Single CU or Watershed Indicators Costing
Single Watershed/CU Costing underlined

Comment [MSOffice1]: then tally all into summary doc. with notes about recommendations for doing all, metadata efficiencies, etc.

Objectives
a) estimating time needed to prepare proposed indicators for implementing
b) estimating time needed to run and process indicator information
c) estimating time needed for preparing and undertaking associated projects
d) estimating time needed for reporting out on indicator information (e.g. habitat status reports and web-mapping application)
e) attributing cost estimates to a) through e)

General Notes
-Cheryl-we are taking same approach to effort and costing as done in the SARA Action Plans (these plans also rank and prioritize works)
-Harmonized Monitoring Committee would be an asset when collaborating on attributes to run in Watershed Statistics
-need to have good meta-data for all work going into/or being referenced in the web-mapping application
-In generating estimates, used $40/hr for data entry, $250/day for data extraction type work, $700/day for field and analysis type work, DFO in-kind support $300/day at Bi-3 level), $300/day GIS management
-Estimates typically generated on preparation time, monitoring, roll-up and reporting
-Developing data sharing agreements with other groups e.g. municipalities would facilitate information transfer and reduce costs
-ID'd additional effort and cost required for overall GIS support at bottom of document,
-haven't accounted for inputting information into habitat status reports, developing overview reports, consultations, coordination

Indicator costs and Project Specific Notes

1. Stream and Lake Pressure Indicators**: Watershed: Total land cover alterations, Riparian disturbance, Watershed: Road Density**
AI-Ask Malcolm Gray what cost would be for the Province-H. Stalberg, done 2,250K in two years
-3/4 FTE (250/dayx5x50weeks/yr)= 47K for GIS support to do to whole province per run e.g. every five years
-Use the Provincial Forest Health Database for Mountain Pine Beetle predicted range for ID'ing threat extent
Total=2250K+47K=2297K

Yukon
For Yukon, using existing information e.g. mineral development/mining claim, 2 weeks (10days) x 700= 7K
For new satellite imagery possibly 2 million and 2 years effort to report out on.

-For single watershed/CU
a. One approach might be to have Watershed Statistics develop the information, if done it would be free as a result of an MoU, however uncertain how topical it is. If have to do new, perhaps cost 25K for most recent snap-shot, not trends. Use the Provincial Forest Health Database for Mountain Pine Beetle predicted range for ID'ing threat extent. Cost uncertain.
b. Might also be able to mine existing information e.g. from mineral development/mining claims or from forestry e.g. work Kim Hyatt has done in the Barkley Sound area 10 days x 700=7.0K. One objective of Barkley pilot is to test this objective.

-for both approaches just do every 5 years

2. Streams and Lakes Project- **To enable weighting of different land-use types, do probability analysis of different types of land use impacts**.
Literature review by student or casual, 2 mo's work (7K) plus 1 week oversight effort by DFO (2K), total 9K

Science doing this year, no additional cost to WSP (value @ Literature review by student or casual, 2 mo's work (7K) plus 1 week oversight effort by DFO (2K), total 9K)

3. Streams and Lakes Project- **Develop correlation between road density, road network (via spatial analysis), stream network (S1, S2, etc.), fish distribution and crossing type e.g. culvert, bridge, etc..**
Include in weighting project, no additional cost.

-Single CU/Watershed
-No costs determined.

4. Stream Pressure Indicator-**Water extraction**
AI-Ask the NCC what amount of effort for BCI EcoRegion for water extraction indicator so that we can extrapolate across Region-H. Stalberg, done
AI-Ask the NCC if they are automating the process for water extraction-H. Stalberg, done
NCC Sarah Loos advised weren't developing an automated process as only doing once. Took a few days to crunch through the data; part involved figuring out units and talking to Province. Simple process, and definitely not fancy GIS work; it mostly consisted of simple overlays.
-Based on Sarah's experience 22 days for rest of B.C. and incorporation into the web-mapping application 22 x $250= 5.5K
-2 weeks to compare watershed ratios 10x $250 total 2.5K
-development of metadata 2 day x 250= 0.5K
-Total for first year=8.5K

-might have to run again in 10 years time e.g. when Climate Change impacts might be incorporated into the L'eau precipitation model

Yukon
AI-Heather check with NCC to see if L'eau is in the Yukon, Done
-No, L'eau not available *yet*
Yukon water board has the water licencing information

-For single CU/Watershed similarly to BC Interior Project few days to do, so in total 1 week of effort
-development of metadata 2 day x $250= 0.5K (efficiencies gained in continued monitoring as wouldn't have to repeat this effort)
-1 week to do analysis, make comparisons between smaller watersheds and incorp. into web-mapping appl'n 5x$250=1.75K
-Total 0.5K + 1.75K=2.25K

-recommend do entire province at one time

5. Streams, Lakes and Estuaries Pressure Indicators-**Permitted Discharges**
Data unconsolidated, won't presently pursue, therefore no current cost

Yukon
In Yukon permitted discharges all available through Yukon Water Board, so they have info. on location, type of discharge, duration. Defer evaluation until BC data consolidated.

