United States Department of the Interior

BUREAU OF RECLAMATION
Upper Colorado Regional Office
125 South State Street, Room 6107
Salt Lake City, Utah 84138-1147

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MEMORANDUM

To: Reclamation Leadership Team (see list)

Through: J. William McDonald — JUL 1 2010
Deputy Commissioner – Policy, Administration, and Budget

Robert J. Quint — JUN 30 2010
Acting Deputy Commissioner - Operations

From: Rick Ehat — 28 JUN 2010
Chairman, Coordination and Oversight Group

Subject: Technical Capability Report

One of the principle responsibilities of the Coordination and Oversight Group (COG) is to monitor Bureau of Reclamation's corporate and business processes for technical services by gathering data to track workload distribution and maintenance of technical capability. Accordingly, the COG developed a comprehensive listing of technical capabilities within specified functional areas that currently exist within Reclamation, specifically within nine Service Provider Organizations (SPOs) and asked each SPO to identify the number of staff with specific technical capabilities and the experience level at which these capabilities exist in their offices. Technical services managers were also asked to note whether or not their organizations were "self sufficient" with regard to each technical capability, and to report on their ability to sustain that capability. The data was collected and summarized showing totals for each of the SPOs individually and collectively. The list of the capabilities that the COG investigated and the resulting responses are compiled in the attached Summary Table of Functional Areas and Technical Capabilities for All Reclamation Service Provider Organizations (Table). When developing this Table, the COG focused on "critical" capabilities where Reclamation must have in-house capability to accomplish its mission and/or remain a "smart buyer" when procuring technical services.

The COG reviewed the Table line by line. Based on that review, the COG identified several capabilities that were possibly in error or endangered and/or required further analysis. These capabilities are highlighted in orange in the "Reclamation Total" column of the Table. The COG has developed the attached summary report to document the analysis, conclusions, and action plans/recommendations associated with these capabilities as appropriate.

has developed the attached summary report to document the analysis, conclusions, and action plans/recommendations associated with these capabilities as appropriate.

The COG will lead the development of action plans and recommendations and will engage the appropriate subject matter experts and managers from your staff during that process. The resulting action plans and recommendations will be presented to the Deputy Commissioner of Operations. In addition, the COG identified several areas for close monitoring and urges the associated manager(s) to develop, where appropriate, staffing attrition plans.

The COG anticipates updating and reporting on this Table annually in order to monitor for trends and identify areas where the agency appears to be at greatest risk of losing expertise. The COG appreciates your continued support and assistance in implementing Reclamation's business model to provide agency-wide processes and procedures for obtaining and managing technical services in collaboration with our customers. If you have any questions regarding the Table or report, please contact your respective COG member or me at 970-385-6507.

Attachments-2

Reclamation Leadership Team
Commissioner, Attn: 91-100000, 92-00000, 94-00000, 94-30000, 96-00000, 96-40000
Directors, Attn: 84-40000, 84-50000, 86-60000, 84-21000, 84-27000, 86-68000, 86-61000, 86-62000
Regional Directors, Attn: PN-1000, MP-100, LC-1000, UC-100, GP-1000

cc:
Area Office Managers:
CCA-1000 (Gray), SRA-1000 (Gregg), GCP-1000 (Murillo), SCC-100 (Jackson), NC-100 (Person), CVO-100 (Fujitani, Acting), KO-100 (Fry), CC-100 (Finnegan), LO-100 (Parr), MPC-100 (Welsh), PXAO-1000 (Erwin), YAO-1000 (McCloskey), LCD-1000 (Rice), SCAO-1000 (Steele), ALB-100 (Hamman), PRO-100 (Barrett), WCG-CDeAngelis (DeAngelis), UC-600 (Spiker), FCCD-100 (Longwell), MT-100 (Jewell), NK-100 (Thompson), TX-Trevino (Trevino), DK-100 (Breitzman), WY-1000 (Lawson), EC-1000 (Collins)

Service Provider Organizations
GP-2000 (Peterson), PN-3000 (Brawley), MP-200 (Stroppini), UC-210 (Bytheway), LC-6000 (Palumbo), 86-68010 (Luebke), FCCO-100 (Longwell), FCCD-5000 (Ehat), PRO-100 (Barrett), MPCO-100 (Welsh)

COG Members and Alternates
84-40000 (Baals), 84-55000 (Stock), 86-68300 (Knight), 86-68400 (Boyle), PN-6500 (Horsburgh), PN-3800 (Relf), MP-115 (Gore), MPCO-100 (Welsh), UC-1000 (Scott), FCCD-5000 (Ehat), PXAO-2000 (Dent), YAO-1000 (Virden), GP-4300 (Peterson), OK-Allard, 96-40000 (Schuelke) (w/ att to each)

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T:\Correspondence\BSchuelke\Transmittal of COG Tech Cap Report to RLT

SUMMARY STATUS REPORT

TECHNICAL CAPABILITIES WITHIN RECLAMATION

JUNE 28, 2010

PREPARED BY:

COORDINATION AND OVERSIGHT GROUP (COG)

(FY 2009 data with analysis and clarification in 2nd quarter of FY 2010)

Executive Summary:

A Coordination Oversight Group (COG) responsibility is to track Reclamation's technical services business practices and monitor the agencies technical capability. Accordingly, the COG developed a comprehensive listing of technical capabilities that currently exist within Reclamation's nine Service Provider Organizations (SPOs). In September 2009, the COG asked each SPO to report on the number of staff with specific technical capabilities; the experience level of those staff; whether or not their organizations were "self sufficient" with regard to each technical capability; and whether or not their organization can sustain that capability.

After compiling this information, the COG analyzed the data and obtained clarifications from the SPOs as necessary. The results of this effort are presented in the attached "Summary Table of Functional Areas and Technical Capabilities."

Generally, it appears Reclamation's broad range of technical expertise is sustainable and capable of performing the agency's mission. However, the COG identified three skill sets as potential "endangered" capabilities and is currently developing Action Plans. They are: (1) Structural analysis and design of plant facilities (pumping plants and power plants – Power Plants emphasis); (2) Structural and hydraulic analysis, evaluation and design of concrete dams – High end analysis capability; and (3) Design and analysis of temperature control/selective withdrawal structures. The Action Plans will further analyze these capabilities from a corporate perspective including analysis of any related business practices, advance planning data, outsourcing advantages and disadvantages, human resource options, long term corporate need, organizational options, etc. Subject matter experts and managers will be engaged as appropriate. The Action Plans and recommendation(s) will be presented to the Deputy Commissioner of Operations. In addition, the COG identified several areas for close monitoring and urges the associated manager(s) to develop, where appropriate, staffing attrition plans.

A wider breadth of information, such as staff utilization, workload predictability, and strategic outsourcing will be analyzed in concert with the capability data in the future. The COG plans to update this analysis of technical capability annually.

