Appendix 2-A:

Concurrent Research Summaries

Appendix 2-A:
Summary of Projects Conducted Concurrent to WRIA 18 Plan Development
(I.e., results not included in Chapter 2)

I. Supplemental Watershed Planning Grants

A. Multipurpose Water Storage Grant, $100,000

1. East WRIA 18 Surface Storage

Water Storage Site Feasibility Study, Montgomery Water Group, Inc., June 30, 2003.

Primary goal to identify and evaluate potential surface water storage sites that could be used to store flow diverted from the Dungeness River during high flow periods for later use during periods of low streamflow. Conclusions include:

- Potential sites located high in the existing conveyance system would benefit the greatest number of possible users, and provide the most operational flexibility.
- A benefit to fisheries would result from increasing instream flow. The cost:benefit ratio was not defined for this study.
- Projected costs for the various alternatives identified range from $1,050,000 to $3,415,000. Unit costs for storage range from $6,851 to $16,310 per acre-foot.
- The best water storage site as determined by this study appears to be the 500 acre-foot "Atterberry Road – Enlarged" alternative. The estimated cost for this alternative is $3.4 M. The unit cost is $6,851 per acre-foot. In addition to the construction costs, the annual operation and maintenance costs were estimated to be $5,000 - $10,000.
- Development pressures and population growth will continue to reduce the number of viable sites suitable for addressing water storage needs and goals.

1. East WRIA 18 ASR

Aquifer Storage and Recovery Evaluation Report, TetraTech-FW, Inc., July 2003.

The contractor for this study developed the Dungeness regional groundwater model earlier in 2003. They utilized the model to determine whether ASR in the shallow aquifer might provide low-flow season benefits to surface and groundwater systems in the Dungeness watershed. Results are encouraging with regard to benefits to shallow groundwater and streamflow in small streams. Additional modeling could clarify optimal locations and depths for recharge.

2. West WRIA 18 ASR

Aquifer Storage and Recovery Preliminary Feasibility Study, Pacific Groundwater Group *and* Groundwater Solutions, Inc., June 2003.

This project was conducted in two phases. After the first phase, "Preliminary Hydrogeologic Evaluation," the consultants were contracted for additional work ("Hydrogeologic Characterization") in areas that warranted further study. One area of moderate potential was identified (central Dry Creek) for storage, however, the cost-benefit ratio for various scenarios makes implementation highly unlikely. The consultants gave a presentation to the advisory group in July; other players involved in community/municipal and instream water resource management were invited but, unfortunately, most did not attend.

B. Water Quality grant, $100,000

1. Use of Biomarkers to Dungeness Bacterial Pollution

   County staff time was spent preparing and negotiating the contract, coordination with the contractor, Battelle and preparing the financial reports. The rest of the funds were spent by Battelle Memorial Institute, who reviewed microbial source tracking methods and determined their scientific merit and applicability to Dungeness Bay and watershed. The final report is attached.

   The results of this report will help the Sequim-Dungeness Clean Water Workgroup (subcommittee to Dungeness River Management Team) determine if microbial source tracking should be pursued to identify bacterial pollution sources in the Dungeness area. The group will evaluate the cost-benefit of performing these tests and whether the answer will be accurate enough to facilitate remediation of pollution sources. If one of these methods is pursued, this report will provide guidance on the most appropriate method for local conditions and questions. Further, information from this report can be used to write a grant application for project funding.

2. Stormwater Impacts on Sediment Quality in Urbanizing Clallam County Streams

   The final QAPP and report is attached. County staff time was spent preparing and negotiating the contract, preparing and finalizing the QAPP for this project, coordination with Battelle Memorial Institute, site reconnaissance, and collecting and preparing County GIS info for Battelle. Battelle conducted the study with some subcontracting to AmTest, Inc. for organic analyses.

   This study presents new information on stormwater impacts to stream quality within WRIA 18. Metal and hydrocarbon contaminants were found in all streams. For a station in Bell Creek, current stormwater BMPs were shown to be inadequately treating stormwater from a large commercial area. In Morse Creek, BMPs for Hwy 101 were adequately treating strormwater because less pollution reached the creek bed. A site-specific stormwater signature was developed from direct highway run-off sediments, using Arsenic as a normalizer. This ratio was compared to all stream results and represented enrichment from pollution. Enrichment was most often found in areas downstream of road crossings. Data from this study were compared to other Puget Sound Studies (USGS studies). In general the Clallam County stream sediment data and the USGS stream sediment data are very similar and show basically the same trends.

