



Prepared for



and the  
State Water Resources Control Board  
Nuclear Review Committee

Independent Third-Party  
Interim Technical Assessment

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for the  
**Offshore Modular Wedge Wire Screens  
for San Onofre Nuclear Generating Station**

Prepared by



Bechtel Power Corporation

Report No. 25761-000-30R-G01G-00002 Rev. 0

July 11, 2012

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## **List of Abbreviations and Acronyms**

BLM	Bureau of Land Management
Caltrans	California Department of Transportation
CDFG	California Department of Fish & Game
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CPUC	California Public Utility Commission
EPCRA	Emergency Planning and Community Right-To-Know Act
EPRI	Electric Power Research Institute
FAA	Federal Aviation Administration
fps	foot per second
GWA	Government of Western Australia
mgd	million gallons a day
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NYSDEC	New York State Department of Environmental Conservation
OHP	Office of Historic Preservation
RC	Resource Commission
RCRA	Resource Conservation Recovery Act
RWQCB	Regional Water Quality Control Board
SCE	Southern California Edison
SDRWQCB	San Diego Regional Water Quality Control Board
SONGS	San Onofre Nuclear Generating Station
SPCC	Spill Prevention and Countermeasure Control Program
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
USACE	U.S. Army Corp of Engineers
USEPA	U.S. Environmental Protection Agency
WDR	Waste Discharge Requirement



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*Report No. 25761-000-30R-G01G-00002*

## 1. Executive Summary

This study summarizes the findings of the first phase of a detailed evaluation to assess the viability of the modification of the intake water system to add wedge wire screening technology to the once-through cooling system for the San Onofre Nuclear Power Station (SONGS), in support of the Nuclear Review Committee's initiative to identify strategies to implement the California Statewide Policy on the Use of Coast and Estuarine Waters for Power Plant Cooling, that is, strategies that comply with the Section 316b, *California Once-Through Cooling Policy*, Phase II rules.

The design and use of wedge wire screens has been thoroughly evaluated within this report. The wedge wire technology affects impingement and entrainment reductions in three ways: (1) the screens act as a physical barrier to prevent aquatic organisms sufficiently larger than the screen slot size from being entrained, (2) sweeping current in the source water tends to move the aquatic organisms away from the entrained flow field and reduce impingement by moving organisms past the screen faces, minimizing direct contact with intake, and (3) hydrodynamic exclusion of early life stages results from the small through-slot velocity at the screens.

There have been a number of past studies that evaluated effectiveness of wedge wire screens on improving impingement and entrainment loss. The wedge wire screen technology has been recognized by the industry and accepted by permitting agencies as having the ability to effectively reducing impingement mortality with proper engineering design. The wedge wire screen technology can be effective in reducing entrainment loss of juvenile and adult fish due to the physical barriers to entry afforded by the wire matrix. Its performance regarding entrainment reduction for larvae and eggs, however, is highly site-specific and is the subject of ongoing assessments and debates. There is currently no site-specific assessment regarding the potential reduction of entrainment impacts from the use of wedge wire screens that could adequately characterize the benefits. However, based on recent field evaluations, studies, and assessments for the cooling water intakes of other power facilities, it is expected that this technology will offer some level of entrainment protection for all life stages, assuming there is a focused screen site selection process that will avoid biologically sensitive and production areas and appropriate consideration of the local hydrodynamics of the source water to augment the physical barrier of the screens.

The external approval and permitting assessment for the wedge wire system identified a list of potentially applicable federal, state, and local permits and approvals that, not surprisingly, focused on its significant impacts to the marine environment. The efforts to conduct a successful California Environmental Quality Act (CEQA) and secure the U.S. Army Corp of Engineers (USACE) Section 404 permit, California Coastal Commission Coastal Development Permit, State Lands Commission Lease, National Pollutant Discharge Elimination System (NPDES) permit modification will represent the primary regulatory challenges.

These permits are all expected to be contentious and have lengthy processes that will be aligned with the CEQA/Environmental Impact Report review process. The primary issue of concern will be assessing the balance of the wedge wire system construction impacts to the sensitive and productive marine habitats versus its ability to further reduce impingement impacts that are already partially mitigated by the existing intake system.



The wedge wire screening technology has been reviewed against each of the Phase 1 criterion and the results are summarized below. The overall finding is that although this technology is feasible, there are several significant technical and operational challenges. These key challenges include the lack of seawater operational experience, the potential for significant additional maintenance to maintain the cleanliness of the screens, the contentious permitting process, and the complexities of the construction approach. These challenges are challenges that can be overcome, that is, they do not represent fatal flaws at this stage of the assessment.

<b>Criterion</b>	<b>Status</b>
External Approval and Permitting	No fatal flaws
Impingement/Entrainment Design	No fatal flaws, but the technology's effectiveness regarding entrainment impact mitigation needs better characterization.
Environmental Offsets	No fatal flaws.
First-of-Kind-to-Scale	No fatal flaws.
Operability of General Site Conditions	No fatal flaws.
Seismic and Tsunami Issues	No fatal flaws.
Structure and Construction	No fatal flaws.
Maintenance	No fatal flaws.
<b>Conclusion</b>	<b>Technology is a candidate for Phase 2 review.</b>

## **2. Background and Introduction**

### **2.1 Purpose/Scope of Study**

This study is performed in accordance with the requirement established by the State Water Resources Control Board (SWRCB) for Southern California Edison (SCE) to conduct a detailed evaluation to assess compliance alternatives to once-through cooling for SONGS. This requirement is associated with the California *State-wide Policy on the Use of Coast and Estuarine Waters for Power Plant Cooling* that established uniform, technology-based standards to implement the Clean Water Act Section 316(b), which mandates that location, design, construction, and capacity of the cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts.

This report describes the detailed evaluation of offshore wedge wire screen technology for SONGS based on the list of site-specific criteria approved by the Nuclear Review Committee. The evaluation process includes critical review of published data and literature, consultation with permitting agencies, and technical assessment supported by engineering experience and judgment. No new field data was collected as part of this effort. The results of the evaluation are used to characterize the feasibility of this technology and its possible selection as a candidate for further investigation in a follow-on phase of this study.

## 2.2 Regulatory History

### 2.2.1 Federal

The United States Environmental Protection Agency (USEPA) has proposed standards to meet its obligations under the Section 316(b) of the Clean Water Act to issue cooling water intake safeguards. Specifically, this section requires that NPDES permits for facilities with cooling water intake structures ensure that the location, design, construction, and capacity of the structures reflect the best technology available to minimize the harmful impacts on the environment. These impacts are associated with the significant withdrawal of cooling water by industrial facilities that remove or otherwise impact significant quantities of aquatic organisms from the waters of the United States. Most of the impacts are to early life stages of fish and shellfish through impingement and entrainment. Impingement occurs when fish and other aquatic life are trapped against the screens when cooling water is withdrawn resulting in injury and often death. Entrainment occurs when these organisms are drawn into the facility where they are exposed to high temperatures and pressures—again resulting in injury and death. (USEPA, 2011)

In response to a consent decree with environmental organizations, the USEPA divided the Section 316(b) rules into three phases. Most new facilities (including power plants) were addressed in the Phase I rules, initially promulgated in December 2001. Existing power plants were subsequently addressed, along with other industrial facilities, in the Phase II version of the rules, issued in February 2004. Since then the rule has been challenged, remanded, suspended, and repropoed. The current proposed version of the rule dictates that all existing facilities that withdraw more than 2 million gallons per day (mgd) of water from waters of the U.S. and use at least 25 percent of the water they withdraw exclusively for cooling purposes would be subject to:

- Upper limit on the number of fish killed because of impingement and determining the technology necessary to comply with this limit, or
- Reduce the intake velocity to 0.5 feet per second (fps) (through-screen) or below, which would allow most fish to avoid impingement.

Large power plants (with actual intake flow of 125 mgd or greater) would also be required to conduct a study to help their local permitting authorities (SWRCB) to determine site-specific best technology available for entrainment mortality control. Note that this version abandoned the original performance standards approach, which mandated the calculation of baseline against which reduction in entrainment and impingement can be measured.

The Section 316(b) Phase II final rule is expected to be issued July 27, 2012. When the final rule becomes effective, it is likely to include an implementation timeline, which would drive the implementation of technologies to address the impingement requirements within 8 years (2020).

### 2.2.2 State

The SWRCB is responsible for ensuring compliance with the finalized Section 316(b) rules in California and it has been actively pursuing a parallel path regulatory program that is focused on the state's coastal generating stations with once-through cooling systems including SONGS. The SWRCB's *Use of Coastal and Estuarine Waters for Power Plant Cooling Once-Through Cooling Policy* became effective October 2, 2010. This policy established statewide technology-based requirements to significantly reduce the adverse impacts to aquatic life from once-through cooling. Closed-cycle wet cooling has been selected as best technology available.





Affected facilities, including SONGS, are expected to:

- Reduce intake flow to a level commensurate with that attainable with a closed-cycle wet cooling system and reduce through-screen velocity to 0.5 fps or below—Track 1, or
- Reduce impacts to aquatic life comparably by other means – Track 2

This policy is being implemented through a so-called “adaptive management strategy,” which is intended to achieve compliance with the policy standards without disrupting the critical needs of the state’s electrical generation and transmission system. A Nuclear Review Committee was later established to oversee the studies. This committee will investigate the ability, alternatives, and costs for both SONGS and DCP to meet the policy requirements. This study is a direct outgrowth of the adaptive management strategy to implement this Once-Through Cooling Policy (Bishop, 2011).

### **Current Cooling Water Intake System and Section 316(b) Compliance History – SONGS**

SONGS operates two independent cooling water intake structures to provide cooling water to Unit 2 and Unit 3. Each unit’s water withdrawal rate is nominally 828,000 gpm or 1,192 mgd. Both units withdraw water from separate, parallel submerged conduits extending 3,183 feet offshore, terminating at a depth of 32 feet in the Pacific Ocean. The submerged end of each conduit is fitted with a velocity cap to minimize fish entrainment by transforming the vertical flow to a lateral flow, which encourages a flight response from fish close to the structure.

