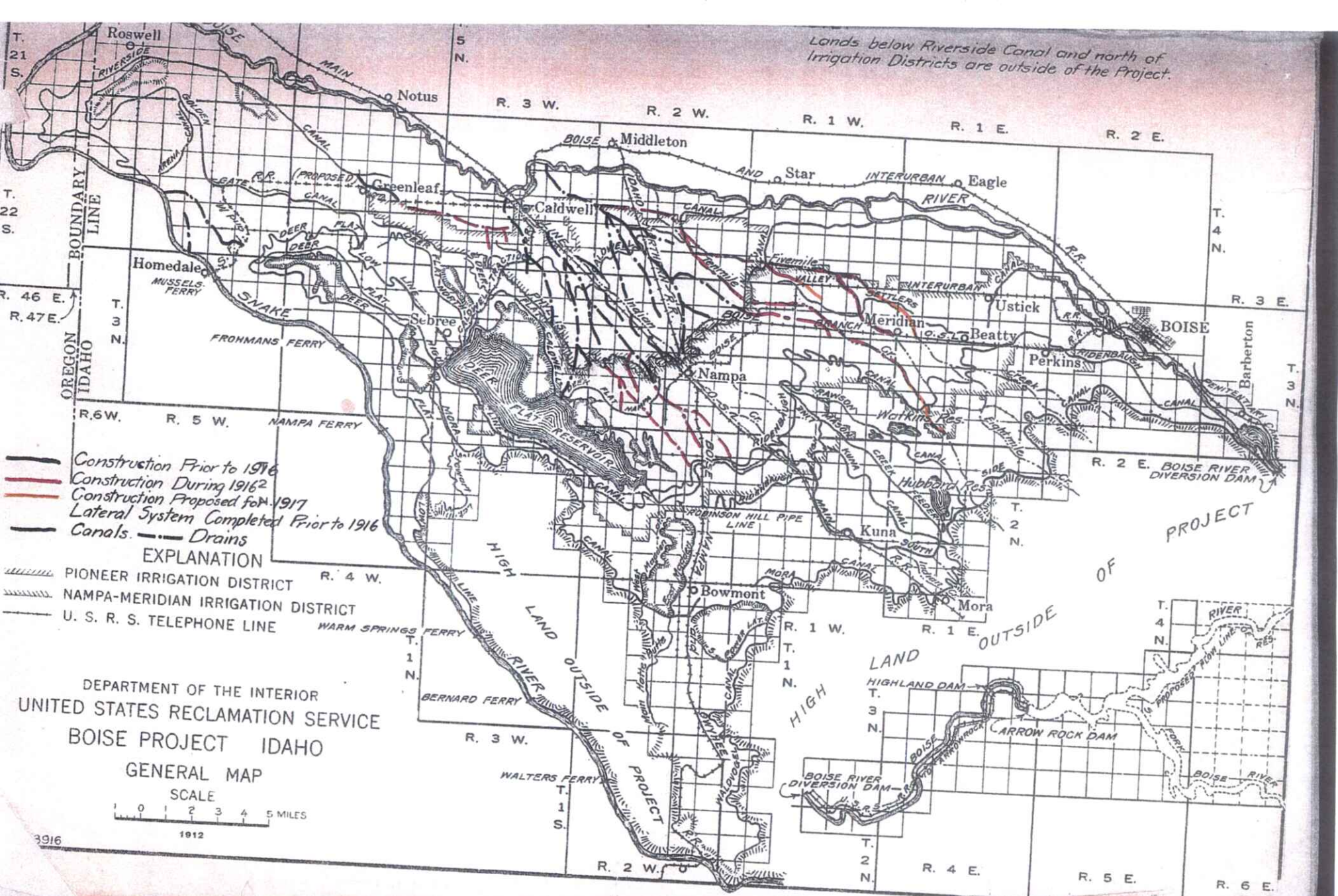
IDAHO

for

1916.

* * * *





and below dam 250 feet.

June 23, 1916.

EXCAVATION RECORD 1916.

Name of Drain	Section	Lin. Feet	Aver.	Miles	Cubic Yds.	Date	D
		Excavated	Cut	Excav.	Excavated	Commenced	Comp
West End	5'-1½:1:	26,095:	11.8:	4.94:	257,689:	Nov. 19 '15:	Apr.
Parker	5'-1¼:1:	4,450:	11.4:	.84:	36,552:	Apr. 29 '16:	May 1
Bardsley Gulch	5'-2:1:	7,800:	7.0:	1.48:	37,866:	Mar. 30 '16:	Apr.
Caldwell Feeder	6'-1¼:1:	4,771:	6.4:	.91:	16,930:	May 30 1916:	June
Wilson	5'-1½:1:	27,360:	10.1:	5.18:	206,049:	Jan. 3 1916:	May 1
	4'-1:1:				* 1,509:		
Orr	5'-1½:1:	7,940:	10.7:	1.50:	66,928:	Jan. 10 '16:	Feb.
Joseph	5'-1½:1:	6,100:	10.7:	1.16:	51,343:	Jan. 8 1916:	Jan.
Elijah	5'-1½:1:	26,225:	10.7:	4.97:	219,225:	Jan. 30 '16:	June
	4'-1:1:				* 876:		
Aaron	5'-1½:1:	7,100:	10.6:	1.35:	58,807:	Apr. 3 1916:	Apr.
Furdam	5'-1½:1:	19,820:	10.7:	3.75:	167,020:	June 26 '16:	Sep.
Five Mile	5'-1½:1:	8,395:	11.0:				
	10'-2:1:	11,650:	10.9:				
	8'-2:1:	39,947:	10.5:	11.34:	670,947:	Dec. 22 '15:	not c
Ten Mile	6'-2:1:	60,490:	10.9:	11.47:	672,230:	June 12 '16:	"
Nine Mile	5'-1½:1:	18,380:	10.0:	3.48:	136,266:	Oct. 10 '16:	Dec.
Sky Pilot	5'-1½:1:	9,530:	9.3:	1.80:	62,613:	Dec. 1 1916:	not c
Totals		286,053:		54.17:	2,660,465:		

* Excavation by hand - lava rock.

ANNUAL

PROJECT HISTORY

of

IRISH PROJECT

IDAHO

for

1915

total expenditure on drainage construction of \$557,000, of which \$281,000 is to be paid by the United States in behalf of lands within the District which are watered by the Reclamation Service, and \$266,000 is to be paid by the Nampa-Meridian Irrigation District in behalf of the lands watered by rights belonging to the District. Construction work was commenced under this contract on the cooperative work on the Five Mile Creek Drain, December 21st, and preparations were under way at the close of the year for beginning construction work on two other drains to the South of Nampa.

Features and Costs: For the purpose of proper cost keeping records, the contract work is divided into; (a) The Pioneer District drainage; (b) Cooperative drainage; (c) Nampa-Meridian drainage; while the work on project lands proper is divided into; (d) Farrow Basin drainage; (e) Drainage from Deer Flat Reservoir; (f) Miscellaneous drainage. Drainage work has been accomplished during the year on all the above features except drainage from the Deer Flat Reservoir. The total expenditure to December 31, 1915 on all the drainage features of the project is approximately \$353,000, of which amount, approximately \$104,000 was spent during the past year. This expenditure is divided among the above features about as follows:

