2015-2017 Grant Solicitation

WATER CONSERVATION, REUSE AND STORAGE FEASIBILITY STUDY GRANT PROGRAM

GRANT APPLICATION

APPLICATION INSTRUCTIONS

1. Complete Sections I through VII in the spaces provided.
2. An application must be submitted on a form provided by the Department. An explanation must accompany the application if any of the information required cannot be provided [OAR 690-600-0020(6)].
3. If in hard copy - use 8 ½" x 11" single sided, unstapled pages. Provide any attachments to application also on 8 ½" x 11" single-sided, unstapled pages. Avoid color and detail that will not photocopy clearly.
4. Please Contact the Department's Grant Specialist Jon Unger at **503.986.0869** or Jon.J.Unger@wrd.state.or.us if you have any questions.

Application Deadline: February 1, 2016 5:00 PM,
(Application must be received by this date and time)

Mail application to:

OREGON WATER RESOURCES DEPARTMENT
Attention: Grant Specialist
725 Summer Street NE, Suite A
Salem, OR 97301

KEY GRANT INFORMATION

Introduction. The Water Conservation, Reuse and Storage Grant Program, established by Senate Bill 1069 (2008), is designed to fund the qualifying costs of feasibility studies that evaluate the feasibility of developing water conservation, reuse or storage projects. Oregon is facing increasing water demand and increasingly scarce water supplies. To adequately meet Oregon's diverse water demands now and into the future, Oregonians must use their water wisely and efficiently. That means looking more closely at innovative water conservation and reuse programs and environmentally sound storage projects that capture available water so it can be put to good use when needed.

What is a feasibility study? A feasibility study is an assessment of a proposed plan or method. Typically there should be a previously identified water project that appears to have merit but is lacking important details necessary to determine whether or not to proceed. The feasibility study focuses on helping answer the essential question of "should we proceed with the proposed project idea?" All activities of the study are directed toward helping answer this question. Ideally the project identified will have community support and will have been identified through a collaborative process.

Match Funding. To be eligible for funding applicants must clearly demonstrate funding from a source other than the Program of not less than a dollar-for-dollar match from cash or in-kind services. For example, if $25,000 is requested in Program Funds, then there must be a match of at least $25,000 from another source. The matching funds must be secured or in the process of being secured. The maximum grant award is $500,000.

Eligibility Requirements for Storage Studies. To be eligible for funding for a project feasibility study associated with a proposed storage project that would: Impound surface water on a perennial stream; Divert water from a stream that supports sensitive, threatened or endangered fish; **or** Divert more than 500 acre-feet of surface water annually, the proposed project feasibility study must contain the following elements:

- Analyses of by-pass, optimum peak, flushing and other ecological flows of the affected stream and the impact of the storage project on those flows;
- Comparative analyses of alternative means of supplying water, including but not limited to the costs and benefits of water conservation and efficiency alternatives and the extent to which long-term water supply needs may be met using those alternatives;
- Analyses of environmental harm or impacts from the proposed storage project;
- Evaluation of the need for and feasibility of using stored water to augment in-stream flows to conserve, maintain and enhance aquatic life, fish life and any other ecological values; and
- For a proposed storage project that is for municipal use, analysis of local and regional water demand and the proposed storage project's relationship to existing and planned water supply projects.

See <u>Application Criteria and Evaluation Guidance</u> for assistance in filling out this application.

OREGON WATER RESOURCE DEPARTMENT
WATER CONSERVATON, REUSE AND STORAGE
FEASIBILTY STUDY GRANT PROGRAM

I. Grant Information

Study Name: *Feasibility Analysis of RCC Dam Construction at Big Creek*

Type of Feasibility Study: ☐ Water Conservation ☐ Reuse ☒ Above-Ground Storage
☐ Storage Other Than Above-Ground [Including Aquifer Storage and Recovery (ASR)]

Program Funding Dollars Requested: $ $460,000.00
Note: Request may not exceed $500,000

Total Cost of Feasibility Study: $ $1,203,613.00

II. Applicant Information

Applicant Name: ***City of Newport***	**Co-Applicant Name:**
Address: *169 SW Coast Hwy*	Address:
Newport, OR 97365-3806	
Phone: *(541)574-3369*	Phone:
Fax: *(541)265-3301*	Fax:
Email: *T.Gross@Newportoregon.gov*	Email:

Principle Contact: ***Timothy E. Gross, PE, Public Works Director and City Engineer***
Address: *169 SW Coast Hwy*
Newport, OR 97365-3806
Phone: *(541)574-3369*
Fax: *(541)265-3301*
Email: *T.Gross@NewportOregon.gov*

Certification:

I certify that this application is a true and accurate representation of the proposed work for a project feasibility study and that I am authorized to sign as the Applicant or Co-Applicant. By the following signature, the Applicant certifies that they are aware of the requirements of an Oregon Water Resources Department grant, have read and agree to all conditions within the sample grant agreement and are prepared to conduct the feasibility study if awarded.

Applicant Signature: [signature] Date: *1/31/2016*

Print Name: *Timothy Gross* Title: *Public Works Director/City Engineer*

III. Feasibility Study Summary

Please give a brief summary of the feasibility study using no more than 150 words.

In 2013, Oregon Dam Safety Engineer Keith Mills identified Big Creek Dams #1 and #2 as two of the state's top three priority dams requiring remediation. A geotechnical and seismic evaluation completed in 2013 confirmed serious deficiencies that could result in catastrophic failure during a seismic event, causing loss of the City's sole source of water, flooding and landslides. The City conducted a Phase I site evaluation and seismic risk profile which prioritized a preferred solution for the replacement of the Big Creek Dams, and a secondary solution should the preferred solution not be feasible. In 2014-15, the City conducted a feasibility analysis of dam remediation options. This grant request focuses on funding needed to continue to detail the feasibility of the identified solutions for this critical water storage site, among the most significant on the Oregon coast and strategically important for the City of Newport and its surrounding communities.

IV. Grant Specifics

Section A. Common Criteria

Instructions: Please answer all questions contained in this section. It is anticipated that completed applications will result in additional pages.

1. Describe your goal and how this study helps to achieve the goal.

   The goal of this project is to continue investigating feasibility of the City of Newport's preferred option of a Roller Compacted Concrete (RCC) dam, ensuring the Big Creek Reservoirs are seimically sound, securing access to safe drinking water, and protecting Newport's economy and quality of life. The proposed study helps achieve this goal by enabling the City to conduct pre-design work, conduct surveys of the project site, evaluate geotechnical conditions, assess hydrology feasibility, and prepare budget scenarios. Environmental permitting assessment will be conducted in tandem with this project, but will not be funded by this grant's budget. The information obtained during this study will inform a pending Newport City Council decision to move forward with the RCC dam project.

2. Describe the water supply need(s) that the proposed project addresses. Identify any critical local, regional, or statewide water supply needs that implementation of the project associated with the feasibility study will address. **Responses should rely upon solid water availability and needs data/analysis.** For examples of water supply needs see "Criteria and Evaluation Guidance Document."

   Newport's proposed project will: 1) Secure the City's sole water supply, 2) Expand the storage capacity of the Big Creek Reservoir, and 3) Improve the region's resiliency to natural disasters. The project addresses the only drinking water source available for the City of Newport's year-round population of more than 10,000 residents, a tourist population of roughly 2.5M annually, the fishing industry, brewing industry, and the aquarium -- all of which are crucial to the region's economy. Prior examinations have concluded that both Big Creek Reservoir dams are highly susceptible to structural damage or complete failure during a seismic event. Subsequently, replacement of these dams are among the top three priority projects of the Oregon Dam Safety Engineer. Continuing feasibility research for the preferred replacement option will secure the City's successful approach to maintaining access to safe and affordable drinking water and ensure the region's safety during a seismic event or other natural disaster.

   Newport does not have sufficient redundant water storage facilities to support water demand should the Big Creek Dams fail. The current condition of the dams leaves the City of Newport's citizens and businesses very vulnerable to potential disruptions in water supply and a variety of natural disasters that occur regularly and/or are anticipated to occur including earthquakes, tsunamis, severe storm events, flash floods and landslides.

   The need for additional water supplies in the Mid-Coast Basin is a very real and urgent matter. A 2008 study titled, Lincoln County Water Needs Analysis, completed by WHPacific and GSI, projected that Lincoln County, as a whole, could experience a water deficit of 10.4 MGD by 2020 if additional water supplies are not secured. A list of water planning documents relevant to the Big Creek Dams Remediation project are included in Attachment A. Some districts in the Basin are already unable to meet current demands, let alone future demands. In fact, Otter Rock Water District recently approached the City in an attempt to purchase raw water to transport by truck back to their district to meet their district's current needs. The City of Yachats had severe water restrictions in 2015 due to water shortages. Finally, Georgia Pacific was recently in danger of shutting down operations at its Toledo plant (7 miles east of Newport, employing nearly 400 workers) because it could not draw enough water from the Siletz River to meet current demand.

   Another challenge to meeting water supply needs within the Basin is a mismatch in timing between water supply and demand. Demand for water from the City of Newport spikes in the summer when 250 million tourists visit the area. Newport must increase storage capacity to capture additional water during wet seasons in order to sustain water supplies during a low stream flow/high consumer demand summer sesason. Further, increased *storage capacity will protect instream flow for sensitive fish populations, native subsistence fishing and recreational fishing. Building a new RCC dam provides opportunity to expand storage capacity to help mitigate the impact of high demand during the dry season.*

3. Explain how the proposed project will meet the water supply need(s), and indicate what percentage of that need will be met. (For example: If your water supply need is 20,000 acre-feet of additional water and the project will supply 10,000 additional acre-feet, 50 percent of your need will be met).

The remediation project addresses the only source of drinking water available for the City of Newport (more than 10,000 people, plus 250M visitors annually), and the largest source of drinking water in the Mid-Coast region (population greater than 40,000). The reservoir design considers raw water needs through the year 2030 as determined by the City of Newport's Water System Master Plan adopted in 2008 and revised in 2010. The project will build additional water supply capacity that can serve to support population growth, growth of economic activity and secondary supply resources for nearby water districts in the event of drought similar to that experienced in the summer of 2015.

4. Describe the technical aspects of the feasibility study and why your approach is appropriate for accomplishing the specific study goals and objectives.

Working with HDR, a global engineering firm, the City of Newport has completed initial steps to determine preferred alternatives for the replacement of Big Creek Dams #1 and #2. HDR & Newport have determined the most feasible option is a new Roller Compacted Conrete (RCC) dam downstream from Big Creek Dam #2 (See Attachments B, C, and D). This proposal seeks to continue feasibility studies and other key research to mature plans for RCC dam replacement and prepare the project for the design and environmental review phases.

Funding from this source will support the following project tasks:

Task I: Project Management - Project management will be provided during the next phase of work to guide evaluation activities; monitor and update the project scope of work, budget, and schedule; and, provide appropriate communication with the City. This includes invoicing as well as coordination with the City, the state dam engineer, and the HDR team for completion of evaluations and production of the deliverables. The purpose of this task is to plan and execute pre-design efforts of the HDR team and all subconsultants in accordance with the schedule and budget. Work activities described below will be provided to cover the project management activities.

Task II: Survey of New Dam Site and Surrounding Terrain - There is no existing survey of the area around the proposed site of the RCC dam. A survey will be completed during the first quarter of 2016. The survey will be performed in order to provide suitable site controls and topography for the dam site and related facilities in the surrounding areas such as new access roads, the raw water pipeline, and a fish passage facility. The survey will provide the information needed to estimate excavation volumes, topography, slopes of the future road and pipeline, and it provides the basis for establishing quantities for the new construction. The survey is needed for the design and cost estimates.

Task III: Site Characterization & Explorations - Geologic and geotechnical site characterization work has not previously been performed at the proposed dam site. Site characterization around the new dam location will help inform the feasibility evaluation, design development, and cost estimating. For instance, site characterization work will help estimate the depth to suitable bedrock underneath the dam footprint, and will provide other geologic and geotechnical information needed for planning level designs. HDR will conduct additional site characterization along the proposed road and pipeline route, downstream from the proposed dam, and the relocated road alignment and bridge crossings upstream from the proposed new dam location.

Site characterization work for the new dam will be performed in phases with each phase providing increasingly detailed information needed to address key issues and decision requirements. Early phases will support design configuration and risk management issues. The work will confirm feasibility and lead to a preliminary level design suitable for input to regulatory permits and preliminary design approvals along with establishing funding requirements. Additional explorations may be appropriate during final design to address regulatory requirements and key subsurface risk issues that are identified during the pre-design planning phase.

During this phase, HDR will conduct additional drilling and soil samples testing of the site of the proposed dam, which will inform future site characterization and geotechnical work that will be needed during the design pahse. Data collected during this phase will be used to prepare the Design Criteria Technical Memo, which will provide recommendations for additional work needed to complete the design

Task IV: Design Criteria Memorandum - Prior to initiation of further engineering evaluations, HDR will prepare a design criteria memorandum summarizing the basis for the design of the dam, spillway, outlet, pipeline, roads, and fish passage structures/system.

Included as part of this memorandum will be an update of the desired reservoir storage volume. As previously noted, three components of the storage volume will be evaluated: 1) replacement of existing storage in Big Creek Dams #1 and #2, 2) supplemental storage due to sediment accumulation in the existing reservoirs, and 3) increased storage for future water supply demands.

A key consideration in the design criteria will be the seismic loading that will be used to develop the cross-sectional properties of the dam. Based on previous experience, we anticipate that an earthquake with an estimated recurrence interval of about 1,000 to 5,000 years will be appropriate for design. The methodology used to establish this criteria will be described, including the basis for estimating the tensile strength of the RCC materials and the required seismic performance of the dam for more extreme loading conditions. This includes allowable deformations and post-earthquake stability of the dam for events up to and including a maximum credible earthquake with an estimated recurrence of about one in 10,000 years.

The Design Criteria Technical Memorandum will identify the geologic and geotechnical parameters required to complete this phase and to finalize the geotechnical exploration and the laboratory testing plan. The explorations plan will identify the types and locations of both geophysical surveys and subsurface borings. The laboratory testing plan will identify the number and types of laboratory tests needed to establish the parameters identified in the gap analysis

Task V: Engineering Evaluations of the New, Proposed RCC Dam - A feasibility level evaluation of an alternative RCC dam configuration was completed as part of the previous alternatives evaluation for the project. During this phase, additional geotechnical and structural evaluations will be performed. This includes development of an updated model and corresponding evaluation of static, seismic, and flood loading conditions to refine and further optimize the dam configuration.

HDR will be using the software SAP2000 from Computers and Structures, Inc., and EAGD-SLIDE, a public domain program for these evaluations. SAP2000 is a general purpose, finite element method (FEM) modeling software used for both response spectra analysis and time-history analysis of structural systems. EAGD-SLIDE, Earthquake Analysis of Concrete Gravity Dams including Base Sliding, is a finite element computer program that is used to analyze the potential sliding along the base-concrete interface, allowing the computation of the factor of safety against sliding. EAGD-SLIDE is also used to evaluate the tensile forces in the RCC dam.

Task VI: Hydrology and Spillway, Outlet Works and Fish Passage Analysis - The objective of this task is to refine the configuration of the spillway, outlet works of the new dam, and to develop initial concepts for fish passage around the new dam to use in discussions/negotiations with state regulators of the project.

This task will include appropriate updates of the estimate of the Probable Maximum Flood (PMF) inflow hydrograph, reservoir routing, and hydraulic analyses of the spillway structure to identify a cost effective combination of spillway width to dam crest freeboard requirements. The outlet works, including the intake structure, will be designed to meet dam safety, as well as operational requirements, for both quantity and quality of water released from the reservoir. Fish passage analyses will be based on a possible fish passage facility incorporated into a natural drainage channel in the downstream left abutment area of the new dam.

Task VII: Access Road Feasibility - The existing access road from the lower dam (Big Creek #1) to the upper dam (Big Creek #2) serves as the only access to two private properties located on the north side of the upper reservoir, and to forest/logging land. The access road will have to be re-routed around the new dam structure. The development of the proposed road alignment will be divided into two parts: 1) the road to the top of the new RCC dam and 2) the road past the new RCC dam which provided access to the properties along the raised *upper reservoir pool. This will be done in case funding is not available at the time to complete this task and the two portions can financially be separated.*

Task VIII: Raw Water Pipeline Feasibility - The existing raw water pipeline is a siphon from the lower reservoir across the lower dam to the intake pump station located at the toe of the lower dam (Big Creek #1). The study is considering the feasibility of removing the lower dam structure and reestablishing Big Creek to its pre-development channel. As a result, a new raw water intake pipeline will need to be constructed from the outlet works of the new RCC dam to the existing intake pump station.

Task IX: Environmental Permitting Assessment - (Note: This activity will not be funded by this grant) The objective of this task is to develop an Environmental Compliance Process Framework. This framework will guide future activities and provide a path forward for environmental compliance. This task includes four key sub-tasks. 1)Prepare for preliminary application coordination with US Army Corps of Engineers (USACE) -- which is expected to be the lead federal agency for the National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) consultations -- to instigate the environmental compliance program, inclusive of NEPA, ESA, and the Clean Water Act (CWA). 2) Facilitate a two-hour preliminary application coordination meeting with USACE in Portland. 3) Prepare for and facilitate a one-day regulatory agency kickoff meeting and site visit in Newport, Oregon. Regulatory agencies with permitting/approval roles may include USACE, Oregon Department of State Lands (DSL), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Oregon Department of Fish and Wildlife (ODFW), Environmental Protection Agency (EPA), Oregon Department of Environmental Qualify (ODEQ), State Historic Preservation Office (SHPO), and Oregon Water Resource Department (OWRD). Topics will include the project description, areas of potential impact that relate to resources over which the agencies have regulatory authority, and the regulatory process. 4) Develop an Environmental Compliance Process Framework, including schedule, next steps, roles and responsibilities, and key phases and milestones.

Task X: Fish Passage Alternative Review - The objective of this task is to determine the feasibility to comply with state fish passage requirements via either a waiver or exemption option. The new dam will qualify as a "trigger event" and therefore require compliance with state fish passage law, as per ORS 509.580 through 910 and in OAR 635, Division 412. The waiver process typically requires mitigation if there is a benefit to providing fish passage, whereas the exemption process is valid if there is no benefit or either mitigation or a waiver has already been completed. The Oregon Dam Safety Engineer has identified the requirement that the existing lower dam (Big Creek #1) will need to be removed as part of this project. The existing reservoir will be non-existent at that time and the area will open up to reestablish Big Creek below the new proposed dam. Enhancements along the exposed channel and associated floodplain may be suitable for mitigation by providing a viable alternative to fish passage.

Task XI: Cost Estimates and Schedule - This task will provide a preliminary design level cost estimate and design/construction schedule for the new RCC dam alternative and the related spillway, outlet works, water supply pipeline, roadway, and fish passage project elements. The cost estimate will include a pre-cost schedule for bidding, quantities, unit/lump sum prices of each component of the construction, and planning contingencies.

Task XII: Pre-Design Report - The pre-design report will summarize this entire phase of the project and be used as the basis for the design work which will be the next phase of the project.

Task XIII: Grant Administration and Reporting - Work conducted in this activity will include managing and administering grant funds, fulfilling reporting requirements, providing grant-specific technical assistance, securing matching funds, and corresponding with OWRD staff and City staff.

Task XIV: Administrative, Overhead, and Facilities Allocation - Track costs related to administrative, facilities, and overhead expenditures (estimated at 8%).