The onshore portion of each intake consists of six vertical traveling screens fitted with 3/8-inch mesh panels. Screens are rotated based on the pressure differential between the upstream and downstream faces or manually. A high-pressure spray removes any debris or fish that have become trapped in the screen face. The vertical traveling screens are angled at approximately 30° to incoming flow. This feature, combined with a series of vertical louvers placed in the forebay, guides the fish to a quiet zone at the end of the cooling water intake structure. A fish elevator periodically empties captured fish into a 4-foot diameter conduit that returns them by gravity flow to a submerged location approximately 1900 feet offshore. (Tetra Tech, 2008). Also housed in the cooling water intake structure of each unit are four saltwater cooling pumps, each rated 17,000 gpm. These pumps are safety-related and located downstream of the traveling water screens. Operation of one pump is sufficient to supply the saltwater cooling needs for one unit. The total saltwater cooling flow needs for both units is 34,000 gpm. (SONGS, 2004).

SONGS is also planning to add a “large marine organism protection device” to reduce the spacing between the exclusion bars to less than 9 inches, in conformance with SWRCB’s *Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Water for Power Plant Cooling* (Enercon, 2012).

The SONGS cooling water intake system’s offshore velocity cap, onshore angled traveling screen system collectively helps reduce entrainment and impingement impacts to aquatic life. These systems, along with various previous quarterly impingement monitoring programs, have represented SONGS ongoing measures to demonstrate compliance with previously applicable Section 316(b) regulatory guidance. This guidance can be described as an overarching federal regulation (40 CFR 125.90(b)) and broadly expressed state policies and permit language, which collectively required facilities to implement Section 316(b) rules using professional judgment on a case-by-case basis.



## 2.3 Screening Process (A/B Criteria)

The technology screening process for the Phase 1 portion of the evaluation will be performed using a Criteria Set A/B approach that achieves a technically comprehensive assessment while concurrently minimizing the time and effort required. The screening will be initially performed for Set A criteria. If the technology satisfies all of the Set A criteria, it will be evaluated using Set B criteria.

Set A criteria include the following items that are judged to be critical to the screening process:

- External Approval and Permitting (Nonnuclear Licensing)
- Impingement/Entrainment Design
- Offsetting Environmental Impacts

All remaining criteria are grouped into Set B criteria, which are:

- First-of-a-kind to scale
- Operability general site conditions
- Seismic and tsunami issues
- Structural
- Construction
- Maintenance

During the screening process, if any criterion cannot be met, the screening process is suspended and a summary report for that technology is then prepared.

## 3. Technology Description

At SONGS, the current cooling water system for each unit consists of an 18-foot diameter buried offshore pipeline system that withdraws seawater via a velocity cap intake located approximately 3200 feet offshore. The 18-foot pipe delivers water to onshore pump intake structure through gravity. While the velocity cap intake is a proven technology that substantially reduces fish entrainment, the wedge wire technology is designed to enhance this system's environmental effectiveness even further.

Retrofitting the SONGS existing intake to incorporate wedge wire screen technology will require major structural modification and new construction. This technology involves capping the existing offshore velocity cap intake head and attaching a new manifold with multiple arrays of wedge wire screen modules to the existing 18-foot-diameter pipe for each unit. The location of the wedge wire screens will be offshore and near the existing velocity cap location to maximize the water depth over the screens. The wedge wire screen manifold will be connected to the 18-foot pipe via a new 18-foot-diameter branching junction.

The wedge wire screens will be circular cylinder shape, T-type, and each module will be 8 feet in diameter. This size is the largest available size that boasts some operating experience. Considering the large amount of cooling water withdrawal requirements, the screens will be high-capacity/high-performance type designed based on a maximum slot flow-through velocity of 0.5 feet per second (fps). Due to the existence of sea kelp and other sea life, the optimum slot size should be in the range of 6 to 8 millimeters. Smaller slot sizes can result in clogging of the screens, blockage to the flow, and the subsequent serious impacts to cooling water withdrawals.

A total of 18 screens are required for each unit. The T-shape wedge wire screens will contain internal flow modifiers to ensure that the 0.5 fps velocity criterion is maintained across the screen surface. The screen material will be based on copper-nickel alloy to resist biofouling in the sea environment. Screen arrays will be arranged in the direction of the dominant sea current to effectively sweep the screen surfaces of potential trash. Figures WW-1 through WW-3 show the schematic arrangement for the proposed alternative.

## **4. Criterion Evaluation**

### **4.1 External Approval and Permitting**

#### **4.1.1 General Discussion**

The external approval and permitting assessment focused on identifying the applicable (required) permits and approvals for construction and operation of a variable speed cooling water wedge wire screen system.

The initial assessment effort focused on developing a comprehensive list of potentially applicable permits and approvals at the federal, California, county, and municipal level (as applicable). This applicability of each permit/approval to the proposed variable speed pump option was evaluated. Those permits and approvals that were deemed applicable were subsequently scrutinized to characterize the expected duration and complexity of the regulatory review process. Special attention was directed to identifying environmental impact issues or criteria that would preclude the applicable permit or approval from ever being issued or granted. That is, the focus was to screen each applicable permit or approval for fatal flaws in the associated regulatory review process, which would preclude the wedge wire system from further consideration.

The assessment also focused on identifying the critical path (longest duration) initial preconstruction permitting processes, that is, those that support site mobilization, physical site access, initial earthwork/foundations for each cooling system technology option. The duration of the permitting and the approval process, while not a definitive fatal flaw, could later serve as a screening tool if combined with specific schedule limitations.

Permits and approvals that support later stages of construction and operation that are not critical path to the commencement of construction were also included in the assessment since these items could pose significant operational constraints to future SONGS operations.

#### **4.1.2 Detailed Evaluation**

This summary list of permits provided the basis for subsequent discussions with key relevant regulatory authorities regarding the applicable permit application needs and the permit review time frames. These discussions were also critical for the identification of potential regulatory or permit-related barriers to implementation—fatal flaws.

The following regulatory authorities contacted:

- U.S. Army Corps of Engineers (USACE)
- U.S. Marine Corps – Camp Pendleton
- California Public Utility Commission (CPUC)
- California Coastal Commission
- California State Lands Commission
- State Water Resources Control Board (SWRCB)
- San Diego Regional Water Quality Control Board (SDRWQCB)

- San Diego Air Pollution Control District
- San Diego County Department of Environmental Health

The following sections discuss the relevant key permitting/approval processes for the offshore wedge wire screen technology and summarize these findings in Table WW-1. This table lists the applicable permits and approvals, determines the critical path review processes and most importantly, highlights those processes which may be fatally flawed.

#### **4.1.2.1 Modular Wedge Wire Screen System**

The modular wedge wire screen system is essentially the addition of a new offshore intake system equipped with multiple arrays of wedge wire screens attached to the existing supply conduit for the SONGS cooling system. Section 3 provides detailed description of the wedge wire screen system.

#### **U.S. Army Corps of Engineers**

The U.S. Army Corps of Engineers (USACE) is the lead agency for Clean Water Act Section 404 and Section 10 permitting processes, which are focused primarily on impacts to waters of the United States and waterborne navigation. The offshore wedge wire system will involve offshore cut and fill, which will pose significant construction impacts to USACE jurisdictional waters.

For minor impacts, the USACE has established a general permit program (nationwide permit) for a host of less significant work processes involving waters of the United States. The significant marine work associated with this cooling system option precludes any nationwide permit permitting process for cut/fill and tunneling construction options. SONGS, therefore, would then be faced with securing the more complex individual Section 404/10 permit.

While individual Section 404 permit review periods can be lengthy, the USACE representative for the SONGS area explained that all USACE facilities have goals to issue an individual Section 404 permit within 120 days of deeming the associated application complete (Lambert, 2012). This period is a goal, not a statutory commitment. Consequently, in many cases, this goal is not realized. These delays are often associated with the mandated consulting processes that need to be pursued with the State Historic Preservation Office, U.S. Fish and Wildlife Service, or National Marine Fisheries Service. In other cases, there are extensions of public notice periods or scheduling complications for the public hearing. The applicant for the Section 404/10 permit has to directly pursue consultations with the California Coastal Commission and SWRCB. Receipt of an individual Section 404 permit is contingent on previous receipt of permits from the California Coastal Commission and SWRCB.

This difficult situation process is impeded further by the understaffed local USACE office (two to three permit writers), so permit review durations have been getting longer. For the more complex and contentious situations, the permitting process can extend to 1–2 years. Hence, the USACE permits are often characterized as the critical path permitting process. Given the significant new marine work associated with this cooling technology option, it is likely that the Section 404 will represent a critical path item to the completion of permitting.

Despite the potential for review periods longer than the 120 day target, the USACE did not see any specific barriers or fatal flaws regarding the Section 404 permitting process for the offshore wedge wire screen system.

### **U.S. Marine Corps – Camp Pendleton**

SONGS is located on leased property that is part of the Marine Corps Camp Pendleton. Any significant physical improvements to the SONGS facility, such as addition of closed cooling systems, are potentially subject to a formal review and approval process by the U.S. Marine Corps and U.S. Department of the Navy.

The SONGS resides on land that is subdivided into two leases and 9 easements. The SONGS lease grants the U.S. Marine Corps and the U.S. Department of the Navy authority to review and improve physical improvements on the subject property (Rannals, 2012). While this authority does not formally extend to offshore properties, the Marine Corps is also interested in offshore work in the area, since it could potentially impact their offshore training activities.

While the wedge wire system is not expected to demand any additional federal land nor add any significant land-based structures, it is possible that addition of this cooling system technology will pose sufficient land-based alterations that would trigger a formal review and approval process. If required, the related application is initially submitted to the U.S. Marines/Camp Pendleton (with appropriate site plan drawings and associated written descriptions). This application would be reviewed by the Camp Pendleton staff and the staff would subsequently compile their findings and make a recommendation to the Camp Pendleton Base Commander regarding the application. With this input, the Base Commander would then develop and submit a recommendation to the U.S. Marine Corps headquarters and subsequently to the U.S. Department of Navy. The U.S. Department of the Navy would provide the final approval/denial of the proposed new SONGS facility on leased Camp Pendleton property.

While the wedge wire system may not trigger this formal review and approval process, the associated significant offshore work could be viewed negatively by the Marine Corps, if it appears to compromise their offshore training regimen. It is unclear whether the Marine Corps can (or would choose to) exert influence through their land-based lease and easement arrangement for work carried outside of their lease area.

### **California Public Utility Commission**

Southern California Edison's SONGS is regulated by the CPUC, which is charged with overseeing investor-owned public utilities. Given the lack of significant county involvement on this federal property, the CPUC will likely be designated the Lead Agency for the CEQA review process. CEQA is a regulatory statute that requires state or local regulatory agencies to identify, assess, avoid, or otherwise mitigate the significant environmental impacts from the proposed action—the addition of new cooling system technology.