   The results of this study will be presented to local entities (i.e., Board of Clallam County Commissioners, Clallam County Planning Commission, City of Port Angeles, City of Sequim, the Dungeness River Management Team).

3. Inspection Incentives for Septic Systems along TMDL streams

   County staff time was spent developing contracts with septic designers and locators who participated in the cost-share program, answering questions, and coordinating with landowners and septic designer inspectors.

   Letters to property owners of a septic of concern were sent in early March offering cost incentives to have their systems located and inspected. Funds were provided in a grant from Department of Ecology.

Correspondence from the first letter sent was sparse. Ten property owners contacted either Janine Reed or a designer for inspection information. Four inspections resulted from that correspondence.

A reminder postcard was sent the first week of June notifying property owners that time was running out for reimbursements. That reminder notice generated 19 more property owner responses. Of that group four more had inspections done. More inspections are pending but were not completed prior to the deadline and will be paid for through another funding source.

Inspection results:
Eight total inspections
Seven systems were located either by asbuilt or designer determination of visual evidence and owner knowledge. One system was electronically located, using a tracking device.
Asbuilts indicating location, size, and proximity to creeks, ditches, ponds and the shoreline were documented.
Information was also provided in each inspection regarding whether the system was functioning and needed to be pumped. All those that required pumping were pumped with partial reimbursement coming from another funding source.

Problems noted:
One system was deemed to be failing, no indication of sewage surfacing but the system was not functioning properly. A repair permit was submitted and approved. The property owner has six months to have the system installed but due to the type of system required (sand filter) will need to proceed while dry conditions exist.

C. Instream flow grant, $100,000 originally
a.k.a., Elwha-Dungeness Watershed Instream Flow Recommendations Project
Dungeness River In-Stream Flow Side Channel Study, US Bureau of Reclamation (BOR), February 2003.
The purpose of this project, funded by Washington State Department of Ecology, was to acquire further scientific information for in-stream flows in the Dungeness and Elwha River watersheds. The work was performed by a partnership of the Bureau of Reclamation (BOR), the Jamestown S'Klallam Tribe, and Clallam County.

There were several tasks involved in this grant funded project:

- Conducting fieldwork to investigate relationship between Dungeness mainstem flow and side channels. The results were compiled by BOR in narrative and graphic form.
- Periodically measuring stream flow at specified side channels of the Dungeness River and developing a stream hydrograph for the spring snow melt and summer periods. A hydrograph was developed by Bureau of Reclamation for the stream flow data in each side channel. This will provide a good indication of the impact of irrigation withdrawal on the side channel flows for a particular discharge level.
- Side channels were monitored for flows and temperature. Weekly monitoring data was included in the overall study.
- Side channels were monitored for fish presence and speciation. Monthly summaries of fish usage is included n the BOR report and flow discussions.

- Four Dungeness mainstem flow measurements were taken during summer low flow period in 2002.

BOR developed hydrologic analysis, graphics and final report of low flows in the river and side channels. The report entitled Dungeness River In-Stream Flow Side Channel Study, analyzed flow data from two permanent mainstem gauges, one temporary mainstem gauge, individual mainstem measurements, irrigation outtakes, side channel and staff gauge measurements. The report also includes losing and gaining river reach identification and an examination of hydrologic connections between river and side channels.

Unfortunately, additional fish habitat studies intended for the Elwha basin under this grant were not accomplished due to lack of staff resources.

Citation:
Daraio, J., Bountry, J. and Randle, T. February 2003. "Dungeness River In-Stream Flow Side Channel Study." Prepared for: State of Washington Department of Ecology and Clallam County by U.S. Department of Interior, Bureau of Reclamation. 43 pgs plus appendices.

II. Phase 2 Technical Assessment Grant

A. **Dungeness Groundwater Modeling Evaluation of Full Buildout in the Dungeness River Area,** Tetra Tech FW, Inc., May 2004.
Our Dungeness groundwater modeling contractor ran the model with various potential scenarios of buildout according to current zoning in the study area. The model results included impacts to river flows, small streams, and all aquifers under two scenarios: all new exempt wells pumping from the shallow aquifer, and all new exempt wells pumping from the middle aquifer (at an assumed rate of pumping of 350 gpd). Findings include:
- the middle and lower "confined" aquifers are in hydraulic continuity with the Dungeness River, at minimum
- the shallow aquifer responds similarly when withdrawals are simulated to come from either the shallow or middle aquifer
- withdrawals at a distance from the river (depth, horizontal distance) will change the impact on the river
- buildout = 260% increase in withdrawals and 3.5-12' drop in aquifer water levels, depending on the scenario
- flow reductions in small streams range from 15% - 27%, depending on the scenario
- flow reductions in the Dungeness River could be up to appx. 4 cfs, depending on the scenario