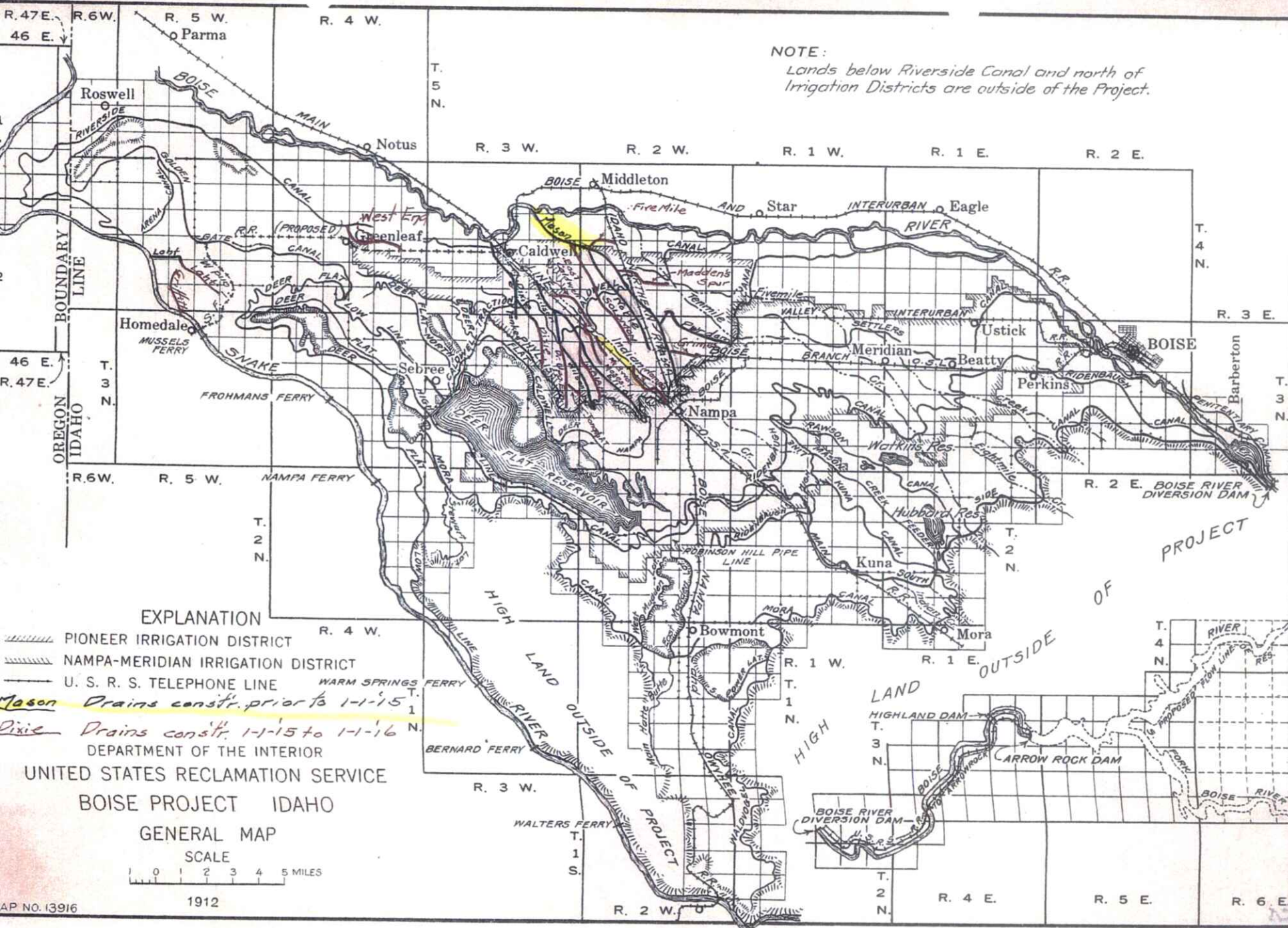


PLATE NO.1.

Feature	Cost to date.	Cost for 1915
A. <i>Pioneer</i>	\$ 256,700	\$ 65,000
B. <i>Camp</i>	1,700	1,700
C. <i>Nampa-Meridian</i>	19,500	6,800
D. <i>Fargo</i>	36,800	30,800
E. <i>Deer But</i>	31,800	---
F. <i>Miscell</i>	8,500	200
Total.....	\$ 352,800	\$ 103,900

INVESTIGATION OF GROUND WATER CONDITIONS AND
LOCATION OF DRAINS.

The principal drainage studies conducted during the year were those in connection with the supplementary contract for drainage in the Pioneer Irrigation District. It has been apparent for some time that drainage was needed in several localities within this District which were unprovided for in the original contract with the United States. Perhaps the principal areas affected were the valleys of Five Mile Creek and its tributary Ten Mile Creek, which were investigated in a preliminary way in connection with an outlet for drainage in the Nampa-Meridian District in 1913 and 1914;. The Indian Creek valley, between Nampa and Caldwell, was also showing seepage, and the settlers petitioned to have this area investigated and drained.

GROUND WATER INVESTIGATIONS, 1915.

TABLE NO. 1.

Name of Area.	Acres Mapped	No. of Test Holes	Scoped Areas	Drains recommended.
Indian Creek Valley	3,000	227	1,730	East Caldwell Midway - Nampa.
West end of P.I. Dist.	3,400	189	400	West End & Parker.
Madden's Spur	1,400	73	730	Madden's Spur
Grimes	460	48	215	Grimes
Jonah *	360	12	350	Jonah
Five & Ten Mile Creeks**	3,320	30	1,560	Five & Ten Mile (Preliminary work done 1914)
Miscellaneous	120	30	60	
TOTAL - Pioneer Dist.	11,660	674	5,015	
Nampa Sub-division**	8,400	150	1,688	Wilson, Elijah, Joseph, Aaron & Orr.
TOTAL - Nampa-M. Dist.	8,400	150	1,688	
Arena Sub-division		15	60	
GRAND TOTAL.....	20,060	839	6,763	

* This drain constructed under original Pioneer Contract.
 ** Cost of this work divided between Pioneer Dist. & Nampa-Meridian Dist.
 *** Preliminary work & estimates in this area made in 1913 & 1914.

TABLE NO. 1.

soil washing, deep plowing and crop selection. The economy of accomplishing drainage before lands become badly alkali-
is forceably proven by the experience of the land owners
in this District.

DISCHARGE OF DRAINS.

Gauging stations were maintained near the outlets of the Mason, Wilson and Dixie drainage systems in the Pioneer Irrigation District and on the Drain from the Upper Embankment, under the supervision of the Project Hydrographer. Weir measurements were also made on the Leht and Griffith drains in Fargo Basin, about twice each week, during the irrigation season. Regular gauge observers were employed at the stations on Mason and Wilson drains, to take readings each day during the year. The records of these various gauges are shown on the attached hydrographs, plates 3, 4 and 5.

The following approximation of the total drainage discharge from the Pioneer District is of interest:

Wilson, Mason & Dixie systems, see graphs.....	25,500	Ac. Ft.
Wilson drain water diverted to Coldwell Canal....	7,200	" "
Wilson " " " for irrigation.....	2,500	" "
Total Estimated discharge of drains.....	35,200	" "
Subtract for inflow from Reservoir drain....	5,000	" "
Approx. total developed in District.....	30,200	" "
Approximate discharge, Indian Creek above		
Wilson drain.....	25,000	Ac. Ft.
Five Mile Creek near river.....	15,000	" "
Total Estimated Creek discharge.....	40,000	" "

The data taken on the seepage flow in the drains and in Indian Creek indicates that about 68,000 acre feet of the drainage discharge and about 15,000 acre feet of the creek discharge was developed water within the District boundaries.

Considering that there is scarcely 30,000 acres tributary to these drains in the Pioneer District, that probably not over seventy per cent, or 21,000 acres are being cultivated, and that the gross amount of water diverted for this area was approximately 90,000 acre feet, it is immediately clear that much of the water discharged by the drains was water applied through irrigation on lands above the District.

Curriculum Vita

Robert D. Schmidt

Education

B.S. Mathematics 1970, University of Minnesota

M.S. Geoengineering/Hydrology 1985, University of Minnesota

Work History

2007 Consulting Groundwater Hydrologist, Boise Idaho.

Develop a groundwater hydrologic model to estimate seepage rates from the proposed Black Rock reservoir near Hanford Washington, and potential impacts on the nearby nuclear reservation. Participate in a collaborative study with University of Idaho economists to develop coupled hydrologic and economic models for the Boise Valley. Use the models to quantify the value of hydrologic/economic externalities associated with canal seepage, drain returns and groundwater pumping in the Boise Project.

2000-2006 Hydrologist, Bureau of Reclamation, PN Regional Office.

Conduct a broad range of groundwater hydrologic investigations in Idaho and Oregon, mostly involving development and application of groundwater models. Develop a GIS water budget data base for the Lower Boise Valley. Project the impact of future Domestic, Commercial, Municipal and Industrial water use in the basin on groundwater resources. Develop analytic element groundwater models of the Boise Project, for use in evaluating hydrologic impacts of new groundwater withdrawals on Reclamation canals and reservoirs. Provide expert testimony with regard to hydrologic impacts of new groundwater withdrawals on Boise Project canals and drains.