The proposed new wedge wire system will certainly trigger preparation of an Environmental Impact Report. The Environmental Impact Report is a detailed report that identifies the potentially significant environmental effects the project is likely to have; identifies feasible alternatives to the proposed project; and indicates the ways in which significant effects on the environment can be mitigated or avoided. This Environmental Impact Report will also be used by other state agencies to support their respective review and approval processes.

Following finalization of the Environmental Impact Report, the CPUC will evaluate whether to certify CEQA compliance. This certification then supports their subsequent decision regarding whether the costs associated with the new cooling system can be reclaimed via a consumer rate base adjustment.

While the CPUC-sponsored review process and decision regarding cost recovery will likely be a lengthy, complex, and contentious process, there are no definitive environmental barriers that preclude successfully completing the CEQA review and a positive record of decision.

### California Coastal Commission

The California Coastal Commission has a broad mandate to protect the coast resources of California which include the SONGS facility, including the Mesa Complex. Consequently, the California Coastal Commission's environmental concerns address a broad range of subject matter include visual resources, land and marine-based biological resources, land use and socioeconomic concerns (for example, recreational use/access). Despite this comprehensive focus, the California Coastal Commission has little in the way of specific, objective criteria that could be used to effectively screen any of the cooling system technology options from further consideration.

The California Coastal Commission representatives (Detmer & Luster 2012) indicated that the Commission recognized that there were no great options to the existing once-through cooling system at SONGS. The California Coastal Commission believes that almost all of the cooling system technology replacement options present some sort of negative impacts. Given that basis, the Commission may consider options that may present additional onshore or different offshore impacts to help mitigate the offshore environmental consequences of the existing once-through cooling system. The Commission mandate to protect the coastal resources offers this agency some latitude to balance one set of impacts versus another. This evaluation process is on a case-by-case basis, which can be translated into the conclusion that there are few triggers that would automatically preclude any cooling system options from consideration, including the offshore wedge wire screen system.

Despite the lack of obvious fatal flaws, the wedge wire system will certainly include significant offshore construction efforts, so the California Coastal Commission will be focused on the deleterious construction impacts on marine resources (for example, local fish, shellfish, vegetation, hard marine substrate, commercial fishing) and the potentially offsetting positive benefits associated with reducing operational impingement impacts. Visual impacts in the coastal zone, a typical key Commission subject area, will obviously not be an important factor for this largely submerged wedge wire screen system. Entrainment or thermal discharge impact matters will also be sideline issues, since they remain largely unchanged with this cooling system.

The California Coastal Commission consideration of these issues and their follow-on approval process is mostly aligned with the CEQA process. That is, any application for a Coastal Development Permit will depend on information that is generated by an associated Environmental Impact Report development process. Consequently, the Commission permit review process will also be aligned with CEQA and consequently its duration will mirror the CEQA timeline (6 months to 1 year). That period offers evidence that the Coastal Development Permit could be a critical path permitting process.

### California State Lands Commission

Construction efforts in subaqueous lands associated with any cooling system modifications will be evaluated/approved by the California State Lands Commission. This review and associated lease approval process can follow three different tracks – as shown below:

- **Categorical Exemption** — applicable to those situations where there are no significant environmental impacts and there are no substantive changes in the existing land use. It is unlikely that this option would apply to any of the potential cooling system options that require marine work.
- **Mitigated Negative Declaration** — applicable for work that poses minor environmental impacts, during noncritical seasons, for limited period of time.

- **Environmental Impact Report/CEQA Process** — applicable for work that could potentially generate significant environmental impacts, uses heavy construction equipment, and/or will continue over a significant time period (months). This review process is not fast-track and could extend for a year.

The California Coastal Commission evaluates each project individually and determines the appropriate review/approval path. As the wedge wire technology will obviously result in a significant addition of cooling system infrastructure to subaqueous lands, SONGS will not be able to pursue the largely administrative categorical exemption path or the streamlined mitigated negative declaration process. This option will invoke the longer, more complex Environmental Impact Report/CEQA review process.

Commission representatives (DeLeon & Oggins, 2012) explained the current process for nonnuclear coastal power plant lease holders to develop and implement their “implementation plan” to meet California’s Once-Through Cooling Policy performance goals has been very slow. Most of these facilities have requested extensions to continue to evaluate the potentially available mitigation strategies. This experience offers evidence that the associated CEQA review will not be an expeditious process. A review period of at least a year is a distinct possibility.

Despite this expected lengthy review process, the wedge wire marine work in subaqueous lands does not appear to offer any specific impacts or regulatory considerations, which represent fatal flaws.

#### **State Water Resources Control Board - San Diego Regional Water Quality Control Board**

While the SWRCB has overall permit authority for California’s two active nuclear power stations, the San Diego Regional Water Quality Control Board (SDRWQCB) has the follow-on inspection and enforcement role for the issue permits. For SONGS, the SWRCB expects to modify the existing NPDES permit in support of the proposed offshore wedge wire screen system. The lack of significant disruption to local land surfaces is expected to negate any need for new waste discharge requirements permit for construction impacts to jurisdictional streambed areas and possibly avoid the need to seek coverage under the general storm water permit for construction activity.

Modular wedge wire screen system construction activities will potentially generate significant, temporary water quality and marine habitat (intertidal and subtidal) impacts. Installation of the wedge wire modular screens and connecting piping via the cut-and-fill process will result in significant localized turbidity impacts and the temporary and permanent loss of a considerable area of biological productive marine habitat area.

Operationally, the offshore wedge wire screen system will effectively reduce the impingement impacts associated with once-through systems. This system will not, by itself, reduce the overall water withdrawal or discharge rates. Consequently, the entrainment-related impacts and thermal discharge impacts to aquatic life will remain largely unchanged.

Given that the cooling water withdrawal and discharge rates will remain essentially unchanged, any revisions to the current SONGS NPDES permit will be limited to compliance provisions of Section 316b, Phase II *California Once-Through Cooling Policy* requirements. There will ostensibly be no changes to the current water treatment system, as this option is still a once-through system that now includes a more effective biological screening system.

Both the SWRCB and SDRWQCB representatives (Jauregui, 2012 and Morris, 2012) explained that there are no obvious regulatory barriers regarding issuance of this revised NPDES permit for any of the cooling system options currently under consideration, including the wedge wire screen system. The SDRWQCB and



SWRCB will not necessarily preclude cooling system options from consideration, even if these options fall short of full compliance with the performance criteria tied to Section 316b, *California Once-Through Cooling Policy*, Phase II rules (that is, through-screen velocity less than 0.5 fps and entrainment/impingement levels equivalent to that associated with a closed-cooling cycle system). The wedge wire screen system entrainment reduction performance will fall well short of closed-cycle cooling attributes.

The SWRCB is ultimately a political body (nine individuals) interested in reviewing as much information/evidence from the applicant and from their own technical staff regarding the feasibility and impacts of various cooling system alternatives. Consequently, none of the SWRCB permits represent a fatal flaw or critical path permitting process to the wedge wire screening system.

### **San Diego Air Pollution Control District**

SONGS is located within the San Diego Air Pollution Control District, a state-designated, non-attainment area for PM-10 and PM-2.5, that is., the District has failed to achieve compliance with the state ambient air quality standards for these pollutants (Annicchiarico, 2012). In addition to this air quality compliance issue, there are also local concerns regarding visibility impacts on the nearest visibility sensitive areas, so-called Class I areas that are comprised national parks (over 6000 acres), wilderness areas (over 5000 acres), national memorial parks (over 5000 acres), and international parks that were in existence as of August 1977. While these situations may have ramifications for those cooling system options that generate significant particulate emissions (closed cooling cycle systems), air quality permits/approvals are not expected to play an appreciable role for the offshore wedge wire system—a system that is not expected to generate any additional operational air emissions.

### **San Diego County Department of Environmental Health**

As SONGS is located entirely on leased federal property that is part of the Marine Corps Camp Pendleton, any significant physical improvements to the SONGS facility are not subject to San Diego County review. The review process is essentially delegated to the U.S. Marine Corps and U.S. Department of the Navy. Consequently, most of the San Diego County regulatory departments (Planning, Public Works, and Building Division) do not directly regulate SONGS.

Despite the fact that the county oversight for SONGS is constrained, there are six separate ongoing county-led regulatory programs at this facility (Mache, 2012). The County Environmental Health Department has received California EPA approval to be the Certified Unified Program Agency responsible for management of the following programs:

- **California Aboveground Storage Tank Program** — mandates development and implementation of a Spill Prevention and Countermeasure Control Program (SPCC) and tank inspections.
- **California Underground Storage Tank Monitoring Program** — addresses fuel storage and leak detection in Mesa Complex and power block area.
- **Hazardous Waste Storage and Treatment** — includes small proprietary oil separation facility.
- **Medical Waste Disposal** — a county ordinance makes this an Environmental Health Department responsibility.
- **Clean Air Act 112r Risk Management Plan** — addresses onsite aqueous ammonia storage



- **Hazardous Material Business Plan** — addresses storage of greater than 55 gallons of chemicals with potential for offsite impacts and addresses the facility's Emergency Planning and Community-Right-to-Know responsibilities.

The wedge wire system will likely not demand any additional chemical additives or force the relocation of any existing chemical and fuel storage systems. Routine maintenance and cleaning of the wedge wire modules could produce an additional waste stream composed primarily of debris and vegetative materials around the modular screen elements. These maintenance wastes and other aspects of wedge wire operation will not present any obvious county-sponsored regulatory barriers or represent critical path permitting processes.

### **Other Regulatory Agencies**

In addition to the key regulatory agencies described above, there are a number of regulatory agencies that could potentially play a role in the permitting of the various cooling system technology options. The U.S. Fish and Wildlife Service, California Department of Fish & Game (CDFG), and California Office of Historic Preservation, for example, often play significant regulatory roles in power plant upgrade projects. Construction and operation of the wedge wire screen system is likely to temporarily and permanently disturb sensitive marine habitat and also reduce impingement impacts to local fish and shellfish. These attributes will make the U.S. Fish and Wildlife Service and CDFG service key parties to CEQA review process, but they are not expected to trigger the need to secure a 2081 Incidental Take Permit because of the lack of marine-based endangered species (Enercon). Since this option primarily involves offshore work and underwater facilities, it is unlikely the cultural or historic resources (land-based) will be impacted.

Installation of this largely submerged screening system will not alter the overall profile of the SONGS facility and will certainly not require significantly tall or large construction equipment. These considerations will preclude significant interactions with California Department of Transportation (Caltrans) (roadway crossings, encroachments, oversized vehicles) and the Federal Aviation Administration (FAA), whose focus would be limited to aviation obstruction impacts posed by tall new permanent or temporary features (less than 200 feet above ground level).