Background:

One of the principle responsibilities of the Coordination oversight Group (COG) is to monitor Reclamation's corporate and business processes for technical services by gathering data to track workload distribution and maintenance of technical capability. To this end, the COG has developed the attached Summary Table of Functional Areas and Technical Capabilities, and has evaluated capability data reported by Reclamation's Service Provider Organizations (SPOs) to identify possible "endangered capabilities" within the agency.

The COG considered a number of automated approaches to identify these "endangered capabilities," each having its own limitations and shortcomings. Since there is no viable automated approach to obtain this information, the COG determined the most reliable means to gather this data was to solicit input from managers of SPOs regarding the technical capabilities and the workforce planning of their respective organizations.

The COG developed a comprehensive listing of technical capabilities within specified functional areas that currently exist within Reclamation's technical resources, specifically within the SPOs, with the intent to issue an annual data call for each of the SPOs to complete. The basic premise for this initial report is that Reclamation is currently meeting its mission thru the multitude of resources available. With the updated information, the COG will monitor trends and identify areas where the agency appears to be at greatest risk of losing expertise. When developing the Table of Functional Areas and Technical Capabilities, the COG focused on "critical" capabilities where Reclamation must have in-house capability to accomplish its mission and/or remain a "smart buyer" when procuring technical services. The COG anticipates adding (and/or eliminating) technical capability categories in this table during future updates to reflect the changing needs and capabilities of the agency. As each Service Provider Organization completes its annual update to the table, they will be asked to suggest changes to the table such as addition (or elimination) of technical capability categories from the table, or addition of more specialized technical capability "sub-categories". The criticality of a capability to Reclamation's mission will be a key consideration as the COG evaluates requests to modify the table.

Process:

On September 8, 2009, a data call, as defined in Reclamation's CMP TRMR-24 (Reclamation's Business Model for Managing Technical Services), was sent to each of the SPOs thru their respective COG Team Members and Alternates. The SPOs are:

- GP - Great Plains Regional Office Engineering Design, Geology and Exploration Services, and Construction Services
- PN - Pacific Northwest Region Resource and Technical Services
- MP - Mid-Pacific Region Division of Design and Construction
- UC - Upper Colorado Regional Office Engineering Services Group
- LC - Lower Colorado Region Engineering Services Office
- TSC - Technical Service Center
- 4CC - Four Corners Construction Office
- PRC - Provo Area Office
- MPC - Mid-Pacific Construction Office

The COG recognizes that much of Reclamation's technical capability resides outside of these SPOs in program offices such as Area Offices, SSLE, and non-service provider organizations within the Regional Offices. However, these program offices are typically only retaining the technical services staff needed to manage the programs and projects for which they are responsible. They generally do not have highly specialized technical capability and/or the capacity to support other Reclamation offices, and were therefore not included in this analysis. Should the data indicate a potential endangered capability, these resources may be more fully considered at that time.

Discussion of Data:

The data call was in the form of an excel spreadsheet. Each service provider was asked to identify the number of staff with specific technical capabilities within their organization; the level (Entry Level, Journeyman Level, or Senior Level) at which these capabilities exist; whether or not their organization was “self sufficient” with regard to the capability; and whether or not they expect to sustain the capability. Managers were asked to use their professional judgment when determining the skill level of their employees. It is important to note that the number of capable employees reported in the table does not relate in any way to the number of FTE's in an organization. One FTE may be capable of performing a wide range of technical work, and would therefore be counted multiple times in the table.

The data presented in the attached Summary Table of Functional Areas and Technical Capabilities shows totals for each of the SPOs individually and collectively. For the purposes of this report, the following definitions are provided:

CAPABLE: An organization that can complete identified work in-house to accomplish its mission and/or remain a “smart buyer" when procuring technical services.

SUSTAINABLE: An organization’s technical capability is considered sustainable, as determined by the appropriate manager, if it can be maintained in the long term given their workload projections, funding, anticipated attrition, and staffing and succession plans.

SELF SUFFICIENT: An organization, as determined by the appropriate manager, is considered self-sufficient if it is fully capable of performing technical work of standard complexity (reports, analyses, designs, etc.) to develop implementable plans, other final technical work products, or technical conclusions without regularly soliciting outside assistance. This definition assumes that intermittent collaborative outreach may be required due to an organization's resource availability or developmental needs, and/or due to the need for specific subject matter expertise.

POSSIBLE ENDANGERED CAPABILITY: An identified work category, as determined by the COG's analysis, where Reclamation is either not self sufficient or the existing capability is not sustainable, or both.

The "SUM" columns in the table present the combined number of capable employees at each skill level for all Reclamation SPOs, and the "GRAND TOTAL" column presents the total number of capable employees at all skill levels within Reclamation's SPOs.

Table cells are color coded to identify capability and sustainability. Cells highlighted in green indicate that a Service Provider Organization is self-sufficient in a particular technical capability, and expects to sustain that capability in the long term. Yellow highlighting indicates that a Service Provider Organization is not considered self-sufficient in a particular technical capability, but expects to sustain their current level of technical capability in the long term. Red highlighting indicates the service provider organization, regardless of the degree to which they are currently self-sufficient, does not expect to sustain a technical capability in the long term.

Analysis:

After compiling the data, the COG performed a comprehensive review. Based on that review, the COG identified several capabilities that appeared endangered and/or required further clarification. These capabilities are highlighted in orange in the "Grand Total" column of the table to indicate that further investigation and analysis was required. The results of this further investigation and analysis are as follows:

a) 1.3.4 - Examination of inaccessible features using remote equipment. Since the data call, the TSC has hired two new employees in this area: one journeyman and one entry level. This function continues to have sufficient workload and now has sufficient staff to be sustainable. While this capability has generally declined in the TSC, the COG analysis indicated some of the regions have been expanding their capabilities in this area and there are sufficient resources to sustain the capability. No further action is planned by the COG at this time.

b) 1.3.5 – Underwater examination of inaccessible features by dive team. Dive teams are currently located in Boise, Idaho and Boulder City, Nevada with supporting divers located throughout Reclamation. The technical capability data call goes only to the identified

service provider offices and as a result does not accurately portray Reclamation's overall capability in this area. Although the capability table indicates seven total divers in Reclamation, the actual number is at least twenty, which the COG has determined to be sufficient to sustain this capability. No further action is planned by the COG at this time.

c) 1.4.1 – Physical barrier analysis design. Clarification was needed from SSLE on programmatic needs/capabilities related to this item. Since the data call, SSLE has filled vacancies to continue to provide this function. With the current staffing level in SSLE and the resources available from the SPOs, the function now has sufficient staff to be sustainable. No further action is planned by the COG at this time.

d) 1.4.2 – Intrusion detection systems. Clarification was needed from SSLE on programmatic needs/capabilities related to this item. The SSLE staff changes related to 1.4.1 will also address this function. As a result, and with the resources available from the SPOs, the function has sufficient staff to be sustainable. No further action is planned by the COG at this time.