5. Describe how the feasibility study will be performed. Include:
    a. General summary statement that describes the study progression.
    b. When the feasibility study will begin.
    c. Listing of key tasks to be accomplished with each task having:
        i. Title

ii. Timeline for completion
iii. Description of the activities to be performed in this key task
iv. Description of the resources necessary for accomplishing the key task

Example:

(i) Streamflow measurement;
(ii) September-April;
(iii) Weekly streamflow measurements will be performed to gather hydrographic data for the hydrologic analysis to take place in May;
(iv) A technician will be hired to perform the streamflow measurements.

(Key tasks listed here are to be placed in Section VI. Project Feasibility Study Schedule for a quick reference "graphical" representation of the schedule.)

i. Task I: Project Management

ii. Timeline: April 2016 - June 2017

iii. Description of Activities: 1) Monitor project progress including work completed, work remaining, budget expended. 2) Invoicing/monthly reports. 3) Subconsultant coordination. 4) Quality control. 5) Schedule management. 6) Meetings.

iv. Resources Necessary: HDR will be contracted to complete project management tasks.

i. Task II: Survey of New Dam Site and Surrounding Terrain

ii. Timeline: April 2016 - June 2016

iii. Description of Activities: 1) Establish permanent site survey control monuments. 2) Verify accuracy of existing LiDar data. 3) Survey of topography. 4) Access Road Survey. 5) Pipeline Alignment Survey. 6) Upper reservoir roadway survey of inundated area (optional task and not included in the first part of the survey).

iv. Resources Necessary: HDR will be contracted to complete the survey of the new dam site and surrounding terrain.

i. Task III: Site Characterization & Explorations- RCC Dam

ii. Timeline: April 2016 - September 2016

iii. Description of Activities: 1) Perform geophysical explorations to provide 2D imagery of the geologic strata within the footprint of the RCC dam and provide guidance for selection of optimal sites for the subsurface drilling. This work will be performed at the beginning of 2016 concurrently with the topographic survey from Task II. Geophysical exploration will consist of Three Electrical Resistivity Tomography lines (marine and land based). 2) Within the dam foundation footprint, perform borings with Standard Penetration Tests (SPTs) at five foot intervals in overburden soils, and with material sampling using Shelby tubes or other appropriate methods at targeted locations. 3) Along to propose lower roadway and pipeline alignment perform mud rotary borings with SPT testing or auger borings with SPTs and material sampling at targeted locations. Up to ten shallow borings would be required to characterize the materials and establish depth to rock and rock strength. 4) Laboratory testing will be performed by a certified laboratory. The analysis of the soils materials will include Atterberg Limits, gradation with hydrometer, fines content, modified proctor testing or max/min density testing and optimum moisture content, and direct shear testing. The analysis of the rock will include unit weight and unconfined compression testing. If bridges or retaining walls are required additional borings would be required during subsequent phases of work. .

Reservoir Rim Slope Characterization - 1) A landslide and slope stability review of the reservoir slopes will be conducted using aerial data and surficial geologic mapping methods. Ground *truthing will be conducted in an attempt to identify landslide areas and landslide prone areas and asses the potential landslide hazards.*

iv. Resources Necessary: HDR will conduct the necessary tasks to complete the site characterization and explorations, with assistance from subconsultant Cardno when necessary.

i. Task IV: Design Criteria Memorandum

ii. Timeline: October 2016 - December 2016

iii. Description of Activities: 1) Development of the desired reservoir storage volume for preliminary design will be coordinated with the initial environmental compliance activities under Task IV as the reservoir storage volume will be a critical component of the project's "Purpose and Need" documentation. 2) Draft Technical Memorandum (TM) will be prepared to support concept design update. 3)TM will be reviewed by the City and State Dam Engineer prior to initiation of engineering analyses. 4) Future updates to the design criteria may be made and the memorandum will remain in draft form until final design phase of project.

iv. Resources Necessary: HDR will conduct the effort necessary to complete the design criteria memorandum.

i. Task V: Engineering Evaluations of the New, Proposed RCC Dam

ii. Timeline: October 2016 - March 2017

iii. Description of Activities: 1) Geotechnical evaluation of the site characterization information to establish a preliminary design level excavation objective (depth to suitable bedrock), foundation grouting and treatment requirements, foundation stability during construction and long-term operation under various loading conditions, and to development engineering properties for input to the structural evaluation of the dam. 2) In conjunction with Tasks II and VI, establish the approximate spillway and dam crest elevations. As part of this subtask, an updated area-capacity curve for the new reservoir site will be developed using a combination of existing and new LiDAR, survey, topographic and existing reservoir elevation/storage information. 3) Static, flood loading, and seismic response modeling of the updated dam configuration – building on the previous performed response spectrum analysis, 2D time-history analysis will be performed for both overflow and non-overflow cross sections of the dam in SAP2000 and the cross section will be refined. EAGD-SLIDE will be used to estimate the factor of safety against sliding and anticipated seismic response of a limited number of time-histories. 3) Construction materials and mix design – a preliminary assessment of construction materials sources will be performed for input to engineering properties of the RCC and for cost estimating. 4) Construction staging and sequencing – a preliminary assessment of the possible construction staging and sequencing will be evaluated. 5) Seepage control - a grout curtain beneath the RCC dam section will be included in the appraisal level designs. Seepage analyses may be performed to evaluate the effectiveness of alternative foundation seepage control measures

iv. Resources Necessary: HDR will conduct the tasks necessary to complete the engineering evaluations for the new proposed RCC Dam. When necessary, HDR will contract with Siemens & Associates to conduct the geophysical survey.

i. Task VI: Hydrology and Spillway, Outlet Works and Fish Passage Analysis

ii. Timeline - October 2016 - March 2017

iii. Description of Activities: 1) Establish hydrologic design of the spillway and outlet works based on the design criteria outlined under Task 4. a) Perform reservoir routing of the probable maximum flood (PMF) inflow hydrograph based on updated area-capacity curve for the new dam and alternative spillway widths. Identify the desired combination of spillway width verses dam crest freeboard based on site topography and cost considerations. b) Develop updated spillway configuration including crest overflow structure, chute, and stilling basin requirements. A stepped spillway chute configuration is anticipated based on previous experience with similar sized RCC dam projects. Downstream channel shaping requirements will also be identified. c) Develop an *updated configuration of the outlet work based on both dam safety and operational requirements. Perform hydraulic analyses as appropriate to configure the intake structure, pipe size and configuration, gates, operators and release facility, and energy dissipater structures. d) Establish a preliminary configuration of alternative fish passage systems based on design criteria outlined under Task IV. This could include restoration activities in the existing dam #1 reservoir pool that will be lowered/eliminated, fish passage at the removed dam #1 site, and fish passage around the proposed new dam. The configurations will be of sufficient detail to engage state regulators in discussion on fish passage alternatives and requirements for the project. 2) Evaluate higher frequency winter flood risks and events to support evaluation of construction flood routing requirements.*

iv. Resources Necessary: HDR will perform the tasks necessary to complete an analysis of the hydrology spillway, outlet works, and fish passage analysis.

i. Task VII: Access Road Feasibility

ii. Timeline: July 2016 - December 2016

iii. Description of Activities: 1) Evaluation of survey data (based on Task II). 2) Evaluation of geotechnical data (based on Task III). 3) Review of environmental impacts (based on Task IX). 4) Development of design criteria for the road to be included in the Task IV Technical Memo. 5) Development of a road alignment (part 1) based on the collected data, including potential creek crossings/culvert areas up to the top of the RCC dam. 6) Development of a road alignment (part 2) based on the collected data, including potential creek crossings/culvert areas past the top of the RCC dam along the upper reservoir raised pool.

iv. Resources Necessary: HDR will complete the activities to determine the feasibility of access roads.

i. Task VIII: Raw Water Pipeline Feasibility

ii. Timeline: July 2016 - December 2016

iii. Description of Activities: 1) Review of survey and geotechnical data (based on Tasks II and III). 2) Review of proposed road alignment (Task VII). 3) Perform preliminary hydraulic calculations to determine pipe size, length and head losses for the pipe based on existing water master plan information provided by the City. 4) Prepare preliminary pipeline design criteria including pipe material, coatings & linings, pressure rating, trench design and appurtenance configuration. 5) Prepare preliminary drawings showing plan and profile of the proposed pipe route layout and major appurtenances (air release valves, drain locations, turnouts, connections). 6) Prepare DRAFT technical specification list and table of contents based on the CSI 6 digit format. 7) Provide assistance to the construction cost estimator (under Task XI) to develop a preliminary opinion of probable construction cost for the pipeline, including specialized equipment and valve budgetary pricing. 8) Prepare preliminary design technical memorandum that compiles the design criteria, hydraulic calculations and preliminary design drawings. 9) One review meeting will be held with City staff to review the comments on the preliminary design report.

iv. Resources Necessary: HDR has the resources necessary, and will be contracted to complete the raw water pipeline preliminary design.

i. Task IX: Environmental Permitting Assessment

ii. Timeline: July 2016 - March 2017

iii. Description of Activities: In this phase, the City will develop a plan for the next phase of work, which will categorize the permitting issues to address during the design phase. Activities included in this phase of work will include: 1) Prepare for Preliminary Application Coordination with USACE, which is anticipated to be the lead Federal Agency for the NEPA and ESA consultations, to instigate environmental compliance program, inclusive of NEPA, CWA, and ESA. a) Facilitated environmental strategy meeting, b) draft purpose and need for subsequent discussions on alternatives with regulatory agencies, c) Initial Alternative Screening Tool, d) analyze project *alternative with Initial Alternative Screening Tool, e) prepare Alternative Screening Analysis Memo, f) prepare Existing Environmental Conditions Briefing Memo, including i) baseline environmental conditions, ii) cultural resources record and literature review, iii) full report. 2) Facilitate a preliminary application coordination meeting with USACE, Portland to a) review the draft Purpose and Need Statement, b) develop a process for NEPA and regulatory compliance, c) determine appropriate materials to initiate NEPA including a 404 permit application, level of detail application and jurisdictional determination, d) determine staffing for NEPA documents, e) present City of Newport's anticipated schedule and process. 3) Prepare for and facilitate a one-day regulatory agency kickoff meeting and site visit in Newport, Oregon. 4) Develop an Environmental Compliance Process Framework, including schedule, next steps, roles and responsibilities, and key phases and milestones.*

iv. Resources Necessary: The City will contract with HDR to complete this phase of the work.

i. Task X: Fish Passage Alternative Review

ii. Timeline: July 2016 - March 2017

ii. Description of Activities: 1) Correspondence with ODFW about a waiver or exemption of the fish passage requirements at the proposed dam. Correspondence includes requesting and reviewing existing information on fish use and habitat of Big Creek, known alternative off-site mitigation opportunities, a Native Mitigation Fish Determination, and a Benefit Analysis. 2) Analysis of the feasibility to obtain a waiver via an alternative to fish passage (e.g., mitigation) within the existing lower reservoir area. Analysis will include a determination of potential fish use in the lower reservoir area and potential fish use in the inaccessible areas upstream of the upper reservoir. 3) Analysis of the feasibility to obtain a waiver via up to two other alternative sites provided by ODFW or City of Newport. 4) Analysis of the feasibility to obtain an exemption. 5) Summary of the options evaluated, including a list of the key actions necessary to complete the option (e.g., "property acquisition"); relative timeframe for each action, measured in months; rough cost estimate, measured in increments of $100K; associated long-term commitments; relative benefit to fish species; and probability of acceptance by ODFW, which is a product of their Commission, Fish Passage Task Force, and comments received from the public and reviewing agencies.

iv. Resources Necessary: HDR will complete the fish passage and alternatives review, with support from various technical experts as needed (e.g., Whooshh Innovations for volitional fish passage systems).

i. Task XI: Cost Estimates and Schedule

ii. Timeline: October 2016 - June 2017

iii. Description of Activities: 1) Estimate of construction quantities for each item of the work included in the bid schedule. 2) Development of unit prices for the following major items of work: a) Common and rock excavation, b) foundation preparation including such items as cleaning, inspection, dental excavation and concrete, grout curtain, etc. c) RCC for dam, d) conventional concrete for spillway, outlet works, dam facing systems and other items of work, e) access road, f) raw water pipeline, g) environmental permitting expenses, h) fish passage mitigation, i) planning contingencies including supplemental site characterization, design, construction management/administration, design contingency and construction change order/claim contingencies, j) prepare summary estimate of total costs, k) prepare estimated design, permitting, and construction schedule for the project.

iv. Resources Necessary: HDR will complete the cost estimate and schedule, with support from cost estimator Dan Hertel.

i. Task XII: Pre-Design Report

ii. Timeline: January 2017 - June 2017

iii. Description of Activities: 1) Draft pre-design report. All technical memorandums that were part of this scope of work will be part of this report and included in the appendices. 2) Addressing *comments from agencies, City, State Dam Engineer. 3) Final pre-design report after input from the City, State Dam Engineer has been received and addressed.*

iv. Resources Necessary: HDR will be contracted to complete the pre-design report.

i. Task XIII: Grant Administration, Reporting, and Strategic Planning

ii. Timeline: April 2016 - June 2017

iii. Description of Activities: Work conducted in this activity will include managing and administering grant funds, fulfilling reporting requirements, providing grant-specific technical assistance services, securing matching funds, and corresponding with OWRD staff and City staff. The City will continue to advance a long-term strategic funding plan to secure a diversified base of funding to design and remediate the Big Creek Dams.

iv. Resources Necessary: Chase Park Grants will be contracted to complete these services.

i. Task XIV: Administrative & Overhead Allocation

ii. Timeline: April 2016 - June 2017

iii. Description of Activities: The City will track costs related to administrative, facilities, and overhead expenditures (estimated at 10%) and other project expenditures for auditing purposes.

iv. Resources Necessary: The City will use existing resources to track and document costs associated with this projec. The information will be kept on file.

6. Please provide the following data and information for the proposed project and the project's sources of water supply:

a. The location of the proposed project. Include the basin, county, township, range and section. Attach a **map** that identifies the project's implementation area to this application.

The project is located in the Big Creek Watershed, Lincoln County, OR. The reservoirs extend across Township 10S, Range 11W, Section 33 (10S11W) and Township 10S, Range 11W, Section 34 (10S11W). A map of the project area is included with this application package (See Attachment E-project location map).

b. The name(s) and river mile(s) of the source water and what they are tributary to, if applicable.

Big Creek and the Siletz River are the source waters for the reservoirs impounded by Big Creek Dams #1 and #2. The Siletz River is a tributary to the Pacific Ocean and the City holds a point of diversion water right and intake at river mile 41.78. Big Creek is a tributary to the Pacific Ocean, Big Creek Dam #1 is located at river mile 0.91 and impounds water between 0.91 and 1.72 miles. Big Creek Dam #2 is located at river mile 1.72 and impounds water between 1.72 and 2.79.

c. Whether the project will be off-channel or on-channel (for above-ground storage only).

On-channel

d. Water availability to meet project storage. For above-ground storage the Department typically evaluates availability using a 50 percent exceedance water availability analysis.

The proposed feasibilty study does not affect a new storage project, but rather an existing storage facility. Sufficient water exists to meet the current facilities' storage needs. The total authorized volume of the reservoir impounded by dam #1 is 200 acre-feet, authorized under Certifications 21358 and 21357. The total *authorized storage volume of the reservoir impounded by Dam #2 is 970 acre-feet, being the total of 625 acre-feet authorized under Permit R-6171 and 345 acre-feet authorized under Certificate 48627. The water stored in Big Creek Reservoirs #1 and #2 is released for municipal use by the City of Newport under Certificate 48628 and Permit S-38220.*

The City has sufficient water rights to fill the proposed storage facility when it exercises diversion rights at the Big Creek and the Siletz River.

e. Proposed purposes and/or uses of conserved or stored water.

The stored water is used for municipal water supply purposes including residential, commercial, and industrial purposes, fish bypass, and fire protection.

f. Environmental flow needs and water quality requirements of supply source water bodies.

In order for the City to accurately consider the impact of the final remediation alternatives, they must conduct a robust and thorough evaluation of the hydrology and water quality impacts of proposed RCC dam construction and operations. In Task IX of the due dilligence tasks, HDR will investigate hydrology, potential water quality, wetland, supply, and habitat impacts associated with each remediation alternative. The intent is for the remediated dam/s to continue meeting the City's water needs while simultaneously supporting in-stream flow, fish, and wetland habitats.

7. What local, state or federal project permitting requirements/issues/approvals do you anticipate in order for the feasibility study to be conducted? If approvals are required, indicate whether you have obtained them. If you have not obtained the necessary permits/governmental approval, describe the steps you have taken to obtain them. If no permits are needed, please provide explanation.

   No permits or governmental requirements are necessary for these feasibility study activities. The proposed feasibility analysis will equip the City with adequate technical details regarding which environmental permits and other approvals are required to complete the proposed option. In addition to identifying permitting requirements, HDR will provide estimates about the level of effort, timeline, cost, potential risks, and mitigation alternatives.

8. Describe the level of involvement, interest and/or commitment of local entities associated with the feasibility study. Describe how the feasibility study and/or proposed project will benefit/impact these entities. Attach letters of support if available.

   Those entities directly involved with the feasibility study include Oregon Fish and Wildlife, Lincoln County, Oregon Water Resources Dam Safety, Oregon Department of Geology and Mineral Industry (DOGMI), and other environmental and land use agencies that the City will need to engage to determine the impacts and concerns associated with the proposed project. The final report generated as a result of this feasibility study will identify future stakeholders that will need to be proactively engaged to move the project to the next phase.

As evidenced by the attached letters of support, other regional entities in support of the City's project include: a) State Representative David Gomberg's office (District 10); State Senator Arnie Roblan's office (District 5); Oregon Policy Manager (Charlie Plybon) from the Surfrider Foundation; and CEO (Vincent Bryan III) from the Whooshh Innovations.

9. Identify when matching funds will be secured, from whom, and the dates of matching funds availability.

   A total of $674,420 in matching funds from the City will be budgeted in fiscal years 2016 and 2017. These matching funds will be in the form of cash contributions ($300,000 in FYE16 and $374,420 in FYE17) and in-kind support for City staff ($30,000 in salary and fringe benefits) and overhead and administrative costs ($39,193, which is approximately 8% of the total grant request).

   Matching funds for fiscal year 2016 were approved in April 2015 and were available starting July 1, 2015. Matching funds for fiscal year 2017 will be secured in April 2016 and available to spend on July 1, 2016.

10. Provide a description of the relevant professional qualifications and/or experience of the person(s) that will play key roles in performing the feasibility study. If the personnel have not been decided upon, include a description of the professional qualifications and/or experience of the person(s) you anticipate will play key roles in performing the feasibility study.

    City of Newport Key Personnel

Tim Gross, Director of Public Works for the City of Newport, will manage and oversee this grant. Tim has worked with the City of Newport for 5 years; 4 years as the Director of Public Works/City Engineer. Prior to joining the City of Newport, Tim spent 12 years working in the municipal sector and 6 years running the municipal engineering division for two different engineering consulting firms. He has a successful track record of managing complex public works projects to completion, on time and within budget. He also has extensive experience managing large federal, state and local grants, contract administration, managing consultants, and collaborating with diverse groups to achieve common goals. Mr. Gross has a BS in Civil Engineering from the University of Minnesota - Twin Cities.

Additional Key Personnel

Most tasks for the proposed project will be completed by the City's Dam Engineer of Record (HDR Engineering, Inc.), including the same technical team that conducted all previous work on the dam remediation investigations thus far. In 2012, the City of Newport selected HDR through a competitive qualifications-based selection process. The proposed work will build upon previous work HDR conducted on behalf of the City from 2011-2016, including the geotechnical analysis, alternatives analysis, and initial feasibility report funded by OWRD. Advancing the work will provide an important level of continuity and continued progress.