B. **Updated and enhanced buildout potential by subbasins**, Clallam County GIS staff (Tom Shindler), July 2004.
Section 2.2, Human Environment, contains numerous tables and figures pertaining to the buildout analysis done by Clallam County DCD in 2002. In 2004, DCD completed an enhanced analysis, with the results corresponding to Table 2.2-3 found in Table 2-A-1 below, as well as in Figures 2.2-1 and 2.2-2. For further details, see notes at bottom of table.

Table 2-A-1 WRIA 18 Updated and Enhanced Residential Buildout Potential by Subbasin

Subbasin	Existing Residential Units	Total Residential Units at Full Buildout			Existing Parcels with Residential Potential		
		Maximum Buildout Scenario	Minimum Buildout Scenario	"Realistic" Buildout Scenario	Total	Currently Occupied	Currently Vacant
Bagley Creek	302.00	1,276.00	471.00	629.00	624.00	302.00	322.00
Bear Creek	165.00	430.00	280.00	363.00	289.00	165.00	124.00
Bell Creek	1,306.00	11,755.00	2,548.00	6,637.00	1,906.00	1,115.00	791.00
Canyon Creek	39.00	56.00	42.00	51.00	50.00	39.00	11.00
Cassalery Creek	790.00	1,952.00	983.00	1,669.00	933.00	776.00	157.00
Chicken Coop Creek	116.00	441.00	264.00	357.00	248.00	116.00	132.00
Dean Creek	15.00	89.00	19.00	37.00	38.00	15.00	23.00
Dry Creek	248.00	2,971.00	449.00	838.00	354.00	248.00	106.00
Dungeness Bay inner	692.00	1,530.00	1,103.00	1,238.00	988.00	689.00	299.00
Dungeness Bay outer	752.00	1,483.00	947.00	1,370.00	795.00	606.00	189.00
Dungeness River	1,596.00	4,120.00	2,134.00	2,934.00	1,793.00	1,331.00	462.00
Elwha River	223.00	1,284.00	441.00	574.00	540.00	223.00	317.00
Ennis Creek	561.00	4,223.00	660.00	1,391.00	708.00	510.00	198.00
Gierin Creek	1,957.00	7,944.00	2,344.00	4,416.00	1,927.00	1,436.00	491.00
Indian Creek	262.00	607.00	421.00	453.00	414.00	252.00	162.00
Jimmycomelately Creek	48.00	407.00	52.00	75.00	96.00	48.00	48.00
Johnson Creek	208.00	2,428.00	705.00	1,566.00	542.00	208.00	334.00
Lees Creek	1,142.00	9,300.00	1,534.00	4,889.00	1,545.00	1,003.00	542.00
Little River	20.00	48.00	29.00	32.00	32.00	20.00	12.00
Matriotti Creek	1,280.00	3,499.00	1,906.00	2,641.00	1,778.00	1,171.00	607.00
McDonald Creek	444.00	898.00	605.00	780.00	656.00	427.00	229.00
Meadowbrook Creek	132.00	329.00	144.00	164.00	177.00	130.00	47.00
Morse Creek	739.00	2,190.00	975.00	1,247.00	1,005.00	687.00	318.00
Other	4,355.00	40,596.00	7,077.00	18,021.00	7,581.00	3,741.00	3,840.00
PA small tributaries	1,779.00	8,310.00	2,109.00	7,728.00	2,073.00	1,631.00	442.00
Peabody Creek	2,881.00	10,704.00	3,138.00	6,702.00	3,258.00	2,581.00	677.00
Sequim Bay small tributaries	298.00	1,842.00	845.00	1,302.00	772.00	297.00	475.00
Siebert Creek	353.00	1,177.00	527.00	661.00	632.00	353.00	279.00
Strait small tribs	1,151.00	2,194.00	1,582.00	1,802.00	1,614.00	1,141.00	473.00
Tumwater Creek	1,492.00	3,327.00	1,572.00	2,629.00	1,452.00	1,236.00	216.00
Valley Creek	1,049.00	3,786.00	1,168.00	2,895.00	1,183.00	939.00	244.00
White Creek	401.00	2,656.00	509.00	1,744.00	532.00	344.00	188.00
TOTAL	**26,796.00**	**133,852.00**	**37,583.00**	**77,835.00**	**36,535.00**	**23,780.00**	**12,755.00**

Source: Clallam County DCD 2004

Notes:

This table differs from Table 2.2-3 in several ways:

1 Zoning and parcel data are updated to 2004. The zoning data is county-wide, including Cities. Consequently, the buildout analysis is valid for the entire area.