e) 2.1.8 – Paleo-hydrologic flood analysis. Clarification was needed as to whether there is enough workload from Dam Safety to sustain this capability. The paleo information is a key component to the flood hydrology work accomplishment. The Dam Safety workload keeps the four staff in the TSC about 40-50% employed, and they fill the remainder of their schedule with fluvial geomorphology work. No further action is planned by the COG at this time.

f) 3.2.2.b and c – Structural analysis and design of plant facilities (pumping plants and power plants). Clarification was needed as to whether there is enough workload to sustain this capability. Although there are similarities, there are also pronounced differences between pumping plants (3.2.2.b) and power plants (3.2.2.c). Staff with hands-on power plant design experience is eligible to retire and limited new plants are coming in to the TSC to permit training of newer staff. The COG has determined that this is an endangered capability. An action plan by the COG is being developed.

g) 3.2.3.c – Structural and hydraulic analysis, evaluation and design of concrete dams. There was concern that the total number identified in 3.2.3.c was misleading. The reported capability reflects Reclamation's ability to perform "routine" analysis typical of the designs prepared by D-8130, but does not capture our ability to complete the high end analysis performed by D-8110. These categories will be clarified for differentiation in the next data call. Based on further investigation, the "high-end" analysis capability concern has been confirmed and the COG has determined that this is an endangered capability. An action plan by the COG is being developed.

h) 3.2.4.e - Structural and hydraulic analysis, evaluation and design of tunnels. Clarification was needed as to whether Reclamation currently has sufficient technical capacity and if there is workload to sustain this capability. Tunnel work in Reclamation is sporadic which makes it difficult to keep tunnel expertise 100% billable. Maintaining Reclamation's ability to be a smart buyer and informed owner is necessary to ensure quick response to concerns with our existing tunnel inventory and to provide assistance with future planning studies. The TSC is moving towards tunnel expertise as a co-lateral duty in order to maintain expertise and high billability. The COG believes this capability should be closely monitored in the future.

i) 4.3.1 – Earthquake loadings, ground motions, response spectra, and probabilistic hazard analysis. Clarification was needed as to whether individual staff members were generally capable in all four of these areas, or if each of these capabilities requires a unique skill set. While not reported as endangered, site specific fault source characterization, probabilistic seismic hazard assessment, earthquake time histories and response spectra are performed by different people with different expertise. Future data calls will break this category into the following subcategories: a) fault source characterization, b) probabilistic seismic hazard assessment, and c) earthquake time histories and response spectra to better evaluate if these different functions are indeed sustainable with the present workload. No further action is planned by the COG at this time.

j) 5.1.4 – Design and analysis of security systems. In future reports, the COG recommends moving 5.1.4 and renumbering it to 1.4.3. With the current staffing level in SSLE and the resources available from the SPOs, this capability is sustainable. No further action is planned by the COG at this time.

k) 5.2.2 – Analysis, condition assessment, trouble-shooting, diagnostics, and testing associated with generators and appurtenant electrical components. The TSC has hired one entry level employee and has two senior, one journeyman, and one entry level currently on staff. The future data calls will be updated accordingly. This function continues to have sufficient workload and now has sufficient staff to be sustainable. No further action is planned by the COG at this time.

l) 5.2.4 – SCADA system design and analysis. The TSC has hired one advanced entry level employee and has a retention initiative implemented to keep a senior level employee long enough to train one entry level and one journeyman. This function continues to have sufficient workload and now has sufficient staff to be sustainable. No further action is planned by the COG at this time.

m) 5.2.6 – Analysis, condition assessment of penstocks and outlet works. Since the data call, the TSC has hired two new employees in this area, one journeyman and one entry level.

The future data calls will be updated accordingly. This function continues to have sufficient workload and has sufficient staff to be sustainable. No further action is planned by the COG at this time.

n) 5.3.1, 5.3.2 and 5.3.3 - Other renewable energy: Design and analysis (electrical engineering) of wind turbines (5.3.1), solar power systems (5.3.2), and geothermal generation systems (5.3.3). We do not currently have workload in these areas but we have the potential to develop these capabilities, including the ability to be a "smart buyer". This category was included in the COG study to allow evaluation of Reclamation's capability considering the Department's emphasis on the renewable development needs of the nation. While this expertise could be further developed within Reclamation, the COG is simply presenting these findings and no further action is planned by the COG at this time.

o) 6.1.1 – Design and analysis of hydraulic control systems. The TSC is using retention incentives to keep retirement eligible senior staff long enough to train one existing journeymen staff and one new staff. The TSC recently hired one new advanced entry level and is in the process of hiring one additional entry level. The COG and management will monitor closely. No further action is planned by the COG at this time.

p) 6.1.2 – Design and analysis of pumps, turbines. If the TSC loses its senior staff, this capability is not sustainable. The TSC is currently using retention incentives to keep retirement eligible senior staff long enough to train two existing journeymen staff and one new entry level staff. The TSC recently hired one new advanced entry level and is in the process of hiring one additional entry level. The COG and management will monitor closely. No further action is planned by the COG at this time.

q) 6.1.6 – Analysis of hydraulic transients in power system waterways. If the TSC loses its senior staff, this capability is not sustainable. The TSC is currently using retention incentives to keep retirement eligible senior staff long enough to train one existing journeymen staff and one new entry level staff. The COG and management will monitor closely. No further action is planned by the COG at this time.

r) 6.2.1 – Design of heating, ventilation, and air conditioning systems. The TSC has one senior staff eligible to retire, one advanced entry level staff person and one entry level staff person. Workload is sufficient to maintain three staff, therefore this is not a concern. No further action is planned by the COG at this time.

s) 6.2.2 – Design analysis of stoplogs, gatehoists, trash racks, etc. The TSC recently hired one new journeyman. Workload is sufficient to maintain staff, therefore this not a concern. No further action is planned by the COG at this time.

t) 6.2.3 – Design and analysis of fire detection and suppression systems. The TSC currently has one senior and one advanced engineer with these skills; however, there is not enough work in this discipline to sustain an FTE. Currently, other technical workload is sufficient to maintain staff and this is not a concern. No further action is planned by the COG at this time.

u) 6.2.4 – Design and analysis of temperature control/selective withdrawal structures. The TSC recently hired one new entry level mechanical engineer, but there is not enough work to sustain an FTE or train any new employees in this area. The COG has determined that this is an endangered capability. An action plan by the COG is being developed.

v) 6.2.5 – Design and analysis of cranes. Not enough work to sustain an FTE in the TSC. However, the TSC recently hired one new journeyman under 6.2.2 which provides the "smart buyer" capability. Since there is capability in the Regions and commercially, this is not a concern. No further action is planned by the COG at this time.

w) 6.2.6 – Design and analysis of fish screens. The TSC currently has one senior staff, one advanced entry level, and one entry level. The workload is sufficient to maintain three staff and therefore is not a concern. No further action is planned by the COG at this time.