Verena Winter, PE, HDR Project Engineer/Project Manager. Verena is a skilled project manager, having led a variety of projects, including the City of Newport’s CM/GC water treatment facility, the initial Newport dam explorations project, and other projects in Oregon. She understands the situation with the Big Creek Dams, having been on this project since the issue was discovered. Her insight, experience, and leadership will enable her to manage the HDR team and outside assistance to determine the design parameters and develop practical solutions. Verena holds a B.S. in Engineering Management from

Bauhaus University (Germany) and an M.S. in Environmental Engineering from Portland State University. She has been employed by HDR for 13 years.

Keith Ferguson, PE, HDR Principal Designer. Keith specializes in dam safety, dam engineering, soil and rock mechanics, foundation engineering, and design, including specialized experience related to the Cascadia Subduction Zone (CSZ). Since 1978, he has participated in more than 350 civil and mining engineering projects including evaluation, design and/or construction services for more than 160 dams and appurtenant structures (e.g. spillways, outlet works, diversion dams), pipelines and tunnel designs. Keith is a recognized expert in dam safety, seepage, and stability analysis of dams. Keith holds a B.S. and an M.S. in Civil Engineering from the University of Colorado at Boulder and has 35 years of experience in the field.

Tia Cavender, MA, GPC, President, Chase Park Grants will provide strategic planning and grant administrative services for the Big Creek Remediation Project. Tia is a certified grant professional with more than 15 years of grant experience in various public and private settings. As principal and lead consultant for Chase Park Grants, Tia counsels local government agencies and technical experts on on innovative ways to secure funding for water infrastructure projects. She holds two masters degrees from the University of Colorado, and is a published author and frequent presenter at professional conferences.

11. If the project concept is ultimately deemed feasible, describe how the project will be implemented. Response should include a tentative funding plan for project implementation (e.g. other state or federally sponsored grant or loan programs) and the project proponent's track record in implementing similar projects.

The proposed project will be funded through a combination of revenue bonds, general obligation bonds, water rate revenue, government grants, and low-interest loans.

In addition to the traditional sources of financing this type of water storage project, the City will invest in pursuing government grants and low-interest loans. For example, the City could choose to pursue funding under three different public financing programs: a) OWRD Water Supply Development Account loan program, b) the Safe Drinking Water State Revolving Loan Fund, and c) the Clean Water State Revolving Loan Fund for the construction of the fish passage facility.

The City will continue to work with its grants consultant to identify grant opportunities for specific elements of constructing the new dam. For example, if the City decides to incorporate a volitional fish passage technology or hydropower facility, those types of projects can sometimes be funded through grants, which would decrease the amount of money taken out in loans. Several of the design features the City will consider during the design phase of the project (projected for FYE 2018-2019) are likely to be fundable through government and private grant programs.

Section B. Unique Criteria

Instructions: Address the set of items below that applies to the type of feasibility study that this grant will fund.

☐ Water Conservation or ☐ Reuse

1. Water Conservation or Reuse projects that are identified by the Department in a statewide water assessment and inventory receive a preference in the scoring process. Contact the Department's Grant Specialist to include your project on the inventory.

2. Explain how the associated project will either: (a) mitigate the need to develop new water supplies and/or (b) use water more efficiently. Reference documentation and/or examples of the success of similar or comparable water conservation/reuse projects that would be available upon request.

3. Provide a description of: (a) Local, state and/or federal permitting requirements and issues posed by the **implementation** of the project associated with the feasibility study and (b) property ownership status within the project implementation area. If permitting or other approvals are not needed please indicate and provide an explanation.

☒ Above-Ground Storage

Please answer the following three questions **BEFORE** proceeding:

Will the project divert more than 500 acre-feet of surface water annually?	☒ Yes	☐ No
Will the project impound surface water on a perennial stream?	☒ Yes	☐ No
Will the project divert water from a stream that supports sensitive, threatened or endangered species?	☒ Yes	☐ No

If you answered "Yes" to any of these questions, by signature on this application, you are committing to include the following required elements in your feasibility study.

Describe how you intend to address the required elements in your feasibility study:

a) Analyses of by-pass, optimum peak, flushing and other ecological flows of the affected stream and the impact of the storage project on those flows.

Task VI of the project will analyze hydrology, infrastructure flows and other ecological flows. The objective of this task is to refine the configuration of the spillway and outlet works of the new dam, and to develop an initial concept for fish passage around the new dam to use in discussions/negotiations with state regulators of the project.

This task will include appropriate updates of the estimate of the PMF inflow hydrograph, reservoir routing, and hydraulic analyses of the spillway structure to identify a cost-effective combination of spillway width to dam crest freeboard requirements. The outlet works, including the intake structure, will be designed to meet dam safety as well as operational requirements for both quantity and quality of water released from the reservoir. Fish passage analyses will be based on a possible fish passage facility incorporated into a natural drainage channel in the downstream left abutment area of the new dam.

b) Comparative analyses of alternative means of supplying water, including but not limited to the costs and benefits of water conservation and efficiency alternatives and the extent to which long-term water supply needs may be met using those alternatives.

In 2015, the City of Newport commissioned a study to assess the feasibility of five different replacement projects for the Big Creek Dams. The study addressed how to deal with the City's existing dams, and confirmed that the Big Creek Reservoir must be remediated because being out of water or developing another source for water in a timely fashion are not viable options. Of those scenarios, an RCC dam replacement project was prioritized as the most feasible means to secure drinking water for the City into the future.

Newport currently delivers water conservation education and is seeking funding to invest in state-of-the-art automated water metering technology to conserve water supply, however it is not anticipated that those projects would lead to any significant additional water source to meet long-term water supply needs.

Via the City's regional, place-based planning efforts for the Mid-Coast region, additional water supply and resuse projects may be identified to meet demand on a broader scale. The place-based planning initiative will occur from 2016-19, and will occur in tandem with a Mid-Coast Basin Study, which will focus on the impact of climate change on future water supplies. Through these comprehensive water planning efforts, the City is studying all aspects of water needs and supply in the Mid-Coast Basin and the results of each study will inform the others.

The following is a list of stakeholders that are involved in a regional planning initiative to address water supply challenges in the Mid-Coast Basin. Starting in July 2016, this group will meet every other month to advance the development of an Integrated Water Resources Plan for the region. These local partners may be called upon to provide input when looking for stakeholder feedback, and the City will keep them informed as the feasibility study progresses. Because the City of Newport is the largest water provider in the Mid-Coast, local entities are interested in knowing the Big Creek water supply is intact and that its vulnerabilities are being adequately addressed. Additionally, multiple state agencies are interested in seeing this study executed, because what is learned can be applied to other Oregon communities in the future.

c) Analyses of environmental harm or impacts from the proposed storage project.

Considerable effort to analyze environmental harm and potential impacts will be undertaken through the scope of work outlined in this proposal. Identifying potential environmental harm will be addressed in Tasks II, VI, IX and X.

d) Evaluation of the need for and feasibility of using stored water to augment instream flows to conserve, maintain and enhance aquatic life, fish life and any other ecological values.

Task IX of the scope of work and tasks for this project will evaluate the need for and feasibility of using stored water to augment instream flows with the intent of maintaining and enhancing aquatic life, fish life and other ecological values.

Is the proposed storage project for municipal use?

☒ Yes ☐ No

If "Yes," then please describe how you intend to address the following required element in your feasibility study:

e) For a proposed storage project that is for municipal use, analysis of local and regional water demand and the proposed storage project's relationship to existing and planned water supply projects.

The City of Newport Water System Master Plan adopted in 2008 and updated in 2010 projects current and future demand and raw water storage needs. The proposed option being studied in this feasibility study considers projected future need through the year 2030. A concurrent Place-based Planning Study being administrated by the City of Newport will analyze water needs and supply on a regional level, which will inform the report completed as part of the feasiblity study.

Proceed in addressing the following items:

1. Describe to what extent the project associated with the feasibility study includes provisions for using stored water to augment instream flows to conserve, maintain and enhance aquatic life, fish life or other ecological values. Projects that include the above provisions receive preference in the scoring process.

   Task IX of HDR's environmental analysis will examine impact to endangered species, stream flows, and required instream flows that will support aquatic life, fish life or other ecologic values. In cooperation with the appropriate agencies the project outcome will comply with all environmental regulations. Based on the required stream flow the dam will be designed to be able to release enough water to maintain the appropriate flows in local streams.

2. Provide a review of: (a) Local, state and/or federal permitting requirements and issues posed by the **implementation** of the project associated with the feasibility study and (b) property ownership status within the project implementation area.

   Newport will prepare preliminary application coordination with USACE, which is anticipated to be the lead federal agency for the project. This will include assessment of necessary compliance programs including the National Environmental Protection Act, Endangered Species Act and Clean Water Act. Additionally, Newport will facilitate a one-day regulatory agency kickoff meeting and site visit in Newport, Oregon. Regulatory agencies with permitting/approval roles may include U.S. Army Corps of Engineers, Oregon Department of State Lands, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Oregon Department of Fish and Wildlife, Environmental Protection Agency, Oregon Department of Environmental Quality, State Historic Preservation Office, and Oregon Water Resource Department. Topics will include the project description, areas of potential impact that relate to resources over which the agencies have regulatory authority, and the regulatory process. The meeting will culminate in an Environmental Compliance Process Framework, including schedule, next steps, roles and responsibilities, and key tasks and milestones.

   Permits Include:
   - National Environmental Policy Act (NEPA)
   - Clean Water Act Section 404/401 and Oregon Removal-Fill permit including: Endangered Species Act Section 7; Magnuson Stevens Fishery Conservation and Management Act; National Historic Preservation Act Section 106; Migratory Bird Treaty Act; Oregon Fish Passage; Coastal Zone Management Act.
   - Bald and Golden Eagle Protection Act (if required)

- Oregon Water Rights
- Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) 1200-C
- City of Newport Conditional Use Permit
- City of Newport Building, Electrical, Plumbing, Mechanical, Sewer/Water Permit
- Oregon State Engineer Design Review and Approval.

The City of Newport owns all property impacted by the proposed improvement. There are several private property owners who's public road access will be impacted by the project but provisions are being made to address and mitigate these impacts.

☐ Storage Other Than Above-Ground [Including Aquifer Storage and Recovery (ASR)]

Please answer the following three questions **BEFORE** proceeding:

Will the project divert more than 500 acre-feet of surface water annually? ☐ Yes ☐ No

Will the project impound surface water on a perennial stream? ☐ Yes ☐ No

Will the project divert water from a stream that supports sensitive, threatened or endangered species? ☐ Yes ☐ No

If you answered "Yes" to any of these questions, by signature on this application, you are committing to include the following required elements in your feasibility *study.*

Describe how you intend to address the required elements in your feasibility study:

a) Analyses of by-pass, optimum peak, flushing and other ecological flows of the affected stream and the impact of the storage project on those flows.

b) Comparative analyses of alternative means of supplying water, including but not limited to the costs and benefits of water conservation and efficiency alternatives and the extent to which long-term water supply needs may be met using those alternatives.

c) Analyses of environmental harm or impacts from the proposed storage project.

d) Evaluation of the need for and feasibility of using stored water to augment instream flows to conserve, maintain and enhance aquatic life, fish life and any other ecological values.

Is the proposed storage project for municipal use?

☐ Yes ☐ No

If "Yes," then please describe how you intend to address the following required element in your feasibility study:

e) For a proposed storage project that is for municipal use, analysis of local and regional water demand and the proposed storage project's relationship to existing and planned water supply projects.

Proceed in addressing the following items:

1. Underground storage projects that are identified by the Department in a statewide water assessment and inventory receive a preference in the scoring process. Contact the Department's Grant Specialist to include your project on the inventory.

2. Provide a review of: (a) Local, state and/or federal permitting requirements and issues posed by the **implementation** of the project associated with the feasibility study and (b) property ownership status within the project implementation area.

V. Match Funding Information

Applicants must demonstrate a minimum dollar-for-dollar match based on the total funding request. The match may include a) secured funding commitment from other sources, b) pending funding commitment from other sources, and/or c) the value of in-kind labor, equipment rental, and materials essential to the feasibility study. For secured funding, you must attach a letter of support from the match funding source that specifically mentions the dollar amount shown in the "Amount/Dollar Value" column. For pending resources, documentation showing a request for the matching funds must accompany the application.

In the "type" column below matching funds may include:	In the "status" column below matching funds may have the following status:
• **Cash** - Cash is direct expenditures made in support of the feasibility study by the applicant or partner*.	• **Secured** - Secured funding commitments from other sources.
• **In-Kind** - The value of in-kind labor, equipment rental and materials essential to the feasibility study provided by the applicant or partner.	• **Pending** - Pending commitments of funding from other sources. In such instances, Department funding will not be released prior to securing a commitment of the funds from other sources. Pending commitments of the funding must be secured within 12 months from the date of the award.

*"Partner" means a non-governmental or governmental person or entity that has committed funding, expertise, materials, labor, or other assistance to a proposed project planning study. OAR 690-600-0010.

Match Funding Source (if in-kind, briefly describe the nature of the contribution)	**Type** (✓ One)	**Status** (✓ One)	**Amount/ Dollar Value**	**Date Match Funds Available** *(Month/Year)*
City of Newport -- FYE2016 (covering expenditures made between 7/1/15 and 6/30/16)	☐ cash ☒ in-kind	☒ secured ☐ pending	*$300,000.00*	*July 16*
City of Newport -- FYE2017 (covering expenditures made between 7/1/16 to 6/30/17)	☒ cash ☒ in-kind	☒ secured ☐ pending	*$374,420.00*	*July 16*
	☐ cash ☐ in-kind	☐ secured ☐ pending		
Oregon Water Resources Department -- Water Conservation & Storage Feasibility Grant Program	☒ cash ☐ in-kind	☐ secured ☒ pending	*$460,000.00*	*July 16*
	☐ cash ☐ in-kind	☐ secured ☐ pending		
	☐ cash ☐ in-kind	☐ secured ☐ pending		
	☐ cash ☐ in-kind	☐ secured ☐ pending		
	☐ cash ☐ in-kind	☐ secured ☐ pending		
	☐ cash ☐ in-kind	☐ secured ☐ pending		
	☐ cash ☐ in-kind	☐ secured ☐ pending		

VI. Feasibility Study Schedule

Estimated Study Duration: April 1, 2016 to June 30, 2017

Place an "X" in the appropriate column to indicate when each Key Task of the project will take place.

	2016			2017				2018 & Beyond
Feasibility Study Key Tasks	**2nd Qtr**	**3rd Qtr**	**4th Qtr**	**1st Qtr**	**2nd Qtr**	**3rd Qtr**	**4th Qtr**	
I Project Management	X	X	X	X	X			
II Survey of New Dam Site and Surrounding Terrain	X							
III Site Characterization and Explorations	X	X						
IV Design Criteria Memorandum			X					
V Engineering Evaluations and New Proposed RCC Dam			X	X				
VI Hydrology and Spillway, Outlet Works, and Fish Passage Analysis			X	X				
VII Access Road Preliminary Feasibility		X	X					
VIII Raw Water Pipeline Preliminary Design		X	X					
IX Environmental Permitting Assessment		X	X	X				
X Fish Passage and Alternative Review		X	X	X				
XI Cost Estimate and Schedule			X	X	X			
XII Pre- Design Report				X	X			
XIII Grant Administration, Reporting & Strategic Planning	X	X	X	X	X			
XIV Administrative, Overhead and Facilities Administration	X	X	X	X	X			

- **Please Note**: Successful grantees must include all invoices and identify which key tasks are associated with each invoice when requesting financial reimbursement.

VII. Feasibility Study Budget

Section A

Please provide an estimated line item budget for the proposed feasibility study. Examples would include: labor, materials, equipment, contractual services and administrative costs.

Line Items	**Number of Units*** *(e.g. # of Hours)*	**Unit Cost** *(e.g. hourly rate)*	**In-Kind Match**	**Cash Match Funds**	**OWRD Grant Funds**	**Total Cost**
Staff Salary/Benefits			*$30,000.00*	*$0.00*	*$0.00*	*30,000*
Contractual/Consulting				*$674,420.00*	*$460,000.00*	*$1,134,420.00*
Equipment (must be approved)						
Supplies						
Other:						
Administrative Costs**			*$39,193.00*			*$39,193.00*
		Total for Section A	*$69,193.00*	*$674,420.00*	*$460,000.00*	*$1,203,613.00*
		Percentage for Section A	***6***	***56***	***38%***	***100%***

** Note: The "Unit" should be per "hour" or "day" – not per "project" or "contract." Units x Unit Costs = Total Cost*
*** Administrative Costs may not exceed 10 percent of the total funding requested from the Department*

Section B

If grant amount requested is $50,000 or greater, you MUST complete Section B. Key Tasks in Section B should be the same as the Key Tasks in Section VI (Feasibility Study Schedule).

Feasibility Study Key Tasks	In-Kind Match	Cash Match Funds	OWRD Grant Funds	Total Cost
I Project Management	*$10,000.00*	*$90,000.00*	*$50,000.00*	*$150,000.00*
II Survey of New Dam Site and Surrounding Terrain	*$1,500.00*	*$70,000.00*	*$50,000.00*	*$121,500.00*
III Site Characterization and Explorations	*$1,500.00*	*$100,000.00*	*$80,000.00*	*$181,500.00*
IV Design Criteria Memorandum	*$1,500.00*	*$25,000.00*	*$25,000.00*	*$51,500.00*
V Engineering Evaluations and New Proposed RCC Dam	*$1,500.00*	*$75,000.00*	*$75,000.00*	*$151,500.00*
VI Hydrology and Spillway, Outlet Works, and Fish Passage Analysis	*$1,500.00*	*$55,000.00*	*$35,000.00*	*$91,500.00*
VII Access Road Preliminary Feasibility	*$1,500.00*	*$35,000.00*	*$35,000.00*	*$71,500.00*
VIII Raw Water Pipeline Preliminary Design	*$1,500.00*	*$35,000.00*	*$35,000.00*	*$71,500.00*
IX Environmental Review Assessment	*$0.00*	*$40,000.00*	*$10,000.00*	*$50,000.00*
X Fish Passage and Alternative Review	*$1,500.00*	*$40,000.00*	*$0.00*	*$41,500.00*
XI Cost Estimate and Schedule	*$1,500.00*	*$25,000.00*	*$25,000.00*	*$51,500.00*
XII Pre-Designn Report	*$1,500.00*	*$40,000.00*	*$40,000.00*	*$81,500.00*
XIII Grant administration & progress reporting, grant-related technical support, strategic planning	*$5,000.00*	*$44,420.00*	*$0.00*	*$49,420.00*
XVI Facilities & administrative costs (8% of direct costs)	*$39,193.00*	*$0.00*	*$0.00*	*$39,193.00*
Total for Section B	*$69,193.00*	*$674,420.00*	*$460,000.00*	*$1,203,613.00*

Totals in Section B must match the totals in Section A

APPLICATION CHECKLIST

Instructions: Use this checklist to ensure that your application is complete. An incomplete application will jeopardize your application's review. **<u>This form does not need to be included in your application packet.</u>**

General

If submitting electronically, the preferred format is either a Microsoft word or Adobe pdf

- ☐ Only one application is included with the packet (other applications must be sent separately).

Paper submissions only

- ☐ The application and attachments are on 8 ½" x 11" paper.
- ☐ The application and attachments are single-sided.
- ☐ The application and attachments are not stapled or bound.

Section I – Grant Information

- ☐ All questions in this section have been answered.
- ☐ The Grant Dollars Requested and the Total Project Cost mirror the totals shown in Section VII.