Finally, the California Energy Commission (CEC) will be largely excluded from the permitting processes primarily because offshore wedge wire screen systems will not boost currently power levels of the SONGS facility, let alone reach the 50 MW thresholds, which would mandate CEC review.

#### **4.1.2.2 Summary**

The external approval and permitting assessment for the wedge wire system identified a list of potentially applicable federal, state, and local permits and approvals that, not surprisingly, focused on its significant impacts to the marine environment. The efforts to conduct a successful CEQA review and secure the USACE Section 404 permit, California Coastal Commission Coastal Development Permit, State Lands Commission Lease, NPDES permit modification will represent the primary regulatory challenges.

These permits are all expected to be contentious and have lengthy processes that will be aligned with the CEQA/Environmental Impact Report review process. The primary issue of concern will be determining wedge wire system construction impacts to the sensitive and productive marine habitats while offering reductions in impingement impacts that are already partially mitigated by the existing intake system. Despite this incremental improvement regarding impingement-related losses, the consistent message from all of the interested regulatory agencies was that there were no environmental impact issues or criteria that would preclude this technology option from securing the necessary construction and operating permits and approvals. That is,

there were no fatal flaws in the associated regulatory review process that would preclude the offshore wedge wire screen system from further consideration.

The assessment also indicated that the Section 404 permit and the CPUC-sponsored CEQA review process will likely represent the critical path review and approval processes (~12 month) for the offshore modular wedge wire screen system. This critical path process does not represent barrier to development of this cooling technology system.

## 4.2 Impingement/Entrainment Design

### 4.2.1 General Discussion

The design of wedge wire screens affect impingement and entrainment reductions in three ways: (1) the screens act as a physical barrier to prevent aquatic organisms sufficiently larger than the screen slot size from being entrained, (2) sweeping current in the source water tends to move the aquatic organisms away from the entrained flow field and reduce impingement by moving organisms past the screen faces, minimizing direct contact with intake, and (3) hydrodynamic exclusion of early life stages results from the small through-slot velocity at the screens.

There have been a large number of past studies that evaluated effectiveness of wedge wire screens on improving impingement and entrainment loss. The wedge wire screen technology has been recognized by the industry and accepted by permitting agencies as having the ability to effectively reduce impingement mortality when properly designed. The wedge wire screen technology can be effective in reducing entrainment loss of juvenile and adult fish due the physical barrier to entry afforded by the wire matrix. Its performance regarding entrainment reduction for larvae and eggs, however, is highly site-specific and is the subject of ongoing assessments and debates. There is currently no site-specific assessment regarding the potential reduction of entrainment impacts from the use of wedge wire screens that could adequately characterize the benefits. However, based on recent field evaluations studies and assessments for the cooling water intakes of other power facilities noted below, it is expected that this technology will offer some level of entrainment protection for all life stages, assuming there is focused screen site selection process that will avoid biologically sensitive and production areas and appropriate consideration of the local hydrodynamics of the source water to augment physical barrier of the screens.

### 4.2.2 Detailed Evaluation

#### 4.2.2.1 Impingement Reduction

The wedge wire screen technology's ability to achieve significant improvements in impingement mortality by combining a slow design through slot velocity (on the order of 0.5 fps) with a high sweeping sea current (1 fps or higher) has been demonstrated in many studies and field evaluations. The wedge wire screen system recommended for SONGS for this evaluation is based on a slot through-flow velocity that does not exceed 0.5 fps and, therefore, will meet the impingement reduction of 316b, *California Once-Through Cooling Policy*, Phase II rules.

#### 4.2.2.2 Entrainment Reduction

- The wedge wire screen technology is a passive screening system with no moving parts and discourages juvenile/adult fish from entering the intake system because of its narrow screen slot size and low slot through-flow water velocities. Early studies and field evaluations of wedge wire screens have con-

cluded that they have little effect on the number of small fish eggs and larvae entrained. More recent studies focused on reductions in entrainment of larger larvae and reported significant benefits by focusing the protection efforts on older larvae that have a greater likelihood reaching maturity. The recent assessments target the *relative* ecological value of entrainment losses with the use of equivalent age 1 fish (the number of 1-year-old fish that eggs, larvae, and juveniles lost to entrainment that would have reached this age if they had not been entrained) as the measurement metric, to ensure that mitigation efforts are actually effective at protecting the fish populations. The two particular studies (Enercon 2010, Normandeau 2009) have specific entrainment benefit estimates for wedge wire screens using 1-year-old equivalents approach.

However, some of the findings related to the entrainment reduction have been challenged, particularly in the case of New York State Department of Environmental Conservation's (NYSDEC or Department) April 2, 2010 Notice of Denial ("Notice") regarding assessments of potential impacts of Indian Point Energy Center Nuclear Generating Units 2 and 3 on striped bass and other fish populations. The NYSDEC stated that adverse environmental impact should be defined as the total numbers of aquatic organisms killed by a cooling water intake structure, not only age 1 equivalent. The NYSDEC further stated that the entrainment reductions estimated in the Indian Point Alternative Technology Report are based on the unproven assumption that hydrodynamics, coupled with active larval avoidance behavior, and not screen slot width, are responsible for the majority of the entrainment reduction observed with cylindrical wedge wire screens. Moreover, the wealth of available industry literature on this topic (Electric Power Research Institute (EPRI) reports of 1998, 2003, and 2005; Taft 2000; Heuer and Tomljanovich 1978; Uziel et al. 1979; Weisberg, et al. 1987) does not support this assumption.

There are more related studies underway in California. For example, the Redondo Beach for the West Basin Municipal Water District study to evaluate the impingement and behavior of larvae that encounter the screens, but are not entrained. Entrainment reduction associated with wedge wire screen technology is very site-specific and highly complicated, as it depends on the combination of many factors such as the abundance of aquatic organisms, temporal and spatial distribution of aquatic species and their life stages present in the source water, hydrodynamic conditions, and the design of the screens and the arrangement and placement of the screen assemblies. A definitive demonstration of the entrainment benefit of using wedge wire screens at SONGS that will satisfy the requirements of 316b, *California Once-Through Cooling Policy*, Phase II rules will require site-specific field testing, and possibly a parallel model analysis.

Even though the total volumetric flow withdrawal will be the same, the wedge wire screens will be relatively more effective in reducing entrainment of the fish egg and larvae compared to the existing velocity cap intake, which has a relatively high inlet velocity of approximately 1.8 fps. The system effectiveness improves if there are local sea current velocities sweeping the screen surface especially when sea current velocities are greater than slot through-flow velocities. Screen performance is expected to be variable depending on the season and aquatic life species. Given these uncertain attributes, it may be necessary for SONGS to conduct further studies and marine monitoring to assess the magnitude of these entrainment benefits to evaluate their compliance with California Once-Through Cooling Policy expectations.

## 4.3 Environmental Offsets

### 4.3.1 General discussion

The environmental offsets are an environmental management tool, which has been characterized as the "last line of defense" after attempts to mitigate the environmental impacts of an activity are considered and exhausted (GWA, 2006). In some cases, significant unavoidable adverse environmental impacts may be able to

be counterbalanced by some associated positive environmental gains. Environmental offsets, however, are not a project negotiation tool, that is, they do not preclude the need to meet all applicable statutory requirements and they cannot make otherwise “unacceptable” adverse environmental impacts acceptable within the applicable regulatory agency.

In some cases, regulatory agencies may be so constrained by their regulatory foundation that offset opportunities are limited or unavailable. The San Diego Air Pollution Control District, for example, has the regulatory authority to offset new air emissions in their district from previously banked emission reductions as long as the new emission sources meet appropriate stringent emission performance criteria. The Air Pollution Control District cannot offset new air emissions with reductions in the impingement and entrainment impacts to aquatic life or reductions in land disturbance. In other cases, the regulatory agencies, such as the California Coastal and State Lands Commissions, have a more broadly based, multidisciplinary review process that supports a more flexible approach to using environmental offsets to generate the maximum net environmental benefit.

With these considerations in mind, the following assessment of offsetting environmental impacts focuses on identifying both positive and negative construction and operational environmental impacts associated the construction and operation of offshore modular wedge wire screen system from a broad range of environmental evaluation criteria.

#### 4.3.2 Detailed Evaluation

The following sections evaluate the air, water, waste, noise, marine and terrestrial ecological resources, land use, cultural and paleontological resources, visual resources, transportation, and socioeconomic issues associated with construction and operation of the offshore modular wedge wire screen system. Given the wide range of environmental impact subject areas under consideration, the systematic approach used in the Diablo Canyon License Renewable Application process was used (PG&E, 2009). Consequently, following discussion of the individual environmental subject areas, the related consequences are categorized as having either positive or negative small, moderate or large impact significance. The specific criteria for this categorization are shown below

- **Small:** environmental effects from not detectable or minor such they will not noticeably alter any important attribute of the resource
- **Moderate:** Environmental effects are sufficient to noticeably alter, but not significantly change the attributes of the resource.
- **Large:** Environmental effects are clearly noticeable and are sufficient to change the attributes of the resource.

The results of these evaluations and impact categorization are subsequently summarized in the Table WW-2.

#### Air

The air quality impacts associated with installing the offshore modular wedge wire screening system are small given that the primarily marine-based nature of the associated construction activities. There will be little or no opportunity to generate fugitive dust from land disturbance activities, as the primary activity will involve offshore marine work. Some additional vehicle-related air emissions can be expected from the small number of outage workforce personal vehicles and over-the-road project construction vehicles. Self-propelled earthmoving equipment will be unnecessary, but there may be some emission sources on temporary

offshore platforms or barges. Construction supplies and wedge wire and piping-related equipment deliveries may be significant in the early phases of construction.

The offshore wedge wire system is not expected to result in a decrease in overall SONGS overall plant efficiency, since the pumping power demands associated with multiple offshore screened intakes should not increase, as explained in Section 4.5.2. As a result, it is not expected to produce any increase in greenhouse gas or other pollutant emissions from replacement fossil power sources.

### **Surface Water**

Offshore modular wedge wire screening system construction activities are primarily marine-based and they have the potential to generate significant temporary water quality impacts. Placement of the wedge wire modular screens and connecting piping will result in localized turbidity impacts from disruption of the local seabed—a potentially large negative construction impact since cut-and-fill practices are used. These construction efforts are not expected to result in any land-based disturbance or storm water-related impacts.