x) 6.2.9.b, 6.2.9.c, and 6.2.9.d – On-site testing/inspection and assessments for startup and performance of penstocks (6.2.9.b), outlet works (6.2.9.c), and pressure vessels (6.2.9.d). It appears item 6.2.9.c, "On-site testing/inspection and assessments for startup and performance of outlet works" is confusing and will be clarified for the next data call. The TSC has two to three individuals capable of performing these items and adequate Comprehensive Facility Review capability. Due to the sporadic nature of this work it is challenging to maintain. However, this capability is not considered endangered, but should be closely monitored in the future. No further action is planned by the COG at this time.

y) 6.3.1, 6.3.2, and 6.3.3 - Other renewable energy: Design and analysis (mechanical engineering) of wind turbines (6.3.1), solar power systems (6.3.2), and geothermal generation systems (6.3.3). We do not currently have workload in these areas but we have the potential to develop these capabilities, including the ability to be a "smart buyer". This category was included in the COG study to allow evaluation of Reclamation's capability considering the Department's emphasis on the renewable development needs of the nation. While this expertise could be further developed within Reclamation, the COG is simply presenting these findings and no further action is planned by the COG at this time.

z) Pacific Northwest Region was asked to review and confirm their staff numbers for construction managements services (7.1.3.a-r)

- 7.1.3.a – Grouting. Should be 0 at the senior level, 3 at the journeyman level, and 0 at the entry level. The capability is self sufficient, but not sustainable. In the future, should this expertise be necessary it is available elsewhere within Reclamation and provides options for future needs.

- 7.1.3.b – Rapid Tunneling. Should be 0 at the senior level, 3 at the journeyman level, and 0 at the entry level. The capability is not self sufficient, nor is it sustainable. In the future, should this expertise be necessary it is available elsewhere within Reclamation and provides options for future needs.

- 7.1.3.c – Controlled Blasting. Should be 0 at the senior level, 3 at the journeyman level, and 0 at the entry level. The capability is self sufficient, but not sustainable. In the future, should this expertise be necessary it is available elsewhere within Reclamation and provides options for future needs.

- 7.1.3.d – Dam Embankment Construction. Should be 0 at the senior level, 3 at the journeyman level, and 2 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.e – Dam Concrete Construction. Should be 0 at the senior level, 3 at the journeyman level, and 2 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.f – Rock Bolts/Tendon Installation. Should be 0 at the senior level, 1 at the journeyman level, and 0 at the entry level. The capability is self sufficient, but not sustainable. In the future, should this expertise be necessary it is available elsewhere within Reclamation and provides options for future needs.

- 7.1.3.g – Large Pump/Turbine Installation. Should be 1 at the senior level, 2 at the journeyman level, and 1 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.h – Generator Rewinds. Should be 1 at the senior level, 1 at the journeyman level, and 0 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.i – Medium/High Voltage Equipment Installation. Should be 1 at the senior level, 1 at the journeyman level, and 0 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.j – Electrical Control System Installation. Should be 0 at the senior level, 2 at the journeyman level, and 1 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.k – Plant Startup. Should be 1 at the senior level, 0 at the journeyman level, and 0 at the entry level. The capability is not self sufficient, nor is it sustainable. In the future, should this expertise be necessary it is available elsewhere within Reclamation and provides options for future needs.

- 7.1.3.l – NACE Coatings Inspection. Should be 0 at the senior level, 3 at the journeyman level, and 1 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.m – Steel NDT Inspection. Should be 0 at the senior level, 2 at the journeyman level, and 0 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.n – Structural Concrete. Should be 0 at the senior level, 3 at the journeyman level, and 1 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.o – Construction claims analysis. Should be 2 at the senior level, 1 at the journeyman level, and 0 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.p – Construction Contract administration. Should be 3 at the senior level, 0 at the journeyman level, and 0 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.q – Construction scheduling. Should be 1 at the senior level, 1 at the journeyman level, and 1 at the entry level. The capability is self sufficient and sustainable.

- 7.1.3.r – Constructability reviews and guidance. Should be 0 at the senior level, 0 at the journeyman level, and 0 at the entry level. The capability is not self sufficient, nor is it sustainable. In the future, should this expertise be necessary it is available elsewhere within Reclamation and provides options for future needs.

Based upon this further analysis and the fact these areas of expertise are available within Reclamation, no further action is planned by the COG at this time.

aa) 8.1.5 – Fish Hatchery Evaluations. The data in the table will be modified for the next data call to reflect the following capabilities in offices not initially identified as a service provider office:

- Mid Pacific – Should be 3 at the senior level, 0 at the journeyman level, and 0 at the entry level. The capability is self sufficient and sustainable.

- Upper Colorado – Should be 0 at the senior level, 1 at the journeyman level, and 0 at the entry level. The capability is self sufficient and sustainable.

- Pacific Northwest – Should be 1 at the senior level, 0 at the journeyman level, and 0 at the entry level. The capability is self sufficient and sustainable.

Based upon this further analysis and the fact this expertise is available within Reclamation, no further action is planned by the COG at this time.

bb) 8.1.10 – Water Quality Modeling. In addition to the data already contained in the table, the table will be modified for the next data call to reflect the following capabilities in offices not initially identified as a service provider office:

- Upper Colorado - Should be 1 at the senior level, 2 at the journeyman level, and 0 at the entry level. The capability is self sufficient and sustainable.

Based upon this further analysis and the fact this expertise is available within Reclamation, no further action is planned by the COG at this time.

cc) 9.1.3 – Lab analysis of substances in soil, sediment and water. In addition to the data already contained in the table, the table will be modified for the next data call to reflect the following capabilities in offices not initially identified as a service provider office:

- Mid Pacific - Should be 1 at the senior level, 2 at the journeyman level, and 2 at the entry level, the capability is self sufficient and sustainable.
- Upper Colorado - Should be 1 at the senior level, 0 at the journeyman level, and 2 at the entry level, the capability is self sufficient, but not sustainable.
- Lower Colorado - Should be 1 at the senior level, 0 at the journeyman level, and 2 at the entry level, the capability is self sufficient, but not sustainable.

No further action is planned by the COG at this time.

dd) 9.3.1.c – Research, testing, and specifications for Geotextiles. Staffing levels driven by workload and the lab's ability to meet the needs of Reclamation, and are assessed on an ongoing basis. No further action is planned by the COG at this time.

ee) 9.3.1.d – Research, testing, and specifications for Coatings. Staffing levels are driven by workload and the lab's ability to meet the needs of Reclamation, and are assessed on an ongoing basis. Currently, the lab is maintaining appropriate staffing levels to remain self sufficient. No further action is planned by the COG at this time.

ff) 9.4.1 – Fish Laboratory. The TSC numbers will be revised in the next data call. The TSC can currently maintain capability with the workload it receives. No further action is planned by the COG at this time.

gg) 9.4.2 – Greenhouse. No changes. Must consider whether this is a capability Reclamation can/should continue to support. This category was included in the COG study to allow consideration for Reclamation's capability regarding the Department's emphasis on global warming. While this expertise could be further developed within Reclamation, the COG is simply presenting these findings and no further action is planned by the COG at this time.

hh) 9.4.3 – Invasive Species. Table should be revised to indicate the TSC has 8 staff. These numbers will be revised in the next data call. No further action is planned by the COG at this time.