-Single CU/Watershed
-No costs determined.

6. Stream Pressure Indicator-**Sediment**
-Monitoring TSS, 2K for each sampler, start with 100K and determine sampling locations based upon high pressure sites and Reference Condition sites e.g. less impacted to try to make comparisons over time e.g 25 RCA and 25 pressure, would likely associate them with stream crossings making installation less onerous
-1 day install, 2 days/yr download= 3 days/yr including travel x 700=2.1K/ close site
-total effort close sites 3 days x 25=75days
-remote sites 9 days effort x 700= 4.5K/site
-effort of 25 remote and 25 close = (25 x 2100) + (25x4500)=165K
-total cost for effort and equipment= 165K+100K=265K first year
-would need to build spreadsheet that ID'd sensitive life-stages for the salmon and then it identified how many days exceeding benchmarks, 3 weeks to build spreadsheet 15x700= 10.5K
-reporting 1 day to put ASCI data downloaded from meter into the spreadsheet and do Q&A and submit info 50sites x 700=35K first year, should be ½ day in subsequent years
-developing meta-data, mapping sites for monitoring and link to spreadsheet -4 GIS days x 250= 1K

-@35 Environment Canada sites, downloading data into spreadsheet also (1/2 day x $700)= 0.35K
-metadata development ½ day x 250= 0.175K
-Total cost for B.C. first year=265K+10.5K+35K+ 1K+.35K+.175=312K
- Total B.C. effort for first year= 75 days close sites + 225 days remote sites + 15 days spreadsheet + 50 days download + 6 days GIS= 371 days

Yukon
Through existing agreement in the Yukon, every year 300-500K spent by DFO
Yukon Territorial gov't collects 10's of 1000's of sites for turbidity, Total Settleable Solids, and Total Suspended Solids, is a huge database, is geo-referenced
4 weeks to go through the data base =20 days x $700= 14K first year, subsequent years less
-would follow process above re. building spreadsheet and tracking exceedances (no extra effort for building spreadsheet), would need to select sentinel/key streams prior at initiation of the project in Yukon
Al-ask Dwight re. effort to develop meta-data, mapping sites for monitoring and link to spreadsheet in web-map application
-Total cost for Region first year 312K+14K= 326K, needs Dwight's estimate of time for Yukon

-One CU/Watershed
-1 day install, 2 days/yr download= 3 days/yr including travel x 700=2.1K/ close site
-remote sites 9 days effort x 700= 4.5K/site
-effort of 1 close and 1 remote site= 2.1K + 4.5K=6.6K
-total cost for effort and equipment= 6.6K+4K=10.6K first year
-would need to build spreadsheet that ID'd sensitive life-stages for the salmon and then it identified how many days exceeding benchmarks, 3 weeks to build spreadsheet 15x700= 10.5K (to build efficiencies, would use this as template for future sites, with life history timing modified as appropriate)
-reporting ½ day to put ASCI data downloaded from meter into the spreadsheet and do Q&A and submit info for 2 sites x ½ $700=0.7K first year, afterwhich there will be efficiencies for future sites in subsequent years
-developing meta-data, mapping sites for monitoring and link to spreadsheet -2 GIS days x 250= 0.5K
-@35 Environment Canada sites, downloading data into spreadsheet also (1/2 day x $700)= 0.35K (would undertake this annually)
-metadata development ½ day x 250= 0.175K (efficiencies gained in continued monitoring as wouldn't have to repeat this effort)
-Total cost for effort (30.5 days total) and equipment first year in one watershed/CU= 10.6K+10.5K+0.7K+0.5K+0.35K+.175=22.83K

Yukon
Through existing agreement in the Yukon, every year 300-500K spent by DFO

Yukon Territorial gov't collects 10's of 1000's of sites for turbidity, Total Settleable Solids, and Total Suspended Solids, is a huge database, is geo-referenced
4 weeks to go through the data base =20 days x $700= 14K first year, subsequent years less
-would follow process above re. building spreadsheet and tracking exceedances (no extra effort for building spreadsheet), would need to select sentinel/key streams prior at initiation of the project in Yukon
-Yukon should therefore be more cost efficient as a result of no field work required