Participate in informational exchanges with other state, federal, tribal, and university hydrologists regarding groundwater model development and application in Idaho and Oregon. Develop models of groundwater and stream interactions in the Bandon Cranberry Water Control District, for the Oregon Water Resource Dept. Develop flow and contaminant transport models for gasoline spill remediation in Payette Idaho and Garden Valley Idaho, for USEPA. Coordinate development and application of groundwater and river system models of the Umatilla basin in Eastern Oregon, to determine flow mitigation requirements for irrigation districts. Direct Reclamation activities related to monitor well construction and hydrologic data acquisition in the Eastern Snake Plain. Member of technical advisory committee for the University of Idaho, Eastern Snake Plain groundwater model enhancement project.

1998-2000 Hydrologist/Team Leader Managed Aquifer Recharge Program, Bureau of Reclamation and Idaho Dept of Water Resources.

Direct hydrologic investigations of managed aquifer recharge in the Eastern Snake Plain, in conjunction with the Idaho Department of Water Resources and the University of Idaho. Use hydrologic models to identify potential managed recharge sites and determine impacts on groundwater level and spring discharge. Evaluate impacts of managed aquifer recharge on Salmon flow augmentation, hydropower rights, rental pool water availability, winter water savings, instream habitat for fish and wildlife. Work with IDEQ and IDWR to establish groundwater monitoring requirements for pilot recharge projects.

1997-1998 Consulting Groundwater Hydrologist.

Develop groundwater hydrologic models for mine closure planning. (sub contractor to DB Stephens and Assoc.)

1995-1997 Hydrologist, Bureau of Reclamation, Denver Technical Support Center.

Perform hydrologic investigations in support of experimental in-situ copper leaching test at the Mineral

RESULTS OF TESTS FOR DEVELOPED SEEPAGE WATER IN DEEP DRAINS CONSTRUCTED BY

U. S. RECLAMATION SERVICE? BOISE PROJECT IDAHO.

Name	Location	Date of Ex- cavation	Character of Water Bearing Strata	Gauging in sec.ft.	Total Sur- face inflow in sec.ft.	Total Under- drainage in sec. ft.	Average Un- drainage per mi. in SF.	Remarks
Drain U. Embk.	28	June 10, -14	Gravel	10-28-14	0.0	3.8	7.7	
"	71	March 1913	Coarse sand	10-28-14	0.0	3.5	4.3	
"	157	Nov. 1912	"	10-28-14	0.0	5.3	3.2	
"	157	"	"	10-28-14	0.0	13.5	4.3	
Mason Creek	390	June 11, -14	Coarse sand	11-2-14	0.0	8.3	5.3	Total above point
"	306	May 5, -14	Gravel	11-2-14	0.0	1.8	1.9	where Drain parallels
"	255	April 4, -14	"	11-6-14	0.3	1.1	1.3	Wilson Slough
"	390	20	"	"	0.3	11.1	1.6	
Elijah Drain	305	June 5, -14	Coarse sand	11-3-14	0.0	3.5	5.0	
"	270	May 25, -14	"	11-3-14	1.2	4.9	3.4	
"	164	April 16, -14	"	11-3-14	0.0	4.3	1.6	
"	305	27	"	"	1.2	13.4	2.4	
Wilson Drain	260	Sept. 20, -14	Coarse sand	11-3-14	0.1	5.7	4.9	
"	288	" 3, -14	"	11-3-14	0.1	3.9	3.0	
"	229	Aug. 5, -14	"	11-3-14	7.8	5.1	5.0	
"	175	July 15, -14	"	11-3-14	0.0	5.0	4.6	
"	360	117	"	11-3-14	8.0	19.7	4.3	
Purdum Drain	211	Aug 22, -14	Gravel & sand	11-5-14	0.0	8	1.8	
"	186	" 15, -14	"	11-5-14	1.1	4	1.4	
"	128	July 28, -14	"	11-5-14	0.4	1.5	1.3	
"	62	July 10, -14	"	11-5-14	0.6	1.4	1.4	
"	311	7	"	"	2.1	4.1	1.1	
Dixie Drain	76	Oct. 27, -14	Sand	11-6-14	0.0	1.9	2.3	2800 ft. 30 1/2" Tile
Noble Drain	245	Oct. 27, -14	Gravel & sand	11-5-14	0.0	1.3	1.1	thru Caldwell
"	186	Oct. 12, -14	"	11-5-14	0.4	3.3	1.8	
"	118	Sept. 20, -14	"	11-5-14	0.4	1.9	1.5	
"	245	51	"	11-5-14	0.8	5.4	1.5	

Park mine in northern Arizona. Conduct pumping tests and develop analytical and numerical groundwater models.

1992-1995 Supervisor, Hydrologic Applications Group, Twin Cities Minnesota Research Center, Bureau of Mines.

Directed multi-disciplinary group of scientists, engineers, and technicians in hydrologic studies related to mining and water resources.

1975- 1992 Hydrologist, Twin Cities Minnesota Research Center, Bureau of Mines.

Develop analytical and numerical models of groundwater flow and contaminant transport in connection with coal and hard rock mining activities. Develop new coal mine dewatering methods. Conduct aquifer tests and develop hydrologic data acquisition systems for aquifer testing. Prepare and publish investigative reports.

Selected Reports and Publications (1990- present)

Schmidt RD, J. Johnson, K. Didricksen, Modeling Groundwater Hydrologic Impacts of the Potential Black Rock Reservoir, USBR Technical Series TS-YSS-19, September 2007, 88 pp.

Schmidt RD, D. Dyke, Z. Cook, A Distributed Parameter Water Budget Data Base for Lower Boise Valley, A collaborative USBR/IDWR report , January 2007, 110pp.

Schmidt RD, Hydrologic Analysis of the Payette Gasoline Spill (USBR report for USEPA) August 2002, 32 pp.

Schmidt RD, Modeling Groundwater and Stream Interactions I the Bandon Cranberry Water Control District Bandon, Oregon, (USBR report for OWRD) July 2002, 74 pp.

Schmidt RD, and K Tarbet, Sand Hollow Groundwater Hydrologic Modeling Investigations, USBR report, March, 2002, 29 pp.

Idaho Dept of Water Resources Investigative Report, Feasibility of Large-Scale Managed Recharge of the Eastern Snake Plain Aquifer System, (coauthored with Paul Castelin, Jeffery Lefkoff, and Rex Harding), December, 1999, 233 pp.

Schmidt RD and D. Earley, New Facilities Investigations: Hydrologic Impact of In Situ Leaching at Cyprus Mineral Park Mine, Aquifer Protection Permit Application submitted to Arizona Dept. of Environmental Quality, July 1 1995.

Schmidt RD, Salovich M.J, Sodhi P, and J. Oswald, Reference Guide and User Manual for MFLOW, an Analytic Element Hydrology Model , USBM Open File Reprort ,1995.

Schmidt RD, Dahl L., Kim K., Paillet, F. and D. Earley, Hydrologic Characterization of a Chalcocite Copper Ore Deposit for In Situ Leach Mining, SME/AIME Annual Meeting, Denver, Co. preprint 95-252, March 6-9, 1995, 21 pp. (accepted by International Journal of Surface Mining, Reclamation, and Environment for publication in 1996)

Earley D., Schmidt RD, Y.C. Kim , Mitigation of Acid Rock Drainage through Application of In Situ Mining Technology to Fracture Hosted, Supergene Copper Sulfide Ore Deposits, Engineering Foundations Conf. on Technical Solutions for Pollution Prevention in the Mining and Mineral Processing Industries, Palm Coast Fl, Jan. 22-27, 1995.

Schmidt, RD, Earley D., and M. Friedel, Dynamic Influences on Hydraulic Conductivity during In Situ

Copper Leaching, in In situ Recovery of Minerals II Proceedings of Engineering Foundations Conf. on in situ recovery of minerals, ed. S Swan and K. Coyne p 259-287, 1994.

Friedel M. , Schmidt RD, Jones P., and Y.C Kim, Geostatistical Analysis of Dynamic Transmissivity Conditions during In situ Copper Leaching, Proceedings: APCOM 92, 23rd International Symposium Computer Applications in the Mineral Industries, Tucson Az., April 7-11, 1992, pp 49-59.

