4.1.17 Optical Wavelength Services (OWS) (L34.1.4)

Qwest has served OWS customers since 1999, with more than 30 major customers in service today including Federal Agencies, Fortune 500 customers, universities and cable companies.

Qwest's Optical Wavelength (λ) Service (OWS) provides dedicated, transparent networks for Agencies [redacted] as required by the traffic model. In addition, Qwest can provide non-domestic and Outside Continental United States (OCONUS) OWS where available on a custom engineered basis. For example, Qwest supports the Transoceanic Optical Transport – Pacific (TOT-P) OWS transport [redacted]

Qwest's OWS is implemented over Dense Wavelength Division Multiplexing (DWDM) equipment for intra-city and inter-city applications. OWS offers bi-directional 2.5 Gbps (Optical Carrier Level 48 (OC-48)) and 10 Gbps (OC-192) with high-speed, unprotected and protected wavelength options. Qwest's wavelength infrastructure enables a broad range of technical capabilities and lowest cost per unit for transport of data. Our service approach provides flexibility and can be adapted to Agency architectures (ring, mesh or linear).

Qwest's network infrastructure will provide fully compliant, highly reliable and evolvable OWS to Agencies. [redacted]

Qwest supports all of the capabilities, features and interfaces required for OWS service. Qwest OWS is a low-risk solution for the Agencies, because our network capacity will easily accommodate forecasted OWS traffic loads now and in the future. Qwest has many years of experience providing OWS, and currently provides OWS to numerous Fortune 500 clients and Government Agencies [redacted]

Figure 4.1.17-1 provides a mapping of OWS Narrative Requirements to Qwest's proposal for OWS.

Figure 4.1.17-1. Table of OWS Narrative Requirements

Req _ ID	RFP Section	RFP Requirement	Proposal Response
6218	C.2.5.4.1.1.4 (7)	The following Optical Wavelength Services (OWS) capabilities are mandatory unless marked optional: 7. [Optional] Protocol Transparency – CONUS and Non-Domestic. The contractor shall support CONUS and Non-Domestic Wavelengths that are rate and protocol independent.	4.1.17.3.1.1
6215	C.2.5.4.1.1.4 (8)(b)	The following Optical Wavelength Services (OWS) capabilities are mandatory unless marked optional: 8. Byte Transparency. The support to framed wavelengths shall include byte transparency where the overhead bytes are passed through without being overwritten (i.e. non-intrusive Synchronous Optical Network/Synchronous Digital Hierarchy (SONET/SDH) processing of the signals). b. If the framed wavelengths supported are not fully transparent, the contractor shall indicate the level of transparency offered for wavelengths at 2.5 Gbps and 10 Gbps.	4.1.17.3.1.1
6209	C.2.5.4.1.1.4 (12)(a)	The following Optical Wavelength Services (OWS) capabilities are mandatory unless marked optional: 12. Access Methods – The contractor shall provide access methods to the ordered wavelength service for an end-to-end offering. a. If the contractor is not able to provide access on his network, it shall indicate what alternatives exist to enable the service end-to-end.	4.1.17.3.1.1
6207	C.2.5.4.1.1.4 (12)(c)	The following Optical Wavelength Services (OWS) capabilities are mandatory unless marked optional: 12. Access Methods – The contractor shall provide access methods to the ordered wavelength service for an end-to-end offering. c. When Agency access is provided via the backbone of the Long Haul (LH) DWDM systems and is not collocated, the contractor shall specify the appropriate reach of the optical interface to be used.	4.1.17.3.1.1
6206	C.2.5.4.1.1.4 (12)(c)	The following Optical Wavelength Services (OWS) capabilities are mandatory unless marked optional: 12. Access Methods – The contractor shall provide access methods to the ordered wavelength service for an end-to-end offering. c. If the distance is too long for interfaces such as fiber connectivity (FICON), Fibre Channel, etc., the mediation devices or gateways needed shall be specified in order to compensate for distance limitations.	4.1.17.3.1.1

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4.1.17.1 Qwest's Technical Approach to OWS Delivery (L34.1.4.1)

Qwest's approach to providing a fully compliant OWS is based on our adherence to proven engineering practices and a standards-based network. The sections that follow describe our approach to service delivery and how our approach benefits the Government. We'll also describe how Qwest OWS

will facilitate the Federal Enterprise Architecture (FEA) objectives, how Qwest proposes to address problems that may be encountered in providing OWS, and how our synchronization network architecture supports OWS.