The offshore wedge wire screen system will not change the overall cooling water withdrawal or discharge rates.

### **Groundwater**

Given the primarily offshore construction environment associated with the installation of the offshore modular wedge wire screening system, no significant additional groundwater resources will be needed.

The offshore modular wedge wire screen system is not expected to require any additional groundwater resources.

### **Waste**

Construction-related waste, including marine bed sediment and recyclable metals associated with surplus piping and wedge wire modules, will be generated during the outage. Marine dredge spoils or tunneling wastes, depending on the nature of pipe installation process, are expected to be considerable. The final disposition of these materials has not been determined. Most of the piping and wedge wire wastes are expected to have salvage value and, therefore, will not represent a burden to offsite disposal facilities. Disposal of the marine sediment, whether directed to an onsite or offsite disposal area, will represent a moderate construction negative impact.

With the operation of the offshore modular wedge wire screen system, physical inspection and cleaning of the individual modular screens as part of the maintenance program have the potential to generate additional biological wastes (vegetative debris). Collection and disposal of these marine wastes represent a small operational negative impact.

### **Noise**

Previous studies have concluded from consultations with the County of San Diego County, City of San Clemente, and Camp Pendleton, that noise levels are expected not to exceed 70 dBA at the nearest public receptor (Tetra Tech). Noise impacts from construction activities for the wedge wire screen system are not expected to be significant for land-based locations, since the primary work areas will be well offshore. Buffer areas around offshore construction zones will likely be established for safety reasons, but that will also serve

to reduce noise impacts to offshore noise receptors (watercraft) and shoreline recreational areas (for example, San Onofre State Beach). Given the remaining potential for noise impacts to the public along the immediate shoreline recreational areas, the construction activities could pose a small negative impact.

Operational noise levels are expected to be largely unchanged following installation of the new offshore screening system.

### **Land Use**

Construction activities associated with offshore modular wedge wire screen system are primarily offshore and these activities will likely temporarily preclude normal recreational activities in waters in the immediate construction areas. As mentioned above, buffer zones will be created and maintained during the course of construction for the safety of the workforce and public. The potential temporary restriction of normal public access in these marine areas represents a small negative impact for this cooling technology option.

The wedge wire screen modules and associated piping (assuming cut and cover placement) will obviously represent a change in land use in those previously natural subaqueous areas that will now host wedge wire screens or pipe. The offshore wedge wire module locations will be located in relatively deep waters in the neighborhood of the current velocity cap locations and therefore should not represent an impediment to surface navigation. However, the module locations may be marked with surface buoys to preclude deep water activities. Given these impacts, operation of this underwater system is expected to offer a small-term negative impact.

### **Marine Ecological Resources**

Modular wedge wire screen system construction activities will potentially generate significant, temporary water quality and marine habitat (intertidal and subtidal) impacts. Installation of the wedge wire modular screens and connecting piping via the cut-and-fill process will result in significant localized turbidity impacts and the temporary and permanent loss of a considerable area of biological productive marine habitat area—a large negative impact.

The low inlet velocity offshore wedge wire screen system will reduce the impacts associated with fish impingement and juvenile fish entrainment compared with the current velocity cap system. The current SONGS once-through system already employs the technologies (that is, offshore velocity cap, angled inshore traveling screens, and fish return system) that serve to reduce these impacts. This wedge wire system will not, by itself, reduce the overall water withdrawal or discharge rates. Despite this, the screen systems will afford some reduction of entrainment-related impacts. Thermal discharge impacts to aquatic life, however, will remain largely unchanged. Overall, this system will, operationally, offer a moderate positive impact relative to the current condition.

### **Terrestrial Ecological Resources**

Construction activities associated with the wedge wire screen system are primarily marine-based and consequently present little or no impact to land areas. There will be no construction impacts to terrestrial natural habitat areas or areas with significant ecological value or sensitivity. Operation of the wedge wire system will similarly present no new threat to these resource areas.



### **Cultural and Paleontological Resources**

Since installation of the wedge wire screens will be confined to subaqueous lands, there is little or no potential to discover new cultural or paleontological resources in these developed areas. Operation of this system will similarly pose no new threat to cultural or paleontological resources.

### **Visual Resources**

All construction equipment will be low profile, that is, the construction support features and equipment will not extend above the height of local facility structures.

The wedge wire intake system will be submerged and will present no permanent change in external profile of the facility.

### **Transportation**

Increased commuting traffic from the construction workforces and construction deliveries could worsen the existing level of service on local roads during the plant outage. While the associated construction period means that related traffic impacts will not be transitory, the necessary workforce is not expected to be large. Consequently, the transportation-related construction impacts should be considered a small negative impact.

Operationally, the offshore wedge wire system will increase maintenance and service requirements for the various submerged screen modules, but any related maintenance staff increases are expected to be minimal. Therefore, there are limited or no operational transportation impacts for this system.

### **Socioeconomic Issues**

While there will be some additional construction-related employment opportunities, these opportunities are not expected to significantly strain local community resources (for example, housing, school, fire/police services, water/sewer).

Operational maintenance staff levels may increase slightly, but will not result in any related community service or resource concerns.

## **4.3.3 Summary**

Table WW-2 summarizes the air, water, waste, noise, marine and terrestrial ecological resources, land use, cultural and paleontological resources, visual resources, transportation, and socioeconomic environmental offsets for the offshore modular wedge wire screen system. The construction impacts could be characterized as having large negative impact significance depending on the nature of the installation method (cut and fill will be used). The construction practice will involve significant marine-based work that will generate increased turbidity during construction in the seawater near construction areas, produce a sizeable marine spoils waste, and result in permanent and temporary losses of biologically productive marine habitat. These impacts are not offset by the limited employment opportunities that may be gained during this same period.

Operationally, there is a moderate positive impact significance related to the offshore modular wedge wire screen systems reduction of the already partially impingement impacts. There is no coincident reduction of cooling water withdrawals, so no change in entrainment and thermal discharge impacts. Overall, the moderate benefits associated with reductions of impingement impacts appear to be outweighed by the significant



(large) impacts associated with the disruption of the marine habitats and associated water quality degradation when the cut-and-fill construction practices are employed.

## 4.4 First-of-a-Kind to Scale

### 4.4.1 General Discussion

This technology is commercially available and can support the high withdrawal flow rate requirements of a once-through cooling system. While the technology has been applied successfully for a once-through cooling system in a freshwater environment, it is a first-of-a-kind in scale for marine application.

### 4.4.2 Detailed Evaluation

The wedge wire technology is widely used for cooling tower makeup water systems with small flows, but with limited use for intakes requiring large water withdrawals. The largest once-through cooling intake with comparable water withdrawal rates is Elm Road Generating Station in Wisconsin, which withdraws 1.56 million gpm of fresh cooling water from Lake Michigan. The screen slot size for screens in this intake is 9 millimeters, which reduces the clogging potential. No wedge wire screen intake system has been identified for a marine application with water withdrawal rates on the similar order as that required by SONGS.

To lessen the potential for biofouling, screen material for marine application would include the use of copper-nickel alloy.

In summary, wedge wire screen in once-through marine application is a first-of-a-kind to scale. However, through proper maintenance and design, the technology is not considered to have a fatal flaw.

## 4.5 Operability General Site Conditions

### 4.5.1 General Discussion

The wedge wire screen technology can be integrated into the existing system with modifications occurring primarily at offshore location, as shown on Figures WW-1 through WW-3. There are no changes to the on-shore pump intake structure equipment, except for complete removal of existing traveling water screens and fish handling systems, as needed.

### 4.5.2 Detailed Evaluation

The detailed evaluation for this technology is as follows:

- The offshore screen/piping design will be based on maintaining the current intake system pressure loss considering the wedge wire screens piping losses. In lieu of the drop across the combination of velocity cap and traveling screens, so that there is an adequate depth of water for the submergence at circulating water pumps suction.
- Due to location, distance, and size of the offshore wedge wire screens, the air backwash cleaning system for the wedge wire screens is not practical. Consequently, the selection of a proper screen slot opening size for these screens and appropriate orientation that will promote effective cleaning by the ocean currents are the key components ensuring the successful screen operation.

- The wedge wire screen technology is applicable to SONGS depending on the slot size and specific site aquatic life condition.
- With Small size wedge screens are susceptible to clogging that impeded the cooling water withdrawals. Therefore, it is paramount that periodic inspections and maintenance be regularly performed.
- The smaller the slot size, the higher the frequency of clogging and, therefore, the greater the number of screens and associated maintenance required.
- Complete stoppage of the flow may result in vacuum conditions inside the screen drums that can result in screen damage, which is a design perimeter that is considered in the screen design.
- Frequent inspection and cleaning of screens, using hydraulic jets from service vessels assisted by divers, is an essential maintenance activity for these offshore screens. The frequency of inspection and diver-assisted cleaning are directly proportional to the seasonal marine growth and debris condition at the screen location. These activities are likely to be pursued from two to four times a year.

In summary, wedge wire screen can be integrated into the existing intake system as long as the maintenance program for the screens are fully implemented and there are no fatal flaws in the operation of the modified intake system equipped with wedge wire screens.

## **4.6 Seismic and Tsunami Issues**

### **4.6.1 General Discussion**

The design criteria on seismic and tsunami will be similar to that used to design the existing intake system structures and the wedge wire system can properly be designed to meet the appropriate seismic requirements and wave-induced forces.

### **4.6.2 Detailed Evaluation**

The detailed evaluation for this section is as follows:

- The structural design will use the same seismic category as that was used for velocity cap design.
- This technology is submerged and located offshore and will be designed to withstand design wave forces.

In conclusion, there are no fatal flaws regarding seismic or tsunami issues.

## **4.7 Structural**

### **4.7.1 General Discussion**

The offshore wedge wire screen system can be designed properly to withstand all design loadings that may be encountered in the open sea environment. This design will consider full collapsing pressure to the outer screen that may be encountered during debris blockage event. The impact on existing structures consists of adding a new pipe branches to the offshore buried 18-foot diameter pipe.

## 4.7.2 Detailed Evaluation

A detailed structure evaluation regarding on the addition of the offshore wedge wire screen system to the existing offshore intake pipe will be performed in the Phase 2 part of the study. At this phase of the assessment, there is little evidence that the existing structure integrity of the offshore intake piping system will be adversely impacted by the addition of the wedge wire screen system, as the construction activity for the tie-in of a new piping branch to the existing 18-foot-diameter pipe will be fully and carefully planned and designed to avoid structural concern.