Schmidt RD, Factors Affecting Residential Water Well Yield in Vicinity of Underground Coal Mines, Proceedings; 3rd Workshop on Surface Subsidence Due to Underground Mining, Morgantown W. Va., June 1-4, 1992, p 244-252.

Schmidt, RD and M. Friedel, Application of Computers in the Analysis of In Situ Leach Mining Hydrology, Proceedings: Indo-American Seminar on Computers in the Mineral Industry - Current State of the Art and Emerging Needs, Dhanbad, India, Nov 10-13, 1991, 21 pp..

Friedel M. and RD Schmidt, Effect of an Unsaturated Setting on the Hydrology of In Situ Copper Leaching Proceedings of SME annual meeting Denver Colo. 91-192 Feb. 25-28, 1991, 12 pp

Kim Y.C., Zhao, Y., Schmidt, RD and K. Behnke, Determination of dynamic permeability changes during In situ Leaching at Cyprus Casa Grande Operation ,Proceedings of SME annual meeting Denver Colo. Feb. 25-28, 91-144,1991,m 16 pp.

Schmidt RD, Behnke, K., and M.. Friedel, Hydrologic Considerations of Underground In Situ Copper Leaching, Proceedings of SME annual meeting, Feb 26-Mar 1, 1990, 12 pp.

Level, E., Murphy, B., Schmidt, RD and M. Salovich, A Hydrologic Data Acquisition System for In Situ Leaching, Proceedings of GEOTECH 90 Oct. 7-9, Dallas, Tx. 1990, 21 pp.

Summary of Purdam Drain Hydrologic Investigations
RD Schmidt
2/8/08

Purdam Model Development and Calibration

A calibrated subsurface flow model (referred to as the Purdam model) was used to determine the effects of irrigation activity within the Boise Project (canal seepage and on-farm infiltration) on aquifer head conditions and subsurface flow into the constructed portion of the Purdam drain, up-gradient from the 63-27475 claimed point of diversion (referred to as the POD).

The Purdam model represents unconfined subsurface flow in a portion of the Boise Valley that includes the Amity Terrace, the Sunrise Terrace and the Whitney Terrace gravel deposits, and the underlying Ten Mile Gravels (Othberg, 1994), (Squires and Wood, 2001). The portion of the Boise Valley represented in the Purdam model is shown in figure 1. The boundaries of the model are aligned with surface water flow features. On the east and west sides, the model boundaries are Ten Mile Creek and Mason Creek. On the north and south sides, the boundaries are the Boise River and the New York canal.

As a result of stratigraphic layers which dip to the northwest, and northwest-southeast trending fault structures which parallel the creek boundaries of the model, subsurface flow in the Purdam model area is generally to the northwest, toward the Boise River (IWRRI, 2004). Consequently almost all of the hydrologic influences affecting Purdam drain return flow originate within the model area.

The Purdam model was developed using the analytic element method (Strack, 1989, Haitjema, 1995) and a groundwater modeling software package developed for the USEPA called GFLOW (GFLOW, 2007). Surficial hydrologic features in the model area including canals, drains, creeks and rivers are all represented in GFLOW as head-specified line source-sink elements. Head conditions for most canals and drains are derived from a digital elevation map (DEM) based on highly accurate LIDAR (Light Detection and Ranging) data (LIDAR, 2007). Figure 2 shows the extent of LIDAR elevation data in the model area. LIDAR data is available for the most important part of the model area including the Purdam drain, the Ridenbaugh Canal, the Kennedy Lateral, and Ten Mile Creek. (A USGS 10 meter DEM is used in areas where LIDAR data is not available.)

On-farm infiltration and precipitation in the model area are represented in GFLOW by spatially-distributed aquifer recharge. Aquifer recharge rates are derived from Boise Valley agricultural water budget data (USBR and IDWR, 2007).

Figure 3 shows the distribution of rivers, canals, creeks, drains, and wasteways represented in GFLOW by line source-sink elements. Figure 3 also shows the boundaries of the terrace gravel deposits which are represented in GFLOW by inhomogeneities in base elevation and aquifer transmissivity, and the locations of observation wells used to

calibrate the model. Observed head conditions within the model area range from 2648 feet near the New York canal to 2430 feet near the Boise River.

The Purdam drain model is calibrated (with respect to hydraulic conductivity and canal bed conductance) using both head and flow data. Fifty-five USGS observation wells located within the model area are used for head calibration. Seepage measurements from two canals near the Purdam Drain, the Ridenbaugh and the Kennedy lateral, are used for flow calibration.

The Purdam model simulates water table elevations and the subsurface component of drain return during the peak of the irrigation season. The observations of groundwater levels used in calibration are from different years, but are all representative of head conditions in shallow gravel layers during July and August.

Model calibration results are shown in figure 4. The absolute difference between modeled and observed water table elevations within the model area is about 10.8 feet, or about 5 percent of the total 218 foot range in head conditions. While the absolute difference between modeled and observed heads gives some indication of the uncertainty in model predictions, a large part of the difference can be traced to uncertainty in the calibration targets themselves (which are from different years). Uncertainty in model predictions of actual head conditions is estimated to be less than half that shown in figure 4.

Uncertainty exists in model predictions of subsurface drain return because of the uncertainty associated with canal and drain conductance properties and canal seepage rates. Uncertainty in drain return is estimated to be about 20 percent of the predicted rate.

Purdam Model Application and Results

The calibrated Purdam model is used initially to simulate water table elevations and drain returns that accompany the present level of Boise Project irrigation activity, specifically canal seepage and on-farm infiltration. Figure 5 is a head contour map generated by the calibrated model, showing irrigation season water table elevations in the vicinity of the Purdam drain. (Portions of the Ridenbaugh Canal, Kennedy Lateral and Ten Mile Creek are also shown.) Arrows indicate the direction of subsurface flow on the Sunrise Terrace.

As noted on figure 5, the surface elevation of the drain at the POD location is 2562 feet. The modeled water table elevation in the underlying terrace gravels at this same location is slightly higher, 2564.9 feet. The upward hydraulic gradient indicates that water in the subsurface is being discharged to the drain at this location. The model indicates that an upward hydraulic gradient exists at almost all locations along the Purdam drain upstream from the POD. The model prediction of total subsurface discharge to the Purdam drain upstream of the POD location is 5.1 cfs.

In the second application, the calibrated Purdam model is used to simulate Purdam drain water table elevations and drain returns in the absence of Boise Project irrigation activity (canal seepage and on-farm infiltration). The second application is intended to simulate pre-development conditions, in which aquifer recharge comes only from (average annual) precipitation.

Figure 6 is a head contour map generated by the pre-development model showing water table elevations in the vicinity of the Purdam drain. As noted, the pre-development head condition at the POD location is 2548.4 feet, which is 13.6 feet below the bottom elevation of the drain. Everywhere upstream of the POD the water table surface is also below the bottom of the drain. The model clearly indicates that under pre-development conditions, subsurface return flow at the POD location in the Purdam drain (if the drain had existed at that time) would have been zero.

Two additional model runs with varying canal seepage and on-farm infiltration conditions in the Nampa-Meridian Irrigation District (NMID) were also made. The first of these simulates lining the Ridenbaugh canal with an impermeable liner. The second simulates the elimination of irrigation activity on just the NMID portion of the Boise Project. Lining the Ridenbaugh canal reduced canal seepage by 42 cfs, which in turn reduced the head at the Purdam drain POD by 0.5 feet (from 2565 feet to 2564.5 feet), drain flow declined by 1.5 cfs (from 5.1 cfs to 3.6 cfs). Eliminating all canal seepage and on-farm infiltration in the NMID portion of the Boise Project reduced the head at the POD by 2.2 feet (from 2564.9 feet to 2562.7 feet), drain flow declined by 4.8 cfs (from 5.1 cfs to 0.3 cfs).

Model Results in relation to Purdam Drain Flow Measurements and Observation Well Hydrographs

A weir and a flume were installed by Reclamation in the Purdam drain in early October 2007. The weir was located about 300 feet upstream of the POD pump and the flume was located about 100 feet downstream. Reclamation monitoring of flow in the Purdam drain began on October 11, 2007 and continued until January 31, 2008 (Table 1).

Even though the irrigation season was over before monitoring began, the calibrated model estimates of flow in the Purdam drain at the POD are comparable to flow measurements made in early October. Early October flow measurements ranged from 3.0 to 3.8 cfs, (see Table 1) as compared to the calibrated model estimate of 5.1 cfs. While the October measurements are slightly lower than model predictions, it is likely that subsurface return flow to the drain would have been somewhat higher in July and August during the irrigation season.