7. Stream Project- **Develop correlation curve of Turbidity Units to TSS**
-Need to install flow actuated automated samplers-they collect turbidity and TSS, they are 6K each
-(some data may be available for interior-done by CanFor for Stream Crossing index e.g. PG)
-Estimate need 6 metering sites in B.C. to capture different geology types x 6K per meter=36K
-Effort install 1 day, automated sampling over 4 month period through freshet with field download 3 separate days, plus decommission 1 day= 5 days/site x 700= 3500 and 15 days at most/remote sites (15x 700)= 10.5K
-estimate of effort with three remote and three close=(3x5x700)+ (3x 15x 700)=42K
-total estimate cost of equipment and monitoring 36 K +42K =74K first year

Yukon
This work already completed in the Yukon
AI-Ask Steve Gotch how many turbidity samplers were used in the Yukon to develop the representative correlation curves to TSS-H. Stalberg, done
In the Yukon minimum 18 unique sites, driven predominantly by principal geology and glaciated or not
Note, Steve expects that BC would have more than 18

AI-Ask Steve how background TSS was calculated in the Yukon-H. Stalberg, done
Rule sets needed to be developed e.g. what time of year used for averaging, type of waterbody then watercourse then put into 3 categories of Total Suspended Sediment background bins i.e. <25mg/l, 25-100mg/l, >100mg/l

Note, field unit for TSS, Turbidity monitoring 2K each, used in the Yukon
AI-Ask Dwight how much effort to install into Web-mapping application

-For single CU/Watershed
-Install one per initial watershed, and review for subsequent watersheds where needed to avoid redundancy
-Install 1 day, automated sampling over 4 month period through freshet with field download 3 separate days, plus decommission 1 day= 5 days/near site x 700= 3500 and 15 days at most/remote sites (15x 700)= 10.5K

-Alternatively, to increase efficiency, would install one during field trip for installing TSS meters (could decrease number of TSS meters by one as well), therefore requiring 1 additional field day = 1 x $700=0.7K
-analysis of data 2 days x $700= 1.4K
-total estimate cost of equipment, monitoring and analysis 6K + 0.7K+ 1.4K= 8.1K first year, in subsequent locations could re-use logger so cost would decrease

8. Stream Status Indicator- **Water Quality**
3 days to ensure links in web-mapping application working 3x250=0.75K costs for first year only, then maintenance

Yukon
3 days to ensure links in web-mapping application working 3x 250=0.75K costs for first year only, then maintenance
- Total for first year for entire Region 2 x 0.75K= 1.5K

-For single watershed/CU, recommend do entire Region 2days x 0.75K= 1.5K

9. Stream Status Indicator-**Temperature, Coho juvenile rearing and; Adult Migration and Spawning for all species**
AI-Find out final # of coho CUs-Ray, done (43)

E. MacIsaac-estimated $72K for Yukon and BC collection and processing of data for all temperature monitoring (both coho juveniles and adult migration and spawning for all species), processing of data includes 5 days effort to increase excel spreadsheet to filter Temperature exceedances of benchmarks for the different life histories
-only certain areas and CUs of the province where temperature may be an issue and monitoring can be concentrated there, Province's work on Temperature sensitive streams can guide this priority setting effort, and we may be able to collaborate with them
-for the Adult Migration and Spawning, coordinate with the Environment Canada sites where possible as well
-estimate 10 days for metadata development, input into web-mapping and linking
10 x$250= 2.5K
-Total 72K+2.5K=74.5K

AI-Contact Mark Nelitz and find out when Provincial analysis of temperature data to determine which streams have high-base temperatures will be completed. This is to allow us to ID monitoring needs e.g. the streams that will be first picked for temperature monitoring will be those with high base temperatures and those that have pressures on them which might make them high e.g. riparian loss, urban development and water extraction- E. MacIsaac, outstanding

-For single CU/Watershed
-10 days effort to collect and process temperature data which includes increaseing excel spreadsheet to filter Temperature exceedances of benchmarks for the different life histories 10 x $700=7.0K

-For one CU/Watershed estimate 3 days for metadata development, input into web-mapping and linking to information 3x$250=0.75K (efficiencies gained in continued monitoring as wouldn't have to develop metadata, and would become more efficient in providing linkages to web-mapping application)
-Total per Watershed = 7.0K + 0.75K= 7.75K

10. Stream Project **Augment Temperature Sensitive streams database, Yukon water Temperature Data, WATEMP Database where needed with Mean Weekly Average temperature**.
AI-Didn't discuss, outstanding for the group