## 4.8 Construction

### 4.8.1 General Discussion

The major construction activities for using this technology are all feasible and include:

- Construct wedge wire assemblies piping manifolds onshore.
- Excavate and install a new 18-foot-diameter branch joint on existing 18-foot-diameter offshore pipe.
- Dredge the seabed for placement of wedge wire assembly manifolds.
- Install the wedge wire piping manifolds and placement of backfill material and seabed riprap and armor protection. A gap for a spool piece between screen manifold and new 18-foot branch line should be allocated.
- Install wedge wire screens on manifolds at the sea bottom.
- Connect wedge wire main manifold to new 18-foot-diameter junction using spool piece.
- Block inlets to offshore velocity cap.
- Evaluate potential removal of traveling screens from onshore pump intake structure.
- Evaluate potential removal of fish-handling system from onshore pump intake structure.

### 4.8.2 Detailed Evaluation

The wedge wire screen pipe manifold assemblies will be built on shore, launched from the surface of a barge, and floated to their design location. The wedge wire assembly manifold and the new 18-foot-diameter branch will be buried with adequate cover. Before the installation of the wedge wire assembly manifold, the seabed will be dredged/excavated to about 15 to 18 feet deep to bury the manifolds. Similarly, for the new 18-foot-diameter branch line, the seabed will be dredged/excavated to 22 to 25 feet deep. Turbidity curtains may be required to minimize suspended solids from reaching the velocity cap.

Upon completion of the manifold and new branch line burial, the seabed will be leveled with graded crushed stone and protected with riprap and armor stone on the top layer for stability and scour protection. Although the installation process will be a challenge, there is no reason to conclude that these efforts will not be successful.

## 4.9 Maintenance

### 4.9.1 General Discussion

There are considerably greater operation and maintenance efforts associated with use of offshore wedge wire screens, as compared to the existing offshore velocity cap operation and maintenance. The major concern will be controlling marine biofouling.

### 4.9.2 Detailed Evaluation

The detailed evaluation will be as follows:

- While narrow-slot wedge wire screens are effective at excluding marine life from entering the pipeline, they are also susceptible to clogging from floating debris.
- Due to distance, size, and number of screens from the shoreline, the use of air backwash system is not practical and screen design should consider this aspect of design.
- The minimum slot size has been initially set at 6 to 8 millimeters. This sizing will be subject to further evaluation considering site-specific marine life impacts.
- Frequent inspection and cleaning of screens using hydraulic jets from service vessels assisted by divers is an essential part of the maintenance program. The frequency of inspection and diver-assisted cleaning are directly proportional to the seasonal marine growth and debris conditions at screen location. These activities will likely be pursued two to four times a year. This frequency will need to be verified by trending the screen condition after they are placed in operation.
- At SONGS, there is an existing thermal shock treatment system that can be applied to both the intake and discharge lines. This system may be used to clean screen intake surfaces.

## 5. Conclusion

Modifying the existing offshore intake system by capping the offshore velocity cap intake head and attaching a new set of manifolds with multiple arrays of wedge wire screen modules to the existing 18-foot-diameter suction pipe is technically feasible and will likely be viewed as complying with the Section 316b, *California Once-Through Cooling Policy*, Phase II rules on the impingement reduction, since the screen thru-slot velocity will be less than 0.5 fps. The reduction of entrainment of fish egg and larvae associated with the wedge wire screens with a slot size of 6 to 8 millimeters will offer limited benefits despite the fact that the cooling water withdrawal rate remains unchanged. Given these uncertain attributes, it may be necessary for SONGS to conduct further studies and marine monitoring to assess the magnitude of these entrainment benefits to evaluate their compliance with California Once-Through Cooling Policy expectations.

Based on the evaluation of Section 4 criteria, this technology should be a candidate for further consideration in the subsequent Phase 2 stage of this assessment.

## 6. Appendixes

None.



## 6.1 Input Data

The input data as cited in this section are from the references listed in Section 6.2.

## 6.2 References

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### **6.3 Sketches**

Figure WW-1. Offshore Wedge Wire Screens Concept Layout

Figure WW-2. Layout for Wedge Wire Screen Intake Cluster for One Unit

Figure WW-3. Sectional View of Wedge Wire Screen Intake Modular Assembly



**Table WW-1.  
Environmental Permit/Approval Assessment: Modular Wedge Wire Screen System  
San Onofre Nuclear Generating Station**

<b>Permit/Approval</b>	<b>Assessment</b>	<b>Permit Review Period (Preconstruction)</b>	<b>Critical Path (Yes/No/NA)</b>	<b>Fatal Flaw (Yes/No/NA)</b>
National Environmental Policy Act – BLM or Other Responsible Lead Federal Agency (Record of Decision, Right of Way)	Not applicable — the addition of the wedge wire system does not constitute major federal action (federal land, funding).	Not applicable	NA	NA
U.S. Department of Navy and United States Marine Corp – Camp Pendleton Lease	Not applicable — U.S. Marine Corp Camp Pendleton and ultimately the U.S. Department of Navy approvals are needed to amend the lease for significant additions to the SONGS leased property or adjacent Camp Pendleton lands. The wedge wire system will not demand any additional land, nor involve any exterior changes to existing structures.	Not applicable	NA	NA
Section 404/10 Permit – U.S. Army Corps of Engineers (USACE)	Installation of the wedge wire system, either via cut-and-fill processes or tunneling, will generate significant impacts to waters of the U.S. and will involve work in navigable waters. Individual form of permit will be required.	120 days from complete application (goal) ~12 months (expected)	Potential	NA
Section 401 Water Quality Certificate – U.S. Army Corp of Engineers (USACE) & Regional Quality Control Board (RWQCB)	Section 401 permit process will parallel Section 404 permit process.	~12 months (expected)	Potential	NA
Nationwide Permit – U.S. Army Corps of Engineers	Not applicable — the installation of the wedge wire system will generate significant impacts to waters of the U.S. that cannot be addressed by the nationwide permitting process.	Not applicable	NA	NA
Section 7 Consultation with U.S. Fish and Wildlife Service (Endangered Species Act of 1973)	Installation of the offshore wedge wire screen system poses significant impacts marine habitat and aquatic life and also serves to reduce operational impingement losses.	Connected to CEQA process	NA	NA
Notice of Proposed Construction or Alteration – Federal Aviation Administration (FAA), Permanent Facilities	Not applicable — the addition of the addition of the wedge wire system will not result in any exterior changes to existing structures.	Not applicable	NA	NA



**Table WW-1.  
Environmental Permit/Approval Assessment: Modular Wedge Wire Screen System  
San Onofre Nuclear Generating Station (cont.)**

<b>Permit/Approval</b>	<b>Assessment</b>	<b>Permit Review Period (Preconstruction)</b>	<b>Critical Path (Yes/No/NA)</b>	<b>Fatal Flaw (Yes/No/NA)</b>
Notice of Proposed Construction or Alteration – FAA, Temporary Construction Facilities	Not applicable — the addition of the wedge wire screen system will not demand the services of a crane or other construction equipment in excess of 200 feet above ground level.	Not applicable	NA	NA
Multiple-Use Class L Limited Land Use Designated Utility Corridor – Bureau of Land Management (BLM) or Other Responsible Federal Agency	Not applicable — superseded by U.S. Department of Navy lease arrangement with SONGS. The addition of the wedge wire system will not require any additional land, nor involve any exterior changes to existing structures.	Not applicable	NA	NA
California Public Utility Commission (CPUC) Approval	CPUC will likely be the Lead Agency for the California Environmental Quality Act (CEQA) review process regarding the proposed wedge wire screen system. The CEQA review process triggers development of a comprehensive Environmental Impact Report.	~12 months	Potential	No
California Energy Commission (CEC) – Final Decision	Not applicable — the addition of the variable speed pump will not result in a net power capacity (increase) >50 MW, the threshold for CEC.	Not applicable	NA	NA
Coastal Development Permit - California Coastal Commission/Local Coastal Programs	Applicable because of the considerable offshore and near-shore development within the coastal zone. While there are no specific fatal flaws with the wedge wire system, the significant construction-related marine habitat impacts and associated limited reduction in operational impingement losses are likely to make for a contentious approval process.	Connected to CEQA (~12 months)	Potential	NA
Coastal Development Lease – California States Lands Commission	Applicable because of the considerable offshore development on subaqueous lands. While there are no specific fatal flaws with the wedge wire system, the significant construction-related marine habitat impacts and associated limited reduction in operational impingement losses are likely to make for a contentious approval process.	Connected to CEQA (~12 months)	Potential	NA
Regional Pollution Control District Permit to Construct (ATC) – San Diego Regional Air Pollution Control District	Not applicable — the wedge wire system will not generate any additional operational air emissions.	Not applicable	NA	NA



**Table WW-1.  
Environmental Permit/Approval Assessment: Modular Wedge Wire Screen System  
San Onofre Nuclear Generating Station (cont.)**

<b>Permit/Approval</b>	<b>Assessment</b>	<b>Permit Review Period (Preconstruction)</b>	<b>Critical Path (Yes/No/NA)</b>	<b>Fatal Flaw (Yes/No/NA)</b>
Regional Control District Permit to Operate (PTC) – San Diego Air Pollution Control District	Not applicable — the wedge wire screen system will not generate any additional operational air emissions.	Not applicable	NA	NA
Title V Federal Operating Permit – San Diego Air Pollution Control District and USEPA	Not applicable — the wedge wire screen system will not generate any operational additional air emissions.	Not applicable	NA	NA
Title IV Acid Rain Permit - USEPA	Not applicable — the wedge wire screen system will not generate any additional operational air emissions.	Not applicable	NA	NA
Dust Control Plan – San Diego Air Pollution Control District	Not applicable — construction of the wedge wire screen system expected to disturb little or ground surfaces and so there is little potential to generate significant dust emissions. The wedge wire system itself will not generate any additional air emissions.	Not applicable	NA	NA
NPDES Industrial Discharge Permit – Regional Water Quality Control Board (RWQCB) and State Water Resources Board	The wedge wire system will not change the cooling water withdrawal or blowdown rates. This system is not expected to demand any changes in the water treatment system. Any subsequent required alteration of the current NPDES permit will be minor.	~6 months	No	No
Notice of Intent (NOI) – National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction Activity, San Diego Regional Water Quality Control Board (RWQCB)	Not applicable — construction of the wedge wire screen system is not expected to disturb ground surfaces or alter storm water management features onsite.	Not applicable	NA	NA
Storm Water Pollution Prevention Plan (SWPPP) – National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction Activity – San Diego Regional Quality Control Board (RWQCB)	Not applicable — construction of the wedge wire screen system is not expected to disturb ground surfaces or alter storm water management features onsite.	Not applicable	NA	NA