Table 1 also shows a generally declining flow rate in the Purdam drain between October and January. (The decline is punctuated by short term increases due to precipitation events.) Although flow in the drain is not expected to drop to zero over the course of a single winter, it is expected that it would drop to zero eventually. Were it not for the start

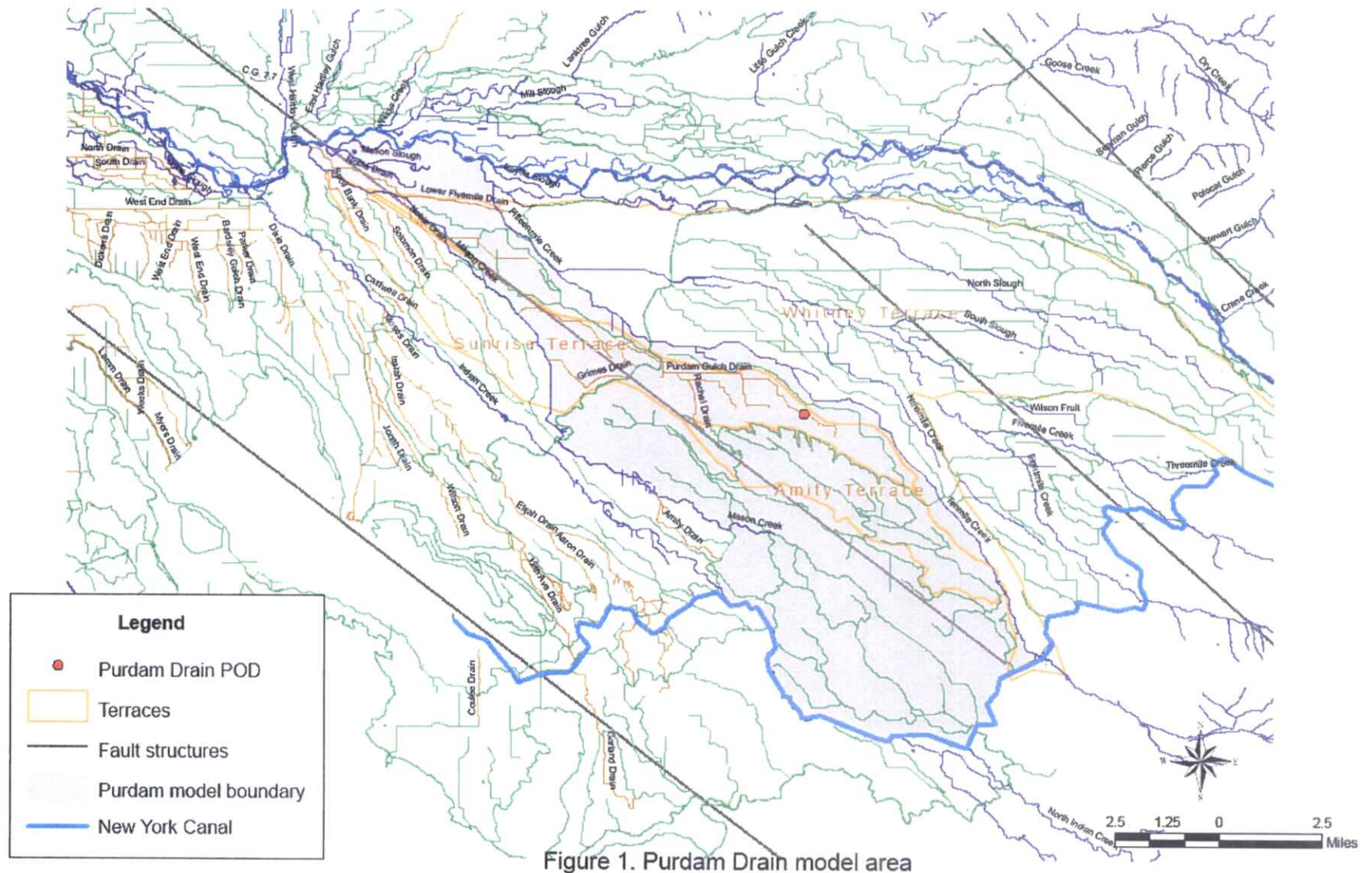
of irrigation activity each April, it is expected that the water table beneath the Purdam drain would eventually return to the level indicated by the pre-development model.

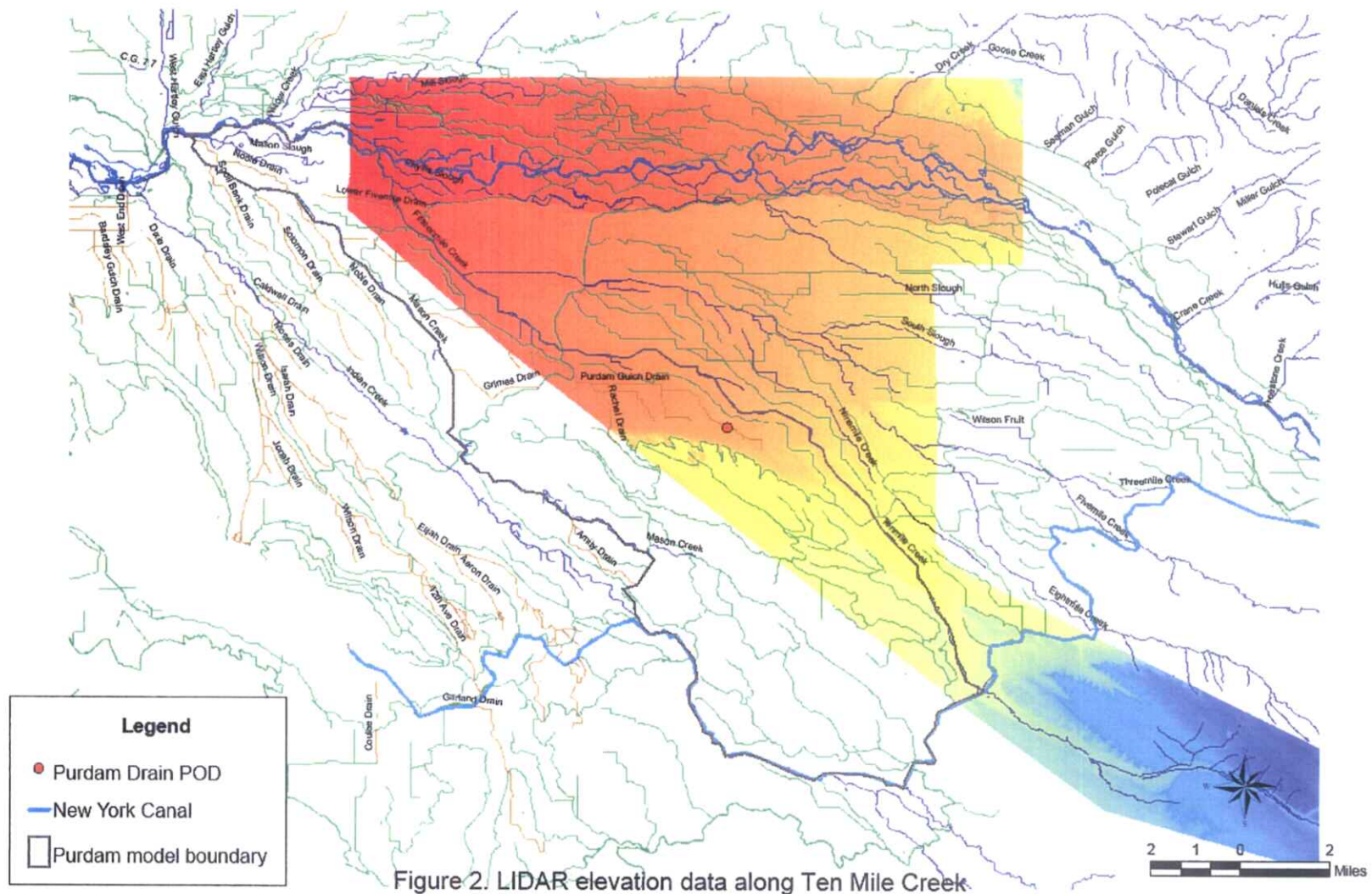
Figures 7, 8 and 9 are hydrographs showing seasonal variations in depth to water in three USGS observation wells located in T03N R1W Sec 14, 15 and 16; on the Whitney, Sunrise and Amity Terraces, respectively. The section 14 observation well is located about a mile east of the Purdam drain POD. The section 15 well is about a half mile south, close to the Ridenbaugh canal; and the section 16 well is about a mile to the northwest of the POD. The hydrographs all show similar seasonal trends in depth to water. Water levels rise throughout the irrigation season and decline during winter months. Between the end of one irrigation season and the start of another, the water table surface typically declines four to six feet, but the decline can be as much as nine feet.