-For single CU/Watershed
Didn't cost out per watershed

11. Stream Status Indicator- **Stream discharge**
-Review data sources identified for the indicator of all streams that had, have or could have salmon
-the most challenging will be identifying the potential salmon bearing systems; these will be a lower priority to be addressed once potential fish distribution models have been completed and confident of results
-1 month effort, 22 days x $700= 15.4K
-putting into web-mapping, creating meta-data and possible links 8 days x 250=4K
-total for first year 15.4+4+=19.4K
-is a paper exercise, suggest revisiting in 5 years

11a. Yukon-not very much literature on stream discharge, so Project needed to address data gap i.e. Audit flow modeling in sensitive rearing areas.
Put into cover e-mail. 12 sites, 6 close with 3 days travel each x $700 and 6 remote sites with 9days travel each x $700, (6 x 3 x 700) + (6 x 9 x 700) = 12.6K + 37.8K= 50.4K
Write up 5 days x 700=3.5K
Total= 50.4K+3.5K=53.9K

11b. Yukon-not very much literature on stream discharge, so Project needed to address data gap i.e. Audit flow modeling in sensitive rearing areas.
12 sites, 6 close with 3 days travel each x $700 and 6 remote sites with 9days travel each x $700, (6 x 3 x 700) + (6 x 9 x 700) = 12.6K + 37.8K= 50.4K
Write up 5 days x 700=3.5K
Total= 50.4K+3.5K=53.9K

-For one watershed/CU 5 days x $700= 3.5K
-Putting into web-mapping, creating meta-data and possible links 2 days x $250=0.5K
-Total 3.5K +0.5K=4.0K

12. Stream Project-**Review Ron Ptolemy water data and where gaps for data exist, examine augmenting and updating with current information**
AI-Uncertain, once #11 undertaken, will be able to develop initial cost estimates

Yukon
For Yukon, the literature not available, project 11a recommended.

-For single CU/Watershed
-Didn't cost out per watershed

13. Stream Project-**Predicted/Potential fish distribution of juveniles and adults**
Investigate if Yukon Habitat Suitability or Provincial FSW models could work for WSP.
AI-Ask E. Parkinson how long to do the whole province, will they show obstructions and/or obstacles, what's the source of information for the obstructions/obstacles and do they include culverts-E. MacIsaac, outstanding

AI-Ask Steve Gotch how much effort would it take to adapt (if required) and apply Yukon model to the entire Territory-H. Stalberg, done
Yukon project in the Alsek drainage (Southwest Yukon) will be complete in 6 months (started in 2005 for a total cost of 500K), Porcupine drainage in North-Central Yukon supporting chum and coho, 4 weeks additional effort required 20 days x $700= 28K

Note-in the interim there is a Yukon FISS database to work from, last updated 2001. Contains 17,839 records of which are 3,775 points or zones on 1,765 waterbodies. These points and zones can have multiple records associated with them. FISS Theme Number of Records: Fish Distribution 6,626; Life History 43; Enhancement and Management 6,423; Potential and Constraints 2,337; Obstructions 372; Land Use 828; Resource Use 593; Value 46; Sensitivity 112; Water Quality 42; References 417 with 153 abstracts.

-For single CU/Watershed
-Didn't cost out per watershed

14. Stream Status Indicator-**Benthic Invertebrates**
AI-Ask Environment Canada how many sites are currently being monitored for CABIN that we could create links to within the web-mapping application-D. McCullough, done
-There are about 300 CABIN sites in B.C. and Yukon, all info. currently in a database that is georeferenced, not all of information is presented in Env. Canada's web-mapping layer however
AI-Request if Env. Canada would consider loading more of their CABIN database information into their web-mapping application to ease our linkages to actual data, Heather outstanding
GIS support required to include data layer into web-mapping application 2 days x 250= 0.5 K

Yukon
-CABIN undertaken in 40 sites by Yukon Territorial Gov't & DFO, DFO contribution 20K per year so no additional cost for WSP
GIS support to link to web-mapping application accounted for above

-For single watershed/CU
- GIS support required to include data layer into web-mapping application 2 days x 250= 0.5 K (efficiencies would be gained as exercise would not need to be repeated, but links maintained)

15. Stream Quantity Indicator-**Accessible stream length, barriers**
FISS- Obstructions are in the Fisheries Information Summary System (FISS) (1:50K), and there are numerous types e.g. Beaver Dam = BD, Cascade = C; Canyon = CN; Culvert = CV; Dam = D; Falls = F; Hydro Dam = HD; Persistent Debris *present for several years = PD; Pump = PU; Rock = R; Log Jam = X; Velocity Barrier = VB. Also noted is (Height: Height of the obstruction in metres) and (Length: Length of the obstruction in metres). FISS entries may or may not be species specific. Fish can be affected by these obstructions, not necessarily blocked from passage. However, FISS also has an entry for **Species Blocked** wherein the species code is recorded where it has been **blocked** by the obstruction. FISS also has category for enhancement efforts e.g. fish ladders and obstruction removal projects to assist in updating information.