**Table WW-1.**  
**Environmental Permit/Approval Assessment: Modular Wedge Wire Screen System**  
**San Onofre Nuclear Generating Station (cont.)**

Permit/Approval	Assessment	Permit Review Period (Preconstruction)	Critical Path (Yes/No/NA)	Fatal Flaw (Yes/No/NA)
Notice of Intent (NOI) – National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Industrial Activity, San Diego Regional Water Quality Control Board (RWQCB)	Not applicable — SONGS NPDES permit addresses operational storm water. No changes to existing storm water management system are expected from addition of the wedge wire screen system.	Not applicable	NA	NA
Storm Water Pollution Prevention Plan (SWPPP) – National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Industrial Activity, Regional Quality Control Board (RWQCB)	Not applicable — SONGS NPDES permit addresses operational storm water. There is no separate operational phase SWPPP.	Not applicable	NA	NA
2081 Permit for California Endangered Species Act of 1984 (Fish and Game Code, §2050 through 2098) – California Department of Fish & Game (CDFG)	The installation of the wedge wire system is expected to impact marine habitat areas, but there are no threatened or endangered species in the immediate marine area.	Not applicable	NA	NA
Lake and Streambed Alteration Agreement - California Department of Fish & Game (CDFG)	Not applicable — the addition of the offshore wedge wire screen system will not result in impacts to jurisdictional streambed areas (waters of the state).	Not applicable	NA	NA
Waste Discharge Requirements (WDR) – San Diego Regional Water Quality Control Board	Not applicable — the addition of the offshore wedge wire screen system will not result in impacts to jurisdictional streambed areas (waters of the state).	Not applicable	NA	NA
Section 106 Review – Office of Historic Preservation (OHP)	Not applicable — the offshore wedge wire screen system will not demand any additional land nor generate any new surface disturbances.	Not applicable	NA	NA

**Table WW-1.  
Environmental Permit/Approval Assessment: Modular Wedge Wire Screen System  
San Onofre Nuclear Generating Station (cont.)**

<b>Permit/Approval</b>	<b>Assessment</b>	<b>Permit Review Period (Preconstruction)</b>	<b>Critical Path (Yes/No/NA)</b>	<b>Fatal Flaw (Yes/No/NA)</b>
Notification of Waste Activity – Resource Conservation Recovery Act (RCRA) Hazardous Waste Identification Number (Small Quantity Generator) – Construction Phase - Department of Toxic Substance Control, USEPA, San Diego County Department of Environmental Health - California Unified Program Agency	Installation of the wedge wire screen system could potentially require an identification number to support management or construction wastes, unless current SONGS identification will be used.	1-2 weeks	No	No
Notification of Waste Activity - RCRA Hazardous Waste Identification Number (Small Quantity Generator) – Operation - Department of Toxic Substance Control, USEPA, San Diego County Department of Environmental Health - California Unified Program Agency	Not applicable — the addition of the wedge wire system will allow for the continuing use of the existing hazardous waste identification number. There will be not impacts to the onsite hazardous treatment facility (oil separation unit).	Not applicable	NA	NA
SPPC Plan - 40 CFR 112 and Aboveground Petroleum Storage Act – San Diego County Department of Environmental Health - California Unified Program Agency and USEPA	Not applicable — the addition of the wedge wire system is not expected to require additional water treatment chemicals.	Not applicable	NA	NA
Underground Storage Tank Permit – San Diego County Department of Environmental Health – California Unified Program Agency and State Water Resources Board	Not applicable — the addition of the wedge wire system is not expected to require the relocation of underground tanks.	Not applicable	NA	NA
Risk Management Plan (Clean Air Act 112r) – San Diego County Department of Environmental Health - California Unified Program Agency and USEPA	Not applicable — the addition of the wedge wire system will not require the addition of any new volatile chemicals.	Not applicable	NA	NA



**Table WW-1.  
Environmental Permit/Approval Assessment: Modular Wedge Wire Screen System  
San Onofre Nuclear Generating Station (cont.)**

<b>Permit/Approval</b>	<b>Assessment</b>	<b>Permit Review Period (Preconstruction)</b>	<b>Critical Path (Yes/No/NA)</b>	<b>Fatal Flaw (Yes/No/NA)</b>
Emergency Planning and Community Right-to-Know Act (EPCRA) – 40 CFR 311 & 312 - San Diego County Department of Environmental Health - California Unified Program Agency and USEPA	Not applicable — the addition of the wedge wire system is not expected to require any new chemicals quantities that exceed applicable thresholds (e.g., 10,000 lbs for hazardous chemicals, 500 lbs for extremely hazardous chemicals).	Not applicable	NA	NA
Land Use Zones/Districts Approval – San Diego County Department of Planning and Land Use	Not applicable — the SONGS property is entirely situated on federal property (U.S. Marine Corps Camp Pendleton property) and the offshore subaqueous lands are the responsibility of the California States Lands Commission.	Not applicable	NA	NA
Conditional Use Plan Amendment – San Diego County Department of Planning and Land Use	Not applicable — the SONGS property is entirely situated on federal property (U.S. Marine Corps Camp Pendleton property) and the offshore subaqueous lands are the responsibility of the California States Lands Commission.	Not applicable	NA	NA
Grading Plan Approval or Permit – San Diego County Department of Public Works & Planning and Land Use	Not applicable — the SONGS property is entirely situated on federal property (U.S. Marine Corps Camp Pendleton property) and the offshore subaqueous lands are the responsibility of the California States Lands Commission.	Not applicable	NA	NA
Erosion and Sediment Control Plan (Rain Event Action Plan) – San Diego County Department of Public Works	Not applicable — similar to the construction-phase SWPPP. No separate submittal is expected to be directed to the county, since the SONGS property is entirely situated on federal property (U.S. Marine Corps Camp Pendleton property) and the offshore subaqueous lands are the responsibility of the California States Lands Commission.	Not applicable	NA	NA
Building Permit (including plumbing and electrical) – San Diego County Building Division	Not applicable — the SONGS property is entirely situated on federal property (U.S. Marine Corps Camp Pendleton property) and the offshore subaqueous lands are the responsibility of the California States Lands Commission.	Not applicable	NA	NA
Domestic Water Supply Permit (public potable water) – San Diego County Department of Environmental Health	Not applicable — no new potable water systems are planned.	Not applicable	NA	NA



**Table WW-1.  
Environmental Permit/Approval Assessment: Modular Wedge Wire Screen System  
San Onofre Nuclear Generating Station (cont.)**

<b>Permit/Approval</b>	<b>Assessment</b>	<b>Permit Review Period (Preconstruction)</b>	<b>Critical Path (Yes/No/NA)</b>	<b>Fatal Flaw (Yes/No/NA)</b>
San Diego County Well Water Permit – San Diego County Department of Environmental Health	Not applicable — no new wells to be developed.	Not applicable	NA	NA
California Department of Transportation (Caltrans) – Oversize/Overweight Vehicles	Not applicable — the wedge wire screen elements and associated piping are expected to be oversized.	Not applicable	NA	NA
Caltrans Heavy Haul Report (transport and delivery of heavy and oversized loads)	Not applicable — the wedge wire screen elements and associated piping are expected to be oversized.	Not applicable	NA	NA
Resource Conservation (RC) Land Use Management Approval	Not applicable — while local municipality rules may supersede this regional land use/watershed protection-related project approval process, this is not the case for SONGS.	Not applicable	NA	NA
Temporary Power Pole – Local municipality or San Diego County Public Works Department	Not applicable — the installation of the wedge wire system is not expected to require local power poles.	Not applicable	NA	NA
Fire Safety Plan Approval, Certificate of Occupancy, Flammable Storage – San Diego County Fire Department	The addition of wedge wire system may require minor revisions to the existing Fire Safety Plan.	1 month for approval of Fire Safety Plan.	No	No
Sewer and Sewer Connections – San Diego County Environmental Health Department	Not applicable — No new sanitary connections are envisioned.	Not applicable	NA	NA
Road Crossing or Encroachment Permit (Caltrans)	Not applicable — the addition of wedge wire system will not pose any road crossing or encroachment issues.	Not applicable	NA	NA

**Table WW-2.**  
**Offsetting Impacts for the Offshore Modular Wedge Wire Screen**  
**San Onofre Nuclear Generation Station**

Category	Impacts – Construction	Impacts – Operations	Magnitude	Construction Impact Significance	Operation Impact Significance
Air	<p>Minor increase in greenhouse gases, NOx, volatile organic compound, CO, and particulate matter from construction equipment, material deliveries, commuting workforce.</p> <p>Increased greenhouse gas emissions from replacement fossil-fuel generation to offset the short term loss of SONGS generation during the plant outage to install wedge system.</p>	While the wedge wire system could result in some reduction of plant efficiency, there should be no significant changes in overall air quality impacts or greenhouse gas emissions during operation.	Insignificant temporary increase in CO <sub>2</sub> greenhouse gas emissions from temporary increase in commuting traffic during associated plant outage.	Small Negative	None
Surface Water	Construction activities are primarily marine-based and they have the potential to generate significant water quality impacts from disruption of the intertidal and sub-tidal lands. Cut-and-fill installation practices will be more disruptive than the tunneling option.	Operational cooling water withdrawal and discharge rates will be remain largely unchanged.	Not applicable	Large Negative – cut and fill  Moderate Negative - tunneling	None
Groundwater	No additional groundwater resources will be needed to support construction.	No additional groundwater resources will be needed to support operations.	Not applicable	None	None
Waste	Significant marine sediment wastes will be generated to facilitate installation of the offshore piping system.	Minor increase in waste generation from maintenance activities on the submerged modular screen systems.	Marine spoil wastes (pending subsequent assessment phase)	Moderate Negative	None
Noise	Buffer areas around offshore construction zones will serve to reduce noise impacts to offshore noise receptors (watercraft) and shoreline recreational areas, but there is the potential for impacts to the shoreline areas.	Operational noise levels are expected to be largely unchanged as a result of the wedge wire system.	Noise impacts above the 70 dBA threshold value may occur along shoreline during construction.	Small negative	None



**Table WW-2.**  
**Offsetting Impacts for the Offshore Modular Wedge Wire Screen**  
**San Onofre Nuclear Generation Station (cont.)**