Trend Analysis from Previous Report:

This is the initial COG report on technical capability. It is anticipated subsequent reports will contain a trend analysis between reporting periods.

Conclusions and Recommendations:

Clearly during these initial COG efforts the clarity of categories of technical capability could be improved. The COG will endeavor in the future to improve in this area.

The COG is currently developing Action Plans for the following capabilities which were determined to be "endangered":

1. Structural analysis and design of plant facilities (pumping plants and power plants – Power Plants emphasis). (Item no. 3.2.2. b and c.)

2. Structural and hydraulic analysis, evaluation and design of concrete dams – High end analysis capability. (Item no. 3.2.3. c)

3. Design and analysis of temperature control/selective withdrawal structures. (Item no. 6.2.4)

These plans will further analyze the issue from a corporate perspective including analysis of any related business practices, advance planning data, outsourcing advantages and disadvantages, human resource options, long term corporate need, organizational options, etc. Subject matter experts and managers will be engaged as appropriate. The Action Plans and recommendation(s) will be presented to the Deputy Commissioner of Operations.

The following areas were identified for close monitoring by the COG and we urge the associated manager(s) to develop, where appropriate, staffing attrition plans:

1. Structural and hydraulic analysis, evaluation and design of tunnels. (Item no. 3.2.4. e.)

2. Design and analysis of hydraulic control systems. (Item no. 6.1.1)
3. Design and analysis of pumps, turbines. (Item no. 6.1.2)
4. Analysis of hydraulic transients in power system waterways. (Item no. 6.1.6)
5. On-site testing/inspection, and assessments for startup and performance of penstocks, outlet works, and pressure vessels. (Items 6.2.9.b., 6.2.9.c., 6.2.9.d.)

The COG plans to update this analysis annually. The next annual capability report calls for data collection in October, 2010, and issuance of a report in January 2011.

With only a few exceptions, it appears Reclamation's broad range of technical expertise is generally sustainable and capable of performing the agency's mission. A wider breadth of information, such as staff utilization, workload predictability, and strategic outsourcing will be analyzed in concert with the capability data in the future.

SUMMARY TABLE OF FUNCTIONAL AREAS AND TECHNICAL CAPABILITIES FOR ALL RECLAMATION SERVICE PROVIDER ORGANIZATIONS

FUNCTIONAL AREAS	TECHNICAL CAPABILITY		NUMBER OF CAPABLE EMPLOYEES																																		
			ENTRY LEVEL										JOURNEYMAN LEVEL										SENIOR LEVEL														
			GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GRAND TOTAL
1.0 GENERAL																																					
1.1 Dam Performance Monitoring	**1.1.1**	Design of performance monitoring instrumentation					5					5					5	5				10		3				3				6	21
	1.1.2	Installation of performance monitoring instrumentation						1				1	2				3	5	3	2		15	7	3				3				13	29
	1.1.3	Maintenance of performance monitoring instrumentation					1	1				2	2				4	5	3	2		16	7	3				3				13	31
	1.1.4	Analysis and evaluation of performance monitoring data		2			4	6				12		1			5	5				11	5	7			1	3				16	39
	1.1.5	Risk Analysis					4	6				10			2		3	10				15		1			1	27				29	54
1.2 Early Warning and Hazard Classification	**1.2.1**	Downstream hazard classification assessment		2			4	2				8		1			4	11				16		5			1	6				12	36
	1.2.2	Downstream consequence analysis including life loss		1			4	2				7					3	14				17		1			1	41				43	67
	1.2.3	Design of early warning systems					4					4			2		5					7		2			2	6				10	21
	1.2.4	Installation of early warning systems					4					4					2			1		3		2			1	4				7	14
	1.2.5	Maintenance of early warning systems					4					4					2			1		3		2			1	4				7	14
1.3 Examinations	**1.3.1**	On-site safety of dams examinations (CFR, PFR, ASI)		2		3	4			4		13		1	2		6	10	2	2		23	7	4			3	41		1		56	92
	1.3.2	Senior Engineer for Dam Safety CFR					1					1			2		2	12				16		1			2	41				44	61
	1.3.3	On-site mechanical examinations				1	1			4		6		2	1		1	3	2	2		11		4			1	9		1		15	32
	1.3.4	Examination of inaccessible features using remote equipment										0			3		1					4		1			1	4				6	10
	1.3.5	Underwater examination of inaccessible features by dive team										0		2			1	1				4					1	2				3	7
	1.3.6	High scale examination of inaccessible features by climb team		2			2					4	1	1			1		4			7	2	4			2					8	19
	1.3.7	On-site O&M examination		2		3	4			4		13	3	1	6		5	3	3	2		23	9	4	8		3	11		1		36	72
	1.3.8	On-site examination of canals	3	1			2	3		4		13	1	1	5		7	9	4	2		29	9	4			5	14		1		33	75
	1.3.9	On-site examination of bridges	2				2			4		8		1	2		5			2		10	5	2		1	5			1		14	32
	1.3.10	Site security assessments				1	1	2		4		8		1				11		2		14		4			1	4		1		10	32
	1.3.11	Power O&M reviews		1			2	1	2			6		3	1		1					5	15		2		1	5				23	34
1.4 Site Security	**1.4.1**	Physical barrier analysis design				1						1		7	3	1						11										0	12
	1.4.2	Intrusion detection systems					1			4		5					1			2		3								1		1	9
1.5 Cost Estimating	**1.5.1**	Preparation of government cost estimates		2	2		4		1	1		10	6	11	4	3	4	9	1	6		44	3		8		10	3	2	2		28	82
1.6 Emergency Management	**1.6.1**	Emergency Action Plans		2			1	2		4		9		1	2		2	4	1	1		11	3	4			2	2				11	31
	1.6.2	Emergency management exercises		2			1	2				5		1			1	4		1		7	3	4			1	3				11	23
2.0 HYDROLOGY AND RIVER HYDRAULICS																																					
2.1 Hydrology	**2.1.1**	Development of inflow design hydrographs		3	2		3	2		1		11		7			2	8		2		19		2			3	6				11	41