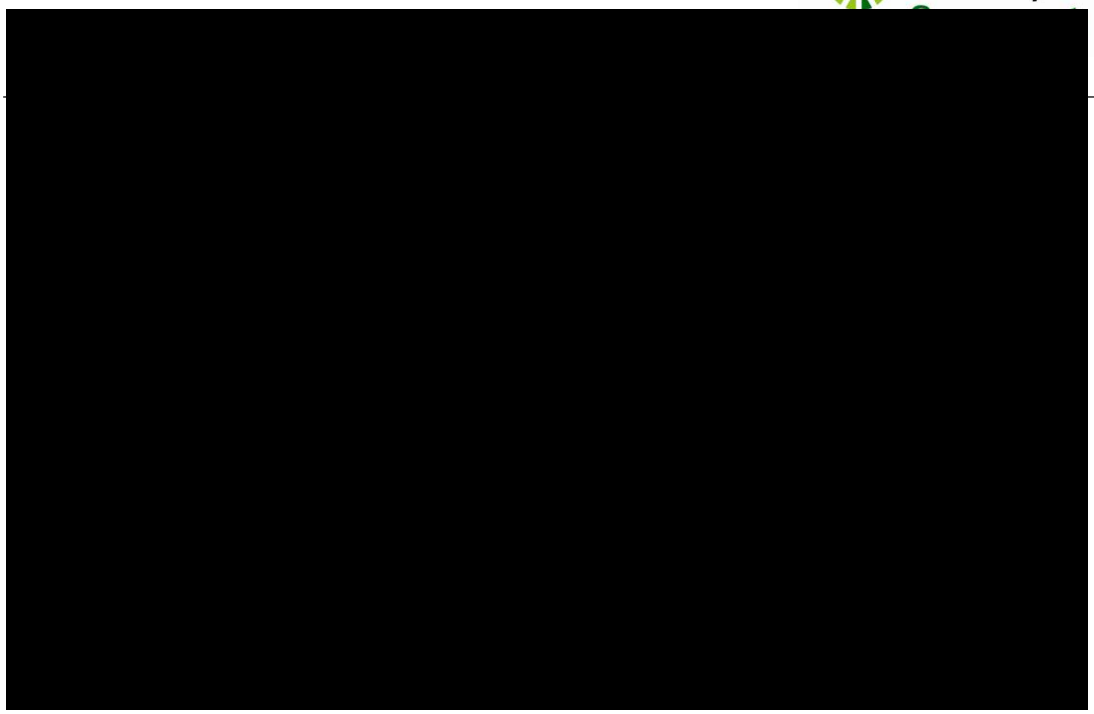
Qwest delivers OWS using the Qwest domestic network and local access providers. Qwest will engineer, monitor and manage the proposed OWS end-to-end to ensure scalability, interoperability and high availability of the service to Agencies. The service provides required capacity and bandwidth for transport of Agencies' voice, video and data traffic, using and conforming to American National Standards Institute, Telcordia and International Telecommunications Union (ITU) standards. The Qwest OWS portfolio includes all required bandwidths and associated interfaces.

4.1.17.1.1 Approach to OWS Delivery (L34.1.4.1(a))

Qwest has the required technical knowledge and resources including pre-sales engineering, network planning, provisioning, operations groups and field support to engineer and implement an optimum solution for the OWS requirements of Agencies.

Standards-Based Network

Qwest's OWS provides all required capabilities and conforms to Optical Internetworking Forum (OIF), Telcordia and ITU standards. Qwest will provide OWS over our DWDM fiber optic transport network. As necessary, Qwest will complete OWS solutions using our local access partners. [redacted]



Qwest OWS provides dedicated duplex data transmission at rates of OC-48/STM-16 and OC-192/STM-64. Qwest delivers service by providing solutions using the Qwest domestic network, local access providers and custom build out of facilities. As required, we will provide alternate protection mechanisms such as geographic diversity. In addition, Qwest can support avoidance routing as a protection method to fulfill all Agency requirements. Qwest has interconnect agreements and physical connectivity with Postal Telephone and Telegraph, Competitive Local Exchange Carriers (CLECs), Incumbent Local Exchange Carriers (ILECs), and fiber providers to deliver outstanding service anywhere Agencies may require service.