Section II – Applicant Information

- ☐ All contact information for the applicant(s) and fiscal officer is complete and current.
- ☐ The certification is signed by an authorized signer.

Section III – Feasibility Study Summary

- ☐ A brief summary, of no more than 150 words, is complete.

Section IV – Grant Specifics

- ☐ All questions in Section A have been answered.
- ☐ If the type of feasibility study is water conservation, reuse or storage other than above-ground, you have contacted the Department and requested project be added to the Oregon Water Resources Department's statewide water assessment and inventory.
- ☐ All applicable questions for the type of grant requested have been answered.

Section V – Match Funding Information

- ☐ Applicant has identified that at least 50 percent match has been sought, secured or expended.
- ☐ Letters of support are included for "secured" match funding sources.
- ☐ Documentation is included for "expended" match funds.
- ☐ Documentation is included for "pending" match funds.

Section VI – Feasibility Study Schedule

- ☐ Estimated project duration dates have been supplied.
- ☐ All Key Tasks of the project are listed.

Section VII – Feasibility Study Budget

- ☐ Section A is complete.
- ☐ Administration costs do not exceed 10 percent of the requested OWRD Grant Funds.
- ☐ If grant amount requested is $50,000 or greater, Section B has been completed.
- ☐ All Key Tasks listed in Section B mirror the Key Tasks listed in Section VI.

ATTACHMENT A

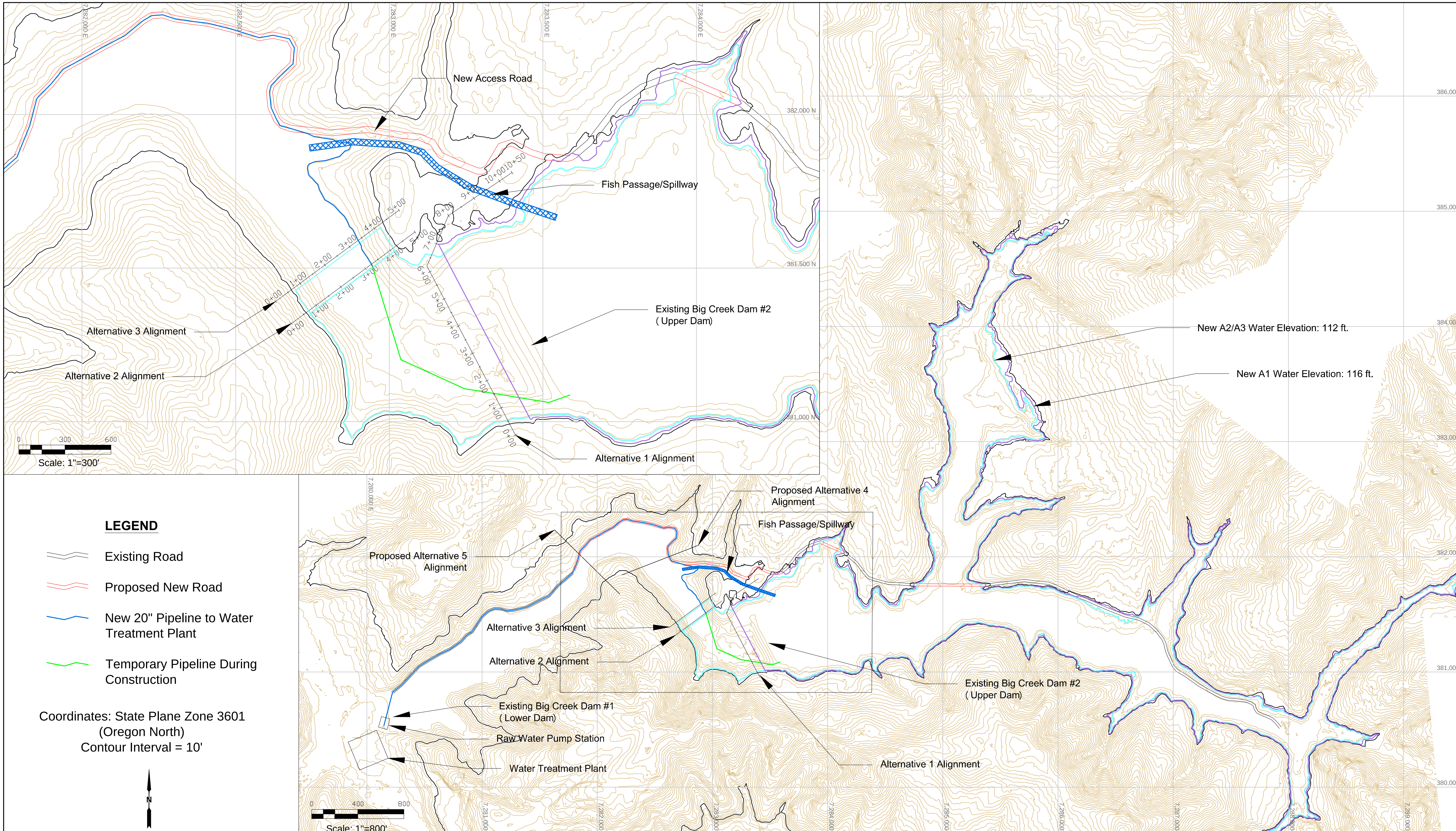
RELEVANT REGIONAL WATER MASTER PLANS

	A	B	E	F
1	**Partner**	**Description of Planning Document**	**Link to Agency Water Planning Documents, Programs or Mission Statement**	**Common Water Management Goals that Support Newport's Feasibility Project**
2	**City of Newport**	City of Newport's Master Water Plan	http://newportoregon.gov/dept/pwk/mwp.asp	The City of Newport is looking for long term planning solutions to develop Rocky Creek dam and reservoir for regional storage, increase the storage volume of Big Creek Basin, develop desalination and utilize estuary or ocean water for potable water treatment, create fish passage for Coho Salmon via new technology.
3	**City of Lincoln City, Oregon**	City of Lincoln City, Oregon Comprehensive Plan, including Lincoln City Estuary Management Plan (1998)	http://www.lincolncity.org/vertical/sites/%7BDDC39B4D-9F7A-4251-AEA0-F594E7F89DDB%7D/uploads/Comprehensive_Plan_with_Amendments_for_Web_Posting_-_2014(1).pdf	There are identified areas of water quality concern in the Lincoln City area, including: Devils Lake, Schooner Creek, and Drift Creek. (1998, p.39) There is a need for streambank protection; to reduce the amount of nutrients permitted to enter Devils Lake; to improve the sewage treatment facility to prevent further degradation of Siletz Bay and Schooner Creek; to explore alternatives to the Schooner Creek sewage outfall; and preservation of wildlife areas such as stream spawning beds and eagle's nests. Lincoln City supports programs to resolve conflicts between the preservation of sensitive wildlife habitats and conflicting uses, with a goal to conserve, protect, and enhance the Siletz Bay Estuary.
4	**City of Toledo**	Master Water Plan	http://www.cityoftoledo.org/water-master-plan/	Water Treatment and Water Storage Needs (e.g., Siletz Intake and Pump Station, Ollala Reservoir Pipeline Crossing, Skyline Drive Storage Tank). **The City is also developing a Water Master Conservation Plan beginning in January 2016.**
5	**City of Depoe Bay**	Water Management and Conservation Plan	http://filepickup.wrd.state.or.us/files/Publications/WMCP/Requested%20Files/Depoe%20Bay/Depoe%20Bay_Draft%20WMCP_1999.pdf	The City is currently developing an updated Water Master Conservation Plan. The City also has a Water Management Plan.
6	**Seal Rock Water District**	Seal Rock Water District's Master Water Plan	http://www.srwd.org/pdf/Master%20Plan.pdf	The Seal Rock Water District (SRWD) is located in Lincoln County, Oregon, approximately in the center of the County coastline. The District serves the coastline between the cities of Waldport and Newport and at no point extends more than 1.5 miles inland from the beach. The current SRWD Boundary encompasses 6,505 acres, or 10.2 square miles. The district is looking into options to treat and supply their own water. Seal Rock currently purchases its water from Toledo.
7		Seal Rock Water District's Water Management and Conservation Plan	http:F11//filepickup.wrd.state.or.us/files/Publications/WMCP/Requested%20Files/Forecast_WMCPs%202012-2014/Seal%20Rock%20Water%20Dist_Final%20Revised%20WMCP_3_3_2014.pdf	This plan summarizes much of the information contained in the Seal Rock Water Master Plan and its two amendments and it includes data to support the requirements of outlined in OAR 690-086-0125(1)–(4).
8	**Port of Newport**	Port of Newport	http://www.portofnewport.com/index.php	Mission statement: To build and maintain waterfront facilities, and promote/support projects and programs in cooperation with other community organizations and businesses that will retain and create new jobs and increase community economic development. Newport Fisheries Center: Mixed use facility that supports the fishing industry by acting as a "hub" for related activity.
9	**The Confederated Tribes of the Siletz Indian**	The Confederated Tribes of the Siletz Indians, 2005- 2015 Comprehensive Plan	http://www.ctsi.nsn.us/uploads/downloads/ComprehensivePlan/Ctsi%20Comprehensive%20Plan%202005-15%20Intro.pdf http://www.ctsi.nsn.us/uploads/Ctsi%20Comprehensive%20Plan%202005-15%20Goals%20%26%20Objectives.pdf	The Tribal staff work with various agencies through out the Northwest on environmental issues including working with the relicensing of Hydro Projects. They also have several other aquatics projects such as a fish hatchery, eel passage, and work on the Willamette Falls. Water quality is a focus so is leaving water instream for fish. Also expressed interest in including an assessment on projected tourism in the Basin.
10	**Lincoln County, OR**	Lincoln County Water Needs Analysis prepared by WHPacific and GSI (2008)	http://www.oregon.gov/owrd/LAW/docs/GrantSum/GA0032_09_Polk_County_Complete_App.pdf	The purpose of this report is to quantify currently available water resources in Lincoln County and evaluate whether existing sources can adequately meet future water demand through 2050. This study will: 1) document current average day and maximum day water demand; 2) forecast future water demand based on growth assumptions; and 3) compare currently available water supply to the projected future water demand.
11		Lincoln County Multi-Jurisdictional Natural Hazards Mitigation Plan (2009)	http://www.co.lincoln.or.us/sites/default/files/fileattachments/emergency_management/page/3785/nhmp.pdf	Lincoln County developed this multi-jurisdictional Natural Hazard Mitigation Plan in an effort to assist Lincoln County, Lincoln City, Depoe Bay, Newport, Toledo, Waldport and Yachats to reduce the risk from natural hazards by identifying resources, information, and strategies for risk reduction. It will also help guide and coordinate mitigation activities throughout the County.
12		Midcoast Watershed Council, Rock Creek (Siletz) Watershed Assessment Final Report	https://nrimp.dfw.state.or.us/web%20stores/data%20libraries/files/Watershed%20Councils/Watershed%20Councils_172_DOC_MCWC%20Rock%20Creek%20(Siletz)_v1.PDF	The residents of Rock Creek were interested in developing a science-based management and monitoring plan to conserve the resources in the Rock Creek watershed (a tributary of the Siletz River). The primary goals of this assessment were to inventory and characterize watershed components and evaluate watershed processes that influence abundance and distribution of salmonids and other valued wildlife. Products of this assessment include monitoring and management recommendations, summary and a base map with GIS data layers, identification of information gaps and a plan for addressing those gaps.

	A	B	E	F
1	**Partner**	**Description of Planning Document**	**Link to Agency Water Planning Documents, Programs or Mission Statement**	**Common Water Management Goals that Support Newport's Feasibility Project**
13	**MidCoast Watersheds Council**	An Approach To Limiting Factors Analysis and Restoration Planning In Sixth Field Sub-Watersheds	http://www.midcoastwatershedscouncil.org/images/assessment/limiting-factors/Methodology.pdf	This document describes an approach used in conducting limiting factor analyses of Coho salmon habitats in five small mid-coastal Oregon 6th field watersheds, including the Steere Creek (Siletz River Basin)and Rock Creek (Devils Lake drainage). The project was funded by the Oregon Watershed Enhancement Board (OWEB), and was administered by the MidCoast Watershed Council (MCWC).
14		Limiting Factors Assessment and Restoration Plan Rock Creek Tributary to Devil's Lake Lincoln County, Oregon (2003)	http://www.midcoastwatershedscouncil.org/images/assessment/limiting-factors/Rock%20Creek.pdf	Final Report Prepared for MidCoast Watershed Council in 1999. The report surveyed estuarine wetland sites in the Alsea and Yaquina basins and prioritized sites for protection and restoration activities.
15		Yaquina and Alsea River Basins Estuarine Wetland Site Prioritization Project (1999)	http://www.midcoastwatershedscouncil.org/images/assessment/1999_Tidal_Marsh_Assessment.pdf	Project to better understand the status and condition of streams and watersheds of the Yaquina and Alsea rivers.
16		MidCoast Sixth Field Watershed Assessment Final Report (2001)	http://www.midcoastwatershedscouncil.org/images/assessment/2001_6th-Field-Assessment.pdf	The study area for this assessment is composed of the Alsea, Salmon, Siletz, Yachats, and Yaquina River watersheds and those watersheds that drain directly to the ocean between Cascade Head and Cape Creek at Heceta Head (Ocean Tributaries).
17		MidCoast Watersheds Council Annual Report	http://www.midcoastwatershedscouncil.org/index.php/what-we-do/annual-reports	The MidCoast Watersheds Council is a local non-profit organization dedicated to improving the health of streams and watersheds of Oregon's central coast so they produce clean water, rebuild healthy salmon populations, and support a healthy ecosystem and economy. The Council works in an area of nearly one million acres, including all streams draining from the crest of the Coast Range to the Pacific, from the Salmon River to Cape Creek at Heceta Head.
18	**Office of the Governor, State of Oregon**	Executive Order 15-09: Directing State Agencies to Plan for Resiliency to Drought, to Meet the Challenge that a Changing Climate Brings	http://www.oregon.gov/gov/Documents/executive_orders/eo_15-09.pdf	Governor Kate Brown responded to Oregon's drought by signing Executive Order 15-09 Directing State Agencies to Plan for Resiliency to Drought, to Meet the Challenge that a Changing Climate Brings on July 27, 2015. The goal of the actions outlined in the Executive Order is to reduce non-essential water use in all state-owned facilities by an average 15 percent or more by December 31, 2020, and to work with private building owners who lease facilities to state agencies to reduce non-essential water consumption at their buildings.
19	**Oregon Water Resources Department**	Report to Governor Kate Brown Implementation of Executive Order No. 15-09 Directing State Agencies to Plan for Resiliency to Drought (November 2015)	http://www.oregon.gov/owrd/docs/FinalReportDroughtEO.pdf	The goal of the actions outlined in the Executive Order is to reduce non-essential water use in all state-owned facilities by an average 15 percent or more by December 31, 2020, and to work with private building owners who lease facilities to state agencies to reduce non-essential water consumption at their buildings. This document is the first progress report to Governor Kate Brown.
20		Oregon's Integrated Water Resources Strategy (2012)	http://www.oregon.gov/owrd/LAW/docs/IWRS_Final.pdf	State and place based planning, water management and development, protection of public health and ecological health, and stable funding. Our place based planning effort was modeled to achieve the goals outlined in the states strategy.
21	**Oregon Department of Fish and Wildlife**	Oregon Plan for Salmon and Watersheds Oregon Coast Coho Assessment Habitat Prepared by Oregon Department of Fish and Wildlife (2005)	https://nrimp.dfw.state.or.us/crl/Reports/AI/Oregon%20Coast%20Coho%20ESU%20Habitat%20Assessment.pdf	In this report, the status and trend of instream physical habitat conditions in the Oregon Coastal Coho ESU are assessed from ten variables collected by the ODFW habitat monitoring program from 198-2003. Habitat conditions are described at the scale of the ESU, four monitoring areas within the ESU, and by four land use categories (agriculture, urban, private forest, and public forest). The condition of habitat is compared among monitoring areas or land use categories.
22	**National Oceanic and Atmospheric Association**	Identification of Historical Populations of Coho Salmon (Oncorhynchus kisutch) in the Oregon Coast Evolutionarily Significant Unit (2007)	http://www.nwfsc.noaa.gov/assets/25/478_08302007_104459_HistPopsCohoTM79Final.pdf	The Oregon Coast Evolutionarily Significant Unit (ESU) of Coho salmon was listed as threatened under the U.S. Endangered Species Act in 1998. This report identifies species and ESU delisting goals, characterizes fish/abundance, identifies factors for decline and limiting factors for the ESU, identifies early actions that are important for recovery, and identifies research, evaluation, and monitoring needs. The report also includes climate data for the Oregon Coast ESU.
23		Final Assessment of NOAA Fisheries' Critical Habitat Analytical Review Team (CHART) For the Oregon Coast Coho Salmon Evolutionarily Significant Unit (2007)	http://www.westcoast.fisheries.noaa.gov/publications/protected_species/salmon_steelhead/critical_habitat/ch-oregon_coast_coho_chart_report_2007.pdf	This report summarizes the results of the critical habitat analytical review team (CHART) charged with analyzing the best available data to assess biological information relevant to making a critical habitat designation for the Oregon Coast Coho salmon Evolutionarily Significant Unit (ESU).

