7. HYDROLOGY – STORAGE

Peak precipitation generally occurs in the Methow Basin during November, December, and January. Mean monthly precipitation from NOAA/NWS COOP meteorological stations in the basin are presented in Section 4, Table 4-3. Mean monthly and annual precipitation estimated using PRISM for each of the sub-basins is presented in Table 4-4. Peak water usage occurs during the summer months, usually in July and August. This shortfall in supply versus demand is partially accommodated through water stored in snowpack, but snowpack generally only supports streamflow through June or July. After that streamflow is solely supported by baseflow, precipitation, and storage. The Methow basin currently has a modest amount of storage (in reservoirs, small dams and snowpack), and virtually no inter-annual surface storage (storage that can support streams through multiple years). Tables 7-1 and 7-2 list the existing reservoirs and dams in the Methow River Basin.

Water storage can include in-stream and off-stream methods such as reservoirs, stream banks, groundwater, and storage tanks, among other storage types. Typically, excess water is collected during periods of high precipitation and high stream flow to be used during times of low flow and precipitation. Having additional water available during low flow periods can be especially important if there is high demand for water.

This chapter summarizes existing and potential storage within the Methow Basin. Background issues and data associated with these reports are also summarized here.

7.1 Background Issues

The Methow Basin is generally a snow pack driven system. Snow pack in the higher elevation regions of the basin provides the primary means of water storage. There are thousands of acres of land within the basin that store water via the snowpack. From a technical standpoint, the distribution and timing of snow accumulation and snowmelt is a key process in describing water storage in the basin. Small variations in magnitude or timing, when aggregated over large areas, can represent significant quantities of water.

From a management perspective, snow pack is essentially un-managed, and low precipitation in the lower basin does not offer much of a secondary water source for late summer water needs or inter-annual drought relief. The current distribution of water in the Methow basin is essentially "run-of-the river," with very little managed storage. Managed storage is a highly valuable component of any water system, and provides a very useful tool for water managers and stakeholders to better manage water resources for fish and people. However, how and where to store water; permitting of storage facilities; and operational strategies of these facilities often require difficult management decisions and careful agency coordination. Storage is an integral part of the State Water Strategy.

Aquifers represent another potential source of storage, either occurring naturally or created through artificial recharge. Section 6 (Groundwater) contains further discussion of groundwater storage.

7.2 Objective and Level of Detail

The objective of this section is to outline existing data related to storage within the basin. Water storage in the form of snowpack is described in Section 4.

7.3 Presentation of Existing Data

Estimates of current storage in the basin are summarized from two sources:

- Water Resources Management Program (Kauffman and Bucknell, 1976); and
- Hydrographic Data - Dams (Ecology, 2001).

Reservoirs are summarized in Table 7-1. Existing Dams and their respective storage volumes are summarized in Table 7-2. Dams information from Ecology identifies 18 dams with a total storage available of 6,071 AF. The majority of these dams are designated for recreation purposes. The location of Existing Dams is shown on Figure 7-1.

Two major water storage studies have been conducted which focus on potential storage in the Methow Basin:

- The Methow River Basin Level B Study (Washington State Study Team, 1977) identified the potential for about 23,500 acre-feet of additional storage in the Basin. Dam heights used in the estimates ranged from 15 to 55 feet, with yields of individual storage projects ranging from 200 to 17,000 acre-feet. The reported storage potential was greatest in the Chewuch Basin (8,000 AF), followed by the Lower Methow (7,365 AF), Twisp (5,900 AF) and Middle Methow (2,250 AF). An additional 17 sites were identified in the report but documentation on the analysis was poor.
- The Methow Valley Water Planning Pilot Project also evaluated storage in the basin (Klohn Leonoff, 1993), and developed one of the most detailed storage studies currently available. This study identified 24 potential reservoir sites; these sites are described in Table 7-3. Possible dam sites were identified based on stream habitat, capacity, capacity/run-off ratio, and dam crest length to reservoir capacity ratio. Dam heights of 40 feet and 80 feet were used in the analysis, and capacity ranged from less than 50 to 700 AF for 40-foot dams and from about 150 to 2,600 AF for 80-foot dams. The reported total storage capacity from the 24 potential sites using 40-foot structures is low at only 5,042 AF. Using 80-foot structures, 25,548 AF of total capacity is reported. Patterson Lake was identified as the first choice for additional storage.