Qwest's OWS consists of a managed and scalable suite of services based on a high-performance OWS fiber optic network designed to maximize availability and reliability. The services are comprised of local access, backbone network, wavelengths and appropriate Service Enabling Devices (SEDs). Qwest's OWS is fully interoperable, providing needed flexibility for complete solutions for requirements of Agencies. The Qwest OWS seamlessly carries a variety of protocols including Synchronous Optical

NETwork (SONET), Asynchronous Transfer Mode (ATM), Frame Relay (FR), Internet Protocol (IP), Private Line Service (PLS) and Ethernet. These services are delivered transparently from end-to-end.

Commitment to Customers

To ensure scalability, interoperability and high availability, Qwest engineers, monitors (including in-service monitoring) and manages end-to-end OWS solutions. Qwest will manage the proposed OWS from its Network Operations Center (NOC) [redacted] Qwest will interface with the NOCs of its partners to monitor and manage the proposed OWS end-to-end to ensure high reliability and availability of the service to Agencies.

4.1.17.1.2 Benefits of Qwest's OWS Technical Approach (L34.1.4.1(b))

Features and benefits of Qwest's approach to OWS are described in [redacted]

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Qwest OWS supports the FEA objectives as outlined in the President's Management Agenda and are described in ***Figure 4.1.17-4***.

Figure 4.1.17-4. Qwest OWS Support to FEA Objectives

FEA Objectives	Qwest Solution
Improve utilization of government information resources to focus on core agency mission and service delivery to citizens by using the FEA	Qwest OWS facilitates connecting users anywhere to information resources using scalable, flexible standards-based network.
Enhance cost savings and avoidance	Provides inexpensive connectivity using standardized, replicable solutions and interfaces. Service can be configured as protected or unprotected based on performance requirements.
Increase cross-agency and inter-Government collaboration	Qwest OWS enables Agencies to enhance collaboration, connectivity and cost-effectiveness, contributing to the transformation of the Federal Government into a citizen-centered, results oriented, market-based organization as set forth in the President's Management Agenda (PMA).

4.1.17.1.3 Solutions to OWS Problems (L34.1.4.1(c))

Qwest has extensive experience in the delivery of OWS services. We apply this experience to ensure the delivery of high quality OWS to Agencies. Extensive pre-deployment laboratory system and integration testing identifies the majority of problems, and Qwest's proactive network and configuration management/fault management systems and methods are leveraged to quickly resolve unforeseeable operational issues. [redacted]

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4.1.17.1.4 Synchronization Network Architecture (L34.1.4.1(d))

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4.1.17.2 Satisfaction of OWS Performance Requirements (L34.1.4.2)

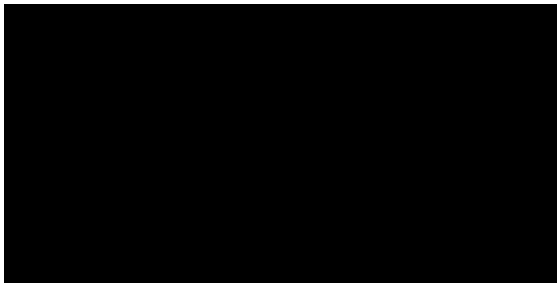
Qwest's proposed OWS solution meets all requirements. Qwest has proven monitoring and measurement systems, procedures and evaluation methods to measure and report on Availability, Time To Restore (TTR), Grade of Service (Restoration Time) and Bit Error Ratio (BER).

4.1.17.2.1 OWS Quality of Service (L34.1.4.2(a))

[redacted] Qwest complies with all of the required Acceptable Quality Levels (AQLs). [redacted] For TTR, Qwest's approach for monitoring and measuring performance indicators is consistent with the Government's requirement for OWS.