The pre-development model, which predicts that in the permanent absence of all irrigation activity in the Boise Project, the water table beneath the Purdam drain would decline by approximately 16.5 feet (or about 13.7 feet below the bottom of the current Purdam drain) is entirely consistent with the water table response observed in these wells during a six month absence of irrigation activity. It is estimated that in the absence of all irrigation activity it would take three to five years for the water table on the Sunrise Terrace to return to its pre-development level.

Conclusions based on Purdam Model results

The Purdam drain model results demonstrate that canal seepage and on-farm infiltration from Boise Project lands are responsible for essentially all of the subsurface return flow occurring in the Purdam drain at the location of the POD, and that the vast majority of the subsurface return at this location comes from canal seepage and on-farm infiltration on the surrounding NMID irrigated lands.





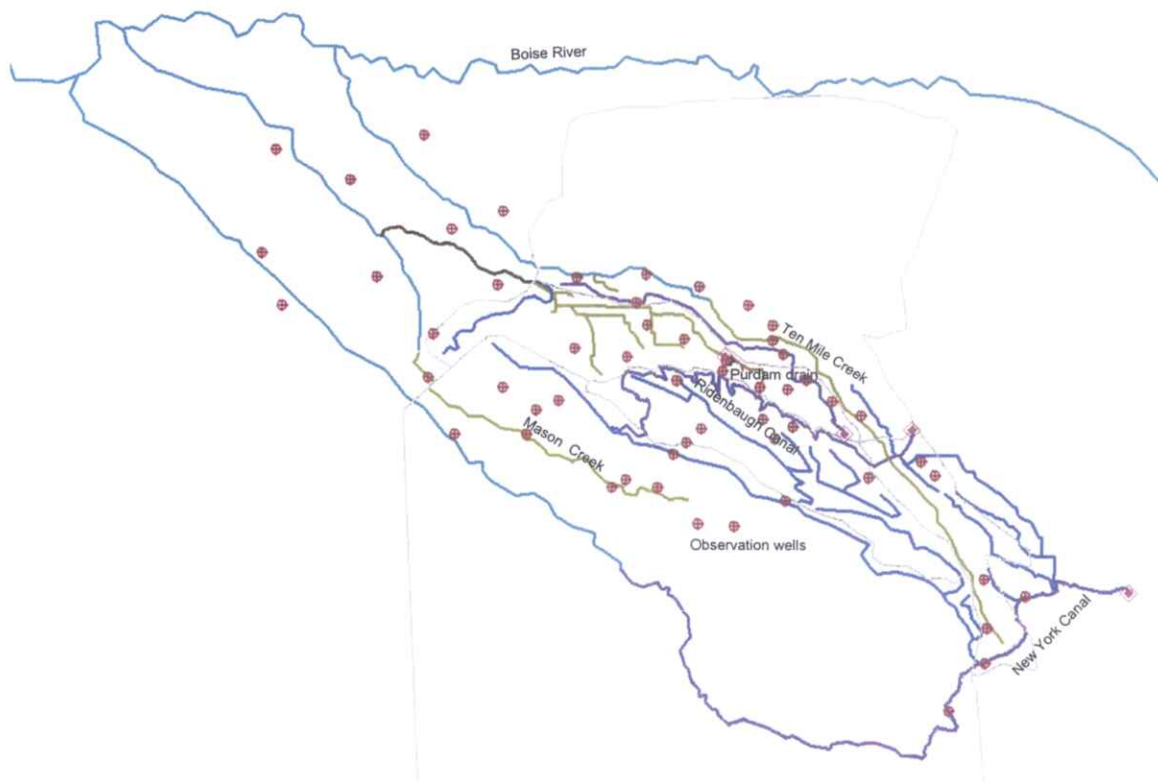


Figure 3. GFLOW model representation of canals, rivers, creeks and drains as boundary conditions in the Purdam model