Both studies recognize that there is plenty of water available in the basin on an annualized basis, and that the value of storage is to store excess spring runoff for use in the summer low flow period, and possibly for use in drought years when even the spring runoff is inadequate (Klohn Leonoff, 1993). Groundwater storage has previously been dismissed as an option due to the assumption of a short lag time for groundwater return to the surface (Klohn Leonoff, 1993). Groundwater storage is discussed further in Section 6.

7.4 Future Analyses

Further analysis of storage facilities and associated basin scale benefits would vary depending on the size of facilities. Large facilities are generally less complex to analyze when compared to the relative size and benefit of the system. Evaluation of a large facility requires analysis of rainfall-runoff in the contributing basin, evaporation from the potential water surface, and ease of distributing water.

Storage possibilities that should be considered in the Methow Basin include:

- Storage tanks
- Commercial/residential roof drains directed to cisterns (underground tanks);
- Deepening of existing ponds;
- Reducing reservoir evaporation by wind barriers, shading, floating covers, etc.;
- Storing water in unused irrigation canals;
- Directing road runoff to small scale storage facilities;
- Groundwater storage of high river flows by well injection;
- Groundwater storage by flooding flat ground areas; and
- Examine and identify groundwater aquifers that are not in continuity with the river aquifer.

These other storage possibilities are more difficult to analyze for basin scale benefits. Data needed to assess the feasibility of storage projects must be more localized, and require additional data gathering before benefits can be studied. In a basin context, small systems, such as storage tanks or ponds, are so small that many systems must be installed before a basin scale benefit can be realized. Difficulty in analyzing such possibilities is also driven by permitting issues that would have to be taken into account before benefits could be estimated.

7.5 QA/QC

Current Dam information available from the Department of Ecology Dam Safety Division is considered of good quality and was gathered through the state dam permitting process. This database includes any dam that impounds 10 AF of water or more. The GIS coverage was last updated in October 1998.

Potential reservoir locations summarized in the Methow Basin Level B Study were developed by the Washington State Study Team for the Pacific Northwest River Basins Commission in 1977. The data is preliminary and is meant to simply supply ideas of storage sites that should be evaluated further.

Potential reservoir locations and capacity developed by Klohn and Leonoff and summarized in this report used contours from USGS 7.5 minute quadrangle maps, runoff estimates from Ecology's Office Report No. 46, "Natural Monthly Stream Flow in the Methow Basin" and fisheries information from the USFW report "Production and Habitat of Salmonoids in Mid-Columbia River Tributary Streams – Appendix D, Stream Catalog", 1992. All of these sources are considered to be of acceptable detail for the scope of watershed planning.

TABLE 7-1

Existing Reservoirs in the Methow River Basin
Reproduced from the Water Resources Management Program, Methow River Basin (December, 1976).

Reservoir Name	Stream Location	Storage (AF)	Surface Area (Acres)	Data Source
Patterson	Little Wolf Creek**	5,000	142.9	Lakes of Washington
Pearrygin	Chewack River (diversions)	1,000	192.0	Vol. II
Alta	None	Lake level maint.	187.4	Eastern Washington
Davis Lake	Bear Creek Drainage*	Approx. 200		

*Closed all year to further appropriations including added storage capacity
** Closed to additional diversions but development of future impoundments is allowed.