[redacted]

[redacted]



[redacted]

4.1.17.2.2 Approach for Monitoring and Measuring OWS KPIs and AQLs (L34.1.4.2(b))

Qwest's proven network architecture and performance measurement and monitoring procedures result in high availability for end-users. [redacted]

Qwest will measure OWS availability in service on an end-to-end basis as required by Amendment 6. COT(HR) will be calculated based on ES

and/or SES as defined by GR-253, G.826 through G.829 and will be expressed in Hours. Availability is computed by the standard formula:

Availability = RI(HR) – COT(HR)/RI(HR) x 100

[redacted]

For Network KPIs, we use [redacted] to display the Network Reliability Scorecard with the KPIs, [redacted]

[redacted]

Qwest monitors on a 7x24x365 basis all NEs of the OWS and SEDs. [redacted]

[redacted]

Qwest maintains a central data repository for key network performance information. [redacted] Data is analyzed, formatted, and sent to operations, engineering and planning for pro-active network enhancement and capacity planning.

[redacted] The calculation for TTR uses the same business rules as the Government requires for its services.

4.1.17.2.3 OWS Performance Improvements (L34.1.4.2(c))

Qwest proposes to meet all required KPIs and AQLs for OWS. In the event an Agency has a specific business need or application problem Qwest is willing to discuss service enhancements. Qwest will operate in good faith to engineer an OWS solution to serve unique Agency needs. Qwest is able to leverage our vast OWS product portfolio which includes a variety of SED providers and specific OWS solutions. Qwest will serve an Agency's business

needs through a special combination of vendor solutions and talented engineering capabilities.

4.1.17.2.4 Additional OWS Performance Metrics (L34.1.4.2(d))

[redacted]

4.1.17.3 Satisfaction of OWS Specifications (L34.1.4.3)

Qwest's OWS is a point-to-point offering provisioned over our DWDM infrastructure. The service is built upon Qwest's domestic fiber network, which rides along railroad rights-of-way. [redacted] Our fiber network provides exceptional reliability to Qwest's OWS service. Qwest satisfies all of the specifications for OWS. The following sections describe Qwest's compliance with the OWS service requirements.

4.1.17.3.1 Satisfaction of OWS Requirements (L34.1.4.3(a))

Qwest fully complies with all mandatory stipulated and narrative features, capabilities, and interface requirements for OWS. The following three sections explain how Qwest will support the capabilities, features, and interfaces requirements of the RFP. It is intended to provide the technical description required per L.34.1.4.3(a), and does not limit or caveat Qwest's compliance in any way.

4.1.17.3.1.1 Satisfaction of OWS Capabilities Requirements (L34.1.4.3(a); C.2.5.4.1.4)

OWS network infrastructure enables a broad range of technical service capabilities; specifically, Qwest supports all technical capabilities required for Networx OWS. Our service approach provides significant flexibility in regard to the delivery of service nationally on our own network and in the metro area through Qwest-owned DWDM and fiber facilities. The service currently supports 2.5 Gbps and 10 Gbps wavelengths. [redacted]

Qwest's OWS supports the full range of topology requirements presented in the RFP. [redacted] illustrates our metro wavelength services.

The following are narratives required by RFP Section J.9 for OWS capabilities.

Protocol Transparency (Req_ID 6218; C.2.5.4.1.1.4 (7))

Qwest provides complete rate and protocol transparency on CONUS and wavelengths. [redacted] Qwest provides complete protocol transparency. [redacted]

Byte Transparency (Req_ID 6215; C.2.5.4.1.1.4 (8b))

Qwest's OWS solution is fully transparent. [redacted]

Access Methods - Alternatives (Req_ID 6209; C.2.5.4.1.1.4 (12a))

Qwest provides end-to-end service on its OWS service including SEDs, if necessary. It offers access through on-net facilities, dark fiber, and third-party wavelength providers to SDPs. [redacted] illustrates the OWS local access options of:

- On-net fiber to the SDP
- Third-party wave loop to the SDP
- Dark fiber or mid-span meet to the SDP

[redacted]

[redacted]

Access Methods – Optical Interface Reach (Req_ID 6207; C.2.5.4.1.1.4 (12c))

Qwest provides end-to-end service to include local access. Qwest maintains many solutions to enable any reach necessary, optimizing for lowest cost and best performance. (See Figure 4.1.17-12 above.) When access is provided, Qwest will specify the appropriate reach for the optical interface.

Access Methods – Mediation Devices (Req_ID 6206; C.2.5.4.1.1.4 (12c))

Qwest provides local access with its OWS service. [redacted]

If need be, Qwest's standard selection and certification process will be applied to identify and certify alternative devices.