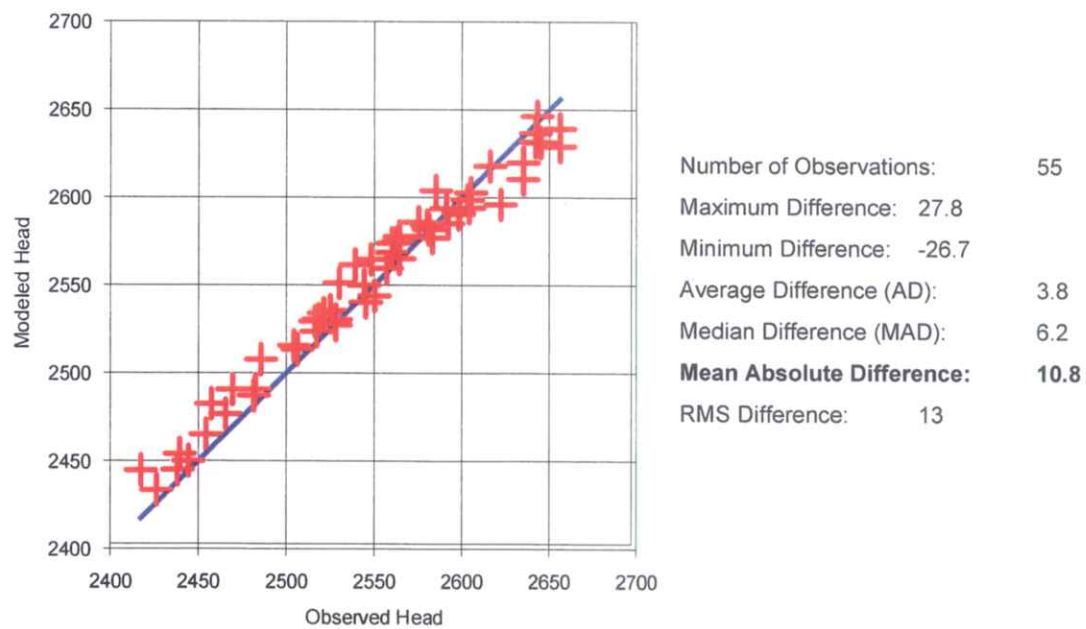


Figure 4. Observed and modeled water table elevations in the calibrated model

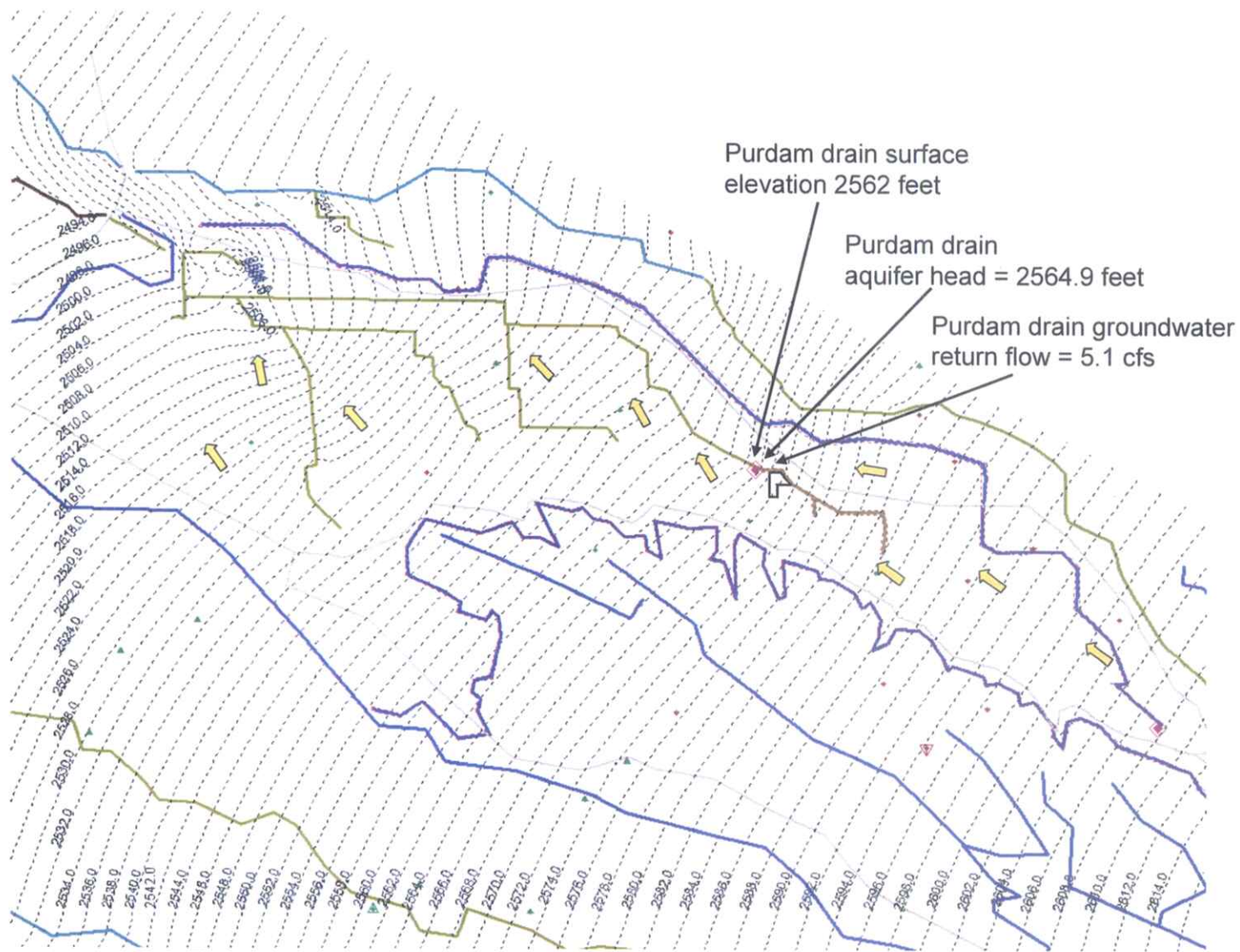


Figure 5. Modeled irrigation season water table elevations in the area of the Purdam drain

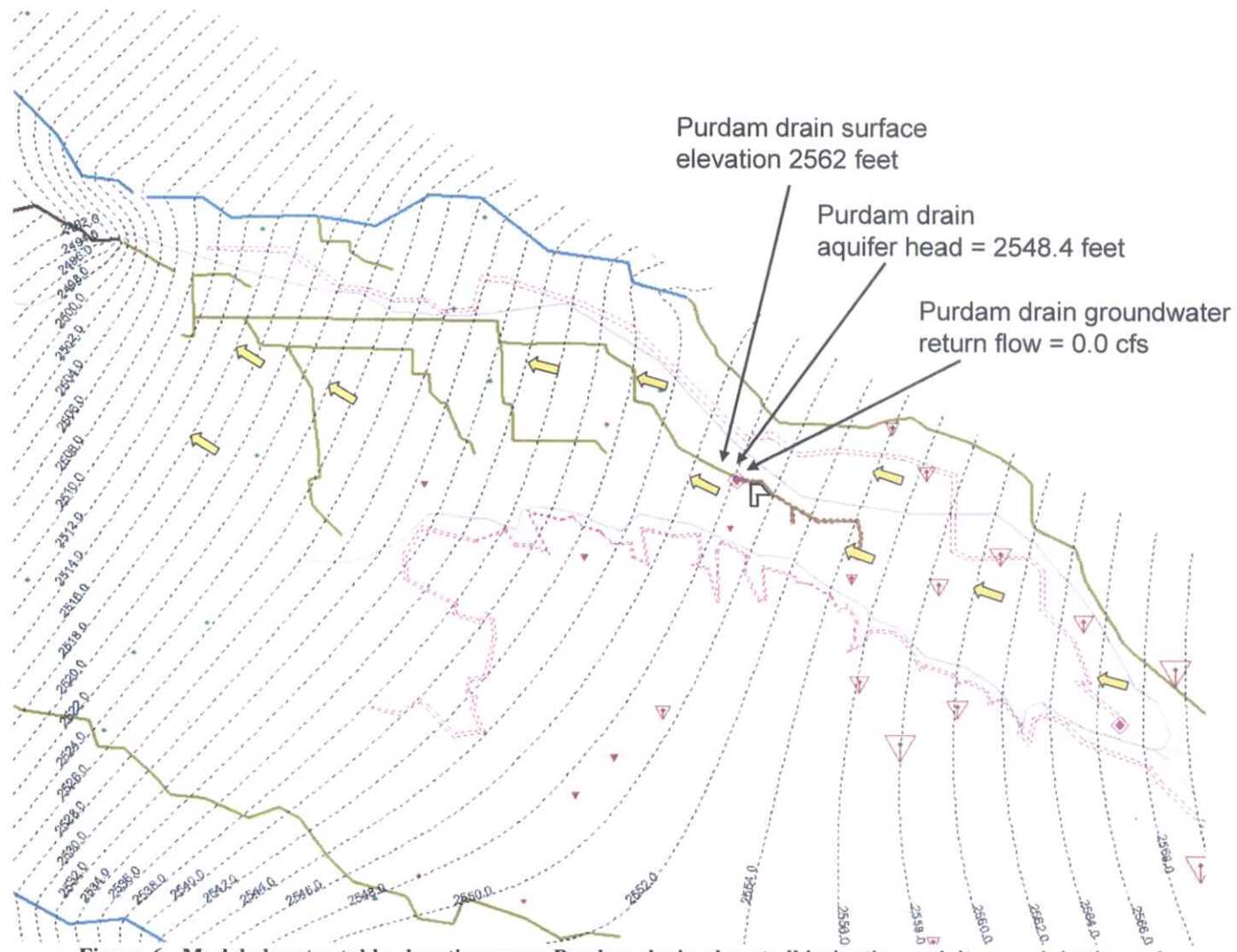


Figure 6. Modeled water table elevations near Purdam drain absent all irrigation activity, precipitation only.

Table 1 Purdam Drain - Weir & Flume Flow Measurements

Date	U/S Weir Readings			D/S Flume Readings		
	Raw Field (Vertical)	Flow (gpm)	Flow (cfs)	Raw Field (Slope)	Flow (gpm)	Flow (cfs)
10/11/2007	0.24	1,443.7	3.2	1.300	1,444.7	3.2
10/12/2007	0.24	1,443.7	3.2	1.325	1,509.2	3.4
10/15/2007	0.27	1,684.0	3.8	1.400	1,713.0	3.8
10/19/2007	0.23	1,366.8	3.0	1.275	1,381.9	3.1
10/22/2007	0.23	1,366.8	3.0	1.300	1,444.7	3.2
10/25/2007	0.24	1,443.7	3.2	1.300	1,444.7	3.2
10/26/2007	0.235	1,405.0	3.1	1.300	1,444.7	3.2
10/29/2007	0.16	877.0	2.0	1.175	1,147.4	2.6
10/30/2007	0.19	1,076.0	2.4	1.150	1,092.9	2.4
11/2/2007	0.18	1,007.8	2.2	1.150	1,092.9	2.4
11/5/2007	0.18	1,007.8	2.2	1.150	1,092.9	2.4
11/7/2007	0.15	814.5	1.8	1.030	853.2	1.9
11/9/2007	0.14	754.1	1.7	1.050	890.7	2.0
11/9/2007	0.14	754.1	1.7	1.050	890.7	2.0
11/13/2007	0.145	784.0	1.7	1.025	844.0	1.9
11/14/2007	0.145	784.0	1.7	1.030	853.2	1.9
11/16/2007	0.175	974.4	2.2	1.035	862.5	1.9
11/19/2007	0.14	754.1	1.7	1.040	871.8	1.9
11/21/2007	0.17	941.4	2.1	1.130	1,050.4	2.3
11/23/2007	0.14	754.1	1.7	1.050	890.7	2.0
11/26/2007	0.14	754.1	1.7	1.050	890.7	2.0
11/27/2007	0.15	814.5	1.8	1.075	938.9	2.1
11/29/2007	0.145	784.0	1.7	1.075	938.9	2.1
12/3/2007	0.14	754.1	1.7	1.050	890.7	2.0
12/5/2007	0.14	754.1	1.7	1.055	900.2	2.0
12/7/2007	0.14	754.1	1.7	1.075	938.9	2.1
12/10/2007	0.135	724.7	1.6	1.042	875.6	2.0
12/13/2007	0.13	695.8	1.6	1.040	871.8	1.9
12/14/2007	0.13	695.8	1.6	1.040	871.8	1.9
12/17/2007	0.13	695.8	1.6	1.045	881.2	2.0
12/18/2007	0.14	754.1	1.7	1.050	890.7	2.0
12/21/2007	0.13	695.8	1.6	1.050	890.7	2.0
1/2/2008	0.13	695.8	1.6	1.050	890.7	2.0
1/3/2008	0.125	667.5	1.5	1.060	909.7	2.0
1/7/2008	0.125	667.5	1.5	1.030	853.2	1.9
1/10/2008	0.12	639.7	1.4	1.030	853.2	1.9
1/14/2008	0.12	639.7	1.4	1.030	853.2	1.9
1/18/2008	0.12	639.7	1.4	1.040	871.8	1.9
1/22/2008	0.11	585.9	1.3	1.030	853.2	1.9
1/25/2008	0.12	639.7	1.4	1.030	853.2	1.9
1/28/2008	0.11	585.9	1.3	1.025	844.0	1.9
1/31/2008	0.11	585.9	1.3	1.030	853.2	1.9