Provincial Obstacles Database- Obstacles in this1:20K data-base utilizes FISS, Resource Analysis Branch inventory studies (RAB), Fish Habitat Inventory & Information Program (FHIIP), Field Data Information System (FDIS), Community Mapping Network (CMN) and BCLAKES. This database is species specific only where FISS has provided that information i.e. blocked.

The process determined for ultimately identifying accessible stream length for a particular area is:
i. use office LEK to undertake paper audit of the barriers, blockages and enhancement efforts pertaining to barriers within FISS, e.g. are they still barriers or have they been rectified, are they now barriers to more salmon species, etc..
ii. superimpose over the audited FISS barriers the obstacles within the 1:20K Obstacles database; conduct office LEK paper audit to ascertain if the barriers in the 1:20K overlay are different than those presented in FISS and if they are barriers to salmon. The barriers where there is uncertainty would require a field audit.
AI-Investigate the obstacles data-base and see what Wendy Beauchamp has done in Lower Thompson CU to get effort estimate for Region-C. Lynch, done
-Very rough estimate developed by saying 4 days to do paper audit of all obstructions to all salmon species in a geographic area the size of the Lower Thompson CU and then estimating that there are 30 equivalent areas like this in the Province- 4 days x 30=120 days effort
-120 days x 250=30K
-Very rough estimate for GIS support to input audited obstacles into web-mapping application and FISS 40 days x 250= 10K
-Total = 160 x 250= 40K
-Review databases again in 5 years to pick-up any new barriers input into the system, this review should cost significantly less as systematic approach will have been developed for auditing and there will be less new obstacles to audit
-In 5 years 10K cost and 40 days effort total.

-Recommend doing this audit work at the same time as the FISS distribution audit to increase efficiency

Note-the above exercise could also be augmented in some areas through partnering with MoT. In early December 07, Sean Bennett asked Doug Nolan, Manager Env. Services in MoT's Northern Region if MoT had crossing geo-referenced and if so had any of them been ID'd as impassable to fish.
Doug Nolan advised,

-The Ministry has a Road Inventory & Maintenance System (RIMS) mapping platform (under development and only available for access by selected MoT staff at this time) that includes georeferenced locations of roadway culverts (i.e. those with a span/diameter under 3 m) and structures (i.e. bridges and culverts with a span 3 m or greater). Accuracy limited as sometimes determined via driving distance from a location.
-RIMS is based on a ESRI platform like other provincial mapping applications such as Habitat Wizard.
-The RIMS database has at least one field for entering whether or not a stream is a fish stream (Yes/No/Unknown). The field has either yet to be populated fully, or contains unreliable determinations of fish presence.
-Some stream crossing structures in MoT Northern Region have been georeferenced in the field in conjunction with environmental assessments the ministry has done for highway improvement projects, or stand-alone fish-passage culvert inspections.
-There have also been a number of more thorough watershed level fish passage culvert inspection initiatives (with involvement of MoE, DFO North Coast, Skeena Fisheries Commission and MoT) completed along highway corridors in the western portion of our region; these studies included georeferencing. (Jeff Lough and Lana Miller are good contacts if you would like further info on these efforts.)
-As well, in October, Kirk Safford from MoE Peace Region recently forwarded a list of about 30 highway crossings in the Tumbler Ridge and Chetwynd areas that MoE had identified as having apparent fish passage barrier issues; the list included georeferenced locations.
-Details of whether or not a structure is a barrier, and whether or not a stream is fish bearing, and what the average channel width is at the crossing, and a crossings' georeferenced location are would be useful information for MoT maintenance, construction and fish passage programs.

Note: could gain the stream-road intersections through the Watershed Statistics process and then work to ID which are highways

Yukon-complete, insert Steve's blurb
My take-through various communication means public was asked to provide information on any known barriers to salmon that they knew of, or if barriers removed, provide details and coordinates. Yukon DFO then audited some of the reported information and found high accuracy.

-For single watershed/CU
-paper audit 4 days x $250=1K
-Very rough estimate for GIS support to input audited obstacles into web-mapping application and FISS 1 day x 250= 0.25K
-Total = 1.0K + 0.25K=1.25K

16. Stream Quantity-**Key Spawning Areas (length)**
Focus is on the extent of Key Spawning Habitat defined as:

Those areas of spawning habitat used foremost annually regardless of escapement.