ATTACHMENT B

DAM ALTERNATIVES OVERVIEW



HDR

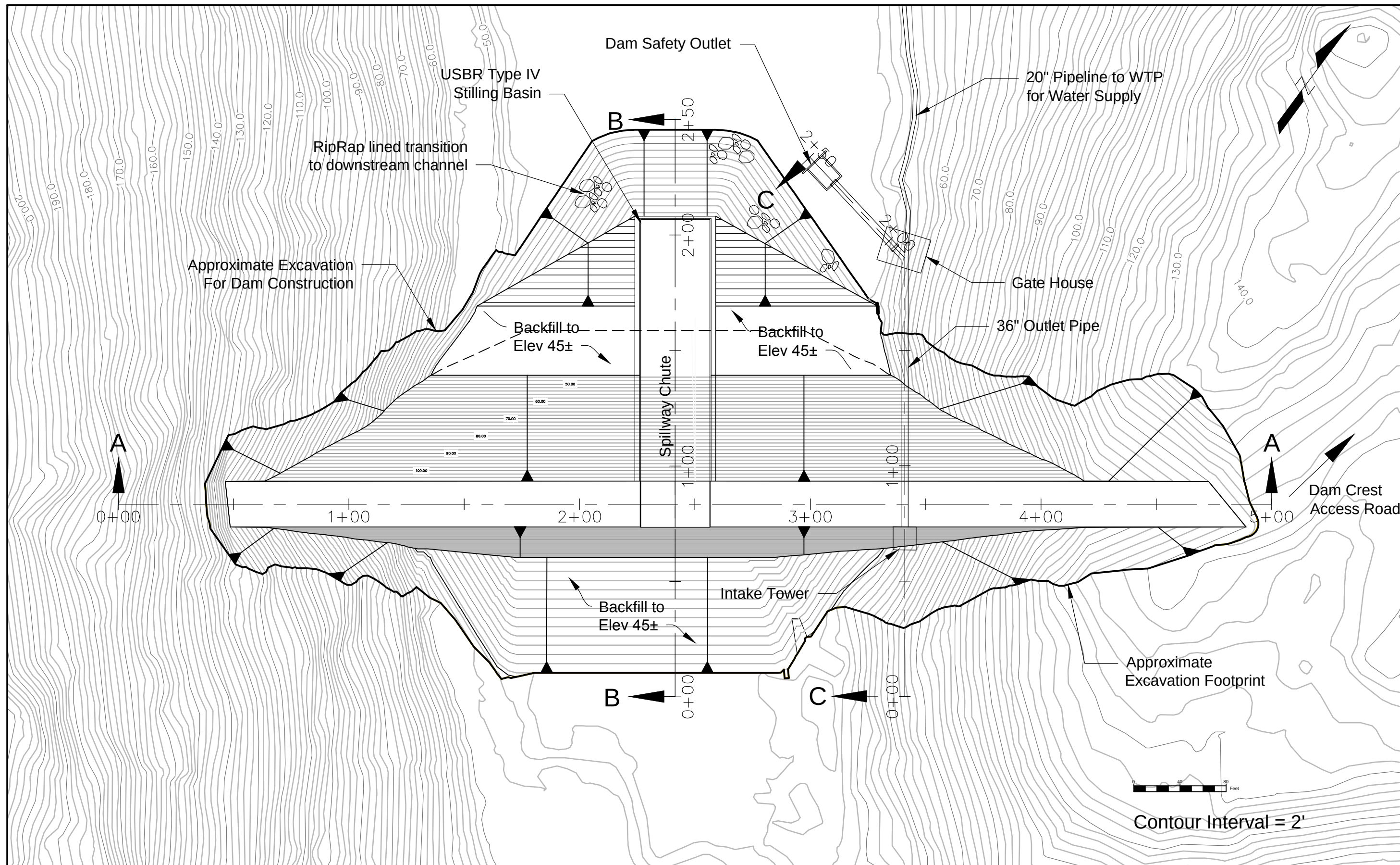
City of Newport
Dam Alternatives Overview

DATE
6-30-2015

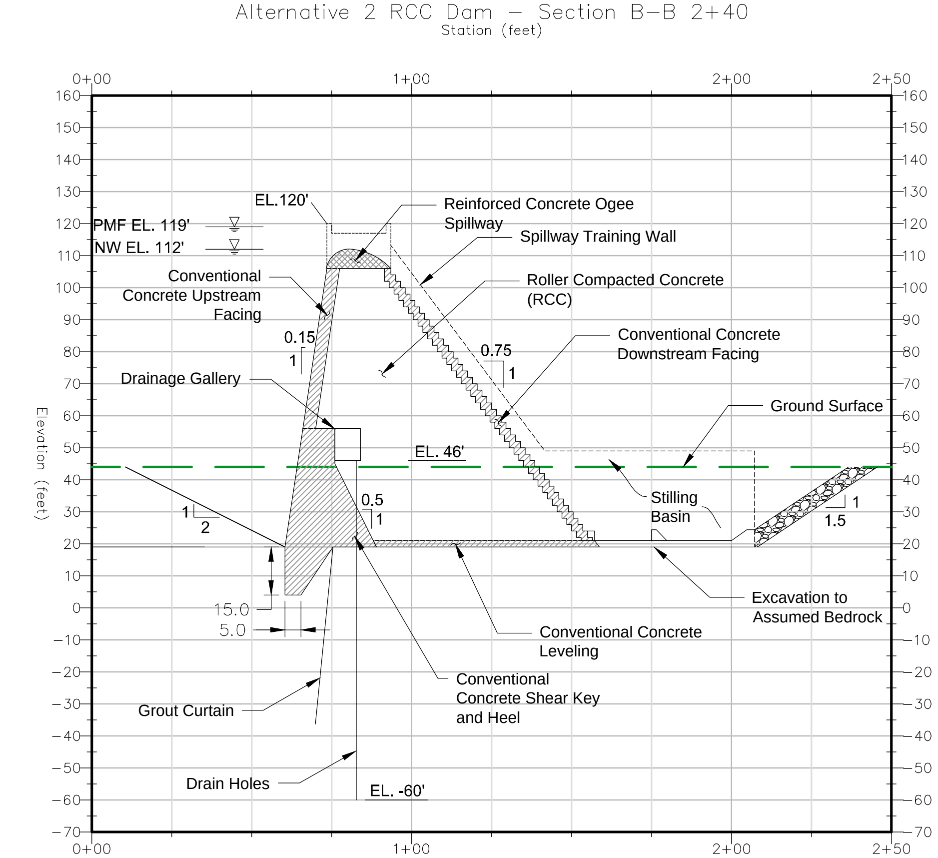
FIGURE
1

ATTACHMENT C

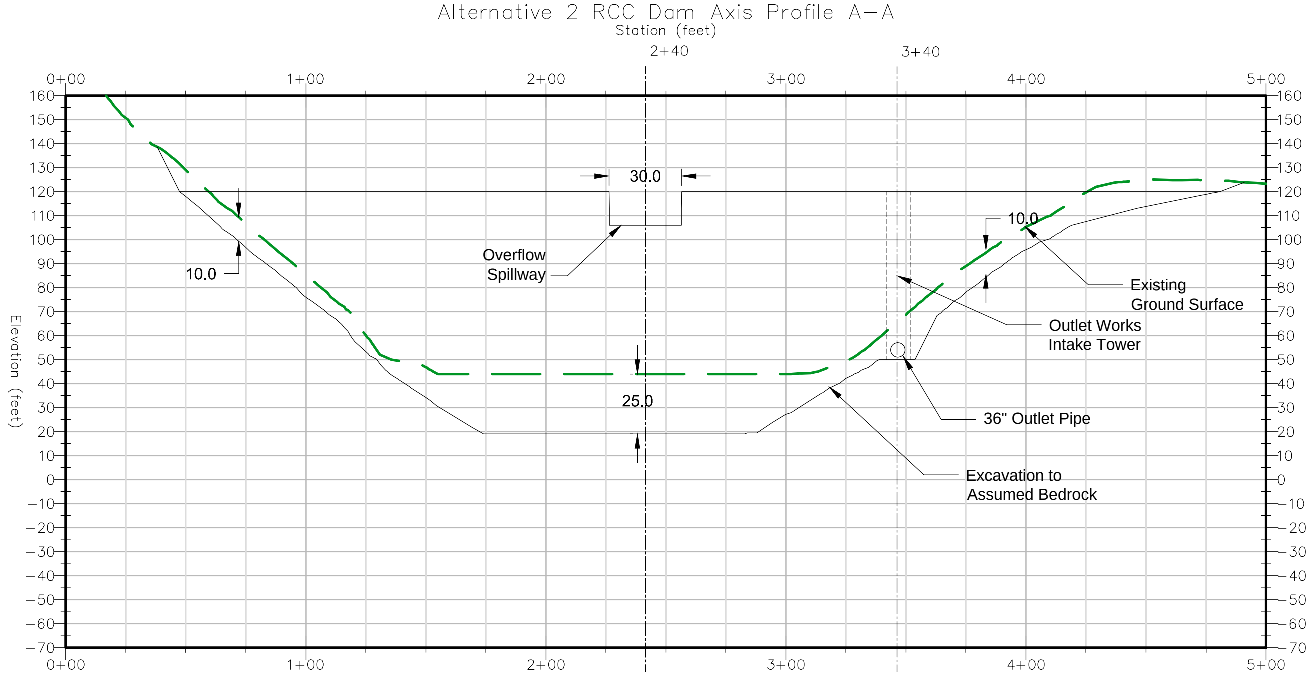
ALTERNATIVE 2 RCC DAM



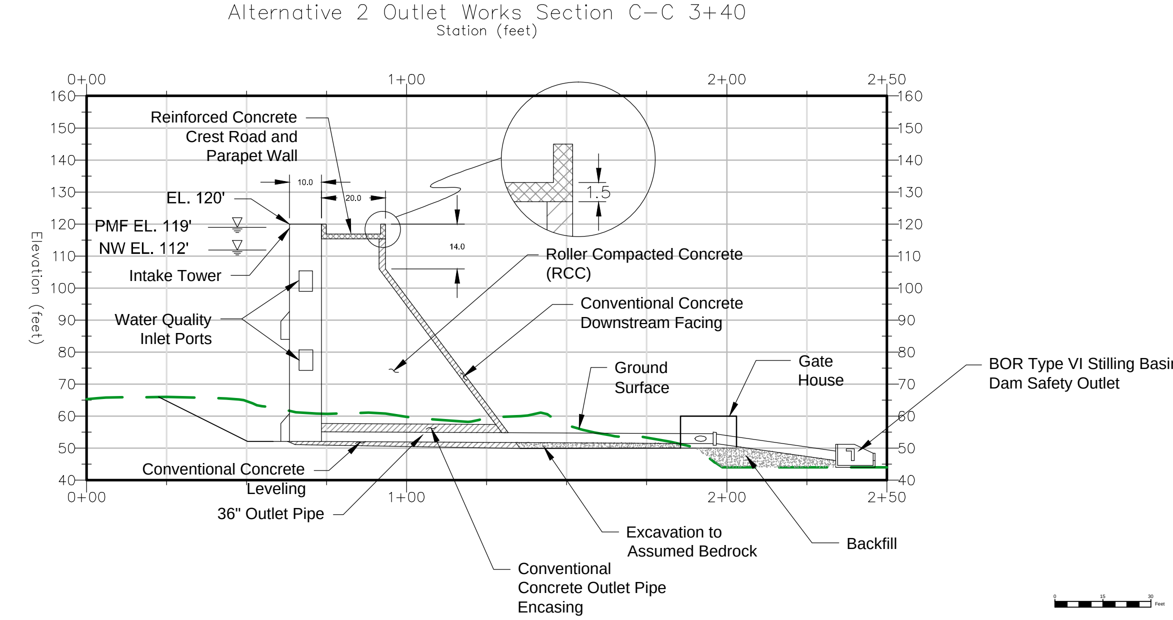
Alternative 2 RCC Dam – Section B-B 2+40



Alternative 2 RCC Dam Axis Profile A-A



Alternative 2 Outlet Works Section C-C 3+40



Embankment Volume:	44,723	CY
Excavation Volume:	30,000	CY
Excavation Area:	1.4	AC
Available Storage Volume:	2577	Ac-Ft
Normal Water Elevation:	112	ft
Dam Height:	101	ft

HDR

City of Newport
Alternative 2 RCC Dam

DATE
6-30-2015

FIGURE
3

ATTACHMENT D

PHASE 3 SEISMIC EVALUATION OF BIG CREEK DAMS #1 AND #2 REPORT EXCERPT

Executive Summary

HDR Engineering Inc. (HDR) has completed the Phase 3 assessment of the static and seismic stability of Big Creek Dam No. 1 (BC 1) and Big Creek Dam No. 2 (BC 2) for the City of Newport (City). This assessment included 1) an update of the seismic hazard characterization and characteristic earthquake time histories at the site based on the most recent research; 2) additional site characterizations including borings and cone penetration testing, sampling and laboratory testing; 3) analysis and evaluation of the field and laboratory test results; 4) developing a more detailed and comprehensive geologic model of the two dam sites along with generalized profiles and cross-sections for engineering evaluations; 5) an update of the previously completed seepage, static and post-earthquake stability analysis; 6) evaluating the expected seismic response (deformations) of both existing dams to a range of potential earthquakes at the site; 7) developing and evaluating alternatives for corrective actions for BC 1 and BC 2; 8) development of decision level cost estimates for the corrective action concepts; and 9) providing a preliminary environmental permitting overview for the corrective action concepts. The findings from this evaluation are summarized in this report.

Verification of Seismic Response Deficiencies

The static and post-earthquake stability and seismic response analyses presented in this report have confirmed seismic deficiencies at both existing dams (BC 1 and BC 2). The estimated deformation of each dam in response to potential earthquakes suggests a high potential for significant damage and/or failure to occur.

Two methods of evaluation have been used to assess potential deformations including 1) the development of a numerical model based on an industry accepted “Newmark” analysis methodology, and 2) an empirical correlation between seismic loading and observed deformations at a variety of existing dam sites (i.e. case history data) The estimated crest deformations for both dams based on these methods were reasonably similar. The numerical evaluation method results reflect the more rigorous approach and predict larger potential deformations consistent with the unusually long duration of ground shaking that would be associated with a Cascadia earthquake event.

The selection of an appropriate earthquake loading conditions for dam safety evaluations and design represents a critical aspect of the study. The Cascadia Subduction Zone (CSZ) hazard is substantial (Richter Magnitude 9) and the understanding of this magnitude of event, and the corresponding peak ground accelerations, and duration of strong shaking that would result at the Newport dam sites is continuing to evolve throughout the industry. Based on the current standard of practice at both the state and federal levels of jurisdiction in the northwest, ground motions with expected recurrence intervals of up to 4975-years have been used as the basis of our assessment and design presented in this report.

Alternatives for Corrective Actions

Based on the outcome of the stability analysis and evaluation, HDR developed three different alternatives to provide a solution for both dams that would provide adequate dam safety and for a continuous drinking water supply following a significant earthquake event. The repairs for BC 1 would be very costly for the gained benefit as the dam does not hold enough water to pay off the costs of its remediation. A decision was made together with the City to not proceed with any corrective actions for BC 1.

Alternative 1 consists of a raise of BC 2 to include the current water storage from BC 1, recovery of storage in the upper reservoir due to sediment accumulation, and increased storage for future water demands in the city. This alternative presents some challenges as the existing reservoir and outlet works would need to stay operational during construction. The foundation excavation volume for this alternative is very large and sufficient construction material would have to be found to replace the excavated foundation material as well as the new embankment section. Because of the potential for significant deformations of the upstream slope of the dam, a new outlet structure would have to be built through the right abutment of the existing dam. Further, a spillway and fish ladder would need to be constructed. This alternative is doable but does not present the most cost effective and most feasible option.

Alternative 2 consists of a new roller compacted concrete (RCC) dam at a location just downstream of BC 2 where the topography of the valley narrows the most.

Alternative 3 consist of a new embankment (earthen) dam at the same location as Alternative 2.

Both alternatives 2 and 3 are acceptable solutions for corrective actions and represent a “least cost” solution for the project purposes outlined above.

Decision Level Estimates of Probable Costs

Decision level cost estimates were developed for Alternatives 2 and 3. At this time, the costs exclude some important project elements as the extent and dimensions of those elements is unknown at this stage of the project. They also include some significant cost uncertainties and hence are not suitable for establishing project funding. Future preliminary design will be required to provide the basis for a funding level cost estimate. The Preliminary design should include such elements as the spillway for Alternative 3, fish ladder, access road, and pipeline to the water treatment plant.

From a decision making standpoint, the cost estimates show that both Alternatives are similar and that a decision on the preferred dam type and configuration can be based on a number of other considerations such as long term operation and maintenance, owner preference and cost risk uncertainties.. Based on discussions with the City, Alternative 2 is recommended for preliminary design. Should a significant issue be identified with this Alternative during the early stages of preliminary design, Alternative 2 can be pursued as the preferred configuration.

Conclusions and Recommendations

Alternative 2 (RCC dam) provides a number of potential advantages to the City such as a relatively short construction timeline, proven seismic performance of concrete dams, lower cost uncertainty, smaller project impact footprint, and preferred spillway configuration

HDR recommends moving forward with a preliminary design of Alternative 2 (RCC dam). The preliminary design will include both geophysical, and boring characterization of the proposed site, a budget level cost estimate, environmental permit preparation, access road refinement, and additional modeling which is required by the state.

1 Introduction

HDR began working with the City of Newport in 2009 on the design and construction of a new water membrane filtration treatment plant. The water treatment plant is supplied with water stored in two man-made reservoirs in Big Creek, denoted Big Creek Dam No. 1 (BC 1) and Big Creek Dam No. 2 (BC 2). BC 1 reservoir is adjacent to the new treatment plant, and BC 2 reservoir is located approximately 1 mile upstream. These reservoirs were formed by the construction of an earthen dam at each location.

During construction of the new plant, geotechnical explorations were performed for the design of a new intake structure located in the BC 1 reservoir. A single boring drilled in October 2011 by Foundation Engineering, Inc. (FEI) showed foundation material to generally consist of very soft to soft clayey silt and very loose to loose silty sands. The initial boring and engineering evaluation also identified that the loose silty sand soils have a potential for liquefaction during a seismic event and that further dam safety related evaluations were indicated.

BC 1 is 315 feet long with a maximum height of 21 feet. The reservoir normally impounds 190 acre-feet of pool. The dam was designed by CH2M of Corvallis, Oregon and constructed by the City of Newport Public Works Department in 1951. Available design drawings depict the dam as a homogeneous compacted clay dam with embankment slopes of 1 vertical (V) on 3 horizontal (H) upstream and 1V on 2H downstream. Drawings show a 5-foot-thick granular drainage zone at the foundation level of the downstream third of embankment.

BC 2 was originally constructed in 1969 and modified and raised in 1975 and 1976. The dam was to be raised by 17 feet to an overall height of 56 feet and a length of 450 feet. The dam is shown with a central core trench and a downstream drainage system. Foundation materials are described as medium to stiff sandy silts over a weak siltstone. The CH2M-Hill, (CH2M-Hill, Predesign Report for the Raising of Big Creek Dam No. 2, City of Newport, Oregon, 4 Sep 1974), states that a seismic coefficient of 0.1 g was used for a pseudo-static analysis and a bedrock acceleration of 0.18 for a Newmark analysis which was used to estimate potential displacement during a seismic event.

1.1 Project Background

As a result of the potential dam safety-related concerns identified in the initial boring at the site, the City requested HDR perform a seismic evaluation of the embankment dams for both BC 1 and BC 2 reservoirs. This evaluation was completed in 2011 and 2012 and consisted of site investigations to characterize the dams' earthen and foundation materials, a probabilistic seismic hazard analysis (PSHA), a geologic hazard assessment, and geotechnical analyses to determine the stability of the dams in the event of potential seismic events. The initial site investigation and characterization program consisted of borings, cone penetration testing, seismic refraction geophysical testing, and laboratory testing.

1.2 Previous Report and Results

In February 2013, HDR submitted the "Big Creek Dam No. 1 and No. 2 Preliminary Geotechnical Investigation and Seismic Evaluation" report (February 2013 Report). This is subsequently referred to as the Phase 2 investigation program. The report described the site characterization program, the soils testing program, an evaluation of the results, and the engineering analysis for the two dams. The report included regional and site geology, seismic hazards, preliminary models of subsurface conditions, results of the seepage and stability analysis, and recommendations for the two dams.

The recommendations included the following:

- The seismic safety of BC 1 was estimated to be marginal while a significant safety deficiency was identified at BC 2.
- Additional site characterizations were recommended in order to further refine stratigraphic models of the existing structures, confirm the mineralogical origin of the soils and the corresponding reasons for the low densities, further refine the engineering properties and behavior of the foundation and embankment soils, and reduce uncertainties that occurred with the limited data sampling conducted. The additional data would also be used to support alternative design concepts.
- An update of the time histories was necessary as the U.S. Geological Survey (USGS) guidelines and regulations had changed due to the available research data from the most recent Chile and Japan subduction zone earthquakes. This was necessary to create alternatives that comply with the most recent safety standards and available design criteria.
- Additional laboratory testing was recommended to further examine the soil characteristics of the additional site explorations and refine the soil properties.
- Further engineering analyses were recommended to include the newly analyzed data and use it for computer models to simulate the behavior of the dams in case of a seismic event.
- Based on the findings of the additional analysis, corrective actions would be developed to mitigate the stability problems of the two dams. A range of rehabilitation concepts and methods was recommended for the next phase of the project.

The results presented in this report have subsequently been described as the Phase 2 investigation program.

1.3 Scope of Current Phase

Beginning in July 2014, HDR performed additional (Phase 3) site characterization and further engineering evaluations including concept design/alternative evaluations to reduce the risk of a dam failure for BC 1 and BC 2 in case of a seismic event. The original Phase 3 scope for the project included: additional site explorations, sampling and laboratory testing at both the BC 1 and BC 2 sites; updating the seismic hazard characterization of the site; developing site hydrology that would be used to assess spillway requirements for modified dam configurations; establishing analysis parameters through integrated evaluation of both the field and laboratory test data; updating the previously completed seepage, static and post-earthquake stability analyses; evaluating new seismic response with Newmark Sliding (Rigid) Block analysis based on a more comprehensive geologic model of the site; and developing and evaluating alternatives for corrective actions at both BC 1 and BC 2.