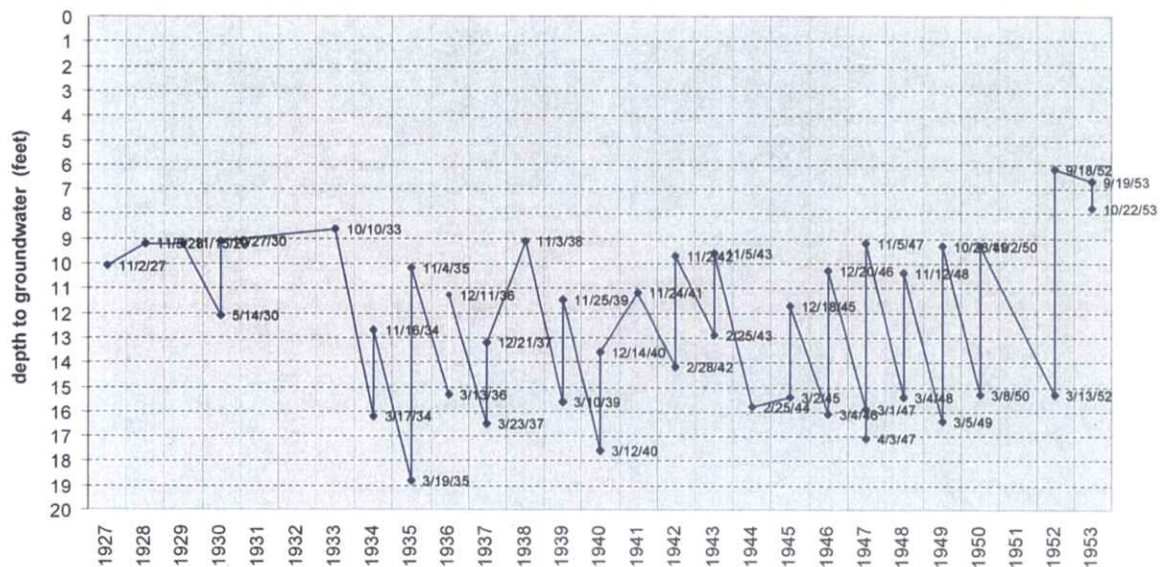


Figure 7. USGS observation well hydrograph, 03N 1W Sec 14.

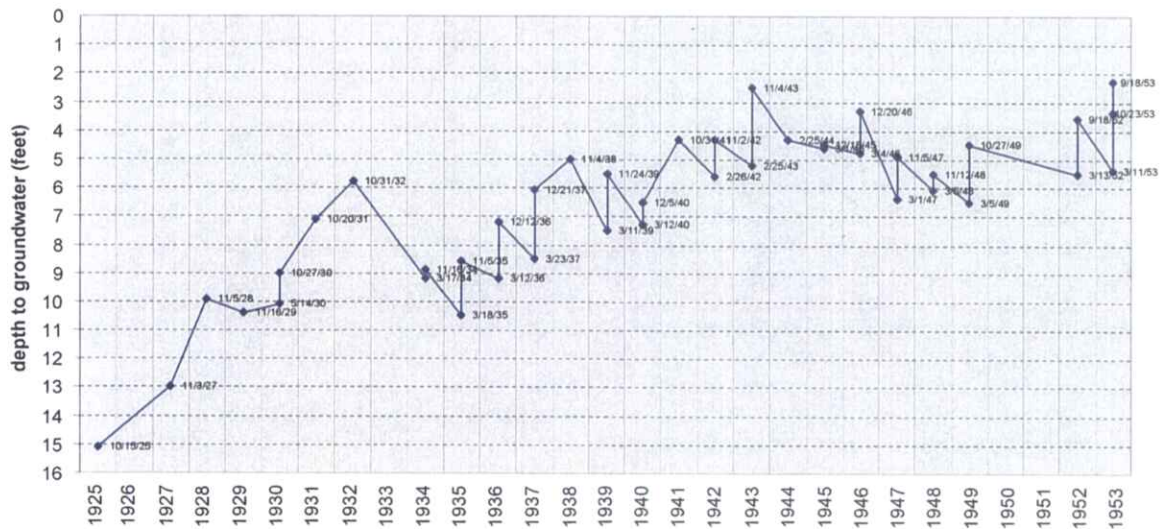


Figure 8. USGS observation well hydrograph, 03N 01W Sec 15.

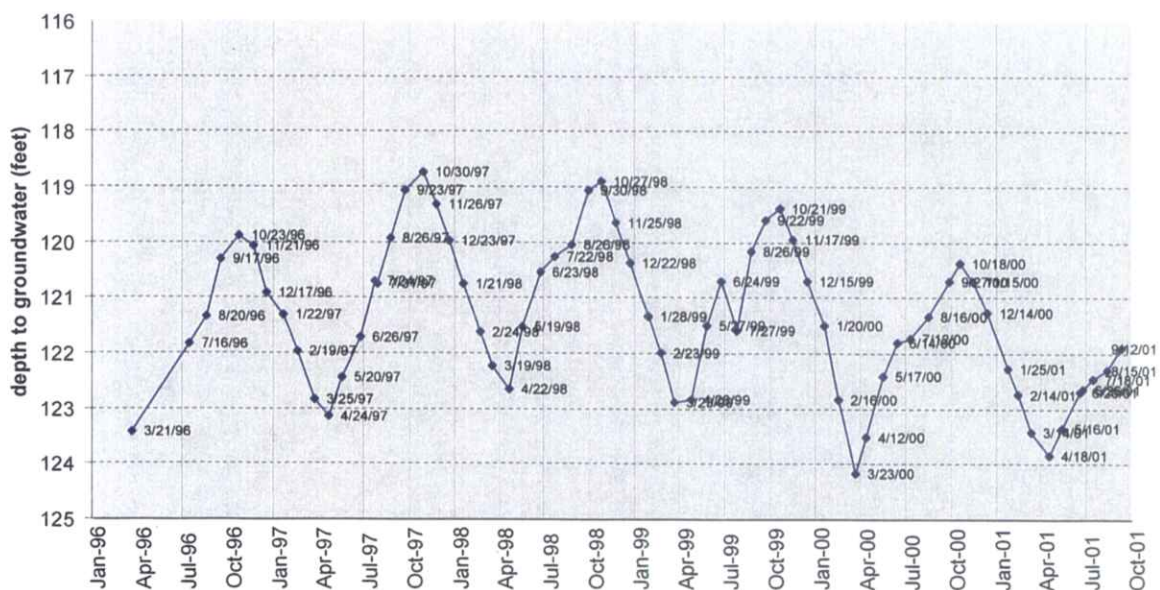


Figure 9. USGS observation well hydrograph, 03N 01W Sec 16.

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