Process determined:
i. Use LEK to audit FISS, recognizing limitations of FISS, e.g. are these areas still the Key Areas, have they been reduced in length
ii. Recommend stock assessment crews geo-reference upstream and downstream extent of Key Spawning Areas not captured in FISS, where crews currently don't (on some years likely habitat more extensive than spawner distribution)

Note-other alternatives are digitizing the points right into Mapster on the TRIM (1:20K) locations and save this as a GIS file in the field w. laptop and wireless or; drawing extent of the sites on the paper maps in the field, and then this would be put onto TRIM: GIS processing would then capture information and put into Mapster and Web-mapping application

iii Add narrative in the CU habitat template re. any changes to the habitat quality e.g. sedimenting in, milfoil displacing spawners, etc..
iv. Where quality appears to be decreasing, others can do further status investigations e.g. compaction.
-FISS audit 1 day per geographic area the size of the Lower Thompson CU for all species
-from discussions with Sean Bennett, their audit of FISS for Chinook and coho distribution and spawning areas in the Lower Thompson Coho CU took ½ day with 4 people
-if 30 similarly sized areas across province to Lower Thompson Coho CU, @ 30 days x $250=$7500
-Note, paper audit of FISS should be undertaken at the same time as the fish distribution audit of FISS
AI-Find out for all species what effort stock assessment puts into monitoring extent of key spawning areas annually-T. Pendray, outstanding
AI-GIS support TBD once we gain feedback from T. Pendray, for now estimate 10 days at 250= 2.5K
-Total 40 days effort and 7.5K+2.5K= 10K

Yukon
They have information currently on key spawning areas, which was very difficult to gain, vast e.g. 75 km for a spawning area, Steve doesn't recommend utilizing this indicator in the Yukon.

Alternative recommendation is to report out subjectively on the overall quality of the spawning habitat for the CU

<u>-For single CU/watershed</u>

-FISS audit 1 day per geographic area the size of the Lower Thompson CU for all species
-from discussions with Sean Bennett, their audit of FISS for Chinook and coho distribution and spawning areas in the Lower Thompson Coho CU took ½ day with 4 people, total 2 days x $300=0.6K
-Note, paper audit of FISS should be undertaken at the same time as the fish distribution audit of FISS
-very rough estimate of doing GIS support work, 2 days x $250= 0.5K
-Total cost= 0.6K + 0.5K=1.1K

17. Lake Quantity, Sockeye Lakes- **Lake Productive Capacity**
-Effort required to go through the Sockeye Lakes database, big Excel spreadsheet and create a distribution curve 1 day x $500= 0.5K
-The sampling stations in the @ 100 lakes all have GPS lat and long's
-Effort for putting into web-mapping application 3 days x $250= 0.75K first year
-1/2 day x 250 for developing metadata= 0.125K
-Total cost for first year=0.5+0.75 +.125=1.4K

-For future runs, recommend every 5 years or 2 in some lakes where great pressure e.g. Osoyoos
-For future years, may be able to do the photosynthetic rate via chlorophyll @20 sites per day can be done
-Effort required 1 week of sampling 10K (includes plane and boat sampling), 1 week processing samples 5 x $700=3.5K,
-data processing into distribution curve 1 day x $500= 0.5K, presenting in web-mapping application 3 days x $250= 0.750K
-Total for future year run=10K+3.5+.5K+0.75K=14.75K

-For future years, may be able to do the photosynthetic rate via chlorophyll @20 sites per day can be done
-Effort required 1 week of sampling 10K (includes plane and boat sampling), 1 week processing samples 5 x $700=3.5K,
-data processing into distribution curve 1 day x $500= 0.5K, presenting in web-mapping application 3 days x $250= 0.75K
-Total for future year run=10K+3.5+.5K+0.75K=14.75K

Yukon
Not currently included in the Sockeye Lake's group work, so would need to do similar effort to the "future years" noted above i.e. total cost 14.75K
Ask steve if he wants to do any of the sockeye lakes work

-For single CU/Watershed
-Didn't cost out per watershed, instead recommended doing the initial analysis with existing data i.e
-Effort required to go through the Sockeye Lakes database, big Excel spreadsheet and create a distribution curve 1 day x $500= 0.5K
-The sampling stations in the @ 100 lakes all have GPS lat and long

-Effort for putting into web-mapping application 3 days x $250= 0.75K first year
-1/2 day x 250 for developing metadata= 0.125K
-Total cost for first year=0.5+0.75 +.125=1.4K