4.1.17.3.1.2 Satisfaction of OWS Features Requirements (L.34.1.4.3(a); C.2.5.4.2)

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The RFP describes Agency requirements for configurations that provide various levels of service protection. The Government has asked for a "routine" level of availability with three different levels of protection. Qwest supports the three routine configurations described in RFP feature numbers 3, 4, and 5. [redacted]

[redacted]

[redacted]

4.1.17.3.1.3 Satisfaction of OWS Interface Requirements (L.34.1.4.3(a); C.2.5.4.3)

[redacted]

Qwest OWS supports all GSA required UNIs including OC-48, OC-192, STM-16, STM-64 optical interfaces in accordance with GR-253 and ITU-T G.707. [redacted]

[redacted]

Qwest will deploy that enable Qwest to fully meet the interface requirements for [redacted]

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4.1.17.3.2 Proposed Enhancements for OWS (L34.1.4.3(b))

Qwest proposes to meet the service requirements for OWS. [redacted]

4.1.17.3.3 Network Modifications Required for OWS Delivery (L34.1.4.3(c))

[redacted]

4.1.17.3.4 Experience with OWS Delivery (L34.1.4.3(d))

Qwest has served OWS customers since 1999, [redacted] Qwest's OWS customers include Fortune 500 companies and Federal Agencies, [redacted]

4.1.17.4 Robust Delivery of OWS (L34.1.4.4)

Qwest's engineering practices ensure Agencies robust and resilient access and backbone networks that will accommodate all of their optical

wavelength service requirements now and in the future. The next section explains how Qwest will support the Government's traffic and the engineering practices to ensure robustness, resiliency and plan for growth.

4.1.17.4.1 Support for Government OWS Traffic (L34.1.4.4(a))

Qwest has analyzed the traffic model provided

Qwest closely monitors network use to develop trended growth patterns. The trended growth data drives Qwest's decisions regarding initiation of new builds. If the Government's actual demand for OWS exceeds the forecast level, Qwest will make the necessary investment to augment capacity as needed.

4.1.17.4.2 OWS Measures and Engineering Practices (L34.1.4.4(b))

[redacted]

Network growth planning is based on analysis of network utilization reports. The traffic patterns, spare capacity, and trended growth rates are combined with available forecasts to determine the need for network augments. In addition, Qwest's centralized engineering team applies a consistent capacity management model to all data services.

4.1.17.5 OWS Optimization and Interoperability (L34.1.4.5)

In the following sections, Qwest describes its approach for optimizing the engineering of the OWS backbone and access networks using several techniques. In addition, [redacted]

4.1.17.5.1 Optimizing the Engineering of OWS (L34.1.4.5(a))

The wavelength network is optimized [redacted] This work is performed primarily by Qwest's Provisioning and Current Planning groups. These groups are dedicated to ensuring that Qwest's state-of-the-art network is used to its fullest potential. When a circuit is designed, Qwest ensures that the shortest route is chosen. In addition, Qwest uses a route that contains the least amount of hand-offs between different systems. A circuit is handed-off between different systems only when required. These practices not only ensure that the network is used optimally, it gives Agencies the least amount of latency on their circuit. Furthermore, this activity attempts to reduce the number of potential points of failure for a given circuit.

4.1.17.5.2 Methods Applied to Optimize the Network Architecture (L34.1.4.5(b))

[redacted] Qwest optimally provisions capacity to maximize efficiency and utilization of our high bandwidth transmission facilities. Qwest continually evaluates new network equipment or upgrades existing equipment to benefit from technological advances that deliver greater wavelength density over existing fiber.

When designing a network solution, Qwest uses site-specific forecasted traffic demands, traffic patterns, available capacity and transmission speeds to design the most efficient network for an Agency. When these systems are optimally designed and utilized, Qwest can provide the highest functionality for the lowest costs to its customers.

4.1.17.5.3 Access Optimization for OWS (L34.1.4.5(c))

[redacted] If warranted, Qwest can build new access to meet Agency requirements, obtain high-capacity access systems from local access providers, or acquire Dark Fiber. [redacted]

As Qwest's metro networks evolve, additional [redacted] systems are deployed to satisfy growth and some grooming becomes possible. [redacted]

4.1.17.5.4 Vision for OWS Internetworking (L34.1.4.5(d))

[redacted]

[redacted]