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FUNCTIONAL AREAS		TECHNICAL CAPABILITY	NUMBER OF CAPABLE EMPLOYEES																													
			ENTRY LEVEL										JOURNEYMAN LEVEL										SENIOR LEVEL										
			GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GRAND TOTAL
	2.1.2	Cross-drainage analysis	2	2	3		3	2		3		15	2	11			2	8				23	2				3	6				11	49
	2.1.3	Water supply forecasting					2					2		3			3			1		7		3			2					5	14
	2.1.4	Climate change impacts					1			1		2		2				4				6		1	1		1	4				7	15
	2.1.5	Snow (runoff) and precipitation estimating					3	2				5		2			2	8		1		13		3	1		3	6				13	31
	2.1.6	Flood frequency and statistical hydrologic analysis	2		2		2	4		1		11	2	8			2	17				29	2				3	18				23	63
	2.1.7	Extreme precipitation and flood event analysis up to the PMF			1		3	4		2		10					2	8				10					3	8				11	31
	2.1.8	Paleo-hydrologic flood analysis					1					1						1				1					1	2				3	5
	2.1.9	Flood inundation mapping					3	2				5		7		1	2	12				22					3	6				9	36
	2.1.10	Groundwater modeling		1			2			1		4			2		1					3		1	2		2	1				6	13
	2.1.11	Reservoir yield analysis					2			3		5		3	3		1	3				10		1			2	5				8	23
2.2 Sedimentation & River Hydraulics	2.2.1	1D river hydraulic modeling		5			3	1		3		12	3	8	2		3	11				27	2				3	6				11	50
	2.2.2	2D & 3D river hydraulic modeling	3				3	1		1		8	2	2			3	11				18					3	2				5	31
	2.2.3	River and reservoir numerical simulation		1		1	3			2		7		4	3		1	15				23		1			2	14				17	47
	2.2.4	Sediment transport numerical modeling and analysis					3					3		2			2	10				14					3	6				9	26
	2.2.5	River restoration analysis & design	2				3					5	1	4	3		2	10				20	2	1			3	6				12	37
	2.2.6	Geomorphologic analysis of river systems					2					2		1			2	4				7		3			1	6				10	19
3.0 ARCHITECTURE AND CIVIL ENGINEERING																																	
3.1 Architecture	3.1.1	Architectural design of buildings and other structures			2	1	1					4		1		3	1			2		7						1				1	12
	3.1.2	Landscape architectural design	3		2	3	2					10					1					1	1					1		1		3	14
3.2 Civil Engineering	3.2.1	Structural design of buildings and other structures	2	2			5	4		2		15	2	6	5		1	11		2		27	1		2	2	5	9		1		20	62
	3.2.2	Structural analysis and design of plant facilities:																															
	3.2.2.a	water and wastewater treatment systems				1	5	1		2		9		2		1	1	2		3		9					5	2				7	25
	3.2.2.b	pumping plants				1	5	5		1		12		2	2	1	1	1		1		8					5	5				10	30
	3.2.2.c	power plants				1	3	3				7			2		2					4					3	4				7	18
	3.2.2.d	switchyards					3	3				6					2	1				3					3	2				5	14
	3.2.3	Structural and hydraulic analysis, evaluation and design of:																															
	3.2.3.a	spillways				2	4	3		2		11		4	2	1	4	14				25					1	20		2		23	59
	3.2.3.b	outlet works			2	2	3	2		2		11				1	3	15				19					1	20		2		23	53
	3.2.3.c	concrete dams				1	1	3		3		8					1	13		2		16					1	14				15	39
	3.2.4	Design and analysis of:																															
	3.2.4.a	fish facilities		2	2	3	4	2		3		16		10			2	4		1		17					1	5		1		7	40
	3.2.4.b	diversion structures		2	3	2	3			2		12	3	10		1	2					16	2				3	1		2		8	36
	3.2.4.c	canals		2	2	1	3	1		2		11	3	9	1		2	3		2		20	2				3	3				8	39
	3.2.4.d	pipelines		2	1	1	3	1	1	2		11	3	9	2	2	2	6		2		26	2				3	4	1	2		12	49
	3.2.4.e	tunnels						1		3		4						4				4						2				2	10
	3.2.5	Roads	2	2	3	1	4	1		2		15	2	7	4	2	3	2		2		22	1				3					4	41

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FUNCTIONAL AREAS	TECHNICAL CAPABILITY		NUMBER OF CAPABLE EMPLOYEES																													
			ENTRY LEVEL										JOURNEYMAN LEVEL										SENIOR LEVEL										
			GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GRAND TOTAL
	3.2.6	Bridges	4		4	1	4			2		15		4	2	1	2	2		1		12	1				4	1				6	33
4.0 GEOTECHNICAL/GEOLOGICAL ENGINEERING SERVICES																																	
4.1 Geotechnical Engineering	4.1.1	Static analysis, evaluation, and design of:																															
	4.1.1.a	embankment dams					3	7		6		16					1	10		2		13						23		2		25	54
	4.1.1.b	foundations		2			5	7		6		20	3	7	6	2	6	10		3		37	3				1	23		1		28	85
	4.1.1.c	underground excavations		2			6	1		3		12		7			5	2		2		16	2				1	2				5	33
	4.1.1.d	soil and rock slopes	2				4	7		3		16	3	3	4		5	10		1		26	2				1	23				26	68
	4.1.2	Dynamic analysis, evaluation, and design of:																															
	4.1.2.a	embankment dams						5		2		7						7		3		10						23				23	40
	4.1.2.b	underground excavations					3	1		2		6					1	2		2		5						2				2	13
	4.1.2.c	foundations					3	5		2		10					1	9		2		12						23				23	45
	4.1.2.d	soil and rock slopes					3	7		2		12					1	12		2		15						24				24	51
	4.1.3	Numerical modeling of seepage						7		2		9						11		2		13						16		3		19	41
	4.1.4	Dewatering evaluation and design					1	5		2		8			4		2	8		2		16						13				13	37
	4.1.5	Irrigation drainage analysis and design		2			4			2		8		5	3		3			2		13	1				2					3	24
4.2 Engineering Geology	4.2.1	Field mapping					2	1	1	3		7		1	4		2	5	1			13	4	6	4			6	1	3		24	44
	4.2.2	Field Exploration by:																															
	4.2.2.a	Hard rock drilling and sampling		2			1	1		1		5		7			1	5				13	4	5				6		3		18	36
	4.2.2.b	Augering		2			1	7		1		11		7			1	14				22	4	5			1	29		3		42	75
	4.2.2.c	SPT's		2			1	7		1		11		7			1	14				22	4	5				29		3		41	74
	4.2.2.d	CPT's					1	3				4						7				7	4	1				20				25	36
	4.2.3	Geologic logging and analysis of soil and rock						5	1	1		7		1	4		1	14	1			21	4	6	4		1	23	1	3		42	70
	4.2.4	Blasting analysis and design					1	2	1			4						2	1			3	4					3	1			8	15
	4.2.5	Grouting designs			1		1	1	1			4			1		1	3	1			6	4	2				4	1	1		12	22
	4.2.6	Borrow material investigations						7	1	1		9		1	4		1	16	1			23	4	6	4		1	29	1	3		48	80
	4.2.7	Groundwater investigations					3	1	1			5		3	1		1	6	1			12	4		1		2	6	1	3		17	34
	4.2.8	Foundation modeling (2-D and 3-D)					1	5				6		1	4		1	3				9	1	6	4					3		14	29
4.3 Seismotectonics & Geophysics	4.3.1	Earthquake loadings, ground motions, response spectra, and probabilistic hazard analysis					2	1				3					1	2		2		5						4				4	12
	4.3.2	Geophysical site characterizations					1	2				3			1		1			2		4						4				4	11
5.0 ELECTRICAL ENGINEERING																																	