HDR performed initial engineering analysis for existing conditions and for alternative configurations involving corrective actions to mitigate the seismic stability problem for both dams in order to develop opinions on the preferred configuration of corrective actions. During the progress of the work, based on input from the City, HDR modified the approach of the corrective action alternatives to include three potential configurations at or near the BC 2 site that each included the following components of water storage along with remediation of dam safety deficiencies:

Upper Reservoir Storage:	970 acre-feet
Lower Reservoir Storage transfer:	200 acre-feet
Upper Reservoir Sediment Recovery:	100 acre-feet
Future Storage Allowance:	1,000 acre-feet
Total Storage:	**2,270 acre-feet**

The original scope of work also included a risk-based assessment to establish the appropriate level of seismic loading to be included in the design, a review of environmental conditions and clearances that would be needed, consultation with the City Engineer and the State Engineer at the Oregon Water Resources Department for dam safety, and preparation of appropriate reports and decision documents.

As a result of the revised storage and configuration requirements for the project described above the risk-based assessment to establish the appropriate seismic design criteria was removed and a preliminary design criteria of a 4,750-year seismic event was used to configure the alternatives. In addition, the scope of engineering analyses was modified in order to complete the engineering analyses within existing budget limits. The approach to engineering analyses was made in order to include evaluation of the concrete dam alternative by: 1) using a Newmark deformation analysis in lieu of a FLAC analysis for the embankment alternatives, and 2) performing a response spectrum evaluation of the concrete dam configuration.

1.4 Project Team

The Project team for the Phase 2 studies presented in this report included HDR as the principal engineer, with support from Cornforth Consultants (Cornforth), the Geotechnical Earthquake Engineering Department of the University of California, Davis (UC Davis), and Marine + Earth Geosciences (MEG).

Cornforth completed the update to the seismic hazards to the most current USGS standards and also supported the field explorations and index property laboratory testing for the samples.

UC Davis provided support to develop the laboratory testing plan and interpretation of field and laboratory testing data based on their research experience.

MEG provided the laboratory testing for all undisturbed samples.

HDR developed and directed the field and laboratory testing program, provided geologic models of the existing dams along with the engineering evaluation of the dams. Based on the outcome of the engineering analysis, HDR developed concept designs for the Alternatives described in this report along with decision level cost estimates. Three alternatives to mitigate the seismic hazard were identified. HDR also provided a preliminary review of project hydrology, and environmental review which entails a list of the necessary environmental permits associated with the proposed alternatives.

Key HDR personnel for this project included the following:

Verena Winter, P.E.	Project Manager
Keith A. Ferguson, P.E.	Principal Engineer
Scott Anderson, P.E.	Senior Geotechnical Engineer
John Charlton, P.G.	Senior Engineering Geologist
Andrew Little, EIT	Project Engineer
Michael Woodward, EIT	Project Engineer
Richard Hannan, P.E.	Technical Review
Farzad Abedzadeh, PE, PhD	Senior Dam Structural Analyst

2 Phase 3 Site Characterization and Evaluation Results

Additional site characterizations and evaluations were performed during Phase 3 and are summarized below.

2.1 Seismic Hazards and Time Histories

A seismic hazard update in support of this phase was performed based on information from recent large subduction zone earthquakes and newly released probabilistic seismic hazard maps as well as the newly released updated regional seismicity and potential ground motions from USGS's 2014 Probabilistic National Seismic Hazard Maps (NSHM) and supporting documentation. The newer information was compared to the results of the February 2013 report and Cornforth provided additional seismic hazard information and acceleration time history parameters for the site evaluation. The revised seismic hazard analyses and updated information are provided in Appendix A.

2.2 Site Explorations

Subsequent to the initial boring completed at the BC 1 site, field investigations to characterize the site subsurface conditions have occurred during two additional phases. The initial boring at BC 1 occurred in 2010 when the problem was discovered. The results of that boring were included in the previous report from February 2013. The second phase of explorations occurred in December 2011 through January 2012. These investigations consisted of mud rotary and hollow stem auger drilling, cone penetrometer testing, and a surface geophysical survey. The results of Phase 2 were included in the report from February 2013 as well. The third phase of investigations occurred in November/December 2013 and is described in this report. This Phase 3 program consisted of mud rotary drillings and cone penetrometer testing, disturbed and undisturbed sampling, and laboratory testing. A detailed discussion of the Phase 3 program of field investigations is presented in Appendix B.

2.2.1 Boreholes and Cone Penetration Testing Results

The 2013 investigations consisted of additional borings, and cone penetration testing at the BC 1 and BC 2 sites. The drilling work was performed by Western States Drilling and the cone testing was done by Northwest Geophysical Associates, Inc. as a subcontractor to Western States. The borings and cone soundings were necessary to better define the stratigraphy at the site including a better definition of the top of rock, and to collect disturbed and undisturbed soil and rock samples. Continuous Standard Penetration Testing (SPT) was performed in all bore holes. In addition to the SPT data, the procedure also allowed for the collection of disturbed soil samples. Further, undisturbed samples were obtained with 3-inch-diameter thin-walled Shelby tube samples at selected depths in the borings using a fixed piston sampler. The disturbed and undisturbed samples were needed for the second phase of laboratory testing.

The subsurface materials encountered in the BC 1 exploratory bore holes generally consisted of approximately 60 feet of silty sand, clayey silt, and silty clay alluvium overlying Nye Mudstone. The subsurface materials encountered in the BC 2 exploratory bore holes generally consisted of approximately 10 to 15 feet of silty sand and clayey silt alluvium, overlying approximately 30 to 35 feet of silty sand, clayey silt, and silty clay alluvium/colluvium, overlying Nye Mudstone.

Two Seismic Cone Penetration Test (SCPTu) soundings with pore pressure measurements were advanced at the BC 1 site and four were advanced at the BC 2 site. The two SCPTs at BC 1 and two SCPTs at BC 2 were advanced near existing borings to provide a comparison between the SCPT data and SPT data. The SCPT tip resistance, sleeve friction, and pore water pressure was measured at 2-inch increments as the SCPT instrument was pushed at a constant rate of 2 centimeters/second. Shear wave velocity and pore water pressure dissipation measurements were conducted at selected depths at all locations. Each of the four SCPTu explorations at BC 2 showed lower permeabilities at the upper elevations and slightly higher permeability with depth. All SCPTs were terminated at refusal. SCPT data is presented in Appendix B.

2.2.2 Laboratory Testing Results

Laboratory testing of soil samples collected from the 2013 site exploration were taken to MEG in Vancouver, British Columbia and, in conjunction with guidance from Dr. Jason DeJong at the University of California at Davis and HDR, a laboratory test program was developed.

The laboratory testing program was developed using Stress History and Normalized Soil Engineering Properties (SHANSEP) framework, which accounts for the stress history and the anisotropy of the soils due to different modes of shearing that are encountered during slope stability analysis. The three modes are triaxial extension near the toe of the slip surface, triaxial compression at the head of the slip surface, and direct simple shear along the base and transitions of the slip surface.

Radiography (x-ray) of the undisturbed samples was performed to evaluate the suitability of the samples for testing and develop a testing plan for the range of samples taken during the exploration. Consolidation testing consisting of load-increment ratio (LIR) and constant strain rate (CSR) consolidation methods were used to evaluate the sample disturbance and stress history profile with depth. Selected samples were then evaluated in shear by direct simple shear (DSS), isotropically consolidated triaxial compression (CIUC) testing. The SHANSEP method assumes that the behavior of the soil can be represented by the undrained shear strength, S_u, divided (normalized) by the effective overburden pressure, σ'_{v0}, with other parameters to take into account the overconsolidation ratio (OCR) and the shape of the curve, the exponent m. To evaluate the suitability of the SHANSEP framework to represent the behavior of the soil, samples were consolidated to three to four times the estimated pre-consolidation pressure identified in consolidation tests corresponding to an OCR of 1 (the soil is considered normally consolidated at this OCR). Several of the test samples were consolidated to three to four times the pre-consolidation stress and then unloaded to an overburden stress that corresponds to a known OCR, typically an OCR of approximately 4. The plots of these tests can be found in Figure D-1.5 in Appendix D. Individual test results are also found in this Appendix D. The result is a framework with which to evaluate the strength of the soil with depth and OCR.

Cyclic DSS (CycDSS) testing was performed to evaluate strength degradation with cyclic loading. Based on the CycDSS testing the soils appeared to have little to no strength degradation to 100 cycles and Post-CycDSS testing yielded soil strengths nearly the same as samples tested in static DSS. A strength reduction was evaluated by using Figure D-1.8 in Appendix D and the average plasticity index from the soils encountered. A reduction of 20 percent was conservatively used to degrade the strength properties from the peak undrained strength to the post-earthquake undrained strength.

2.3 Engineering Parameters and Assessment

The parameters developed in the laboratory testing program and those calculated and estimated based on SCPTu were used for assessing the existing dams with respect to seismic loading. Permeability values were evaluated from SCPTu dissipation testing and laboratory consolidation testing results. A set of upper and lower bound permeability values were used in the seepage analysis and subsequent stability analysis of the dams. The upper and lower bound values did not result in significantly differing Factors of Safety (FOS) for stability.

Based on the laboratory testing program and the in-situ testing which was calibrated to the laboratory testing data, the slope stability models were updated to use the SHANSEP parameters for the alluvial soils in the foundation. A maximum OCR of 4 was used, neglecting the higher OCR values in some samples that were a result of desiccation and shear stress bias at the toes of the dam where samples were collected and SCPTu testing performed. Figure D-1.4 of Appendix D shows the variation of OCR with depth for the free field environment. The dams themselves increase the overburden stress of the foundation soils and thus reduce the OCR of the underlying soils.

Use of the Field Shear Vane (FSV) and SCPTu was complicated by the drainage conditions within the soils encountered. Intermediate types of soils were encountered exhibiting characteristics of both sand-like and clay-like soils. The drainage conditions complicated the interpretation of both the FSV and SCPTu tests; however the use of dissipation testing as part of the SCPTu soundings assisted in identifying the soils that may be experiencing some degree of drainage conditions during the cone penetration testing. This determination was one of the key Phase 3 exploration program findings and helped to limit the use of the parameters estimated from the in-situ testing. Based on the dissipation and laboratory testing, the SCPTu results were subsequently calibrated with the laboratory testing strengths. This allowed the SCPTu test to validate the SHANSEP framework and parameters. As a result, the Phase 3 program found that with the strength of the foundation materials remaining relatively constant across the entire depth of these materials with appropriate consideration of OCR and overburden pressures.

Results of the engineering parameters evaluation are described in more detail in Appendix D.

2.4 Seismic Deficiency Verification

Based on the Phase 3 exploration, laboratory testing and engineering analyses a significant seismic deficiency was verified at BC 1. Analysis results indicated that this dam would be expected to fail by settlement and overtopping under seismic loading for recurrence intervals of 2,475 and 4,975 years. More frequent events, such as the 475-

and 975-year would likely result in significant damage to the dam, outlet works, water supply pump station, and ability to operate the reservoir. The location and configuration of the critical potential failure surface at BC 1 is very deep, making remediation of the site very challenging and expensive. Given the small amount of storage in the reservoir and the very large anticipated remediation costs, rehabilitation of this dam is judged as non-feasible.

The upper dam, BC 2, also has unacceptable deformations (settlement) during the 2475- and 4,975-year recurrence interval seismic events and would also likely fail due to overtopping and/or seepage through transverse cracks that would develop under these loading conditions. Similar to BC 1, the dam would also likely experience significant damage during earthquakes with more frequent return periods. While the upstream slope for BC 2 may be buttressed by some sediment that has accumulated in the reservoir, analysis results indicate that deformations of the upstream slope of BC 2 would be significant for the larger seismic events resulting in damage or failure of the outlet works, intake structure, and discharge pipeline.

A comparison of the estimates of embankment dam deformations using the Newmark analysis numerical methodology presented in this report with case history data and estimated crest deformations using the empirical methodology from Swaisgood (2003) was made to verify results and conclusions. Using the Swaisgood methodology with the range of estimated peak ground accelerations at the Newport sites for different recurrence interval Cascadia earthquake events indicate that for similar embankment dam case histories in the data base, crest deformations ranged from as little as 1.2 inches for the 475-yr return period peak ground acceleration to over 478 inches for the 4,975-yr. return period peak ground accelerations.

Based on the performance of these similar dams, estimated deformations in the range of 24 to 60 inches have a moderate to high potential for very significant damage or failure. When deformations are estimated to be in this range for these recurrence interval earthquake events, the standard of care within the dam engineering community in the US and internationally would suggest that there is dam safety deficiency and justification to take action to mitigate that deficiency. Estimated deformations of over 60-inches have a high to very high likelihood of complete failure of the dam section and not only is there a deficiency, but justification to take more expedited actions to reduce the risk of failure of the dam.

Swaisgood's estimates of percent settlement are based on the combined thickness of the dam height and the thickness of the underlying loose and/or low density alluvial soils. It should be noted that the case histories only include data up to a PGA of approximately 0.71 g and that extrapolation was necessary to project the regression line to the levels of PGA anticipated for the 2,475 and 4,975-year return period events at the Newport sites. A summary of the estimated deformations from the Newmark analyses along with Swaisgood empirical methodology is provided in Table 1 below. Note that the table cells have been colored to represent the deficiency and action categories described above. The orange cells suggest the deficiency and moderate justification for corrective actions. The red cells suggest a deficiency and justification for more expedited corrective actions. The green cells indicate deformations that are below the level associated with a safety deficiency and need for corrective actions.

Results of engineering analyses and seismic deficiency verification evaluations are presented in more detail in Appendix D.

Table 1: Summary of Estimated Embankment Crest/Downstream Slope Deformations at BC-1 and BC-2

Recurrence Interval Event (years)	Estimated Peak Ground Acceleration (PGA – g's)	Est. Deformations - Empirical (Swaisgood, 2003) (inches)			Est. Deformations – Newmark (inches)		
		Lower Bound	Best Estimate	Upper Bound	Lower Bound	Best Estimate	Upper Bound
BC 1							
2475	0.79	15	33	68	50	>76	90
4975	1.12	218	478	>478	116	>160	184
BC 2							
2475	0.79	15	33	68	32	>48	54
4975	1.12	218	478	>478	56	>96	112

3 Alternatives for Corrective Actions

Based on the results of the Phase 3 explorations, laboratory analysis, and the related engineering assessment, it became apparent that rehabilitation of the lower reservoir, BC 1, is non-feasible from an economic standpoint. The location and depth of the critical potential failure surface through the foundation soil underneath the dam makes mitigation of BC 1 very expensive relative to the amount of storage that is in the reservoir. Consequently, based on discussions with the City, HDR evaluated alternatives to mitigate BC 1 by transferring its current storage capacity to the upstream BC 2 remediation alternatives.

3.1 Alternative Options

The decision to not include BC 1 in the corrective action scenario led to increased storage capacity requirements for BC 2. Additional storage for anticipated sedimentation in the reservoirs and for future storage was also included. Future storage was based on the population projection from the 2008 Water System Master Plan (Civil West Engineering Services, Inc.). The Water System Master Plan indicates a need for a 30 percent increase in water supply by 2030. Table 2 lists theoretical storage capacities for the current reservoirs and for the future solution. The maximum theoretical future storage capacity of 2,270 acre-feet (ac-ft) was used for the configuration level layouts and cost estimates for modifications to BC 2.

Table 2. Reservoir Storage Capacities

Description	Upper Reservoir Storage (ac-ft)	Lower Reservoir Storage (ac-ft)	Sediment Storage Allowance (ac-ft)*	Future Storage Allowance (ac-ft)**	Total Storage Allowance (ac-ft)***
Replace Existing Storage	970	200	100	0	1,270
Minimum Future Storage	970	200	100	380	1,650
Maximum Future Storage	970	200	100	1000	2,270

* Future storage allowance equals an increase of 30 percent of current storage capacities combined

** Indicates estimate of current and future sediment in upper reservoir to be recovered by increased reservoir storage

*** Future storage allowance to be based on approximate minimum and maximum estimates of drought and other supply needs over 20- to 50-year planning horizon. These numbers should be appropriate building blocks for an enlargement project Purpose and Need statement that can be approved under appropriate environmental compliance activity

The project team identified five different alternatives upstream of BC 1 to secure the drinking water source for the City. All alternatives were considered but only three remained feasible and underwent an analysis. All alternatives listed below are conceptual and would require further refinement during the next phase of the project.

Figure 1 shows the five different dam axis considered for the alternatives (All figures are located at the end of this report).

3.1.1 Alternative 1: Raising and Modifying the Existing Dam

Alternative 1 includes raising the existing upper dam (BC 2) to achieve the necessary seismic safety and storage capacity. The new crest of this embankment dam would be downstream of the existing crest as the existing reservoir and dam need to stay in operation during construction. The raised dam would be a continuation from the existing upstream slope at a new 3H:1V (Horizontal:Vertical) slope rising to a total dam height of 111 feet at elevation 131 feet. The new water surface elevation would be at elevation 116 feet for a normal water pool. The new crest would be 20 feet wide and the downstream 3:1 slope would extend into the valley downstream of the existing upper dam.

The dam would have an internal filter and drainage system. The foundation soil of the existing dam would remain in place and the foundation soil for the new portion of the dam would be excavated to bedrock and replaced with suitable compacted dam material.

A new outlet structure consisting of a multi-inlet sloping intake structure and a 36-inch discharge pipe installed in a new tunnel system in the right abutment of the dam and discharging through a control structure into a 20-inch diameter treatment plant pipeline, or 36-inch diameter dam safety discharge to the stream channel. The sloping intake structure would have different inlet ports for water quality purposes so water could be drawn from different elevations of the reservoir. The upstream portion of the outlet pipe would be routed through the right abutment of the dam in a micro-tunnel system creating a seal from the reservoir. This pipe would discharge into an outlet vault within the abutment near the dam axis centerline and then through a 10-foot-diameter access tunnel until it daylights at the control structure The spillway and fish ladder would be routed to the north side of the dam. Figure 2 includes details of this embankment alternative.

Advantages of this alternative include reasonably well-defined foundation geometry, the properties of the existing dam materials have been tested and are well understood, the footprint for the addition would be small compared to a new dam, and a cofferdam and dewatering requirements at the downstream side should not be excessive.

Disadvantages include the possibility that construction of a new outlet and spillway may require the existing dam be taken out of service for a period of time (which may cause water supply issues), only the downstream side of the dam is being seismically stabilized and there would still likely be significant damage to the upstream portion of the embankment during a significant seismic event, and the construction schedule for excavating and embankment construction would be limited due to the short construction season for embankment placement.

This alternative would have significant costs associated with construction of the new outlet works described above.