For future year's uncertain

18. Lake Quantity, Sockeye Lakes- **Coldwater refuge zone**
-Drop a multi-meter probe that collects DO and T at same time as Lake Productive Capacity field work therefore no significant additional time required
-Processing time 1 day x $700= $700, analysis for distribution curve 1 day x $700= $700
3 days mapping into web-application 3 x $250= .750K
-1/2 day to develop metadata ½ x 250=0.125
-Total cost= .7+.7++.75+.125=2.3K

For future year's sampling, the initial year's sampling will identify which lakes might have a problematic coldwater refuge zone e.g. Osoyoos, Cultus, Sakinaw). These will then continue to be monitored.
Cost 1K

Yukon-Sockeye analysis not undertaken in Yukon

-For single watershed/CU
-Science undertaking paper analysis on this indicator this fiscal, so WSP costs would be related to meta-data creation (1/2 day x 0.25K) and input into web-mapping application 3 days x $250= .750K
Total cost= 0.75 + 0.15= 0.9K

19. Lake Quantity, Sockeye Lakes- **Shore spawning Area (length)**
-Focus on Key Spawning Areas that stock assessment currently monitors
-Could account for undulating shoreline even with GPS by downloading into Mapster and then GIS could calculate length of shoreline between start and stop points
-wouldn't be able to account for visible depth spawning
-Recommend in future input goes into NuSEDs
AI-Ask Timber how much effort and cost it takes for monitoring key sockeye shore spawning areas-H. Stalberg, done
-Kerri Benner advised Shuswap, Quesnel, Taseko, Nahatlach, Chilliwack and Cultus have sockeye shore spawning enumeration, Kerri Benner didn't know extent in North Coast
Shuswap 2/4 years escapement-8 key locations, 5 days x 2 crew x $700=7K
Quesnel 4/4 years escapement-8 key locations, 5 days x 2 crew x $700= 7K
Taseko, Nahatlatch and Chilliwack do carcass recovery, and underwater video in some locations as can't see the fish, v. difficult to see the habitat therefore v. poor accuracy, not recommended
Cultus deep spawning and v. limited knowledge of where the habitat is, therefore v. poor accuracy, not recommended

AI-H. Stalberg to ask T. Pendray to include this in discussions with North Coast Stock Assessment group, done
-GIS time 1 day for 16 locations 1 x 250= $250
-1 day to manage data and put info. into Mapster and Web-mapping application 1 x 250= 250
-1/2 day metadata development 0.5 x 250= $250
AI- add further data costs upon gaining info. from Tom Pendray

-For single watershed/CU selected Shuswap
Shuswap 2/4 years escapement-8 key locations, 5 days x 2 crew x $700=7K
-GIS time= 1 day to manage data and put info. into Mapster and Web-mapping application 1 x 250= 0.25K
-1/2 day metadata development 0.5 x 250= 0.125K (efficiencies as won't have to redo this information)
-Total =7K + 0.25K + 0.125K= 7.37K, note in summary stock assessment currently doing the escapement and some of the GPS work

Yukon
One lake known to have shore-spawning, isolated, remote, no development and likelihood of seeing effects due to habitat changes limited, Steve recommends don't do

20. Lake Project. **Recommend Sockeye Lakes study group also capture shoreline temperatures**.
-Risky project due to high potential for theft of loggers, and shoreline temperature variability compounded by changes in fetch direction
-Installations need to be anchored and hidden e.g. floating woody material
-Would need min. 20 x $200 loggers per lake, = 4K utilizing a boat and two person crew for install in April to October time period
-Installation 5 days x 2 person crew x $700= 7K, monitoring 1 day in the season x 2 person crew x $700= 1.4K, 1 day processing $700, 2 day reporting x $700= 1.4K and 1 day mapping in web-application $500=15K for 1 lake first year, subsequent years would be similarly costed as can't leave loggers in overwinter
-this costing didn't account for boats or isolated sites

-Yukon, have Chinook rearing lakes and no coho rearing lakes. The temperature of the lake not modified by the riparian zone due to the v. large size of the lake and significant flows through lake as waterbody considered more a widening of the river. This indicator recommended not necessary in the Yukon.