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			ENTRY LEVEL										JOURNEYMAN LEVEL										SENIOR LEVEL										
			GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GRAND TOTAL
5.1 Electrical Design	**5.1.1**	Electrical design for rotating machinery (generators and motors) and appurtenant equipment				1	1	1				3			3			1				4					1	2				3	10
	5.1.2	Design and analysis for electrical features of mechanical equipment		1		1	1	1				4		3	1			3	1			8			2		1	3				6	18
	5.1.3	Design and analysis of Plant electrical equipment		1			1	1				3		3				4	1			8			3		1	3				7	18
	5.1.4	Design and analysis of security systems		1			2					3		3	3							6					1					1	10
	5.1.5	Design and analysis of outdoor electrical distribution systems		1			1	1				3		3				2				5			3		1	2				6	14
	5.1.6	Design and analysis of substations, switchyards, transformers and circuit breakers		1		1	1	2				5		3	1			2				6			2		1	2	1			6	17
	5.1.7	Factory inspections of major electrical equipment		1			1	1				3		3				6	1			10					1	5	3			9	22
5.2 Hydropower Technical Services	**5.2.1**	High voltage insulation testing (AC, DC, Doble) of winding, bus, and cable systems		1			1	1				3		3	1		1	1	3			9	1		2			1				4	16
	5.2.2	Analysis, condition assessment, trouble-shooting, diagnostics, and testing associated with generators and appurtenant electrical components		1			2					3		3	1		1	1				6			2			2				4	13
	5.2.3	Analysis, condition assessment, trouble-shooting, diagnostics, and testing associated with power apparatus					1	2				3					1	2				3						1				1	7
	5.2.4	SCADA system design and analysis			1		1		1			3			2			1				3					1	2				3	9
	5.2.5	Analysis, condition assessment of mechanical components of pumping and hydroelectric powerplants			1	1	1					3			2		1	3	4			10						6				6	19
	5.2.6	Analysis, condition assessment of penstocks and outlet works			1	1	2		1			5			1		1		1			3			1			1				2	10
5.3 Other Renewable Energy	**5.3.1**	Design and analysis of wind turbines					1					1					1					1										0	2
	5.3.2	Design and analysis of solar power systems				1	1	1				3					1	2		1		4						1				1	8
	5.3.3	Design and analysis of geothermal generation systems					1					1					1					1										0	2
6.0 MECHANICAL ENGINEERING																																	
6.1 Hydraulic Equipment	**6.1.1**	Design and analysis of hydraulic control systems			2		1		1			4			1		1	2				4						4				4	12
	6.1.2	Design and analysis of pumps, turbines			1	1	2		1			5		2	2	1	4	2				11					5	3				8	24
	6.1.3	Design and analysis of gates and valves		2	1	2	2	1	1			9		10	2	1	4	1				18					5	4				9	36
	6.1.4	Design and analysis of penstocks and manifolds			3	1	1		1			6					1	1				2						2				2	10
	6.1.5	Design and analysis of steel tanks (air chambers, surge tanks, etc.)			3	2	2		1			8					3					3					4	2				6	17
	6.1.6	Analysis of hydraulic transients in power system waterways										0										0						2				2	2
6.2 Mechanical Equipment	**6.2.1**	Design of heating, ventilation, and air conditioning systems			2		1					3		2	1	1	1	2				7										0	10
	6.2.2	Design analysis of stoplogs, gatehoists, trash racks, etc.			1	3	1	1	1			7		5	2	1	1	2				11			1			1				2	20
	6.2.3	Design and analysis of fire detection and suppression systems				1	1	1				3		2			1	1				4						1				1	8
	6.2.4	Design and analysis of temperature control/selective withdrawal structures			2		1	5				8		1	2		1	4				8						2				2	18
	6.2.5	Design and analysis of cranes	2			2	1					5		2	2		1					5	1					1				2	12
	6.2.6	Design and analysis of fish screens				2	1	1				4		5	2		1	3				11						1				1	16
	6.2.7	Turbine/pump performance and uprate analysis										0		1		1		2	1			5						1				1	6
	6.2.8	Factory inspections of mechanical equipment					3			1		4			2		1	4	1	2		10						4	2	1		7	21