3.1.2 Alternative 2: New RCC Dam

Alternative 2 includes a new gravity dam structure constructed out of roller compacted concrete (RCC) downstream of the existing upper dam (BC 2) at a location where the valley narrows topographically and offers the possibility of a least cost dam project. The new dam would be located within the existing lower reservoir just downstream of the existing upper dam. This dam would have a height of about 100 feet with the crest at elevation 120 feet. The normal water surface elevation would be at 112 feet. The foundation soil would be excavated and the new dam placed on suitable bedrock. The spillway chute and stilling basin would be over the central portion of the dam. The vertical concrete intake tower would be integrated into the upstream face of the dam and would have intake ports at different levels so water can be drawn from different depths for water quality purposes. From the intake tower a 36 inch outlet pipe would be routed through the base of the dam until it daylights at a gate house and forks into the 20-inch raw water pipe which is connected to the water treatment plant, and into the spillway stilling basin to provide a low level dam safety outlet. Structural details would have to be defined at a later point in time but seismic modeling of the new dam showed the need for a conventional concrete shear key and upstream heal section to provide adequate resistance to cracking and sliding in case of the larger seismic events. The facing, spillway portion, stilling basin, and crest road of the dam would also be conventional concrete. Figure 3 includes details of this RCC alternative.

Advantages of this alternative include a more robust structure that is less susceptible to damage from seismic or hydrologic events, a smaller footprint requiring less excavation than a new embankment dam, smaller quantity of material required for the RCC dam, constructed of material that can generally be placed year around, the ability to incorporate the spillway and outlet work into the RCC structure, little maintenance needs, and this alternative that can be constructed while the existing upstream dam remains in operation.

Disadvantages include the location of the structure in the upstream end of the BC 1 pool that would require a cofferdam and increased dewatering efforts, and foundation conditions that have not been defined which may result in some increase in cost.

3.1.3 Alternative 3: New Embankment Dam

Alternative 3 consists of a new embankment structure at the same proposed location as Alternative 2 (RCC dam). The foundation soil would be excavated to bedrock and suitable embankment earthen material would be placed to construct the dam. The height of the dam would be about 108 feet with the dam crest at elevation 128 feet and a new normal water surface elevation of 112 feet. The downstream and upstream slopes of the dam would be 3H:1V. The dam would have an internal filter and drainage system. The outlet works would be placed in either the lower right or left abutment areas on bedrock and include a multi-port sloping intake structure connected to a concrete encased 36-inch-diameter steel outlet pipe through the dam foundation. The multiple intake ports would be placed for water quality purposes. The 36-inch outlet pipe would daylight at a gate house and fork into the 20-inch raw water pipe going to the water treatment plant, and into the 36-inch pipeline discharging to the stream channel for dam safety purposes.

The spillway channel and access road would be north of the proposed dam. Figure 4 includes details of this embankment alternative.

Advantages of this alternative are limited to the ability to continue operation of the upstream dam during construction, and a dam that is less susceptible to seismic and hydrologic events than the Alternative 1 structure.

Disadvantages include the much larger footprint than Alternatives 1 or 2, the geometry for the rock foundation is unknown, there would be a significant increase in the quantity of foundation excavation required compared to Alternative 2. In addition, the downstream cofferdam and foundation dewatering would be significantly larger than Alternative 2. The construction season for embankment placement would be limited and would take the longest to complete of all the alternatives under consideration. This alternative would have the largest risk exposure to floods and other adverse construction conditions of all alternatives under consideration.

3.1.4 Alternative 4: New Dam Option A

Alternative 4 was considered early in the project as a possible new site location for either an RCC or embankment dam. It was thought to be further downstream of the upper dam (BC 2) located in the lower reservoir about 100 yards downstream of proposed Alternatives 2 and 3. This alternative was eliminated from further consideration as the valley is wider at that particular location and the costs for the dam would be much higher than Alternatives 2 and 3 without providing any other benefits. Figure 1 shows the proposed location of this embankment alternative.

3.1.5 Alternative 5: New Dam Option B

Alternative 5 was similar to alternative 4 as it was considered early in the project as a possible new site location for either an RCC or embankment dam. The location was thought to be where the current access road crosses the lower reservoir as the valley narrows the most at that location. This alternative was not considered further as some of the land that the dam would cover does not belong to the City and is outside the city limits. Acquisition and condemnation of the properties and zoning changes did not seem advantageous in relation with providing a better option than Alternatives 1, 2, or 3. Figure 1 shows the proposed location of this dam alternative.

3.1.6 Alternative 6: No Action

Alternative 6 is the No Action alternative and is still an option that the City has to weigh against the possible risk of loosing the only drinking water source for the City in case of a seismic event.

3.2 Other Related Structures

All alternatives include other related structures that would have to be added to make the dam and water supply functional. The intake tower (for RCC dam alternative) or the sloping intake pipe (for embankment dam alternative) would be equipped with three different ports or gates at different elevations. The reservoir stratifies during the summer months and the lower portion of the lake becomes anaerobic and the upper portion becomes aerobic. This influences the water quality of the lake. Different elevated intake gates allow the treatment plant operators to draw water from different depths of the reservoir to avoid the undesired water during the summer. These gates would need the appropriate size of fish screens to avoid fish getting into the pipeline and therefore into the pumps of the treatment plant. The exact size of those screens would be determined during the next phase as it would depend on regulations and requirements for Oregon Department of Fish and Wildlife (ODFW) and other environmental factors.

All dams require a low level outlet for dam safety that acts as an emergency outlet in case the reservoir has to be drawn down rapidly. This outlet would be part of the outlet works for all alternatives and would be located at the downstream toe of the dam. This outlet would have a stilling basin structure at the end to avoid erosion when the water is being released. The RCC dam has a stilling basin at the toe of the spillway in addition to the dam safety outlet.

The embankment dam options would need a separate spillway as the spillway is not part of the actual dam structure as with the RCC dam alternative. This spillway would have to be refined at a later phase as well. The most likely location would be north of the proposed options around the dam running parallel to the access road.

A new fish ladder may have to be built for all alternatives. The exact requirements for sizing and design of the fish ladder would occur during the next phase of the project as it would depend on permit requirements and regulations by the ODFW. Currently, the location of the fish ladder is anticipated to be right next to the spillway for the embankment dams and to the north side near the access road for the RCC dam.

Presently, there is an access road leading from BC 1 to BC 2 and beyond. This road would have to be realigned as it would be blocked and/or flooded by any of the alternatives discussed. A potential new alignment is shown in Figure 1 but further investigation would be necessary during the next phase of the project.

A new raw water pipeline would have to be constructed starting at the outlets works for the dams and continuing to the existing intake pump station where it would tie into the existing pipeline just downstream of BC 1. Preliminary calculations size the pipe to be 20 inches diameter and constructed of ductile iron. The exact alignment would be determined during the next phase but would likely follow the road.

3.3 Comparison of Alternatives

Each alternative provides opportunities and constraints besides the costs of construction. Items that influence the decision making on an alternative are as follows: constructability, excavation volume, construction materials, foundation conditions, spillway design, intake structure, outlet works, necessary dewatering during construction, seismic and hydraulic resiliency of each dam alternative, environmental impacts and permits, operations and maintenance, and most importantly total costs, including geotechnical explorations, design, construction, permitting and contingency for unexpected events. Table 3 summarizes these items for the three preferred alternatives.

Table 3. Summary of Advantages and Disadvantages of Alternatives 1, 2, 3

Opportunity/ Constraint	Alternative 1 Raising Existing Dam	Alternative 2 New RCC Dam	Alternative 3 New Embankment Dam
Constructability	- Requires modifications to existing spillway - Requires temporary outlet works/coffer dam upstream to provide a continuous, uninterrupted water source during construction - Construction season for an embankment-type dam is limited to summer and early fall. - Source of construction materials for the dam have not been identified and may require a significant distance and processing requirements	- Existing reservoir can be in continuous operation - Downstream cofferdam required - Year-round construction possible - Requires construction of a temporary pipeline from the existing dam outlet to the new outlet during construction - Shortest construction prior and smallest construction risk exposure timeframe of all alternatives.	- Existing reservoir can be in continuous operation - Requires construction of a temporary pipeline from the existing dam outlet to the new outlet during construction - Significant increase in required project footprint - Much larger downstream cofferdam required - Construction season for an embankment type dam is limited to summer and early fall
Excavation Volume	- Moderate foundation excavation required at downstream toe	- Smallest foundation excavation required for dam foundation	- Large foundation excavation required for dam foundation; Several times greater than Alternatives 1 and 2
Construction Material	- Need for large amount of suitable foundation and dam material - Would require an off-site source for filter and drainage materials to be used in the dam	- Need for an appropriate off-site source of aggregate for concrete production	- Need for large amount of suitable foundation and dam material - Would require an off-site source for filter and drainage materials to be used in the dam.
Foundation Conditions	- Foundation conditions reasonably well-defined	- Foundation conditions unknown, and could impact final cost of alternative	- Foundation conditions unknown, and could impact final cost of the alternative
Spillway Design	- New spillway would be constructed into abutment with no stilling basin. Potential for significant erosion damage, if used	- Spillway and Emergency spillway co-located in center of dam with stilling basin. Limited potential for significant erosion and downstream channel degradation.	- New spillway would be constructed into upper right abutment which requires more excavation and cost increase once the design is in place
Intake Structure	- Sloping intake on upstream face of dam, requires lowering the water level significantly which would propose a problem to the continuous water supply - Intake pipe routed through the dam via tunnel in lower right abutment - Sloping intake difficult to operate and maintain	- Intake tower included in dam structure with limited footprint - Intake pipe would be short through the narrow dam compared to Alternatives 1 and 3 - Limited susceptibility to seismic damage	- Sloping intake on upstream face of dam - Intake pipe routed through the dam via tunnel - Sloping intake difficult to operate and maintain

Table 3. Summary of Advantages and Disadvantages of Alternatives 1, 2, 3

Opportunity/ Constraint	Alternative 1 Raising Existing Dam	Alternative 2 New RCC Dam	Alternative 3 New Embankment Dam
Outlet works	- Outlet as a combination of the water supply line to the treatment plant and the dam safety outlet.	- Outlet as a combination of the water supply line to the treatment plant and the dam safety outlet.	- Outlet as a combination of the water supply line to the treatment plant and the dam safety outlet.
Dewatering	- Small downstream cofferdam required for dewatering of area covering the new footprint - Moderate dewatering effort	- Significant downstream cofferdam required (dam located in upper part of reservoir BC 1) - Significant quantity of dewatering may be required	- Cofferdam much larger than Alternative 2 (downstream toe of dam located further downstream in reservoir of BC 1) - Dewatering quantity likely significantly greater than Alternative 2
Seismic Resiliency	- Limited damage due to seismic shaking still probable - Upstream portion of dam still susceptible to significant damage	- Low probability of significant damage resulting from seismic shaking	- Moderate potential for damage resulting from seismic shaking
Hydraulic Resiliency	- Potential for erosion damage during design flow	- Reduced potential for erosion during design flow	- Potential for erosion during design flow similar to Alternative 1
Environmental impacts	- Increase in inundation area - Extensive permitting process - Requires smallest footprint of the three alternatives	- Increase in inundation area - Extensive permitting process - Moderate interruption of existing lower reservoir due to footprint of new dam	- Increase in inundation area - Extensive permitting process - Significant interruption of existing lower reservoir due to footprint of new dam
Maintenance	- Requires annual maintenance to manage vegetation, burrowing animals, erosion, and other potential damage - Maintenance cost similar to Alternative 3	- Structure very resistant to damage and deterioration - Least cost maintenance	- Requires annual maintenance to manage vegetation, burrowing animals, erosion, and other potential damage - Maintenance cost similar to Alternative 1
Total costs	- Most costly due to new outlet works requirement	- Similar to Alternative 3	- Similar to Alternative 2

4 Preliminary Environmental Review

Each alternative would require permits from federal, state, and local agencies. Although the alternatives differ, the necessary work for each alternative would require the same permits and approvals as described in detail in Appendix C. Therefore, the preliminary environmental review does not differentiate permit requirements between alternatives. At this point it is difficult to gauge if one alternative would be more challenging to permit than another. To date, no agencies have been contacted to discuss the project in detail. This section provides an overview of anticipated permitting efforts.

4.1 Major Permits and Timelines

There are several major permits required for this project. Those permits and timelines are described in Table 4. Other permits aside from those listed in this table may be applicable but are not anticipated to be as complicated.

Table 4. Overview of Major Permits and Timelines

Required Permit	Timeline	Submittal Occurs at Engineering Design Level (approximate)
National Environmental Policy Act (NEPA)	12-18 months	15-30%
Clean Water Act Section 404/401 and Oregon Removal-Fill permit Other permits processed concurrently with applications: • Endangered Species Act Section 7 • Magnuson Stevens Fishery Conservation and Management Act (Magnuson Stevens Act) • National Historic Preservation Act (NHPA), Section 106 • Migratory Bird Treaty Act • Oregon Fish Passage • Coastal Zone Management Act	6-18 months	30%
Bald and Golden Eagle Protection Act (if required)	4-6 months	30%
Oregon Water Rights	9-12 months	30%
Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) 1200-C	60 days	100%
City of Newport Conditional Use Permit	30 days	60%
City of Newport Building, Electrical, Plumbing, Mechanical, Sewer/Water Permit	30 days	100%
Oregon State Engineer Design Review and Approval	2 months	100%

4.2 Additional Studies and Potential Costs

The project schedule can be influenced by the permitting process due to approval timelines for certain permits and the potential for unanticipated conditions that may arise and delay the permitting process. This can also delay design as well as construction and increase overall project costs.

Risks associated with complex permitting and stringent permit terms and conditions can result from lack of advance knowledge of the potential impact to sensitive environmental resources or public controversy. Early coordination with the agencies and identification of necessary environmental studies upfront would minimize the risk for permitting process delays. Anticipated environmental studies include completing a cultural resource evaluation and wetland and waters delineation, developing mitigation plans, updating the Emergency Action Plan, and preparing a biological assessment.

Depending on the nature of the project, permitting costs can range from 1 to 6 percent of the overall construction costs.

5 Decision Level Estimates of Probable Costs

The three alternatives presented in Section 3 of this report were further investigated in terms of costs for comparison of feasibility between the three alternatives. The cost estimates were prepared for the purpose of comparing alternatives and not for budgeting purposes. Budgetary costs would be provided during the next phase of the project as part of the preliminary design. These costs would include input from contractor estimating methods for the key units and lump sum items as well as further evaluation of construction material sources and costs.

A number of important budget items are not included in this estimate. The costs for those items would have to be added onto the total costs during the next phase of the project. These items would not make a difference in the outcome of the estimates for comparison purposes between the alternatives as they are similar for each alternative. The items purposely left out include: fish ladder, spillway (for embankment option, spillway is included in the RCC dam), access road to the dam, access road around the reservoir to provide access to the forest land and private properties, and the pipeline from the dam to the water treatment plant. Table 5 summaries the items not included in the cost estimate and the reasoning for exclusion.

Table 5. Excluded Items from Cost Estimate

Excluded Item	Alt 2 – RCC Dam	Alt 3 – Embankment Dam
Spillway	n/a spillway included	Exact alignment of spillway is unknown due to lack of survey and geotechnical information of the area
Fish ladder	Type and requirements of fish ladder are unknown at this point. Environmental assessment is necessary to determine the requirements and size for the fish ladder. It is not possible to set a number to this line item.	
Access Road to Dam	Exact alignment of access road is unknown due to lack of survey and geotechnical information of the area.	
Access Road Around Reservoir	Exact alignment of road unknown due to lack of survey in this area.	
Pipeline to Water Treatment Plant	Exact alignment is unknown due to several options for routing of this pipe and unknown access road alignment.	

5.1 Costs Estimate for Alternative 1 – Upper Dam Embankment Raise

Based on discussions with the City, a cost estimate for Alternative 1 was not completed and has been deferred to be updated at a later date if appropriate and necessary. The reasons for this include: the difficulty with constructability and keeping a continuous drinking water source during construction which makes this alternative less favorable; due to the upstream slope deformation concerns of this dam in a seismic event, replacing the outlet works presents a significant risk to the functionality of the system;

and during the last annual dam inspection in spring of 2015, the State Engineer observed some seepage distress in the pipe inside the dam of the current outlet works. These present concern of the overall stability of the existing dam. Experience on other similar projects suggests that the costs for a new outlet works for Alternative 1 are estimated to be disproportionately higher than for Alternatives 2 and 3 and would make this alternative the most expensive by a relatively wide margin.

5.2 Costs Estimate for Alternative 2 – RCC Dam

A planning level cost estimate for comparison purposes was prepared for Alternative 2 RCC Dam. The estimate includes site preparation, work associated with the dam and other structures associated with the dam (spillway and outlet works) and appropriate cost contingencies for a) design elements not included in the current layout b) permitting, c) engineering during construction, and d) a construction change order/claim contingency percentage. HDR developed a concept design as described in section 3.1.2 for the RCC alternative shown in Figure 3. Based on that concept design, quantities were estimated for each line item and an approximate cost calculated. Table 6 presents a summary of the costs providing a range of costs from a lower bound unit cost to an upper bound unit cost. The items listed in Table 5 were excluded in this cost estimate and need to be added to the construction cost estimate for the next phase. The decision level cost estimate for the RCC dam alternative ranges from $13.7 to $19 million. This number includes the spillway for the dam as an RCC dam has the spillway embedded in the structure.

Table 6. Planning Level Cost Estimate - RCC Dam Alternative 2

Bid Item	Description	Quantity	Unit	Lower Bound Unit Cost	Upper Bound Unit Price	Lower Bound Cost	Upper Bound Cost
Prep Work						**$ 306,225**	**$ 400,257**
1	Clearing and grubbing, stripping topsoil, reclamation of disturbed areas	1.4	Acre	$ 20,000	$ 26,000	$ 28,000	$ 36,400
2	Flood control coffer dam downstream	4,329	CY	$ 25	$ 33	$ 108,225	$ 142,857
3	Temporary pipe from existing dam to downstream of new dam	1,000	LF	$ 170	$ 221	$ 170,000	$ 221,000
Main Dam						**$ 7,853,000**	**$ 10,207,600**
4	Excavation - Foundation General	30,000	CY	$ 8	$ 10	$ 240,000	$ 300,000
5	Embankment - Backfill	15,000	CY	$6	$ 8	$ 90,000	$ 120,000
6	Fill - Roller Compacted Concrete	32,200	CY	$ 80	$ 104	$ 2,576,000	$ 3,348,800
7	Conventional Concrete Reinforced	1,000	CY	$ 750	$ 975	$ 750,000	$ 975,000
8	Conventional Concrete Non-Reinforced	12,100	CY	$ 325	$ 423	$ 3,932,500	$ 5,118,300
9	Construction De-watering	1	LS	$ 125,000	$ 162,500	$ 125,000	$ 162,500
10	Foundation Treatment - Grout Curtain	3,000	LF	$ 16.50	$ 21	$ 49,500	$ 63,000
11	Outlet Works Gates - Slide (Fabrication and Construction)	7,500	LB	$ 12	$ 16	$ 90,000	$ 120,000
Other						**$ 175,000**	**$ 228,600**
12	Intake structure and outlet works	1	EA	$ 100,000	$ 130,000	$ 100,000	$ 130,000
13	fishscreen for intake structure	2,500	LS	$ 12	$ 16	$ 30,000	$ 40,000
14	pipeline thru dam 36"	200	LF	$ 225	$ 293	$ 45,000	$ 58,600
Total Base Construction Cost (BCC)						**$ 8,334,225**	**$ 10,836,457**
15	Design Contingency			25.0%	30.0%	$ 2,083,556	$ 3,250,937
16	Mobilization/Demobilization construction			5.0%	5.0%	$ 416,711	$ 541,823
17	Construction, CO/C Contingency			8.0%	10.0%	$ 666,738	$ 1,083,646
Total Construction Cost						**$ 11,501,231**	**$ 15,712,863**
18	Permitting			3.0%	3.0%	$ 345,037	$ 471,386
19	Design and Site Characterization			7.0%	8.0%	$ 805,086	$ 1,257,029
20	Engineering Support during Construction			9.0%	10.0%	$ 1,035,111	$ 1,571,286
Total Cost (Rounded)						**$ 13,700,000**	**$ 19,000,000**

5.3 Costs Estimate for Alternative 3 – Embankment Dam

A planning level cost estimate for comparison purposes was prepared for Alternative 3 Embankment Dam. As for Alternative 2, the estimate includes site preparation, work associated with the dam, other structures associated with the dam, and appropriate contingencies for a) design costs, b) permitting, c) engineering during construction, and d) a construction change order/claim contingency. HDR developed a concept design as described in section 3.1.3 for the Embankment Alternative shown in Figure 4. Based on that concept design, quantities were determined for each line item and an approximate cost was calculated. Table 7 presents a summary of the costs providing a range of costs. The items listed in Table 5 were excluded in this cost estimate and need to be added to the construction cost estimate for the next phase. The option Embankment dam alternative ranges from $12.9 to $17.8 million. These numbers does not include the spillway for the dam as the spillway is a separate structure for embankment dams.