Category	Impacts – Construction	Impacts – Operations	Magnitude	Construction Impact Significance	Operation Impact Significance
Land Use	Construction activities are primarily offshore and they may temporarily preclude normal recreational activities in nearby waters.	The wedge wire screen modules and associated piping represent a change in land use of the marine bed and could preclude some waterborne activities.	Work schedule (pending subsequent assessment phase)	Small negative	Small negative
Marine Ecological Resources	Construction will potentially generate significant, temporary water quality and marine habitat impacts (localized turbidity impacts and loss of marine habitat). These impacts will be more significant for the cut-and-fill installation option than the tunneling option.	Further reduces impingement impacts that are already partially mitigated. Overall water withdrawal or discharge rates are unchanged. Entrainment impacts may be somewhat reduced, but the thermal discharge impacts to aquatic life will remain largely unchanged	Marine bed area (pending subsequent assessment phase)	Large Negative – cut and fill Moderate Negative – tunneling	Moderate Positive
Terrestrial Ecological Resources	Since construction will be confined to previously disturbed land, there is no potential to disturb natural habitats or other areas with significant ecological value or sensitivity.	No permanent loss of natural habitat areas or other areas with significant ecological value or sensitivity.	Not applicable	None	None
Cultural & Paleontological Resources	Since construction will be confined to previously disturbed land, there is little or no potential to discover new cultural or paleontological resources in these developed areas.	No permanent loss of cultural or paleontological resources.	Not applicable	None	None
Visual Resources	All construction equipment will be low profile, i.e., not extend above the height of local facility structures.	The wedge wire intake system will be submerged and present no permanent change in external profile of the facility.	Not applicable	None	None
Transportation	Increased traffic from the construction workforce and construction deliveries could temporarily worsen the existing level of service on local roads during the plant outage.	The wedge wire screen system will not significantly alter the current number of plant deliveries or operating personnel.	Workforce and Level of Service (pending subsequent assessment phase)	Small Negative	None

**Table WW-2.**  
**Offsetting Impacts for the Offshore Modular Wedge Wire Screen**  
**San Onofre Nuclear Generation Station (cont.)**

Category	Impacts – Construction	Impacts – Operations	Magnitude	Construction Impact Significance	Operation Impact Significance
Socioeconomic Issues	While there will be some additional construction-related employment opportunities, these opportunities are not expected to significantly strain local community resources (e.g., housing, school, fire/police services, water/sewer).	Maintenance staff levels are expected to be largely unchanged in response to the wedge wire system.	Workforce (pending subsequent assessment phase)	Small Positive	None

Notes: Levels of Impact of Significance

- Small:** Environmental effects from not detectable or minor such they will not noticeably alter any important attribute of the resource
- Moderate:** Environmental effects are sufficient to noticeably alter, but not significantly change, the attributes of the resource.
- Large:** Environmental effects are clearly noticeable and are sufficient to change the attributes of the resource.





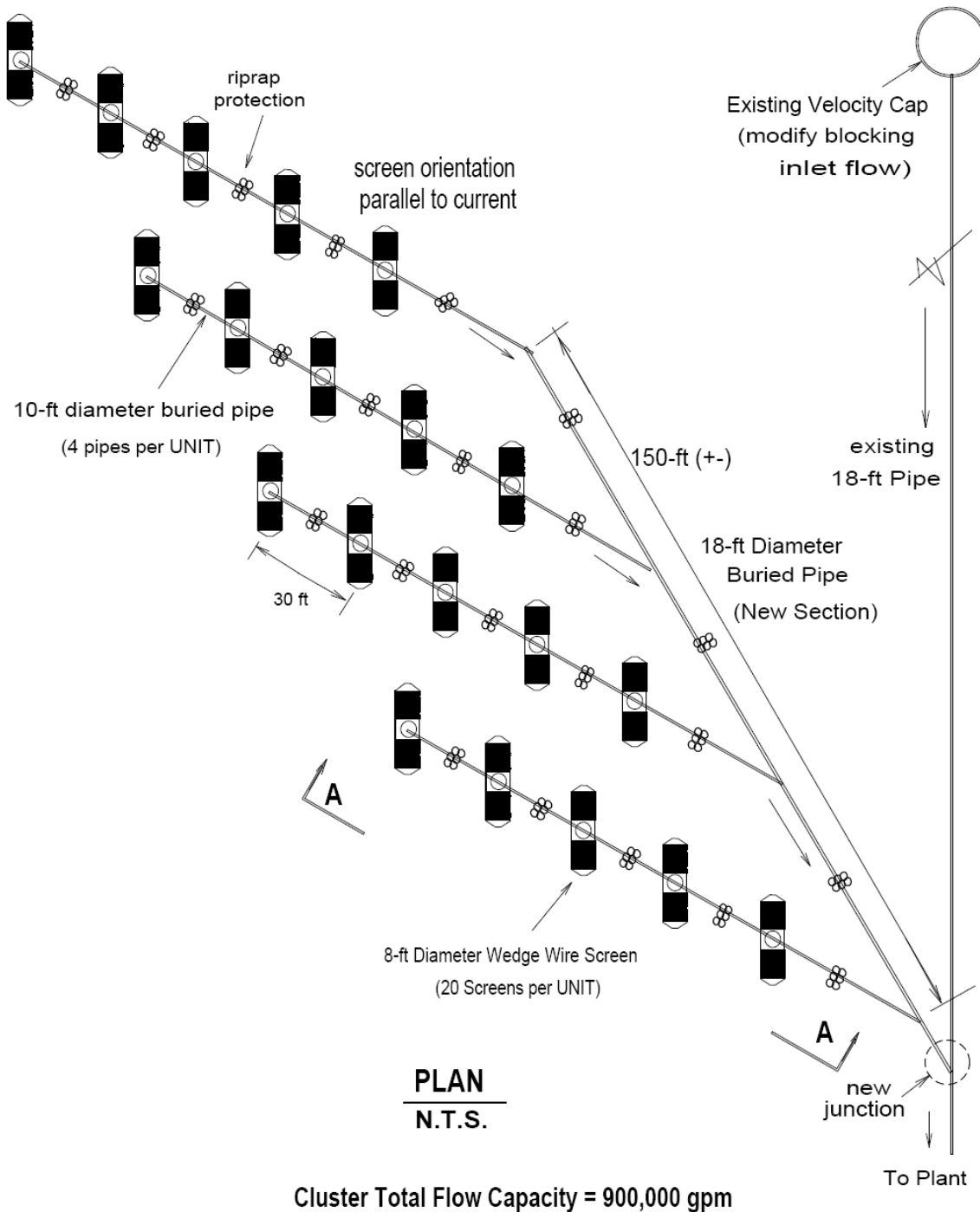


Figure WW-2. Offshore Wedge Wire Screens Concept Layout

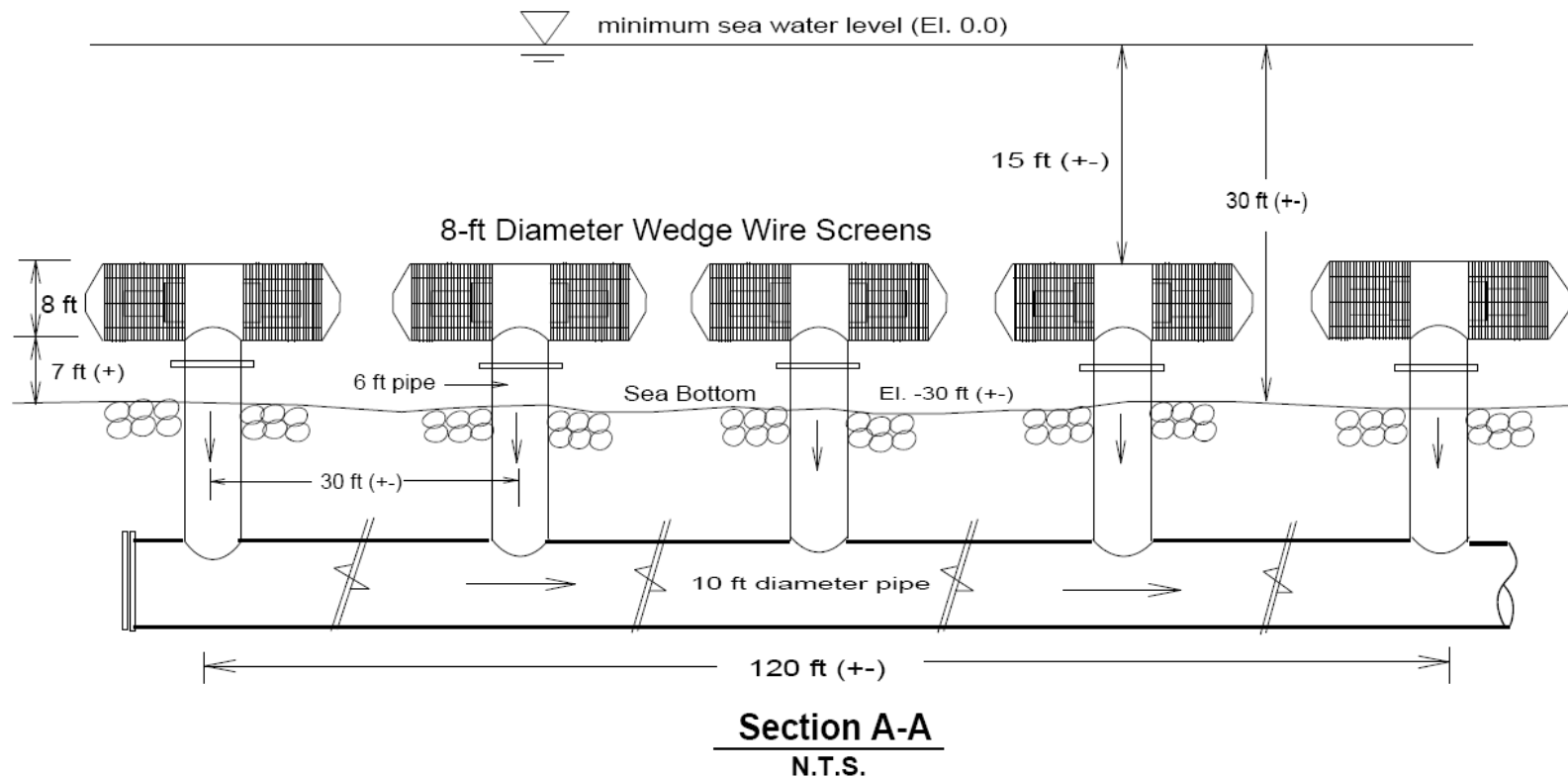


Figure WW-3. Sectional Viwe of Wedge Wire Screen Intake Modular Assembly