-For single CU/Watershed
-Didn't cost out per watershed

21. Lake Project **Create a model to ID land conversion on deltas in lakes utilizing Watershed Statistics data**.
-Watershed Statistics cannot automatically do this due to challenges in defining the shoreline

AI-C. Lynch will ask Wendy Beauchamp how much effort to do this manually, we would then need to prioritize which lakes to do the deltas in e.g. those 20% with the highest watershed land conversion percentage and/or riparian loss

-For single CU/Watershed
-Didn't cost out per watershed

22. Estuary Pressure Indicator- **Marine vessel traffic**
-Data free from the Coast Guard, format Excel spreadsheets
-1 week processing and reporting 5 days x $500= 2.5K
-2 days presenting in web-application 2x $250= 0.5K
-Total effort 3.0K

-for single watershed/CU
-1 day to process and report x $500=$500
-1.5 days for meta-data development and to present in web-application 1.5 x $250= 0.375K
- recommend undertaking entire project first time around as many CUs use same tracking sites

23. Estuary Project. **Model for coarse particulate matter distribution in estuaries**-use estuarine gradient from CHS data and lease information for log-storage. May be able to use deposition model from Scotland for log-storage.
Uncertain, TBD

-For single CU/Watershed
-Didn't cost out per watershed

24. Estuary Pressure Indicator- Disturbance of riparian, intertidal (e.g. Carex and Typha) and sub-tidal (e.g. eel-grass) habitats. **Rate of Increase in Estuarine Tenures.**
-We are reporting out on Environment Canada's and Ducks Unlimited's roll-up every five years
-Effort 5 days to sort and insert into web-mapping application in first year, subsequent years should be less as system for doing this will be documented
-5 x $500= 2.5K
-development of metadata ½ day x 250=0.175
-Total = 2.5K +0.175=2.7K

-For single watershed/CU
-1 day to sort and insert into web-mapping application 1x $500= 0.5K
-development of metadata ½ day x 250=0.175K (efficiency in future as wouldn't have to create again)
-Total-0.675K
-recommend doing all in first year

25. Estuary Status Indicator- **Chemistry e.g. N, P, N:P and Contaminants e.g. Metals, PAHs and PCBs**
-Effort inserting links to Environment Canada monitoring sites into the web-application 3 days x $250=0.75K
-Total=0.75K

-Single watershed/CU 1 day to insert links 1 x $250= 0.25K
-Total =0.25K
-recommend doing all sites first time around

26. Estuary Status Indicator and Project-**Percent Saturation and stratification in sub-set of estuaries**
-**AI-**R. Lauzier to advise on effort and costs, outstanding

-For single CU/Watershed
-Didn't cost out per watershed

27. Estuarine Quantity Indicator **(Riparian, sedge, eelgrass and mudflat)**
-Riparian to be captured by Province on a 5 year basis in more developed estuaries through the CRIS program so can track this, other habitat types of insufficient resolution to report out on habitat quantity with the exception of FREMP area
-Effort to pull information from Province, including load into web-mapping application 5 days x $500= 2.5K in first year, subsequent year should be less through documentation of initial process
-FREMP costs uncertain
-meta data development 2 days x 250= 0.5K
-Total= 2.5K + 0.5K=3.0K

-For single CU/Watershed
-Effort to pull information from Province, including load into web-mapping application 1 day x $500=0.5K, subsequent year should be less through documentation of initial process
-FREMP costs uncertain
-meta data development 2 days x 250= 0.5K (efficiencies will be gained as won't have to create metadata in the future)
-Total= 0.5K + 0.5K=1.0K

28. Estuary and Stream Project- **Develop a Predictive model for stream and estuarine off-channel habitat.**
-Group uncertain if should be pursued

-For single CU/Watershed
-Didn't cost out per watershed

29. Estuary

Develop sampling program for presence/absence of key indicator species of invertebrates in the estuary as an alternative to RCA or IBI

-For single CU/Watershed
-Didn't cost out per watershed

Overall GIS Update Process and Publishing (establishing links in web-mapping application) of the GIS update process is dependent upon volume of new information. This specifically is referring to Overview reports, Habitat Status reports, population status reports, integrated planning documents; not the individual indicator related GIS workload accounted for above.
Total 10 days x 250=2.5K.

Overall GIS Project management internal 20 day x 300= 6K

For single CU/Watershed
½ day posting 0.5 x 0.25= 0.125K
½ day management 0.5 x 0.3= 0.150K
Total 0.125K + 0.150K= 0.275K

End of WSP Specific Projects

Further Joint Projects with other programs

30. Stream, Lakes and Estuaries- **Increase FPR information to allow for calculations of habitat gains i.e. include quantity, geo-referenced location, and the same standards are used to quantify that habitat**
-C. Lynch has already developed Project Charter for this
-Effort required 1 day workshop 1.5K, 5 days for business anlalyst 5 x 700= 3.5K
-Total =5K

31. Stream, Lakes and Estuaries Project- **Capture gains/losses in project reviews, mitigation efforts, authorized and unauthorized works**
Uncertain