Table 7. Planning Level Cost Estimate - Embankment Dam Alternative 3

Bid Item	Description	Quantity	Unit	Lower Bound Unit Cost	Upper Bound Unit Price	Lower Bound Cost	Upper Bound Cost
Prep Work						**$ 396,225**	**$ 517,257**
1	Clearing and grubbing, stripping topsoil, reclamation of disturbed areas	5.9	Acre	$20,000	$26,000	$ 118,000	$ 153,400
2	Flood Control coffer dam downstream	4,329	CY	$25	$33	4 108,225	$ 142,857
3	Temporary pipe from existing dam to downstream of new dam	1,000	LF	$170	$221	$ 170,000	$ 221,000
Main Dam						**$ 7,085,140**	**$ 9,161,560**
4	Excavation - Foundation General	124,280	CY	$13	$17	$ 1,615,640	$ 2,112,760
5	Embankment Fill	301,000	CY	$14	$18	$ 4,214,000	$ 5,418,000
6	Embankment Filter Material	15,000	CY	$30	$39	$ 450,000	$ 585,000
7	Construction De-watering	1	LS	$480,000	$624,000	$ 480,000	$ 624,000
8	Foundation Treatment - Grout Curtain	3,000	LF	$17	$21	$ 49,500	$ 63,000
9	Riprap and Bedding	4,200	CY	$30	$39	$ 126,000	$ 163,800
10	Conventional Reinforces Concrete	200	CY	$750	$975	$ 150,000	$ 195,000
Other						**$ 362,500**	**$ 472,600**
11	intake structure and outlet works	1	EA	$175,000	$227,500	$ 175,000	$ 227,500
12	Fish screen for intake structure	2,500	LS	$12	$16	$ 30,000	$ 40,000
13	pipeline thru dam 36"	700	LF	$225	$293	$ 157,500	$ 205,100
Total Base Construction Cost (BCC)						**$ 7,843,865**	**$ 10,151,417**
20	Design Contingency			25.0%	30.0%	$ 1,960,966	$ 3,045,425
21	Mob/Demob construction			5.0%	5.0%	$ 392,193	$ 507,571
22	Construction. CO/C Contingency			8.0%	10.0%	$ 627,509	$ 1,015,142
Total Construction Cost						**$ 10,824,534**	**$ 14,719,555**
23	Permitting			3.0%	3.0%	$ 324,736	$ 441,587
24	Design and Site Characterization			7.0%	8.0%	$ 757,717	$ 1,177,564
25	Engineering Support During Construction			9.0%	10.0%	$ 974,208	$ 1,471,955
Total Cost (Rounded)						**$ 12,900,000**	**$ 17,800,000**

5.4 Comparison Costs Estimates for Alternative 2 & 3

As previously stated, the two cost estimates where prepared for comparing alternatives and assisting in the identification of the preferred alternative to move forward. From a decision making standpoint, the costs for Alternatives 2 and 3 are similar. It should be noted that the RCC dam cost estimate includes the spillway, but the embankment dam does not. The preferred alternative decision needs to be based on advantages and disadvantages of the alternatives presented in Table 3.

Based on the cost estimates, advantages/disadvantages, and overall experience of HDR, we recommend that Alternative 2 be selected for preliminary design. Alternative 3 can be further considered should any future investigations of the site indicate a significant challenge or cost increase to Alternative 2.

6 Conclusions and Recommendations

Phase 3 explorations and engineering analyses have confirmed significant seismic deficiencies with both BC 1 and BC 2 dams. Configuration level analyses and design layouts have provided important information about alternatives to remediate the seismic deficiencies of the Big Creek dams and how to move forward in the future in order to provide the City of Newport with a safe and reliable drinking water source after a seismic event.

6.1 Key Conclusions

Phase 3 of site characterization work provided the basis to update the site model and analysis, and increased the confidence in the findings of the study. The analysis indicated that both existing dams are unsafe due to excessive deformations that would occur during a large seismic event. Some form of remediation is needed to provide appropriate dam safety and water supply security for the City.

Based on the Phase 3 findings, the project purpose was modified to provide all current water storage capacity and an increased water supply meeting master planning requirements at the upper site. Decommissioning of the lower dam and reservoir (BC 1) would be required by the state. The storage from the BC 1 reservoir needs to be recovered. Also increased storage due to sediment accumulation and future water storage capacities needs to be provided with the new modifications.

Several alternatives have been identified that would meet the modified project purpose. The chosen alternatives to proceed include either a new RCC dam or embankment dam at a location immediately downstream of the upper dam (BC 2). Configuration level studies have indicated that both types of dam at this location can be designed and constructed to provide safe and secure water supply for earthquake events that have a minimum recurrence interval of about 5,000 years or higher. Such safety is consistent with state requirements and federal projects with similar potential consequences of dam failure.

6.2 Recommendations

The recommendation to move forward to provide the City with a safe and secure drinking water source is to build a new RCC dam (Alternative 2) at the location just downstream of the existing upper dam (BC 2). Based on the results of the current study, the RCC alternative would provide the most secure and stable option in case of a seismic event. Constructability of an RCC dam is less complicated and takes the least amount of time compared to the embankment option. The footprint of an RCC dam is less and provides fewer disturbances in terms of environmental impact compared to the embankment option. The preliminary costs show the RCC dam is a feasible option compared to the embankment dam.

Preliminary designs that include a comprehensive characterization of the new dam site are needed to update the configuration of the dam, to provide budgetary cost estimates, and to provide information required for permitting of the dam. Such preliminary design would be the objective of the next phase of work.

Information necessary for a preliminary design is geotechnical data of the new proposed site to provide the depth of bedrock and to characterize a foundation concept for the new dam.

The environmental permitting process can be started and prepared for the actual permitting process. A concept for the remediation of Big Creek can be developed at the location of the lower reservoir after the BC 1 dam has been removed. Dialog with ODFW should be started about fish ladder requirements and possible remediation opportunities.

A detailed budgetary cost estimate needs to be prepared that represents actual orders of magnitudes of costs. Based on this preliminary design cost estimate the search for funding and finance options can be explored.

Further, the access road to the dam and around the reservoir would be defined with the help of a comprehensive survey that has to take place to develop a preliminary design. The spillway for the embankment option has to be refined as well with the help of a topographic survey.

A schedule would need to be developed that presents the next steps of this project.

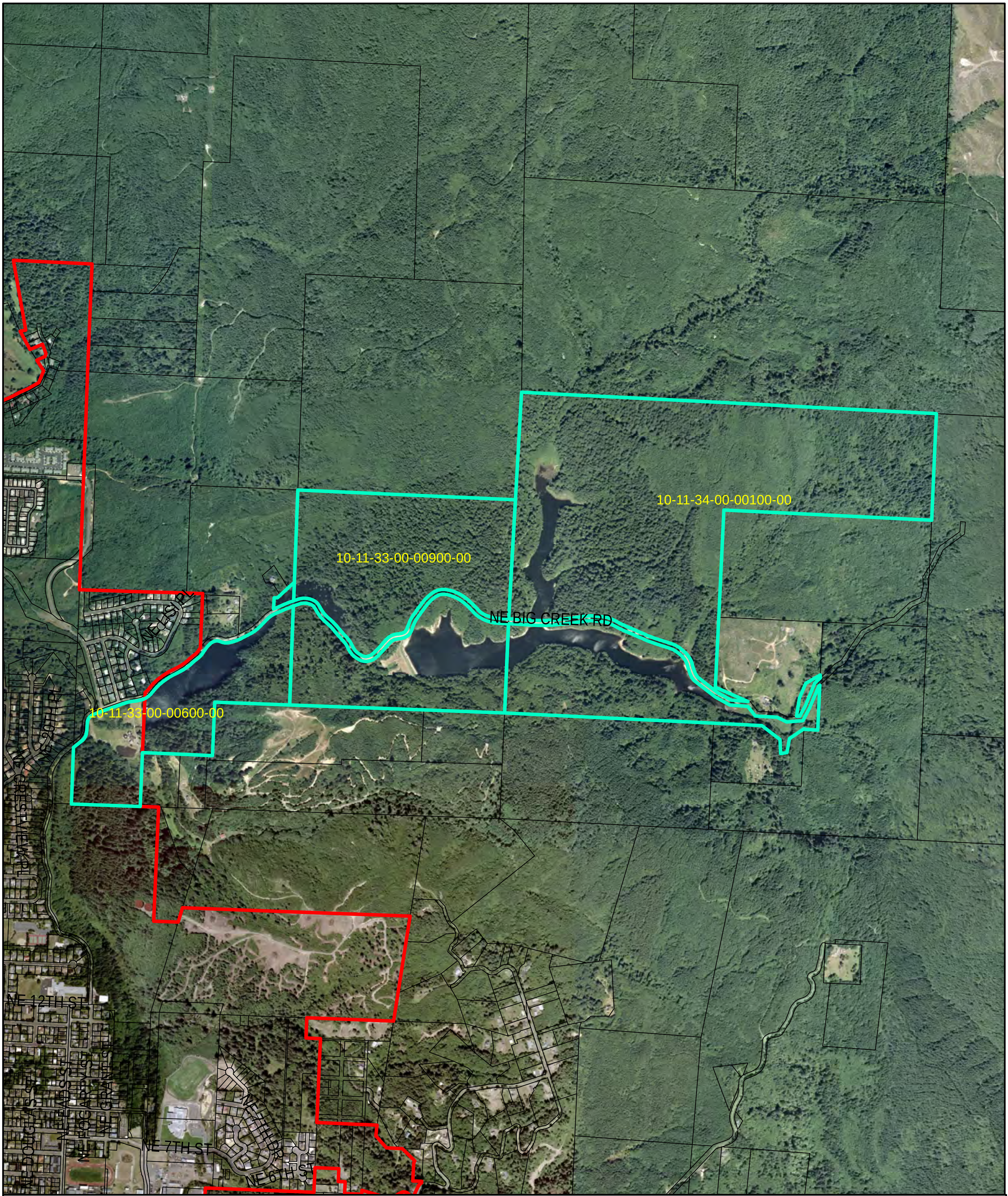
Some additional modeling analysis for the new dam is necessary during the preliminary design of the dam. This analysis would include two design earthquakes: the biggest crustal and the biggest fault earthquake. Both modeling results would have to be presented to the State to determine the design earthquake requirements for the new dam.

The consequences of a safety related failure of the dam needs to be updated to represent the culvert conditions where Big Creek flows underneath Highway 101 and then into the Ocean. It is likely this culvert would be blocked by debris or damaged in a seismic event. This scenario is not reflected in the current dam breach and inundation limits prepared for consequence evaluations and emergency planning in the Emergency Action Plan report. With the new dam arrangement, a new Emergency Action Plan would also need to be developed once the new dam is in place.

Overall, HDR recommends proceeding with the preliminary design of an RCC dam (Alternative 2) at the identified location. If further explorations show that the foundation soils are not suitable for this option, a refinement of Alternative 3 can be investigated.

ATTACHMENT E

PROJECT LOCATION MAP



NEWPORT

City of Newport
Engineering Department
169 SW Coast Highway
Newport, OR 97365
Phone:1.541.574.3366
Fax:1.541.265.3301

City of Newport - Water Supply Reservoirs

Water Supply Reservoir Parcels
Newport City Boundary

Feet
0 750 1,500 3,000

N E S W

LETTERS OF SUPPORT

DAVID GOMBERG
STATE REPRESENTATIVE
DISTRICT 10

HOUSE OF REPRESENTATIVES

January 27, 2016

Mr. Jon Unger
Water Conservation, Reuse and Storage Grant Program
Oregon Water Resource Department
725 Summer Street
Salem, OR 97301

RE: Letter of Support for the City of Newport's SB1069 Grant Application

Dear Mr. Unger:

I am writing to support the City of Newport in their application for a SB 1069 Water Conservation, Reuse and Storage Grant to support water system evaluations. The city has conducted initial evaluations to discern an urgent need to replace Big Creek Dam #2, a critical piece of infrastructure that serves as the City's sole potable water resource, Big Creek Reservoir.

Engineers have determined that Big Creek Dam #2 is not seismically sound and highly vulnerable to failure. Continued pre-planning activities are necessary to develop a seismically sound replacement dam, which will serve to reduce risk of dam failure, subsequent flooding and loss of water resource for the City of Newport.

In addition to serving the City of Newport itself, the dam and Big Creek Reservoir is increasingly recognized as a water source for the entire mid-coast regional population of 40,000 residents. Recent droughts in nearby water districts have highlighted the importance of the Big Creek Reservoir. During the recent dry period in 2015, multiple affected water districts approached the City to purchase water needed to serve their residents.

Given the context of climate change and water scarcity, matched with increasing vulnerability to seismic events, the time to make this 100-year investment in critical infrastructure is now.

Funding from the Oregon Water Resources Department is necessary to keep pace with these concerns and replace the faltering Big Creek Dam #2 as soon as feasibly possible. Thank you for your time and consideration of this matter. I am appreciative of your department's past service to the Mid-Coast region, and hope to continue our successful partnership to secure water supply for the City of Newport.

Sincerely,

Rep. David Gomberg

900 Court St NE Salem, OR 97301 | 541-921-2038 | rep.davidgomberg@state.or.us

ARNIE ROBLAN
STATE SENATOR
District 5

OREGON STATE SENATE
900 COURT ST. NE, S-417
SALEM, OR 97301

January 25, 2016

Mr. Jon Unger
Water Conservation, Reuse and Storage Grant Program
Oregon Water Resource Department
725 Summer Street, Salem, OR 97301

RE: Letter of Support for the City of Newport's application for SB1069 funding

Dear Mr. Unger:

I am grateful for this opportunity to write this letter of strong support for the City of Newport’s (City) request for funding from the Water Resources Department’s (WRD) Water Conservation, Reuse and Storage Grant Program. A grant award would help the City continue its effort to replace Big Creek Reservoir, a project critical to the region’s quality of life and economic capacity.

The 10,000 residents living in the City are dependent on the Big Creek Reservoir as the sole source of water. Research into the structural integrity of Big Creek Reservoir indicates that it is not seismically sound to withstand a catastrophic event. As such, failure of the Big Creek Reservoir would leave the City’s population and water dependent economy without water.

Recent studies illustrate the strong likelihood of a seismic event occurring on Oregon’s west coast. To adequately assess the feasibility of developing and replacing Big Creek Reservoir for water, the City identified a preferred alternative - a Roller Compacted Concrete (RCC) dam construction. However, additional funding is necessary to continue the second phase of a feasibility research into this preferred dam replacement option.

My office commends the City of Newport for taking the science and related threats seriously. Replacing Big Creek Reservoir is among the top priorities of this municipality and for good reason. RCC dams have evolved over the years into a specialized hydrological technology for water conservation projects that are able to withstand catastrophic seismic event. The additional funding would help the City refine its hydrological analyses while determining the engineering and financial feasibility of the project.

I am pleased to offer my strong support of the City of Newport’s effort to address increasing water needs by way of innovative new strategies for water conservation, reuse and storage. Also, I want to thank you in advance for your careful consideration of this request to ensure that our coastal communities are resilient in the face of increasing natural disasters due to climate change. Please feel free to contact me by phone at work (503) 986-1705 or by email at sen.arnieroblan@state.or.us if I can be of any further assistance.

Sincerely,

Arnie Roblan

State Senator Arnie Roblan, Senate District 5

Office Phone: (503) 986-1705 – Email: sen.arnieroblan@state.or.us
District Office: P.O. Box 1410, Coos Bay, OR

SURFRIDER FOUNDATION

January 25, 2016

Mr. Jon Unger
Water Conservation, Reuse and Storage Grant Program
725 Summer Street
Salem, OR 97301

RE: Letter of Support for the City of Newport's application for SB 1069 funding

Dear Mr. Unger,

Please accept this letter of support for the grant application the City of Newport is submitting for funding to the Oregon Water Resources Department SB 1069 Funding program. We are in full support of the City's Feasibility Study to research and execute the best option for remediation of the Big Creek Dams in Newport, Oregon.

We appreciate the City's actions to address the seismic vulnerability and potential flood risks at Big Creek Dam #2. The Big Creek Reservoir the sole source of water for the residents of the City of Newport. These preventative actions and planning serve to reduce the risk of dam failure and, along with it, flooding of the surrounding regions and loss of the City's water supply.

This project aligns well with the Mission of the Surfrider Foundation as it seeks to protect water quality. The planning and foresight put into the feasibility study has the potential to protect not only the quality of water in the Big Creek Reservoir, but the citizens as well. As the Surfrider Foundation's statewide Oregon Policy Manager, I have worked closely with the City of Newport on several water quality projects both professionally and as a citizen of Newport over the last twelve years.

We support the City's application for grant funding from the Oregon Water Resources Department and its efforts to protect their citizens and potential quality of water. Thank you for considering the City's application.

Sincerely,

Charlie Plybon
Oregon Policy Manager

P.O. Box 99

South Beach, OR 97366

cplybon@surfrider.org

(541) 961-8143

WHOOSHH

January 28, 2016

Jon Unger
Oregon Water Resources Department
725 Summer, Salem, OR

RE: Letter of Support for Big Creek RCC Reservoir Feasibility Study

Dear Mr. Unger:

Whooshh Innovations is excited to support the City of Newport's feasibility study specific to remediation of the Big Creek Reservoirs. We understand that evaluating various fish passage alternatives is an aspect of the City of Newport's planned research, and we are pleased to assist with the evaluation.

Whooshh fish transport systems can safely, timely, efficiently and effectively provide adult passage over stream barriers where conventional ladders or other mechanisms do not make economic sense. Our solutions can provide new opportunities to support endangered species on the Oregon coast, at locations such as the Big Creek Reservoir.

Over the past year, the team at Whooshh Innovations has partnered with the City to explore potential applications for a volitional fish passage technology at the Big Creek Reservoir in lieu of the traditional fish ladder system currently in place. In June 2015, we provided a live demonstration of a volitional fish passage system at the lower Big Creek Dam during the City's 1st annual Protecting Coastal Waterways event for local municipal agencies. Preliminary analysis indicates that a volitional system at the Big Creek Reservoirs is a viable option for supporting fish habitats, not only now, but also after the City builds its replacement dam.

In December 2015, we also joined the City's regional planning team to address integrated water resources planning in the Mid-Coast Basin. As part of that project, we'll help advance discussions about the feasibility of restoring a native fish population at Rocky Creek Reservoir.

We are honored to be partnering on these projects, and look forward to exploring how volitional fish passage systems can help restore habitat connections in Newport while working with the City to forward plans and feasibility studies that support improved fish habitat and ecosystems.

Sincerely,

Vincent E. Bryan III
Chief Executive Officer

(206) 801-3565 | 1449 130th Avenue Northeast, Bellevue, Washington 98005-2253