2 Three buildout scenarios are included, all based on current zoning only:

The maximum buildout scenario determines the number of units that could be built with all services present, all bonuses used and no critical area or open space limitations. It also includes the full residential development of commercially zoned lands that also permit residential use.

The minimum buildout scenario determines the number of units that could be built if no additional services are present, no bonuses are used, all critical area limitations are accounted for (see below), and no land is transferred out of open space designation. It does not include any residential development of commercially zoned land, even if residential development is permitted.

The "Realistic" Buildout Scenario assumes services provided within UGAs, but does not include cluster or TDR bonuses. It removes the relevant critical area portion of each parcel from the land area available for development, but provides for reasonable use exeptions on half of those parcels that would otherwise be rendered unbuildable. It does not include residential development of commercial land.

3 Parcels with Residential Potential include those zoned for residential use, or those with an existing residential use. Note that both some parcels that are currently occupied and some vacant parcels could be further subdivided.

III. Additional projects

A. Port Angeles Harbor Shoreline Habitat Assessment, Pentec, Inc., December 19, 2001 (available from Department of Community Development office at PA City Hall)
Evaluates salmonid habitat of the shoreline and nearshore areas within Port Angeles Harbor. Eighteen (18) habitat assessment units were assessed using the Tidal Habitat Model developed by Pentec Environmental and the City of Everett. The outer (eastern) ends of the harbor provide the best habitat, and the inner (western) part of the harbor where industrial activity is the greatest have the least value habitat, as expected.

B. City of Port Angeles Wetlands Inventory, Sheldon & Assoc., May 10, 1995 (available from Department of Community Development office at PA City Hall)
Study supported a comprehensive stormwater management plan. A field wetland inventory was conducted by Sheldon and Associates in February and August 1994. Limited in some instances by site access, the inventory provides general information about the presence, extent, and some characteristics of wetlands within the City and did not delineate wetland edges using joint federal methodology. Except for wetlands associated with streams and marine shorelines (Ediz Hook lagoon), there are no large wetlands inside the City limits.

C. Sargeant, D. 2002. Dungeness River and Matriotti Creek Fecal Coliform Bacteria Total Maximum Daily Load Study. Environmental Assessment Program, Washington State Department of Ecology, Olympia, WA. Publication Number 02-03-014.
The Washington State Department of Ecology conducted a total maximum daily load (TMDL) study for fecal coliform bacteria in the Dungeness River (and its lower tributaries) and tributaries to Dungeness Bay. This study identified water quality goals for these freshwaters to meet WA water quality standard and NSSP shellfish growing water standards for fecal coliform bacteria. Bacteria reductions were needed in the Dungeness River, Matriotti Creek, Meadowbrook Creek, Cooper Creek and the Golden Sands area.

D. Hempleman, C. and D. Sargeant. 2002. Water Cleanup Plan for Bacteria in the Lower Dungeness Watershed, Total Maximum Daily Load Submittal Report. Southwest Regional Office, Washington State Department of Ecology, Olympia, WA. Publication Number 02-10-015.
The Water Clean-up was submitted WA Dept. of Ecology to the US EPA. It was approved by US EPA in July 2002. This clean-up plan incorporates the Clean Water Strategy and identifies the actions that will be taken to mitigate bacterial pollution.

E. Rensel, J. 2003. Dungeness Bay Bathymetry, Circulation and Fecal Coliform Studies: Phase 2. Rensel Associates, Arlington WA.
This study was funded by the Jamestown S'Klallam Tribe and used as the technical basis for the Dungeness Bay TMDL report.

F. Sargeant, D. 2004. Dungeness Bay Fecal Coliform Bacteria Total Maximum Daily Load Study. Environmental Assessment Program, Washington State Department of Ecology, Olympia, WA. Publication Number 04-03-012.

G. Hempleman, C. and D. Sargeant. 2004. Water Cleanup Plan for Bacteria in Dungeness Bay, Total Maximum Daily Load Submittal Report. Southwest Regional

Office, Washington State Department of Ecology, Olympia, WA. Publication Number 04-10-026.

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