TABLE 7-2

Existing Dams in the Methow River Basin
Washington Department of Ecology, 1998

Dam Name	Stream Name	Owner Name	Purpose	Storage (AF)	Surface Area (Acres)
Hawkins Dam	Tr-Benson Creek		Irrigation	35	4
Chalfa Dam	Tr-Benson Creek		Irrigation	50	9
Wolf Creek Diversion Detention Dam	Wolf Creek Diversion Channel	Wolf Creek Reclamation District	Irrigation	8	8
Chewack Canal Diversion Dam	Chewack River	Chewuch Canal Company	Irrigation	2	2
Wright Ponds-West Pond Dam	Tr-Pearrygin Creek		Small Farm Pond	18	18
Moccasin Lake Dam	Tr-Thompson Creek-Offstream		Recreation	415	27
Patterson Lake Dam	Rader Creek	Wolf Creek Reclamation District	Recreation	3330	150
Rabel Dam	Tr-Benson Creek		Recreation	100	11
Beaver Lake Dam	Beaver Creek	Dept. of Agriculture, Forest Servic	Recreation	60	31
Libby Lake Dam	North Fork Libby Creek	Dept. of Agriculture, Forest Servic	Recreation	380	10
Davis Lake Dam	Tr-Bear Creek		Recreation	500	61
Sullivan Pond Dam	Tr-Chewack River	Washington Dept. of Wildlife	Recreation	30	30
Campbell Lake Dam	Tr-Beaver Creek	Washington Dept. of Wildlife	Recreation	50	11
Pearrygin Lake Dam	Lake Creek	Chewuch Canal Company	Recreation	1000	210
Wenner Lake No. 5 Dam	Tr-Benson Creek		Recreation	9	3
Peters Reservoir No. 2	Tr-Methow River		Recreation	12	3
Alder Gold-Copper Co Tailings Dam No. 1	Tr-Methow River	Alder Gold-Copper Company	Mine Tailings	50	50
Alder Gold-Copper Co Tailings Dam No. 2	Tr-Methow River	Alder Gold-Copper Company	Mine Tailings	22	22

TABLE 7-3

Potential Reservoirs in the Methow River Basin
Reproduced from the Water Surplus through Storage Report (Klohn Leonoff, 1993)

Site Name	**Dam Base Elev. (feet)**	**Capacity**		**Drainage Area (sq miles)**	**Mean Annual Runoff (acre-ft)**
		40' Dam (acre-ft)	**80' Dam (acre-ft)**		
Alder Creek	1,800	571	2,615	8.3	889
Bear Creek	2,280	64	470	15.3	4,078
Beaver Creek	1,920	269	1,665	83.0	29,217
Benson Creek	1,960	401	1,747	32.0	3,892
Black Canyon Creek	1,200	78	397	21.9	4,764
Boulder Creek	2,560	175	727	76.9	33,037
Chewuch River	3,720	342	2,226	96.0	114,649
Cow Creek	1,640	44	282	5.6	300
Crater Creek	5,520	53	346	3.1	2,179
Cub Creek	2,520	237	1,026	16.5	10,432
Eagle Creek	3,000	24	159	13.3	14,230
Eightmile Creek	2,520	714	3,582	42.6	30,794
Falls Creek	2,800	318	1,424	26.3	16,512
Foggy Dew Creek	4,800	114	549	11.9	8,332
French Creek	1,800	167	1,425	30.2	1,613
Goat Creek	2,680	98	464	31.5	25,160
Libby Creek	1,560	78	455	39.2	15,716
Lost River (Monument)	3,000	124	535	76.9	102,569
Lost River (Yellowjacket)	2,440	478	2,429	67.1	103,013
Martin Creek	5,000	52	261	6.5	4,938
McFarland Creek	2,040	370	1,401	10.1	2,702
Squaw Creek	1,760	79	467	12.1	3,216
Texas Creek	1,720	153	676	8.6	459
War Creek	3,280	39	220	24.9	30,942