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			ENTRY LEVEL										JOURNEYMAN LEVEL										SENIOR LEVEL										
			GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GRAND TOTAL
	6.2.9	On-site testing/inspection and assessments for startup and performance of:																															
	6.2.9.a	pumps and turbines			1		1			2		4			1		1	1	2			5						3	3			6	15
	6.2.9.b	penstocks			1		1			2		4			1		1			1		3						1	2	1		4	11
	6.2.9.c	outlet works			1		1			2		4			1		1		1	1		4						2	2	1		5	13
	6.2.9.d	pressure vessels					1			3		4					1					1						1	2			3	8
6.3 Other Renewable Energy	6.3.1	Design and analysis of wind turbines					1					1					1					1										0	2
	6.3.2	Design and analysis of solar power systems				1	1					2					1			1		2										0	4
	6.3.3	Design and analysis of geothermal generation systems										0					1					1										0	1
7.0 CONSTRUCTION AND OTHER SERVICES																																	
7.1 Construction Management	7.1.1	Resident Engineer		1			2			2	4	9	3	2			3			1	4	13	2	1			2				1	6	28
	7.1.2	Field Engineer		1			2				4	7	3	4			3			1	4	15	2	1			2		1	1	1	8	30
	7.1.3	Construction inspection of:																															
	7.1.3.a	Grouting	2			1	2				3	8	3	5			5			2	2	17	6				3		4	4	1	18	43
	7.1.3.b	Rapid Tunneling	5				1			1	4	11	2	5			2		2	2	2	15							1	4	2	7	33
	7.1.3.c	Controlled Blasting				1	2			3	4	10		5			1		2	2	3	13	1						3		3	7	30
	7.1.3.d	Dam Embankment Const.	2				7	2	3		5	19	4	5			6	9	7	3	5	39	3				2	20	3	3	4	35	93
	7.1.3.e	Dam Concrete Const.	2			1	7		3	3	5	21	4	5			6		7	1	3	26	2				2		3		3	10	57
	7.1.3.f	Rock Bolts/Tendon Install	2				5	2		2	4	15	3	5			4	7	2	2	3	26	3				2	8	3	4	3	23	64
	7.1.3.g	Large Pump/Turbine Install	2				4		4	2	2	14		7			4	2	1	1	1	16					2	3	4		2	11	41
	7.1.3.h	Generator Rewinds		1			4				2	7		2			4				2	8					2				1	3	18
	7.1.3.i	Medium/High Voltage Equipment Install	6	1			4			1	2	14	2	2			4		3		1	12					2		3		1	6	32
	7.1.3.j	Electrical Control System Install	6	1			4	1	1	1	2	16	2	2			4	2	1		2	13					2	3	2		1	8	37
	7.1.3.k	Plant Startup					4		5		3	12		2			4		2	1	2	11					3	1	3		2	9	32
	7.1.3.l	NACE Coatings Inspect.	3				4		4			11	5	5			3		1	1		15					5		4	1		10	36
	7.1.3.m	Steel NDT Inspect.		1			4					5		5			3		2	2		12					3		2	1		6	23
	7.1.3.n	Structural Concrete	2	1		1	7		4		7	22	4	5			4		4	2	4	23	2				2		2	4	3	13	58
	7.1.3.o	Construction claims analysis				1	2		6	1	5	15		5			3	1	1	2	2	14	5	1			4	1	2	2	4	19	48
	7.1.3.p	Construction Contract administration					2		5	1	6	14		5			3		2		4	14	5	4			4		4	2	2	21	49
	7.1.3.q	Construction scheduling		1			2		2	3	5	13		1			3	2	2	1	3	12	5	1			4	2	1		2	15	40
	7.1.3.r	Constructability reviews and guidance		1			2		5	1	4	13		3			3		6	1	4	17	5	1			4	2	4	1	4	21	51
	7.1.4	Field Testing of:																															
	7.1.4.a	soil	2			1	3	6	3		4	19	4				2	11	4	2	2	25	3				3	18	2	3	3	32	76
	7.1.4.b	concrete	2			1	3		3		4	13	4				2		4	2	2	14	2				3		2	3	3	13	40
7.2 Surveys, Mapping, & GIS/Remote Sensing	7.2.1	Land Surveys (GPS)		2	2		3					7		11	2		2	6		2		23			2		1	5	3	2		13	43
	7.2.2	Land Surveys (Lidar)			2		3			1		6			1		1	1				3		4	1		1	1				7	16
	7.2.3	Construction surveys		2	2		3					7		5	2		2			2		11			1		1		3	2		7	25
	7.2.4	Photogrammetry			2		2	1		1		6			2		1	2				5			1			2				3	14

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FUNCTIONAL AREAS		TECHNICAL CAPABILITY	NUMBER OF CAPABLE EMPLOYEES																													
			ENTRY LEVEL										JOURNEYMAN LEVEL										SENIOR LEVEL										
			GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GRAND TOTAL
	7.2.5	Reservoir sedimentation surveys					1	5				6					1	1				2						3		2		5	13
	7.2.6	Bathymetric surveys of rivers and reservoirs			1		1	5				7			1		1	1				3			1			4		2		7	17
	7.2.7	Hydroacoustic surveys					1	5				6					1	5				6						6				6	18
	7.2.8	GIS	1				2					3	1	3	2	1	1	11				19	1	4				9		1		15	37
	7.2.9	Remote Sensing					2					2			1	1	1					3		4	1			1				6	11
8.0 ENVIRONMENTAL AND ECONOMIC SERVICES																																	
8.1 Environmental Studies	8.1.1	Limnological studies					1			1		2		1				2				3		2				4		2		8	13
	8.1.2	Aquatic habitat analysis						2		1		3			3			5				8		4	2			5		3		14	25
	8.1.3	Fish and wildlife population analysis										0			3			8				11		2	2			4		2		10	21
	8.1.4	Field bio-assessments								1		1			5			4				9		2						3		5	15
	8.1.5	Fish hatchery evaluations										0			2							2		1				1				2	4
	8.1.6	Invasive species research and management					1			1		2		1			1	6				8		1				2		2		5	15
	8.1.7	Aquatic ecology research						1		1		2		3	3			7		2		15		3	2			9				14	31
	8.1.8	ESA Consultation										0		1	6			1				8		4	2					2		8	16
	8.1.9	NEPA (EA/EIS Preparation)					2			1		3		1	6		4	2				13		3	2			1		2		8	24
	8.1.10	Water quality modeling										0		2								2		1								1	3
	8.1.11	Water quality studies										0		2				3				5		3				6				9	14
	8.1.12	Cultural resource assessments			1		1					2			4							4		1	2					1		4	10
8.2 Economics	8.2.1	NEPA economic impact analysis					1					1					2	6		1		9			1			4		1		6	16
	8.2.2	Cost/Benefit analyses for project planning					1					1					1	4		1		6			1		4	4		1		10	17
	8.2.3	Payment capacity determinations					1					1		1			1	2		1		5			1		4	1		1		7	13
	8.2.4	Cost allocation analysis and computation					1					1		2			1	1		1		5			1		4	2		1		8	14
9.0 LABORATORY SERVICES																																	
9.1 Water Quality	9.1.1	Research and development for water desalination processes						1				1						6				6						6				6	13
	9.1.2	Research and development of other impaired water treatment processes						1				1						6				6						6				6	13
	9.1.3	Lab analysis of substances in soil, sediment and water										0		1			1	2				4		3				1				4	8
	9.1.4	Field Sampling					2	1				3		1	1		4	6				12		4	7			5				16	31
9.2 Hydraulic Laboratory Services	9.2.1	Hydraulic research, testing, analysis using:																															
	9.2.1.a	Computational modeling					1	1				2					2	11				13					3	6				9	24
	9.2.1.b	Physical modeling						1				1						3				3						7				7	11
	9.2.1.c	Erosion and sediment deposition modeling					2					2					3	11				14						8				8	24
9.3 Materials Research and Engineering	9.3.1	Research, testing and specifications for:																															
	9.3.1.a	Concrete					2	1		1		4					3	3		1		7						4				4	15
	9.3.1.b	Soils/rock					2	6		1		9					3	9		1		13						20				20	42
	9.3.1.c	Geotextiles						1				1						2				2						5				5	8
	9.3.1.d	Coatings						1				1						2				2						1				1	4

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FUNCTIONAL AREAS	TECHNICAL CAPABILITY		NUMBER OF CAPABLE EMPLOYEES																													
			ENTRY LEVEL										JOURNEYMAN LEVEL										SENIOR LEVEL										
			GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GP	PN	MP	UC	LC	TSC	4CC	PRC	MPC	SUM	GRAND TOTAL
	9.3.1.e	Corrosion						1				1						1				1						1				1	3
9.4 Environmental Laboratories	9.4.1	Fish laboratory						1				1										0										0	1
	9.4.2	Greenhouse						1				1										0										0	1
	9.4.3	Invasive species										0					1					1										0	1

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